SYSTEMATICS OF CLUPEOID FISHES OF THE INDO-PACIFIC REGION

by

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A THESIS

SUBMITTED FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

IN THE FACULTY OF SCIENCE

UNIVERSITY OF LONDON

DEPARTMENT OF ZOOLOGY AND APPLIED ENTOMOLOGY

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY

SOUTH KENSINGTON, LONDON SW7 2AZ

January, 1980

TO

MY PARENTS

AND TO

MILLIONS OF THAI CHILDREN

WHO HAVE NO OPPORTUNITY TO LEARN

Abstract

The clupeoid fishes (families Clupeidae and Engraulidae) of the Indo-Pacific region, and in particular the genera and species that abound in Southeast Asian waters, have for the first time been thoroughly revised on the basis of adequate material. In all, some fourteen thousand specimens have been examined, including the types of 189 nominal species. Types and original descriptions have been reassessed in order to resolve the many existing anomalies in the systematics of the group. An attempt has been made to develop better means of identification, clearer concepts of geographical ranges and more precise ideas regarding the phylogeny within the clupeoids.

A large number of both internal and external features were explored in all the genera and often all the species of a genus. Both morphometric and meristic characters were tabulated and in many cases expressed as scatter diagrams. Of major importance were numbers of gillrakers, fin rays, scales, scutes, pseudobranchial filaments, pyloric caeca and fronto-parietal striae. Anatomical features included the form of the gas bladder and digestive tract and such osteological elements as the circumorbital bones, urohyal, hyoid arch, gillrakers, predorsal bones and caudal skeleton. A particular study was made of scale morphology and the hitherto neglected patterns of scale arrangement on various parts of the body.

As a result, 154 Indo-Pacific clupeoid species are recognised (2 subspecies), belonging to 32 genera (5 subgenera) and 9 subfamilies. Nine genera are monotypic, whereas 5 genera hitherto considered monotypic were found to include 2-4 species (Etrumeus, Dussumieria, Clupeichthys, Escualosa and Pellona). Sardinella and Thryssa are now split into 2 and 3 subgenera respectively. Some 28 nominal species hitherto relegated to junior synonymy have been recognised as valid species. In addition, 23 new species have been described :

Etrumeus whiteheadi
Clupeichthys aesarnensis
Spratelloides lewisi
Sardinella (Sardinella) neglecta
Herklotsichthys lossei
Herklotsichthys gotoi
Nematalosa flyensis
Gonialosa whiteheadi
Anodontostoma thailandiae
Pellona dayi
Ilisha striatula
Ilisha obfuscata
Stolephorus brachycephalus
Stolephorus tysoni
Stolephorus ronquilloi
Stolephorus dubiosus
Thryssa (Scutengraulis) kammalensoides
Thryssa (Scutengraulis) polybranchialis
Thryssa (Scutengraulis) whiteheadi
Thryssa (Scutengraulis) stenosoma
Thryssa (Scutengraulis) dayi
Setipinna wheeleri

In addition, Sardinella (Clupeonia) richardsoni has been proposed as a new name to replace Richardson's isingleena (suppressed by the International Commission).

The majority of these 154 species are inshore, coastal fishes, but 19 are estuarine or anadromous; 22 species are endemic to rivers near the equator.

Special attention was paid to illustrations of the species and of the anatomical features studies, resulting in about nine hundred line drawings. Distribution maps were prepared for all species, as well as diagrams illustrating phyletic relationships.

Keys are given to families, subfamilies, genera, subgenera, species and subspecies. For each species is given a full synonymy, diagnosis, remarks on the synonymy, etc., distribution and list of material studies. The main taxonomic features studies are discussed in separate sections, chiefly with regard to taxonomic use and phylogenetic significance.

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Introduction

The clupeoid fishes include the sardines, herrings and sprats (Clupeidae) and the anchovies (Engraulidae). In world fishery statistics they account for between a quarter and a third of total catches. In the Indo-Pacific region they are one of the dominant fish groups, remarkable for both their diversity and their sometimes wide distribution. They are of exceptional importance to the fisheries of the area, contributing both to industrialized fishery operations (especially purse-seines) and to small artisanal fisheries.

The systematic history of the Indo-Pacific clupeoids began with the descriptions by Linnaeus of *Clupea thrissa* (= *Clupanodon thrissa*), *Clupea mystus* (= *Coilia mystus*) and *Clupea sinensis* (unidentified - type lost), all of which came from China and appear in the *Systema naturae* of 1758. These were followed by the description by Forsskål of *Clupea baelama* (= *Thryssa (Thrissina) baelama*) in his work on Red Sea fishes of 1775, and seven years later by Broussonet's description of *Clupea setirostris* (= *Thryssa setirostris*) in 1782. Considering that nearly two hundred clupeoid species occur in this area, it is surprising how slowly this clupeoid fauna became known and named. By the beginning of the 19th century, only 7 species (as recognised here) had been named; by 1850, however, another 56 had been described, largely through the work of Hamilton-Buchanan and Valenciennes; another 32 were added by the end of the century by Bleeker and others. This does not, of course, take into account the very many nominal species proposed. The names of authors, dates of their works and number of valid species described are listed chronologically below.

Linnaeus (1758: 2)	Bloch (1795: 2)
Forsskål (1775: 1)	Schneider (1801: 2)
Broussonett (1782: 1)	Lacepède (1803: 1)
Walbaum (1792: 1)	Hamilton-Buchanan (1822: 9)

van Hasselt (1823: 1)

Cuvier (1829: 3)

Bennett (1830, 1831: 2)

Gray (1831, 1835: 2)

Rüppell (1837: 3)

Swainson (1839: 1)

Dekay (1842: 1)

Richardson (1845, 1846: 3)

Schlegel (1846: 4)

Valenciennes (1847, 1848: 17)

Bleeker (1849, 1850, 1851, 1852 1854, 1855, 1858, 1859, 1866 1872: 23)

Cantor (1850: 1)

Guichenot (1863: 1)

Günther (1868, 1874, 1880: 4)

Day (1869, 1873, 1878: 4)

Ramsay & Ogilby (1886: 2)

Ogilby (1897, 1911: 3)

Rutter (1897: 1)

Fowler (1900, 1935: 2)

Boulenger (1900: 1)

Jordan & Starks (1905: 1)

Gilchrist & Thompson (1908: 1)

Weber & DeBeaufort (1912, 1913: 3)

Regan (1917: 3)

Fowler & Bean (1923: 1)

Jordan & Seale (1925, 1926: 3)

Herre (1927, 1936: 2)

Deraniyagala (1929: 1)

Hardenberg (1931, 1933, 1934, 1936: 4)

Durand (1940: 1)

Whitley (1940: 1)

Munro (1956, 1964: 4)

Chu & Tsai (1958: 1)

Strasburg (1960: 1)

Babu Rao (1966, 1970: 2)

Berry & Whitehead (1968: 1)

Whitehead (1968: 1)

Seshagiri Rao (1975: 1)

Roberts (1978: 1)

Present work (1980: 23)

Omitted from this list is the work of Russell (1803) on the fishes of Vizagapatnam (Coromandel) since he did not employ Linnaean binomials but used vernacular names. Nevertheless, his descriptions and drawings were quite accurate and formed the basis for a number of subsequent binomials by van Hasselt, Cuvier, Swainson and Valenciennes. In the present century, the most important early synopses of Indo-Pacific clupeoids were those by Weber & DeBeaufort (1913) and by Fowler (1941); Herre's checklist of

Philippine fishes included useful synonymies of the clupeoids, which brought those of Fowler twelve years forward.

In the modern era, clupeoid studies were revived by Whitehead in a series of publications, some revisional, some dealing with type collections and some regional (1962a, 1962b, 1963a, 1963b, 1964a, 1964b, 1964c, 1965a, 1965b, 1966a, 1966b, 1967a, 1969a, 1969b, 1970, 1973b) also, Whitehead, Boeseman & Wheeler (1966), Talwar & Whitehead (1971) and Ramaiyan & Whitehead (1978).

Although numerous publications exist on Indo-Pacific clupeoid fishes, the only single modern work with keys to all genera and many of the species is Whitehead's Synopsis of Indian clupeoid fishes (1973b) For the most part, the species and even genera are recognisable to only a few specialists and the patient work of generations of field biologists is frequently found to be almost useless because of dubious identifications. At the same time, almost all modern works on the clupeoids have recorded uncertainties or problems of identification and have called for further revisionary studies.

Rather few existing works have described species or even genera on more than superficial characters. The specimens have generally been gathered from restricted areas and many workers have not examined the relevant types or seen comparative material; moreover, many field workers are still using the older literature. As a result, the geographical ranges of species are exagerated or otherwise distorted, and the ranges of morphometric or meristic characters are also distorted. To some extent, however, this can be forgiven, since identification is sometimes extremely difficult, especially in the field. Many closely related and very similar species can be caught in the same net; the live colouration is usually not striking and rather soon fades; and for a number of species the type material is in poor condition or even lost, while most of the earlier descriptions are difficult to interpret (indeed, some type material includes two quite separate species). Some of the difficulties were overcome by Whitehead's studies of the types of major authors, such as Bloch, Schneider, Lacepède, Cuvier, Valenciennes, Bleeker, Richardson and Day (in the papers cited above). These papers solved most of the nomenclatural problems but were not based on sufficient modern material to resolve fully the taxonomy of the group.

Some attempts have been made to review particular anatomical features in some or all clupeoids. The most important have been Nelson's study of gill arches, hyobranchial structure and infraorbital bones (1967a, 1967b, 1969, 1970a); Miller's work on gill arches, and epibranchial organs (1969); and Harder's pioneer work on gut form (1957 , 1958 , 1960). These have had quite important effects on the classification of the clupeoids, but they are not wholly satisfactory because of misidentifications or use of rather few specimens.

During the past four years I have had an excellent opportunity to study Indo-Pacific clupeoid fishes on the basis of the huge collection now in the British Museum (Natural History). With some thirteen thousand registered specimens, together with very many types, it must be the largest and most important in the world. In addition to these, I have been able to study the collection of the Rijksmuseum van Natuurlijke Historie in Leiden, and those in the Muséum Nationale d'Histoire Naturelle in Paris. I have also borrowed type and other specimens from some twenty institutions or people in Australia, North America, Asia and Africa. As a result, there are rather few species of which I have not examined an adequate sample. One rare example is the engraulid Stolephorus Sp. B of Ronquillo (1970), of which no material seems to exist; I have omitted it here since its status is doubtful.

The present work began as a study of Southeast Asian clupeoids, but it soon became obvious that the area had to be extended since many species range outside it and it was not always clear whether these were truly conspecific. The work was enlarged to cover most of the Indo-Pacific area, from the eastern coasts of Africa, including South Africa, eastward to Hawaii, northward to China and Japan, and southward to Australia. This proved essential when distribution patterns were examined, since no real confidence could be placed on published accounts. For example, Herklotsichthys punctatus has hitherto been considered widespread throughout the entire area, whereas in fact it is confined to the Red Sea; its congener H. quadrimaculatus, considered merely a junior synonym until now, is the widespread species. This largely resulted from mixture of the type specimens. It was not possible, however, to study in any detail certain genera occurring only at the northern and southern boundaries of the Indo-Pacific region, e.g. Sardinops, Sprattus, Clupea, Potamalosa, Hyperlophus, Sauvagella, Spratellomorpha and Gilchristella. In addition, I have also omitted the wide-ranging Chirocentrus (2 species fide Whitehead, 1973b) of the related family Chirocentridae. The Elopidae, Megalopidae and Albulidae, included in the order Clupeiformes by earlier workers, are now known to be only very distantly related (Greenwood et alii, 1966).

In the course of this work I have examined some fourteen thousand specimens, ranging in size from 11 to 509 mm S.L., belonging to 154 species (2 subspecies) of 32 genera (5 subgenera) in 9 subfamilies. Nine genera are monotypic, but 5 genera formerly considered to contain a single species are now found to include up to four species (Etrumeus, Dussumieria, Clupeichthys, Escualosa and Pellona). Perhaps surprisingly, since the clupeoids are essentially a marine group, there are at least 22 species that have been found in fresh waters, while another 19 species are estuarine or anadromous. Three of 23 new species described here are riverine and most of the other 20 are of limited distribution. The new species will be formally described in a separate work. In addition to these, many junior synonyms have been resurrected as a result of examination of their types and comparison with more extensive material than was studied by previous workers.

A greater range of morphometric, meristic and anatomical characters have been examined than in any previous study. Where possible, all species in a genus have been studied, usually with a good selection of specimens, but a few rare species have had to be omitted. In all, some 47 proportional and meristic measurements have been taken from specimens of each species, although only the pertinent ones have been used here in the tables, figures, descriptions and keys. Previous studies have often ignored useful internal characters, some of which reinforce existing taxonomies, while others suggest rather different solutions. In this study the gas bladder and digestive tract were considered the two most important clues to relationships of the visceral organs. Selected osteological features were also studied, including the jaws, circumorbital bones, hyoid arch, urohyal, gillrakers, predorsal bones and caudal skeleton. The scales of clupeoids have also been rather neglected in previous works, but examination of the pattern of scale striae in most species, as well as the arrangement of scales on certain parts of the body, has revealed many features of great taxonomic importance. As a result, much clearer diagnoses are now given of both species and genera.

Accurate line drawings (left lateral view) have been made for all species, together with selected anatomical features. Keys are given to all taxa, from families down to subspecies, and for each species there is a full synonymy, diagnosis, description of range, notes on problems in the synonymy or unusual features, and a list of the material studied. Where necessary, specimens are indicated as suitable for neotype designation. A few nominal species without types and with poor original descriptions still elude identification, as for example Clupea ovalis, Clupea tempo, Clupea sinensis and Harengula abbreviata. Since there seems to be no likelihood that their identity can ever be established with any certainty, it is recommended that the names are eventually suppressed as nomina dubia.

In separate sections the various anatomical features have been discussed and their relevance to the taxonomy and phylogeny of the group assessed. The form of the gas bladder, its point of connexion with the gut, and the form of the gut itself, all seem to give important phylogenetic information, although interpretation of trends is complicated by the fact that a species or genus may show the primitive condition in one feature, but a very specialized condition in another. Scales also seem to yield useful phylogenetic information. Interrelationships have been expressed in tentative diagrams, which often illustrate parallel trends within the Clupeidae and Engraulidae; the point at which the two families diverged, however, still remains elusive, as also the point of departure of the rat-tailed anchovies (Coiliinae) from the main engraulid stem. Only a world-wide study, including fossil forms, will resolve this.

The clupeoid fishes have long been the subject of intensive biological and fishery research, chiefly in the temperate waters of the Northern Hemisphere, but also off the coasts of Peru and Chile, as well as South Africa and southern Australia. In such waters the clupeoid fisheries are often for a single dominant species, or at most three or four. The general biology of such species, their growth rates, periods of reproduction, eggs, larvae, food and racial variation, are reasonably well known. In tropical waters the number of species that enter a fishery may be as many as fifteen or twenty and it is not uncommon for ten or more species to be caught in the same net, presumably because they shoal together. Knowledge of their taxonomy, let alone their biology, is correspondingly small. However the last two decades have seen a dramatic increase in the catches of such tropical clupeoids and with it an increasing need for more precise biological information.

Perhaps the most important clupeoid in the whole Indo-Pacific region is the Indian oil-sardine, Sardinella (Sardinella) longiceps, whose fishery (mainly off the western coast of India) has been well described by Nair (1960).

Other important clupeids are Sardinella (Clupeonia) gibbosa, S. (C.) albella, Amblygaster sirm, Herklotsichthys quadrimaculatus, Ilisha elongata, I. megaloptera, I. melastoma, Tenualosa toli, T. ilisha, T. reevesii, Konosirus punctatus, Nematalosa nasus and Anodontostoma chacunda. Of moderate importance to fisheries are Dussumieria acuta, Sardinella (Sardinella) lemuru, Sardinella (Clupeonia) sindensis, S. (C.) zunasi, S.(C.) marquesensis, Amblygaster leiogaster, Herklotsichthys castelnaui, H. lossei, Opisthopterus valencienesi and Hilsa kelee. Of the Engraulidae, the most importance species to fisheries is ubdoubtedly Engraulis japonicus in Japanese and southern Australian waters. Other important anchovies are Stolephorus buccaneeri, S. heterolobus, S. devisi, S. indicus, S. commersonii, S. waitei and S. insularis. In the case of Stolephorus, the catches are almost always multispecies, except when shoals of S. indicus and perhaps S. heterolobus are encountered. Other engraulids which enter the fisheries are Thryssa (Thrissina) baelama, T. (Scutengraulis) vitrirostris, T. (S.) hamiltonii, T. (S.) mystax and Coilia nasus. The clupeoids listed here are found over quite large parts of the Indo-Pacific, but there are several species of more restricted range which are nevertheless important to particular fisheries. Of these, the most important are Nematalosa papuensis, N. flyensis, N. erebi, Clupeichthys aesarnensis and Setipinna brevifilis.

The majority of clupeoid fishes are fairly small. The largest Indo-Pacific species is probably the shad Tenualosa reevesii, a microphagous feeder; the largest specimen examined here was 509 mm S.L. The smallest clupeoid in this region is Clupeichthys perakensis, which apparently attains only 28.2 mm S.L. and is perhaps mature at little over 20 mm. However, the Indo-Pacific region does not seem to have produced the complete dwarfism found in the West African rivers, where Thrattidion noctivagus and Sierrathrissa leonensis are mature at only about 18 mm S.L. Measurements of museum specimens are perhaps misleading, especially as regards maximum size for species, but certainly Ilisha elongata, Tenualosa toli and T. ilisha are among the largest marine clupeoid species, while Nematalosa erebi, and Thryssa (Scutengraulis) scratchleyi are the largest freshwater species. All these fishes reach about 250-350 mm S.L.

The clupeoids are not only exploited as a source of fresh and immediately marketed protein. They are also canned, dried, salted, marinated and smoked or are used in the production of fish meal. As elsewhere, clupeoids are also an important source for baitfish in tuna fisheries (Schaefer, 1954, 1961; Alverson & Shimada, 1957; Kearney, Lewis & Smith, 1972). The nehu or Stolephorus purpureus is now an important baitfish in Hawaii, although Tinker (1944) noted that in the past it was dried for consumption by the islanders its use as a food is now forbidden by law for the area. Finally, it can be noted that the ovaries of certain species are highly esteemed, especially those of Tenualosa toli and T. macrura by the natives of the western coast of Kalimantan (Hardenberg, 1936). The total production of clupeoids in the study area, according to the FAO Yearbook for 1976 was 1, 216, 436 metric tons. This number however, excludes those catches from China, Japan, Korea and USSR (FAO area 61), and also the tropical east Pacific (FAO area 77), which partly shared the borders of study area of this work; their total catches were 619, 807 and 1, 802, 420 metric tons, respectively.

The present study does not claim to be definitive; it deals with about half the world clupeoid fauna, it encompasses only some of the internal anatomical characters that have been so neglected in the past, and no attempt has been made to examine the functional significance of those characters explored; myology has not been studied, while biological characters are largely omitted because of the unreliability of identifications in the published literature. However, the results of this work should lay a firmer basis to future studies, while the osteological drawings should be of considerable use to palaeontologists and ones who study the stomach contents.

Table 1. Systematic list of Indo-Pacific clupeoid species; those from South-east Asia (Burma, Thailand, Malaya, Singapore, Indonesia, Cambodia, Vietnam and Philippines) are indicated by an asterisk (*).

Family Clupeidae

Subfamily Dussumieriinae

1. Etrumeus teres (DeKay, 1842)
2. E. whiteheadi n. sp.
3. Dussumieria elopsoides Bleeker, 1849*
4. D. acuta Valenciennes, 1847*

Subfamily Pellonulinae

5. Ehirava fluviatilis Deraniyagala, 1929
6. Dayella malabarica (Day, 1873)
7. Clupeoides borneensis Bleeker, 1851*
8. C. hypselosoma Bleeker, 1866*
9. C. papuensis (Ramsay & Ogilby, 1886)
10. C. venulosus Weber & DeBeaufort, 1912
11. Corica laciniata Fowler, 1935*
12. C. soborna Hamilton-Buchanan, 1822*
13. Clupeichthys bleekeri (Hardenberg, 1936)*
14. C. aesarnensis n. sp.*
15. C. goniognathus Bleeker, 1855*
16. C. perakensis (Herre, 1936)*

Subfamily Spratelloidinae

17. Spratelloides gracilis (Schlegel, 1846)*
18. S. lewisi n. sp.
19. S. delicatulus (Bennett, 1831)*
20. S. robustus Ogilby, 1897

Subfamily Clupeinae

21. Sardinella (Sardinella) longiceps Valenciennes, 1847
22. S. (S.) neglecta n. sp.

23. S. (S.) lemuru Bleeker, 1853*

24. S. (Clupeonia) jussieui (Valenciennes, 1847)

25. S. (C.) sindensis (Day, 1878)

26. S. (C.) gibbosa (Bleeker, 1849)*

27. S. (C.) fimbriata (Valenciennes, 1847)*

28. S. (C.) albella (Valenciennes, 1847)*

29. S. (C.) dayi Regan, 1917

30. S. (C.) fijiense (Fowler & Bean, 1923)

31. S. (C.) tawilis (Herre, 1927)*

32. S. (C.) hauliensis(Chu & Tsai, 1958)

33. S. (C.) brachysoma Bleeker, 1852*

34. S. (C.) richardsoni n. sp.

35. S. (C.) zunasi (Bleeker, 1854)

36. S. (C.) marquesensis Berry & Whitehead, 1968

37. S. (C.) melanura (Cuvier, 1829)*

38. S. (C.) atricauda (Günther, 1868)*

39. Amblygaster sirm (Walbaum, 1792)*

40. A. clupeoides Bleeker, 1849 *

41. A. leiogaster (Valenciennes, 1847)*

42. Herklotsichthys quadrimaculatus (Rüppell, 1837)*

43. H. koningsbergeri (Weber & DeBeaufort, 1912)*

44. H. castelnaui (Ogilby, 1897)

45. H. gotoi n. sp.*

46. H. lossei n. sp.

47. H. spilura (Guichenot, 1863)

48. H. punctatus (Rüppell, 1837)

49. H. dispilonotus (Bleeker, 1852)*

50. Escualosa elongata n. sp.*

51. E. thoracata (Valenciennes, 1847)*

Subfamily Alosinae

52. Hilsa kelee (Cuvier, 1829)*

53. *Tenualosa toli* (Valenciennes, 1847)*

54. *T. macrura* (Bleeker, 1852)*

55. *T. reevesii* (Richardson, 1846)*

56. *T. ilisha* (Hamilton-Buchanan, 1822)*

57. *T. thibaudeaui* (Durand, 1940)*

58. *Gudusia chapra* (Hamilton-Buchanan, 1822)

59. *G. variegata* (Day, 1869)*

Subfamily Dorosomatinae

60. *Clupanodon thrissa* (Linnaeus, 1758)*

61. *Konosirus punctatus* (Schlegel, 1846)

62. *Nematalosa erebi* (Günther, 1868)

63. *N. chanpole* (Hamilton-Buchanan, 1822)*

64. *N. arabica* Regan, 1917

65. *N. come* (Richardson, 1846)*

66. *N. nasus* (Bloch, 1795)*

67. *N. japonicus* Regan, 1917*

68. *N. vlaminghi* (Munro, 1956)

69. *N. papuensis* (Munro, 1964)

70. *N. flyensis* n. sp.

71. *Gonialosa whiteheadi* n. sp. *

72. *G. manmina* (Hamilton-Buchanan, 1822)

73. *G. modesta* (Day, 1869)*

74. *Anodontostoma chacunda* (Hamilton-Buchanan, 1822)*

75. *A. selangkat* (Bleeker, 1852)*

76. *A. thailandiae* n. sp.*

Subfamily Pristigasterinae

77. *Pellona ditchela* Valenciennes, 1847*

78. *P. dayi* n. sp.

79. *Ilisha sirishai* Seshagiri Rao, 1975 *

80. *I. novacula* (Valenciennes, 1847)*

81. I. megaloptera (Swainson, 1839)*

82. I. elongata (Bennett, 1830)*

83. I. filigera (Valenciennes, 1847)*

84. I. macrogaster Bleeker, 1866*

85. I. pristigastroides (Bleeker, 1852)*

86. I. kampeni (Weber & DeBeaufort, 1913)*

87. I. striatula n. sp.

88. I. melastoma (Schneider, 1801)*

89. I. obfuscata n. sp.

90. Opisthopterus valenciennesi Bleeker, 1872*

91. O. tardoore (Cuvier, 1829)*

92. Raconda russeliana Gray, 1831*

Family Engraulidae

Subfamily Engraulinae

93. Engraulis japonicus Schlegel, 1846*

94. Stolephorus purpureus (Fowler, 1900)

95. S. buccaneeri Strasburg, 1960*

96. S. heterolobus (Rüppell, 1837)*

97. S. devisi (Whitley, 1940)*

98. S. indicus (van Hasselt, 1823)*

99. S. commersonii Lacepède, 1803*

100. S. brachycephalus n. sp.

101. S. chinensis (Günther, 1880)*

102. S. waitei Jordan & Seale, 1926*

103. S. holodon (Boulenger, 1900)

104. S. andhraensis Babu Rao, 1966*

105. S. tysoni n. sp.

106. S. ronquilloi n. sp.*

107. S. insularis Hardenberg, 1933*

108. S. dubiosus n. sp.*

109. S. baganensis Hardenberg, 1931*

110. S. tri (Bleeker, 1852)*

111. Thryssa (Thrissina) baelama (Forsskål, 1775)*

112. T. (Scutengraulis) chefuensis (Günther, 1874)

113. T. (S.) rastrosa Roberts, 1978

114. T. (S.) scratchleyi (Ramsay & Ogilby, 1886)

115. T. (S.) aestuaria (Ogilby, 1911)

116. T. (S.) kammalensis (Bleeker, 1849)*

117. T. (S.) kammalensoides n. sp.

118. T. (S.) vitrirostris (Gilchrist & Thompson, 1908)

119. T. (S.) adelae (Rutter, 1897)

120. T. (S.) dussumieri (Valenciennes, 1848)*

121. T. (S.) mystax (Schneider, 1801)*

122. T. (S.) polybranchialis n. sp.

123. T. (S.) gautamiensis Babu Rao, 1970

124. T. (S.) malabarica (Bloch, 1795)

125. T. (S.) hamiltonii Gray, 1835*

126. T. (S.) whiteheadi n. sp.

127. T. (S.) purava (Hamilton-Buchanan, 1822)

128. T. (S.) stenosoma n. sp.

129. T. (S.) dayi n. sp.

130. T. (S.) spinidens (Jordan & Seale, 1925)*

131. T. (Thryssa) setirostris (Broussonet, 1782)*

132. Papuengraulis micropinna Munro, 1964

133. Lycothrissa crocodilus (Bleeker, 1850)*

134.1 Setipinna tenuifilis tenuifilis Valenciennes 1848*

134.2 S. tenuifilis gilberti Jordan & Starks 1905

135. S. papuensis Munro, 1964*

136. S. melanochir (Bleeker, 1849)*

137. S. taty (Valenciennes, 1848)*

138. *S. wheeleri* n. sp.*

139. *S. phasa* (Hamilton-Buchanan, 1822)

140. *S. brevifilis* (Valenciennes, 1848)

141. *Heterothrissa breviceps* (Cantor, 1850)*

Subfamily Coilinae

142. *Coilia ramcarati* (Hamilton-Buchanan, 1822).

143. *C. borneensis* Bleeker, 1851*

144. *C. reynaldi* Valenciennes, 1848

145. *C. coomansi* Hardenberg, 1934*

146. *C. rebentischii* Bleeker, 1859*

147. *C. neglecta* Whitehead, 1968*

148. *C. dussumieri* Valenciennes, 1848*

149. *C. rendahli* Jordan & Seale, 1926

150. *C. grayii* Richardson, 1845*

151. *C. lindmani* Bleeker, 1858*

152. *C. macrognathus* Bleeker, 1852*

153. *C. mystus* (Linnaeus, 1758)*

154. *C. nasus* Schlegel, 1846

Acknowledgements

I cannot adequately express my gratitude to Dr P.J.P. Whitehead, Head of the Fish Section at the British Museum (Natural History), who initially suggested this topic of research and throughout my study gave me every assistance; I was able to draw on his extensive knowledge of clupeoid fishes and freely to use his unpublished as well as published data, as well as to discuss day-to-day problems. He has read the draft of this thesis and made many useful suggestions.

To Mr H.E. Goto, Division of Life Sciences, Imperial College, University of London, I am extremely grateful for kind advice, encouragement and interest.

This work was supported by scholarships from the British Council, which also covered visits to Paris and Leiden, and my sincere gratitude goes to the London and Bangkok staffs for arranging this.

I also benefitted from a Royal Scholarship and for this I am indebted to His Majesty King Bhumibol Adulyadej of Thailand for so graciously bestowing his patronage.

Realizing that the results of my study would be of considerable importance to Thai as well as other fisheries, it was Professors I. Chandhrastitya and B. Indrambarya who initiated and supported my application for a Royal Scholarship. My warmest thanks to them.

My work at the British Museum (Natural History) included the freest use of library, specimen and other facilities and I extend sincere thanks to the authorities. In particular, I am especially indebted to Dr Whitehead and Mr A.C. Wheeler for their help over nearly four and a half years.

Great numbers of type and other specimens were made available for this study by loans to Dr P.J.P. Whitehead from a number of individuals and institutions. I wish to thank the following people: Drs J.R. Paxton and F. Talbot (AMS); Dr J.E. Böhlke (ANSP); Mr L.P. Woods, Drs R.K. Johnson and G.S. Glodek (FMNH); Mrs S. Mongkolprasit (KUMF); Drs W.J. Fink and K.E. Hartel (MCZ); Dr M.-L.

Bauchot (MNHN); Mr J. Karnasut (NIFI); Mr O.K. Sumadhiharga (NIOA); Dr P. Kähsbauer (NMW); Dr M. Boeseman (RMNH); Mrs M.M. Smith and Mr E. Matama (RUSI); Dr W. Klausewitz (SMF); Drs W.N. Eschmeyer and W.C. Freihofer(SU,CAS); Drs S.H. Weitzman, B.B. Collette and L.W. Knapp (USNM); Dr E. Bertelsen (UZMK); Dr J.R. Allen, Mr R. McKay and Dr B. Hutchins (WAM); Dr C. Karrer (ZMB); and Dr P.K. Talwar (ZSI). I am particularly grateful to Dr M.-L. Bauchot and Mlle M. Desoutter of the Museum National d'Histoire Naturelle, Paris, and Dr M. Boeseman of the Rijksmuseum van Natuurlijke Historie, Leiden, who kindly provided working facilities in their institutions during my visits. Thanks are also extended to the following generous people for their courtesy through the donation and information of specimens from different areas: Dr A. Maugé (Madagascar), Dr J.E. Randall (Persian Gulf), Mrs L. Wongrat (Thailand), Mr G.F. Losse (Indonesia), Dr T. Roberts (Borneo and Papua New Guinea), Mr I.A. Ronquillo (Philippines), Dr S.C. Shen (Taiwan) and Mr T. Takita (Japan).

I also wish to acknowledge the Government of Thailand for official granting me leave of absence to England and complete my study.

Material and method

The material examined for this study comprised some 14, 000 specimens, as well as types of about 189 nominal species. These specimens are mainly in the collections of types and other material in the British Museum (Natural History), London; I also examined further specimens in the Rijksmuseum van Natuurlijke Historie, Leiden and the Muséum National d'Histoire Naturelle, Paris. Other type or non-type specimens were kindly lent or donated by some twenty three institutions (listed on p.24) and persons. The majority of the specimens are in spirit, but some dozens of them are dry skins or stuffed specimens; many of the later have been mounted on stands. A few spirit specimens appear to have dried out at sometime in the past. Many dozens are alizarin stained specimens in the British Museum (Natural History), which were prepared by earlier workers. Some useful unpublished data were also supplied to me for the present study by Dr P.J.P. Whitehead.

Most measurements were made with divider and ruler to the nearest one-tenth of a millimeter, but on occasions small and critical species were measured with the help of micrometer. Any character which was suspected of abnormality or damage was omitted. This was also the case with the slightly regenerated caudal part (pseudocaudal) of Coilia; in this genus, the number of anal rays and lateral scales were counted, but only the highest counts were considered worthy of inclusion in the diagnosis of the species, since the slender caudal part of these fishes is often torn off and bears a regenerated fin of various sizes. In the preparation of the scatter diagrams for Coilia the preanal fin length has been used instead of standard length. On the basis of this material, a detailed investigation was carried out on some 47 external and internal characters. However, for the time being and with the advantage of many new and more trenchant systematic characters, only the pertinent measurements have been presented here. Full description of most species is postponed and instead I have preferred to present the data as scatter diagrams, frequency tables, distributions, side view figures of each species and extensive series of illustrations of various characters. The raw data, however, will be used in future studies.

For the present work, morphometric and meristic data of each species or subspecies have been taken from fishes from the widest distributional, and size ranges possible. As it is not the purpose of the present study to investigate geographic variation, the tables of data have been compiled without reference to provenance. In order to illustrate the best frequency and scatter patterns of numerical and morphometric characters, as many specimens as possible or available have been used. In many instances, however, only material of a limited size-range was avialable to me, so that the characters (counts and proportions) given in the tables, figures, keys or description may not necessarily be correct for specimens falling far outside the size range described.

For the osteological study, the individual or series of bones were carefully cut from the specimen(s). This was usually after the digestive tract, its appendages and gas bladder had been thoroughly studied. The whole fish (or just head and tail) was transferred from alcohol into 10% formalin solution for 2-3 months (in some cases up to 6 months depending on the degree of spirit absorbtion of the specimen). The alizarin - KOH method was used to clear and stain the bones. Finally, they were kept in glycerin. The preparation of scales was made after Kobayashi's method (1958); in order to make examination easier, scales were carefully taken from the sampled area (pl. 1a) and preserved in 10% formalin solution for sometime. Later, they were cleared with water or 5% KOH solution. They were then stained with alizarin - KOH to observe and draw the structure in detail. The concentration of formalin and KOH solutions were slightly varied when necessary. Skeletal elements and scales were drawn by using a camera lucida attached to a dissecting microscope.

Aware that the satisfactory identification of a clupeoid species usually depends on a combination of characters, rather full keys have been prepared and coordinated with figures and tables. An attempt has also been made to group genera and species in a phyletic manner to indicate their relationship. However, grouping them by tribes and the definitions of these is postponed until the genera and species from other parts of the world are similarly examined.

Regarding adjectival names for higher taxa, the uniform ending ine, id, oid and iform, as adopted by Norden (1961) and Gosline (1963), have been used for subfamily, family subordinae and ordinal groups, respectively. All the types and their associated specimens which were studied or "fixed" by Whitehead (1964b, 1966a, 1967a, 1969a, 1970), Whitehead, Boeseman & Wheeler (1966) and Talwar & Whitehead (1971) have been reexamined. I included also many other types beyond the limit of those works or overlooked. In the list of specimens examined for each species or subspecies, the institutional abbreviations and catalogue numbers (if catalogued) are given, followed by in parentheses, the number of specimens and size ranges in mm S.L. and the locality data. In the synonymy for each species, only references to original species descriptions or pertinent nominal species that can be recognised with certainty are listed. This is, however, almost a repetition of Whitehead (1973b). Mispelled names or homonyms are neglected. Names are arranged by date priority or page priority, if necessary. Species which have been considered as nomina oblita, nomina nuda or nomina dubia are included. The system of classification above generic level used here is similar to the latest work of Whitehead (loc. cit.).

During this study some museum specimens have been found suitable for neotype designation for certain nominal species and they are indicated for future action if necessary. This has been done with reference to the International Code, Article 75 (C) (5), which requires that a neotype come as nearly as practicable from the original type-locality.

Counts:- All rays in dorsal, anal, pectoral and pelvic fins have been enumerated. The last two elements in the dorsal and anal which (rarely) emerge from the same base are treated as a single ray. The anterior several unbranched fin rays in the dorsal and anal fins were originally separately counted, but they have sometimes been included as a total count in frequency tables. The unbranched pectoral and pelvic fin ray, which is constantly represented by one ray, has always been included in one total count. This is excepted for the filamentous pectoral rays of Coilia, which have been separately counted. Counts were in many cases made on both pectoral fins of the same fish and the data included in the total frequency of pectoral fin rays. This was usually done in species of which only a few specimens were available for the present study.

The principal branched caudal fin rays, which have been found to be constant at 9 + 8, have not been included in the tables; counts of the preceding (segmented or unbranched) upper and lower caudal rays were not made.

Scale counts in the lateral series have been made from the scale just above the angle of the gill opening along the horizontal myoceptum to the level of the posterior edge of the hypural plate. In the case of deciduous scales, the scale pockets or myomeres have been counted instead, since their interspaces are equivalent to that of the scales as clearly illustrated by Wallin (1957). For the count of scale pockets this was made possible by pushing a wet finger against the pockets from tail to head. The scales in transverse series were counted in an oblique natural scale row from dorsal origin downward and backward to mid ventral profile or vice versa. Predorsal scales have been counted on the midline (or the series of scales just beside the mid-dorsal ridge whenever appropriate), from in front of the dorsal origin or predorsal spine to one scale behind the occipital process. Circumpeduncular scales were counted from the scale on the upper midline of the caudal peduncle in a zig-zag pattern down to the scale before the one on the lower midline of the peduncle (or vice versa) and multiplied by two. Prepelvic scutes have been counted from the anteriormost one to the last one just between the pelvic fin origin, if there is one there. Postpelvic scutes have been counted immediately behind the last prepelvic scute to the last posterior one. Gillraker counts have been made on the first gill arch separately for the mediopharyngobranchial (wherever possible) the epibranchial, the ceratobranchial and the hypobranchial; practically, however, they have been presented as total upper gillrakers and lower gillrakers in figures and text. Branchiostegal rays, pseudobranchial filaments and fronto-parietal striae have been counted on either sides. All pyloric caeca, from right and left sides of the stomach, have been counted as a single series.

Measurements:-

Standard length: snout tip to posterior edge of hypural plate, or practically the flexure line anterior to the caudal base.

Total length: snout tip to posterior tip of upper caudal lobe or distal end of caudal fin in Coilia.

Fork length: snout tip to posterior tip of shortest middle caudal ray, but not in case of Coilia. Total length and fork lengths were made only for comparison with data used by early authors.

Body length: vertical distance from origin of dorsal fin to ventral profile, or greatest distance when dorsal fin is absent.

Body width: greatest width of body, usually taken just behind humeral region.

Depth of caudal peduncle: least depth of caudal peduncle.

Head length: snout tip to posterior edge of opercular bone.

Head width: greatest width between both sides of operculum.

Dorsal length of head: snout tip to posterior tip of occipital process.

Snout length: snout tip to anterior border of eye.

Eye diameter: vertical diameter of eye.

Postorbital distance: posterior border of eye to posterior edge of opercular bone.

Interorbital width: distance of narrowest part between eyes.

Upper jaw (maxilla) length: snout tip to posterior end of maxilla.

Height of dorsal fin: distance from origin of dorsal fin to tip of longest anterior ray.

Dorsal fin base: distance from origin of first dorsal fin ray to base of last ray.

Predorsal fin length: snout tip to origin of first dorsal fin ray.

Postdorsal fin length: distance from origin of first dorsal fin ray to anteriormost procurrent caudal ray.

Length of dorsal filament: greatest distance from base of last dorsal ray to tip of filament.

Height of anal fin: distance from origin of anal fin to tip of longest anterior ray.

Anal fin base: distance from origin of first anal fin ray to posterior base of last ray.

Preanal fin length: snout tip to origin of first anal fin ray.

Length of pectoral fin: from origin of upper pectoral fin ray to tip of longest ray; for Coilia, the nonfilamentous pectoral have been measured in the same manner.

Prepectoral fin length: snout tip to origin of uppermost pectoral fin ray.

Length of pectoral filament: from origin of upper pectoral fin ray to tip of filament, or longest filament in Coilia.

Length of pelvic fin: from origin of first pelvic ray to tip of longest ray.

Prepelvic fin length: snout tip to origin of first pelvic fin ray.

Pectoral-pelvic distance: distance from origin of uppermost pectoral fin ray to insertion of first pelvic fin ray.

Pelvic-anal distance: distance from origin of first pelvic fin ray to origin of first anal fin ray.

Length of caudal fin: from origin of anteriormost procurrent caudal ray to tip of upper caudal lobe.

Length of longest gillraker:	from base of longest gillraker on ceratobranchial to its tip.
Length of corresponding gill filament:	from base of gill filament opposite to the longest gillraker to its tip.
Length of outer and inner hemibranchs:	from bases of shortest outer and inner gill filaments at angle of first gill arch to their tips.
Base of pseudobranch:	end of end of basal part of the organ.

Abbreviations of Institutions:-

The following institutional abbreviations are used to denote the location of specimens studies. If no museum number appears, the specimens were uncatalogued at the time I examined them.

AMS	Australian Museum, Sydney (catalog numbers with the prefixes B, I, IA or IB).
ANSP	Academy of Natural Sciences of Philadelphia.
BMNH	British Museum (Natural History), London.
CSIRO	Commonwealth Scientific and Industrial Research Organization, Australia (catalog numbers with the prefix C).
CTNRC	Centre for Thai National Reference Collection, Bangkok.
FMNH	Field Museum of Natural History, Chicago.
KUMF	Kasetsart, University Museum of Fisheries, Bangkok.
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
MFLB	Marine Fisheries Laboratory, Department of Fisheries, Bangkok.
MNHN	Muséum National d'Histoire Naturelle, Paris.
NIFI	National Inland Fisheries Institute, Department of Fisheries, Bangkok.
NIOA	National Institute of Oceanography, Amboina.
NMW	Naturhistorische Museum, Vienna.
QM	Queensland Museum, Brisbane (catalog numbers with the prefix I).

RMNH	Rijksmuseum van Natuurlijke Histoire, Leiden.
RUSI	J.L.B. Smith Institute of Ichthyology, Rhodes University, Grahamstown.
SMF	Natur-Museum und Forschungs-Institut Senckenberg, Frankfurt-Main.
SU	Standford University (collection transferred to California Academy of Sciences, CAS).
USNM	National Museum of Natural History, Smithsonian Institution, Washington.
UZMK	Universitets Zoologiske Museum, Copenhagen (catalog numbers with the prefixes C or CN).
WAM	Western Australian Museum, Perth (catalog numbers with the prefix P).
ZMB	Zoologisches Museum, Humbolt Universität, Berlin, East Germany.
ZMBI	Zoological Museum, Bogor, Indonesia.
ZSI	Zoological Survey of India, Calcutta (catalog numbers with the prefix F).

Systematic account

Key to the clupeoid fishes of the Indo-Pacific region

As I have stated elsewhere in this work, the main function of a key is to make identification practicable. This is by no means easy for clupeoid fishes, especially when morphometric and meristic characters show often considerable ontogenetic variation and when anatomical features are not easily described in a few words. I have preferred, therefore, to let the following keys serve as much for broad diagnoses as for ready identification. To simplify the keys, would be to make them artificial and thus rob them of such phylogenetic information as they contain. Certain identification at species level requires reference to the scatter diagrams, frequency tables, distributional maps and the drawings.

Key to the superfamilies, families and subfamilies of Indo-Pacific clupeoid fishes

1A. Body very elongate, greatly compressed, belly somewhat carinate but no ventral scutes; dorsal much nearer to caudal than to snout tip, pelvics very small with 7 rays; eyelids covering eyes completely; teeth very large and fang-like in both jaws; scales very small, without striations; intestine straight and no pyloric caeca, gas bladder cellular; predorsal bones wanting; (2 species, Chirocentrus dorab and C. nudus, see comprehensive work of Whitehead, 1973b. They are omitted in this study) .... Chirocentroidae

Chirocentridae

1B. Body fairly compressed to cylindrical, belly keeled or rounded, usually with scutes; dorsal (not present in Raconda) origin near mid-point of body; pelvics (not present in Opisthopterus and Raconda) with 7-10 rays; teeth usually small or absent, but caniniform in Clupeichthys and Lycothrissa; scales medium or large, usually with striations; intestine greatly varying, from straight to very long and characteristic coiling, pyloric caeca 1 to very numerous, gas bladder tubular; 1-30 predorsal bones .... Clupeioidae 2

2A. Articulation of lower jaw and posterior end of maxilla always before middle of eye, jaw bones variously dilated, dentary and anguloarticular overlapping each other, without coronoid process, retroarticular present, jaw teeth sometimes absent; if urohyal has thick or expanded edges these are on its ventral portion; hyoid arch short; antorbital without ventral processes, first suborbital never reaching the third one; predorsal bones rod-,T-or cone-shaped; midfrontal ridge not developed; no predorsal scute, scales without posterior striae; branchiostegal membranes overlapping each other anteriorly; pelvic rays 7-9; eyelids with vertical opening in middle (but completely covering eyes in Etrumeus); intestine straight or coiled........... Clupeidae 3

3A. Branchiostegal rays 11-18; belly rounded and without scutes (except for W-shaped pelvic scute); premaxillae very small and rectangular; pectoral base very near to ventral profile, pelvic rays 8; predorsal scales median, alar scales wanting; adipose tissue covering eye completely in Etrumeus or leaving a small vertical slit in Dussumieria; gas bladder open to outside at anus, intestine straight; 2-3 fused epurals .... Dussumieriinae, p. 32

3B. Branchiostegal rays 4-8; belly keeled or rounded with scutes (except Spratelloides); premaxillae large and elongated; pectoral base well above ventral profile, pelvic rays 7-9; predorsal scales usually paired and overlapping in midline, but not in Clupanodon and Konosirus; wide vertical slit in adipose tissue covering eye; gas bladder forming a blind end or open to outside at anus; 1-3 epurals 4

4A. Anal short, always behind dorsal fin base with 10-28 rays, pelvics present, with 7-9 rays; mouth inferior, subterminal or slightly superior; fronto-parietal ridges absent, ill defined or with well developed striae; predorsal scales usually median, sometimes paired and overlapping in midline; branchiostegal rays 4-8; lower gillrakers 10-508, gillrakers absent on posterior face of 2nd epibranchial; gas bladder without posterior prolongation (except for Clupanodon and Konosirus); midcaudal gap between hypurals 2-3 always present, 1-3 epurals 5

5A. Body variously compressed to cylindrical; upper jaw without notch at centre, teeth in jaws usually present; no dorsal filament; pelvic rays 7-9; alar scales present or absent; intestine short except in Sardinella (Sardinella) and without 3rd primary flexure, pyloric caeca long, stomach normal, pneumatic duct emerging from distal end of elongated fundus of stomach; 1-3 epiurals; branchiostegal rays 4-7; gillrakers and pyloric caeca usually fewer in numbers; humeral spot wanting or very pale*.. 6

6A. Predorsal scales median; total ventral scutes 1-21 (absent in Sprattelloides); no frontoparietal striae; single and elongate pectoral axillary scales usually present; upper and lower gillrakers 6-14 + 13-37; gas bladder forming a blind end and not open to outside at anus; pyloric caeca 1-14; 1-2 epurals; small fishes, attaining about 86.0 mm S.L. 7

7A. First supramaxilla wanting; jaw teeth villiform or caniniform; anal origin slightly behind dorsal, with 13-21 rays, pelvic with 7-8 rays, its base just before or below dorsal origin, ventral scutes usually present but sometimes very poorly developed; alar scales wanting; upper and lower gillrakers 6-14 + 13-30; branchiostegal rays 5-7, 1-2 rays on posterior ceratohyal; fundus of stomach short and bluntly rounded posteriorly, pyloric caeca 1-6; dermosphenotic vestigial; cross-section of urohyal I-or abbreviated Y-shaped; freshwater or estuarine .... Pellonulinae, p. 32

7B. First as well as 2nd supramaxillae present; jaw teeth villiform or absent; anal very near to caudal, with 10-14 rays, pelvic with 8 rays, its base below middle of dorsal; ventral scutes absent except W-shaped pelvic scute; alar scales present; upper and lower gillrakers 7-12 + 19-37; branchiostegal rays 6-7, 3 of these on posterior ceratohyal; fundus of

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*A distinct humeral spot is exceptionally present in Herklotsichthys gotoi n.sp.

stomach very long and tapering posteriorly, pyloric caeca 8-14; derosphenotic absent; cross-section of urohyal strongly inverted Y-shaped; marine (single Indo-Pacific genus, Spratelloides) .... Spratelloidinae, p. 42

6B. Predorsal scales usually median (except paired and overlapping in most species of Sardinella (Clupeonia)); total ventral scutes 25-35, very well developed; frontoparietal striae distinct and well defined; pectoral axillary scales consisting of more than one scale or apparently absent; upper and lower gillrakers 12-24 + 30-254; gas bladder open to outside at anus (except in Escualosa); pyloric caeca 16-233, 2-3 epurals; larger fishes, usually attaining about 225 mm S.L. .... Clupeinae, p. 34

5B. Body fairly compressed; upper jaw with either a distinct median notch or the premaxillae deep, no 1st supramaxilla and the dentary flared outwards; no teeth in jaw*; dorsal filament sometimes present, pelvic rays 8; alar scales absent**;intestine very long and forming a 3rd primary flexure (except some species of Alosinae), pyloric caeca short and very numerous, stomach gizzard-like or muscular without fundus, pneumatic duct emerging from posterior surface of cadiac stomach; 2-3 epurals; branchiostegal rays 5-6; pyloric caeca usually uncountable; humeral spot usually present and distinct 8

8A. Mouth subterminal, most of lower jaw overlapped by upper when mouth closed; both supramaxillae well developed; no dorsal filament; stomach muscular or semi-gizzard-like and horizontal, 3rd primary flexure of intestine sometimes present, pyloric caeca short or moderate in length; pectoral axillary scales single and moderately elongated in Tenualosa (but consist of several small scales in Hilsa and Gudusia variegata); branchiostegal rays 6 .... Alosinae, p. 35

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* Microscopic teeth are developed on premaxilla of Konosirus punctatus.

** Alar scales weakly developed in Hilsa (pers. observ.), Alosa, Pomolobus and Brevoortia (fide Svetovidov, 1964) of the Alosinae.

8B. Mouth inferior or subterminal, lower jaw usually hardly invested by upper jaw when mouth closed, 1st supramaxilla wanting*, maxilla usually dilated anteriorly; dorsal filament present or absent; stomach gizzard-like and vertical, 3rd primary flexure of intestine present, pyloric caeca short and extremely numerous; pectoral axillary scales consisting of more than one small scale, or else absent; branchiostegal rays 5-6 .... Dorosomatinae, p. 36

4B. Anal long, its origin just behind base of last dorsal ray or usually before it, with 34-93 rays, pelvic rays 7 or absent; mouth superior, lower jaw projecting strongly; frontoparietal ridges very elongated and narrow; predorsal scales median; branchiostegal rays usually 6, rarely 5 or 7, lower gillrakers 17-28, several rudimentary gillrakers present on posterior face of 2nd epibranchial; gas bladder with short or long single or bifid posterior prolongations (except Pellona), pneumatic duct emerging from a short distance behind oesophagus; no midcaudal gap between hypurals 1-2; 3 epurals ...... Pristigasterinae, p.38

2B. Articulation of lower jaw and posterior end of maxilla always behind middle of eye, both jaws slender, the anterior shaft-like end of anguloarticular inserting into posterior slit of dentary, coronoid process present, retroarticular absent, jaw teeth always present; urohyal usually forming thick or expanded edges on its upper portion, hyoid arch long; antorbital large, with two ventral processes, first and third suborbitals greatly produced posteriorly and reaching each other; predorsal bones rod-shape; midfrontal ridge slightly or greatly developed; predorsal scute usually present (absent in Engraulis and most Stolephorus), scales with posterior striae or reticulations, predorsal scales median, branchiostegal membranes not overlapping each other anteriorly; 7 or 10 pelvic rays; adipose tissue covering eyes completely; intestine straight (but twisted in Engraulis).. 9

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* 1ts as well as 2nd supramaxillae present in North American species of Dorosoma.

9A. Body more or less cylindrical or compressed and oblong; caudal forked; mouth inferior or superior, 1st supramaxilla more or less developed or absent; pectorals normal, axillary scale single and elongate, pelvic rays 7, anal rays 14-81; gillrakers present on posterior face of 3rd gill arch (except Thryssa (Scutengraulis) rastrosa), branchiostegal rays 9-20, posterior ones increasingly expanded; gas bladder sometimes partly (anterior half) or wholely modified into a very slender tube; pyloric caeca 7-43, hypural series vertically truncate posteriorly; 2 or usually 3 epurals .... Engraulinae, p. 62

9B. Body 'rat-tailed', tapering posteriorly, caudal pointed and confluent with anal; mouth inferior, both supramaxillae well developed; upper pectoral rays modified into 9-19 free filaments, axillary scale broad and lying under upper pectoral filaments, pelvic rays 7 or 10, anal rays 73-117; no gillrakers on posterior face of 3rd gill arch; branchiostegal rays 9-13, all slender; gas bladder large and forming a blind end before anus, pneumatic duct emerging from a short distance behind oesophagus; pyloric caeca 7-19; hypural series forming an oblique edge posteriorly; 0-2 epurals (single known genus, Coilia) ... Coiliinae, p. 78

FAMILY CLUPEIDAE

Dussumieriinae: key to the genera

1A. A single (2nd) supramaxilla; adipose eyelids covering eyes entirely; cleithral lobe very narrow and long; anal rays 10-13, pectoral rays 14-17, pelvics below last dorsal ray or behind it; scales horizontally ovate, isthmus entirely scales, no basal scaly sheathes on dorsal and anal, pectoral axillary scale long, predorsal scales 15-19; pneumatic duct emerging from posterior end of fundus of stomach, pyloric caeca very short and extremely numerous; antorbital large; about 13 predorsal bones; midcaudal gap between hypurals 2 and 3 very deep; 3 epurals; cutaneous canals on maxilla very well developed .... Etrumeus, p. 39

1B. Two supramaxillae present; adipose eyelids only partly covering eyes, leaving a small vertical slit dorsally; cleithral lobe moderately developed; anal rays 14-18, pectoral rays 12-15, pelvics under dorsal base; scales verticaly ovate, only basal half of isthmus covered with scales, basal scaly sheathes on dorsal and anal moderately developed, many small and pointed pectoral axillary scales, predorsal scales 22-29; pneumatic duct emerging from just behind oesophagus, pyloric caeca 27-60 and finger-like; antorbital very small; about 20 predorsal bones; midcaudal gap between hypurals 2 and 3 moderately developed; 2 fused epurals; no cutaneous canals on maxilla..Dussumieria, p. 39

Pellonulinae: key to the genera

1A. Teeth of jaws, vomer and palatines weakly developed or absent, but sometimes a group of canine teeth on symphysis of lower jaw, premaxillae without teeth on buccal surface; maxilla short, reaching not further than front border of eyes; two separate posterior anal rays sometimes present, pelvic with 8 rays, its base usually slightly before dorsal origin (but just behind it in Dayella); anterior longitudinal striae on scales usually present, scales on isthmus normally overlapping each other; various parts of Indo-Pacific 2

2A. Anal without separate rays; lower portion of 3rd suborbital narrow, exposed portion of interoperculum narrow; 2 epurals; cross-section of urohyal an inverted T or Y or rod-shape 3

3A. Belly rounded; prepelvic scutes lacking keels, no postpelvic scutes, posterior interpelvic scale median; lower gillrakers 24-30; endemic to South Indian Peninsula 4

4A. Gillrakers absent on posterior face of 3rd epibranchial; teeth in jaws weakly developed; 2nd supramaxilla much shorter than half length of maxilla; prepelvic scutes 5-8; branhiostegal rays 5-6; pelvic base just before dorsal origin (monotypic, E. fluviatilis) .... Ehirava, p. 90

4B. Gillrakers present on posterior face of 3rd epibranchial; teeth in jaws moderately developed; 2nd supramaxilla slightly longer than half length of maxilla; prepelvic scutes 1-4; branchiostegal rays 5; pelvic base just behind dorsal origin (monotypic, D. malabarica) .... Dayella, p. 91

3B. Belly keeled; pre- and postpelvic scutes prominent, interpelvic scales paired; lower gillrakers 12-24; endemic to S.E. Asia and Papua New Guinea .... Clupeoides, p. 40

2B. Anal with last two rays separate; lower portion of 3rd suborbital expanded anteroventrally, exposed portion of interoperculum broad; 1 large epural; cross-section of urohyal rod-shaped; teeth in jaws very small; lower gillrakers 19-27 .... Corica, p. 41

1B. Both jaws with canine-like teeth throughout their entire lengths; buccal face of premaxilla, as well as vomer and palatines, with a group of large teeth; maxilla long and reaching slightly behind front border of eye; last two anal rays separated from rest, pelvic with 7-8 rays, its base about below dorsal origin; striae on scales vertical, but widely interrupted at centre and devoid of anterior longitudinal striae, interpelvic scales paired, scales on base of isthmus paired and not overlap in midline; 2 epurals; cross-section of urohyal rod-shaped; lower gillrakers 13-19; freshwaters of South China Sea area .... Clupeichthys, p. 41

Spratelloidinae: a single genus, Spratelloides (see p. 42).

Clupeinae: key to the genera

1A. Inner surface of oesophagus lined with oblique series of polygonal mucosal buds; pyloric caeca 33-205; lower gill rakers 33-254; predorsal scales usually paired and overlapping in midline (except some of Sardinella (Clupeonia) species), pectoral axillary scales usually a series of pointed scales; last two anal rays enlarged and produced; teeth on palatines and pterygoids weakly developed or apparently absent; pelvic rays 8-9; 2-3 epurals .... Sardinella, p. 43

1B. Inner surface of oesophagus lined with longitudinal folds or longitudinal series of polygonal mucosal buds; pyloric caeca 12-233; lower gill-rakers 26-52; predorsal scales median; pectoral axillary scales apparently absent (but well-developed in Amblygaster); prominent patches of teeth on palatines and pterygoids (except in some species of Herklotsichthys); pelvic rays 7-8; 3 epurals........................ 2

2A. Pelvic rays 8; last two anal rays either slightly enlarged and produced or normal, pectoral rays 14-19; branchiostegal rays usually 6, rarely 7; transverse scales 11-12,; gas bladder opens to outside at anus; posterior part of maxilla and 2nd supramaxilla not much enlarged; body usually metallic blue on back sometimes with series of dark spots along flanks or back 3

3A. Vertical striae of scales interrupted at centre; frontoparietal striae 8-19; last two anal rays slightly enlarged and produced, tip of pectorals well before dorsal origin; lower posterior part of 2nd supramaxilla about the same size of the upper part; lower portion of 3rd suborbital normal; lower gillrakers 26-43; pyloric caeca 85-233; body rather rounded, belly only slightly keeled.... Amblygaster, p. 47

3B. Vertical striae of scales continuous; frontoparietal striae 3-8; last two anal rays normal or very slightly enlarged, tip of pectorals reaching below dorsal origin or very nearly so; lower posterior part of 2nd supramaxilla much larger than the upper part; lower portion of 3rd suborbital more or less expanded anteroventrally; lower gillrakers 28-52; pyloric caeca 17-130; body moderately rounded, more usually compressed, belly distinctly keeled.... Herklotsichthys, p. 48

2B. Pelvic rays 7; last two anal rays normal; pectoral rays 12-15; branchiostegal rays 4-5; transverse scales 10; gas bladder forming a blind end before anus; posterior part of maxilla and 2nd supramaxilla greatly enlarged and more or less rectangular; frontoparietal striae 7-11; lower gillrakers 27-41; pyloric caeca 12; body lacking metallic blue on back but with two dark narrow lines on midline of back and a silvery lateral bond along flanks ..... Escualosa, p. 50

Alosinae: key to the genera

1A. Scales large, with many vertical striae, evenly arranged in horizontal series along flanks, lateral scales 37-47, transverse scales 13-19, circumpeduncular scales 12-18, predorsal scales 13-21; pelvics usually below anterior dorsal rays; snout usually longer than eye (or nearly so in young fish); stomach muscular or semi-gizzard-like, intestine with or without 3rd primary flexure 2

2A. Scales fimbriated and perforated, pectoral axillary scales a series of pointed scales, predorsal scales 13-16, circumpeduncular scales 12-14, alar scales obsolete; frontoparietal ridges well developed and with 8-14 striae; premaxillae short; cleithral lobe prominent; gillrakers on inner arches curled outwards; gill filaments of outer hemibranch on 1st gill arch not more than half length of the inner ones; inner surface of oesophagus lined with mucosal buds; pyloric caeca more or less finger-like and restricted to duodenum; gas bladder open to outside at anus; 3 epurals .... Hilsa, p. 156

2B. Scales not fimbriated or perforated, pectoral axillary scale single and moderately elongated, predorsal scales 17-21 (except 14-15 for Tenualosa toli), circumpeduncular scales usually 16, alar scales wanting, frontoparietal striae slightly developed and covered by skin or absent; premaxillae long or moderate; cleithral lobe slightly developed; gill-rakers on inner arches normally straight or only slightly curled; gill filaments of outer hemibranch on 1st gill arch more than half length of the inner ones; surface of oesophagus with longitudinal mucosal folds or buds; pyloric caeca short and reaching some way along anterior part of intestine; gas bladder open or not to outside at anus; 2-3 epurals .... Tenualosa, p. 50

1B. Scales small, with only a few wavy vertical striae, only arranged in regular series along upper part of flanks, lateral scales 77-91, transverse scales 30-36, circumpeduncular scales 32-36, predorsal scales 21-39, dorsal scaly sheath very low; pelvic base usually just before dorsal origin; snout much shorter than eye; inner surface of oesophagus lined with longitudinal mucosal folds, stomach semi-gizzard-like, intestine very long and forming a 3rd primary flexure, gas bladder not open to outside at anus; 2 epurals..... Gudusia, p. 52

Dorosomatinae: key to the genera

1A. Predorsal scales paired, overlapping or not overlapping in midline, anterior postdorsal scales without posterior median extension; maxilla usually expanded and bending downwards posteriorly, 2nd supramaxilla tapering anteriorly; branchiostegal rays 5-6; 2-3 epurals; marine or freshwater 2

2A. Predorsal scales paired, but not overlapping in midline; last dorsal ray filamentous; mouth large, subterminal, upper jaw straight and reaching slightly behind front border of eye, anteroventral lamina of maxilla slightly expanded, edge of lower jaw only slightly flared outwards; intestine very long, the loop formed by the 3rd primary flexure bent downward initially; gas bladder with a short posterior prolongation and open to outside at anus; branchiostegal rays 6, 2 on posterior ceratohyal; marine 3

3A. Premaxilla shorter than half length of maxilla, untoothed; lateral scales 45-50, circumpeduncular scales 18, predorsal scales 21-25 pairs, a small pectoral axillary scale; total ventral scutes 28-30; intestinal loop formed by 3rd primary flexure bending downward and backward; cross-section of urohyal X-shaped; 2 epurals; a dark humeral spot followed by several more along flanks; N. China Sea, Andaman Sea (monotypic, C. thrissa)........................... Clupanodon, p. 170

3B. Premaxilla longer than half length of maxilla and exceptionally with villiform teeth; lateral scales 51-55, circumpeduncular scales 18-24, predorsal scales 26-31 pairs, pectoral axillary scales consist of a series of small scales; total ventral scutes 32-36; last anal ray prolonged into a short filament; intestinal loop formed by 3rd primary flexure bending downwards and forwards; cross-section of urohyal inverted Y-shaped; 3 epurals; a humeral spot present, upper half of flanks with several rows of smaller dark spots; N. China Sea, Japan (monotypic, K. punctatus) .... Konosirus, p. 172

2B. Predorsal scales paired and overlapping in midline; last dorsal ray filamentous or normal; mouth small, inferior, upper jaw bending downwards posteriorly and rarely reaching front border of eye, antero-ventral lamina of maxilla greatly expanded, premaxillae large, edge of lower jaw greatly flared outwards before end of maxilla; intestine long, loop formed by 3rd primary flexure only bending backwards; gas bladder not open to outside at anus; branchiostegal rays 5-6, 1 on posterior ceratohyal; marine or freshwater 4

4A. Last dorsal ray filamentous; 2-3 epurals; branchiostegal rays 5-6; marine or freshwater of Indo-Pacific.... Nematalosa, p. 53

4B. Last dorsal ray normal; 3 epurals; branchiostegal rays 5; freshwater of northern coast of Bay of Bengal...... Gonialosa, p. 56

1B. Predorsal scales median, all postdorsal scales with posterior median extension, maxilla straight and tapering posteriorly, 2nd supramaxilla very slender; gas bladder not open to outside at anus; branchiostegal rays 5, 2 on posterior ceratobranchial; 2-3 epurals; marine .... Anodontostoma, p. 57

Pristigasterinae: key to the genera

1A. Toothed hypomaxilla present; several anteriormost prepelvic scutes greatly enlarged; pelvics moderate, 8.5 - 10.3 % S.L.; about 7 predorsal bones; gas bladder without postcoelomic prolongation .... Pellona, p. 58

1B. No toothed hypomaxilla; anteriormost prepelvic scutes normal; pelvics small, 3.1 - 7.4 % S.L.; predorsal bones 9-30; gas bladder with postcoelomic prolongation 2

2A. Anal rays 34-53, pelvics present, first pectoral ray only slightly ossified; head large, 21.2 - 30.0 % S.L., space enclosed by fronto-parietal ridges broad; exposed portion of suboperculum more or less rectangular; mouth moderately oblique; pyloric caeca 15-83; gas bladder with short, long or long and bifid postcoelomic prolongations; about 9 predorsal bones .... Ilisha, p. 58

2B. Anal rays 51-92, pelvics absent, first pectoral ray greatly ossified; head narrow and short 16.1 - 22.9 % S.L., space enclosed by frontoparietal ridges narrowly elongated; exposed portion of suboperculum very narrow; mouth strongly oblique; pyloric caeca 22-31; gas bladder with a pair of long postcoelomic prolongations; predorsal bones 21-30 3

3A. Dorsal present, anal rays 51-65; head 19.1 - 22.9 % S.L.; distal end of maxilla bluntly rounded and scarcely projecting beyond 2nd supra-maxilla; predorsal bones about 21; scales with vertical interrupted striae; lateral scales 46-56; pyloric caeca 22-31 .... Opisthopterus, p. 60

3B. Dorsal absent, anal rays 81-92; head 16.1 - 18.0 % S.L.; maxilla slightly tapering posteriorly; predorsal bones 30; scales thin and without striae; lateral scales 60-68; pyloric caeca 23. (monotypic, R. russeliana) .... Raconda, p. 217

Etrumeus: key to the species

1A. Upper and lower gillrakers 12-15 + 28-35 in fish larger than 50.0 mm S.L.; dorsal rays usually 20-22, anal rays 10-12; pelvics inserting just behind dorsal base (or below it in very young fish); 2nd supra-maxilla slightly shorter than half length of maxilla; lateral scales 52-58, predorsal scales 16-18, transverse scales 12-15 .... E. teres, p. 83

2A. Upper and lower gillrakers 16-18 + 36-39 in fish larger than 50.0 mm S.L.; dorsal rays 18-20, anal rays 12-13; pelvics inserting below last dorsal ray (or just before it in very young fish); 2nd supramaxilla slightly longer than half length of maxilla; lateral scales 48-51, predorsal scales 15, transverse scales 11 .... E. whiteheadi n.sp., p. 84

Dussumieria: key to the species

1A. Depth of body usually 16.0 - 22.2 % S.L.; lower gillrakers usually 22-32, gillrakers scattered with asperities along edges; branchiostegal rays usually 13-17; pyloric caeca usually 41-60; exposed portion of scales normally transparent .... D. elopsoides, p. 85

2B. Depth of body usually 22.2 - 28.5 % S.L.; lower gillrakers 19-26, gillrakers densely toothed, with asperities along edges; branchiostegal rays usually 12-15; pyloric caeca usually 27-41; exposed portion of scales with many horizontal apical marginal lines .... D. acuta, p. 88

Ehirava: monotypic, see generic key (p. 33)

Dayella: monotypic, see generic key (p. 33)

Clupeoides: key to the species

1A. 2nd supramaxilla longer than half length of maxilla, premaxillae elongated and minutely toothed, teeth on symphysis of lower jaw villiform; upper corner of operculum slightly below upper border of eye; no striae on posterior half of scales, lateral scales 33-39, predorsal scales 12-14, transverse scales 10-11, pectoral axillary scale moderately developed, its length 40-50 % of pectoral length; anal rays 15-19; gillrakers 9-19 + 12-24, slender and with asperities; 2 branchiostegal rays on posterior ceratohyal; pneumatic duct without a V-shaped bend; S. China Sea 2

2A. Upper and lower procurrent caudal rays distinctly spinose; gillrakers 9-12 + 18-24; ventral scutes 9-12 + 6-9; lateral scales 35-39; depth of caudal peduncle 11.3 - 12.5 % S.L.; head and body without prominent markings .... _C. borneensis_, p. 92

2B. Upper and lower procurrent caudal rays slightly spinose; gillrakers 6-10 + 12-19; ventral scutes 7 + 6; lateral scales 33-35; depth of caudal peduncle 14 % S.L.; tip of snout, lower jaw and back dotted with dark melanophores, a silvery band along flanks .... _C. hypselosoma_, p. 93

1B. 2nd supramaxilla shorter than half length of maxilla, premaxillae short, blunt and toothless, teeth on symphysis of lower jaw caniniform; upper corner of operculum opposite upper border of eye; several striae on posterior half of scales, lateral scales 38-42, predorsal scales 14-19, transverse scales 11-12, pectoral axillary scale vestigial or absent; anal rays 17-22; gillrakers 9-13 + 15-19, broad and without asperities; 1 branchiostegal ray on posterior ceratohyal; pneumatic duct with a V-shaped bend; pyloric caeca 4-5; a prominent band along flanks, tapering anteriorly; Papua New Guinea 3

3A. Body depth 17-3 - 22.4 % S.L., depth of caudal peduncle 7.9 - 10.2 % S.L., head length 23.0 - 26.7 % S.L., eyes 5.5 - 9.5 % S.L., upper jaw length 7.5 - 10.6 % S.L.; predorsal scales 17-19; pyloric caeca 5 .... C. papuensis, p. 94

3B. Body depth 25.9 - 28.7 % S.L., depth of caudal peduncle 10.7 - 12.8 % S.L., head length 22.0 - 22.9 % S.L., eyes 5.5 - 6.9 % S.L., upper jaw length 5.8 - 7.2 % S.L.; predorsal scales 14-15; pyloric caeca 4 .... C. venulosus, p. 96

Corica: key to the species

1A. Upper and lower gillrakers 10-13 + 23-27, total 33-40; lower gillrakers on 2nd gill arch 22-23; predorsal bones 9, pin-shaped; pyloric caeca 4; estuarines of the Gulf of Thailand and S.W. Borneo .... C. laciniata, p. 96

1B. Upper and lower gillraker 9-11 + 19-21, total 28-32; lower gillrakers on 2nd gill arch 15-18; predorsal bones 12, rod-shaped; pyloric caeca 5; Ganges estuary and S.W. Borneo .... C. soborna, p. 97

Clupeichthys: key to the species

1A. Pelvic rays 8; branchiostegal rays 6-7; scutes 8-10 + 6-8, total usually 15-17; scales horizontally oblong and with interrupted vertical striae, predorsal scales 12-18, transverse scales 9-10, pectoral axillary scales present, 23 - 65 % S.L. of pectoral length; eyes 7.3 - 8.8 % S.L.; anal origin more or less behind tip of last dorsal ray; lower gillrakers 15-19; pyloric caeca 5-6; a band along flanks, at least on caudal peduncle 2

2A. Pectoral axillary scale 51 - 65 % S.L. of pectoral length; total anal rays 16-18 + 2; predorsal scales 15-18; pseudobranchial filaments 12-16; a faint dusky band usually present along posterior part of flanks, a pair of narrow pigmented lines along midline of back from dorsal to caudal; Kapuas river, S.W. Borneo..... C. bleekeri, p. 99

2B. Pectoral axillary scale 23 - 53 % S.L. of pectoral length; total anal rays 12-17 + 2; predorsal scales 12-15; pseudobranchial filaments 10-13 3

3A. Gillrakers 8-10 + 17-19; lateral scales 33-38; predorsal scales 12-15; a dusky band along flanks fading anteriorly, scattered dark dots sometimes present on head, a pair of pigmented lines from occiput along midline of back to caudal; N.E. Thailand .... C. aesarnensis n. sp., p. 99

3B. Gillrakers 8 + 15-16; lateral scales 33-34; predorsal scales 12; a distinct silvery band along flanks, head without dark dots, a faint band of microscopic dots along midline of back from dorsal to caudal; Sumatra and middle courses of Chao Phraya river, Thailand .... C. goniognathus, p. 101

1B. Pelvic rays 7; branchiostegal rays 5; scutes 7-9 + 4-6, total 11-14; scales vertically oblong and without anterior vertical striae, predorsal scales 10-11, transverse scales 11; pectoral axillary scales vestigial or wanting; eyes 8.9 - 10.0 % S.L.; anal origin below base of last dorsal ray; lower gillrakers 13-15; pyloric caeca 4; a broad band along flanks, a longitudinal series of black dots usually present at middle of its posterior part; Perak river, Malaya .... C. perakensis, p. 102

Spratelloides: key to the species

1A. A silvery grey band along flanks, caudal without prominent dark markings; scales with interrupted striae at centre; maxilla toothed, posterior lower portion of 2nd supramaxilla larger than upper portion; parhypural process bending downwards and slightly curved forwards; anal rays 11-13; gillrakers 7-13 + 9-37 2

2A. Silvery band along flanks evenly distinctive throughout its course; lateral scales 42-48; pyloric caeca 11-14; pneumatic duct inserting to gas bladder at some distance far behind pelvic base; widely distributed .... S. gracilis, p. 102

2B. Silvery band along flanks fading anteriorly; lateral scales 39-43; pyloric caeca 8-10; pneumatic duct inserting to gas bladder at just behind pelvic base; endemic to east of Papua New Guinea .... S. lewisi n. sp., p. 104

1B. No band along flanks, 2 prominent dark streaks on caudal base; scales with continuous vertical striae; maxilla edentulous posterior lower portion of 2nd supramaxilla about the same size as upper portion; parhypural process bending downwards and backwards; anal rays 10-11; gillrakers 9-12 + 26-35 3

3A. Posterior edge of scales smoothed, lateral scales 35-41, transverse scales 6-7, predorsal scales 8-13, pectoral axillary scale usually 60 - 81 % S.L. of pectoral length; widely distributed .... S. delicatulus, p. 105

3B. Posterior edge of scales toothed, lateral scales 42-46, transverse scales 8-9, predorsal scales 13-16, pectoral axillary scale usually 49 - 63 % of pectoral length; endemic to S.E. Australia and New Zealand .... S. robustus, p. 108

Sardinella: key to the subgenera

1A. Pelvic rays 9, anal rays 15-18; scales neither fimbriated nor perforated, vertical striae interrupted at centre, transverse scales usually 12-13; lower gillrakers 100-254; pseudobranchial filaments 18-28; intestine very long and forming a double recurved loop at front of stomach; pyloric caeca 133-205; 2 epurals, the upper half of anterior one branched .... Sardinella (Sardinella), p. 44

1B. Pelvic rays 8, anal rays 17-22; scales usually fimbriated or perforated, sometimes simple, vertical striae characteristic for species, varying from interrupted or overlapping to continuous at centre of scales; transverse scales usually 11; lower gillrakers 33-134; pseudobranchial filaments 11-22; intestine forming a single normal loop below stomach; pyloric caeca 33-76; 3 or rarely 2 normal epurals .... Sardinella (Clupeonia), p. 44

Sardinella (Sardinella): key to the species

1A. Head length 29-35 % S.L.; gillrakers 117-241 + 150-253, those on inner gill arches distinctly curled outwards; anterior double loop of intestine on both sides of oesophagus well developed; exposed portion of scales with fine circuli; confined to coasts of India and N.W. coasts of Arabian Sea .... S. (S.) longiceps, p. 108

1B. Head shorter 26-29 % S.L.; gillrakers 51-166 + 77-188, those on inner gill arches moderately, slightly or not curled outwards; anterior double loop of intestine on both sides of oesophagus moderately or incompletely developed; exposed portion of scales with or without circuli; coasts of Kenya, Tanzania or China and S.E. Asia 2

2A. Gillrakers 108-166 + 143-188, those on inner gill arches moderately curled outwards; pyloric caeca 160-205; exposed part of scales with very fine circuli; endemic to coasts of Kenya and Tanzania .... S. (S.) neglecta n.sp., p. 110

2B. Gillrakers 51-153 + 77-188, those on inner gill arches either straight or curled outwards; pyloric caeca 133-151; exposed part of scales usually without circuli; China and S.E. Asia .... S. (S.) lemuru, p. 111

Sardinella (Clupeonia): key to the species

1A. Predorsal scales paired and overlapping; origin of dorsal usually with (but sometimes without) a dark spot, tips of caudal lobes usually without jet black marking (except for S. (C.) hualiensis and probably S. (C.) fijiense) 2

2A. Total ventral scutes 30-35, but usually 32-34; vertical striae on scales interrupted and with a wide gap at centre; origin of dorsal with a dark spot 3

3A. Body depth 30-34 % S.L.; gillrakers 52-61 + 88-101, without asperities; scales slightly fimbriated but not perforated; pyloric caeca 39; endemic to Mauritius.................. S. (C.) jussieui, p.114

3B. Body depth usually 22-30 % S.L.; gillrakers 18-46 + 38-77, with asperities; scales fimbriated and perforated; pyloric caeca 53-76.... 4

4A. Body depth usually 22 - 30 % S.L.; gillrakers 18-46 +38-77; perforations on scales fewer and usually concentrated on posterior middle of scales; Northern coasts of Arabian Sea and Persian Gulf .... S. (C.) sindensis, p.115

4B. Body depth usually 24 - 30 % S.L.; gillrakers 18-31 + 38-59; perforations on scales numerous and evenly scattered; Indo-Pacific .... S. (C.) gibbosa, p. 117

2B. Total ventral scutes 28-33, but usually 29-32; vertical striae on scales interrupted, overlapping or continuous at centre; dorsal origin with or without a dark spot 5

5A. Dorsal origin with a dark spot; scales fimbriated and perforated, vertical striae interrupted at centre (but some occasionally continuous in S. (C.) dayi) 6

6A. Gillrakers 20-47 + 41-82; body depth 25-39 % S.L. 7

7A. Gillrakers 27-47 + 54-82; body depth 25 - 34 % S.L.; scales slightly perforated and usually with a produced posterior edge at middle in adults; pyloric caeca 42-68 .... S. (C.) fimbriata, p.119

7B. Gillrakers 20-36 + 41-68; body depth 25 - 39 % S.L.; scales densely perforated in adult, posterior fimbriated edge normal; pyloric caeca 33-62 .... S. (C.) albella, p.121

6B. Gillrakers 54-78 + 88-126; body depth 36 - 37 % S.L. .... S. (C.) dayi, p.124

5B. Dorsal origin with or without a dark spot; scales either fimbriated and perforated or entire, vertical striae overlapping or continuous at centre 8

8A. Scales neither fimbriated nor perforated; gillrakers 33-103 + 61-134; body depth 29 - 31 % S.L.; origin of dorsal without a dark spot 9

9A. Gillrakers 51-103 + 87-134, slender and smooth; anal rays 18; pelvics below 6th-7th dorsal rays; urohyal narrow; several faint dark streaks usually present along upper part of flanks, tips of dorsal and caudal lobes dusky or black; marine, confined to Fiji and New Guinea .... S. (C.) fijiense, p.125

9B. Gillrakers 33-40 + 61-74, scattered with asperities; anal rays 19-22; pelvics below 7th-10th dorsal rays; urohyal deep; flanks without dark streaks, dorsal and caudal without dark markings; endemic to freshwater lake of Luzon, Philippines .... S. (C.) tawilis, p. 126

8B. Scales fimbriated and perforated; gillrakers 21-42 + 42-74; body depth 24 - 39 % S.L. 10

10A. Origin of dorsal with a dark spot; pyloric caeca 60-73 11

11A. Gillrakers 28-35 + 51-66; body depth 29 - 34 % S.L.; tips of dorsal and caudal lobes black; Taiwan .... S. (C.) hualiensis, p.126

11B. Gillrakers 25-39 + 48-67; body depth 30 - 39 % S.L.; dorsal and caudal without dark markings; Madagascar, India, S.E. Asia and N. Australia ... . S. (C.) brachysoma, p.127

10B. Origin of dorsal without a dark spot; pyloric caeca 38-44 12

12A. Gillrakers 36-42 + 63-74; body depth 32 - 36 % S.L.; perforations on scales well developed; 3 epurals ..... S. (C.) richardsoni n.sp., p.129

12B. Gillrakers 21-31 + 42-58; body depth 24 - 33 % S.L.; perforations on scales slightly developed; 2 epurals... S. (C.) zunasi, p.130

1B. At least some predorsal scales median; origin of dorsal without a dark spot, tips of caudal lobes jet black (except S. (C.) marquesensis); gillrakers 15-58 + 28-81; vertical striae on scales interrupted and with a wide gap at centre; lower posterior portion of 2nd supramaxilla larger than upper portion 13

13A. Scales neither fimbriated nor perforated, lateral scales 38-42; predorsal scales 11-15; dorsal rays 16-18, anal rays 17-20, pelvics below 4th-8th dorsal rays; scutes 15-18 + 11-14, total 27-31; gillrakers apparently naked; one or more obscure dark streaks along flanks 14

14A. Caudal without prominent markings, a faint dark band along flanks; gillrakers 15-58 + 27-81; eyes 6.9-8.4, mean 7.9 % S.L.; endemic to Marquesas Islands .... _S._ (_C._) _marquesensis_, p. 131

14B. Tips of caudal lobes black, several faint dark bands along flanks; gillrakers 20-41 + 38-74; eyes 6.3-8.4, mean 7.5 % S.L.; Indo-Pacific .... _S._ (_C._) _melanura_, p. 132

13B. Scales fimbriated and perforated, lateral scales 43-46; predorsal scales usually 16; dorsal rays 18-19, anal rays 17-18, pelvics below 8th-11th dorsal rays; scutes 18-20 + 14-15, total 32-35; gillrakers 20-26 + 39-43, with many asperities; eyes small 6.3-6.9, mean 6.6 % S.L.; tips of caudal lobes black; S.E. Asia ...... _S._ (_C._) _atricauda_, p. 134

Amblygaster: _key to the species_

1A. Lower gillrakers usually 33-42; pyloric caeca 140-234; pneumatic duct joining gas bladder at a short distance vertically behind pelvic base; a series of 10-20 dark spots along flanks .... _A._ _sirm_, p. 135

1B. Lower gillrakers 26-33; pyloric caeca 84-120; pneumatic duct joining gas bladder at just above pelvic base; no dark spots along flanks ... 2

2A. Body depth 24 - 27 % S.L., predorsal length 48 - 50 % S.L., postdorsal length 50 - 53 % S.L., eyes 6.8 - 7.6 % S.L.; lower gillrakers 26-31; pelvics below base of 5th-9th dorsal ray .... _A._ _clupeoides_, p. 137

2B. Body depth 21 - 25 % S.L., predorsal length 50 - 53 % S.L., postdorsal length 47 - 50 % S.L., eyes 6.0 - 6.9 % S.L.; lower gillrakers 31-33; pelvics below base of 1st-3rd dorsal ray .... A. leiogaster, p.138

Herklotsichthys: key to the species

1A. No prominent ridges of teeth on palatine and pterygoids; lower gillrakers 29-52; intestine long and forming a single simple loop below stomach (not recorded in H. gotoi); lower part of 3rd suborbital greatly expanded anteroventrally; pectoral axillary scales consist of a series of pointed scales; pyloric caeca 46-129 2

2A. Predorsal scales paired and overlapping in midline, a series of additional winge-shaped median scales present under them; alar scales vestigial or absent 3

3A. Posterior edge of scales usually toothed, a few postdorsal scales just before caudal with a posterior median prolongation; body depth 18 - 30 % S.L., eyes 6.2 - 10.2 % S.L.; pectorals short 14 - 21 % S.L.; no dark markings along flanks; Indo-Pacific .... H. quadrimaculatus, p.139

3B. Posterior edge of scales not toothed, all postdorsal scales without a posterior median prolongation; body depth 32 - 41 % S.L.; eyes 9.6 - 11.9 % S.L.; pectorals 21 - 25 % S.L., their tips reaching well behind dorsal origin or a short distance before insertion of pelvics; Timor, Arufa and Banda Seas .... H. koningsbergeri, p.144

2B. Predorsal scales paired and very slightly overlapping in midline, a series of additional rounded median scales present under them; alar scales absent 4

4A. Body depth 30 - 40 % S.L.; lower gillrakers 39-52; postdorsal scales without a posterior median prolongation (except a few scales just before caudal); tips of dorsal and caudal lobes usually black, no humeral spot .... H. castelnaui, p. 145

4B. Body depth 41 % S.L.; lower gillrakers 34; postdorsal scales with a distinct posterior median prolongation (except a few scales just behind last dorsal ray); dorsal and caudal without any markings, a distinct humeral spot present .... H. gotoi n. sp., p. 147

1B. Prominent ridges of teeth on palatines and pterygoids; lower gillrakers 29-39; intestine more or less straight without loop below stomach; lower part of 3rd suborbital moderately expanded ventrally; pectoral axillary scales slightly developed or absent; pyloric caeca 17-43 5

5A. A prominent dark blotch on dorsal fin, no dark spots on back 6

6A. Body depth 26 - 28 % S.L.; pyloric caeca 36-43; a series of dark spots along flanks; endemic to N. Arabian Sea and Persian Gulf .... H. lossei n. sp., p. 147

6B. Body depth 28-35 % S.L.; pyloric caeca 27-35; no dark markings along flanks; endemic to Zanzibar and Reunion Is. .... H. spilura, p. 148

5B. No prominent dark blotch on dorsal fin, either two large black saddle spots or many scattered small black spots on or near midline of back 7

7A. Body depth 24 - 30 % S.L.; scutes 16-19 + 9-14; pyloric caeca 29-34; fundus of stomach long and terminating a short distance behind pelvic base; many scattered small but distinct spots on back at each side of dorsal base or behind it; Red Sea and Gulf of Suez .... H. punctatus, p. 149

7B. Body depth 30 - 35 % S.L.; scutes 14-15 + 11-13; pyloric caeca 17-19; fundus of stomach short and terminating a short distance before pelvic base; a large black saddle spot on posterior part of dorsal base and another a short distance behind; S.E. Asia .... *H. dispilonotus*, p.151

Escualosa: key to the species

1A. Body slender, depth 25 % S.L.; depth of caudal peduncle 8.3 % S.L.; pelvic base below base of 3rd dorsal ray; total ventral scutes 30; gillrakers 26 + 41; a narrow silvery band along flanks, its greatest width about half diameter of eye; distinct paired lines of dark dots on midline of back from head to caudal, frontoparietal region densely spotted with minute dark brown dots, hind edge of caudal narrowly darkish .... *E. elongata* n. sp., p. 153

1B. Body deep, depth 27 - 37 % S.L., depth of caudal peduncle 10.7 - 13.2 % S.L.; pelvic base usually below but sometimes just before or behind dorsal origin; total ventral scutes 28-30; gillrakers 16-25 + 27-40; greatest width of silvery band along flanks about an eye diameter; paired lines of dark dots on midline of back not distinct; fronto-parietal region blackish, hind edge of caudal broadly darkish .... *E. thoracata*, p. 154

Hilsa: monotypic, see generic key (p. 35)

Tenualosa: key to the species

1A. Head small 22 - 27 % S.L.; caudal 31 - 42 % S.L.; maxilla and associated bones similar to *Sardinella*; mandible deep, its greatest depth about 2.5-2.6 in its length; gillcover forming a transverse edge posteriorly, exposed portion of operculum rectangular with its lower edge at about 12-15° to horizontal; depths of urohyal about 3.3-4.8 in its length; pyloric stomach muscular, fundus of stomach slightly developed; intestine short and without 3rd primary flexure; pseudobranch not attenuated and without ventral groove; lower gillrakers 60-100, no asperities or mucosal buds; no spots along flanks except an obscure humeral blotch; marine 2

2A. Body depth 31 - 40 % S.L.; head 25 - 27 % S.L.; caudal 31 - 34 % S.L.; maxilla long and reaching to below eye centre, 10.5 - 12.1 % S.L.; suboperculum with rounded posterior margin; cleithral lobe barely apparent; total ventral scutes 28-30; lateral scales usually 38-41, predorsal scales 14-15; inner surface of oesophagus lined with longitudinal folds broken up into small mucosal buds posteriorly; gas bladder open to outside at anus .... _T. toli_, p.161

2B. Body depth 32 - 37 % S.L.; head 22 - 25 % S.L.; caudal 40 - 42 % S.L.; maxilla short 7.0 - 8.1 % S.L.; suboperculum almost rectangular; cleithral lobe small; total ventral scutes 30-31; lateral scales 43-44, predorsal scales 18-20; inner surface of oesophagus lined with mucosal buds; gas bladder not open to outside at anus .... _T. macrura_, p.162

1B. Head large 27 - 33 % S.L.; caudal 25 - 31 % S.L.; maxilla and associated bones more or less club-shaped; mandible slender, its depth about 2.8-3.1 in its length; gillcover forming a rounded edge posteriorly, exposed portion of operculum broadly rectangular or more or less quadrangular with its lower edge at about 25-37° to horizontal; depth of urohyal about 7.9-13.3 in its length; pyloric stomach semi-gizzard-like; intestine long with a perfect or imperfect 3rd primary flexure; pseudobranch rather attenuated and with groove below; lower gillrakers 62-316, scattered with asperities or rows of mucosal buds on the upper edges; a series of dark spots or blotches along flanks, including humeral blotch 3

3A. Gillrakers scattered with asperities; body depth usually 31 - 35 % S.L.; depth of urohyal about 7.9 in its length; marine or estuarine .... _T. reevesii_, p.163

3B. Gillrakers with rows of mucosal buds on the upper edges; body depth 31 - 41 % S.L.; urohyal very slender, its depth about 10.3-13.3 in its length; estuarine or riverine 4

4A. Head length 28 - 32 % S.L.; premaxilla short, about 2.9 in length of maxilla; frontoparietal striae 4-7; dorsal rays 18-20; pectoral rays usually 14-16; vertical striae on scales continuous, lateral scales 44-47, transverse scales 17-19; total ventral scutes 30-33; lower gillrakers 62-272; inner surface of oesophagus lined with longitudinal mucosal folds; series of dark spots along flanks terminating before anal origin; estuarine or riverine of Arabia, India and Burma .... <u>T. ilisha</u>, p. 164

4B. Head length 30 - 33 % S.L.; premaxilla longer, about 2.5 in length of maxilla; frontoparietal striae 2-3; dorsal rays 16-17; pectoral rays 12-14; vertical striae on scales usually interrupted at centre; lateral scales 40-42; transverse scales usually 15-16; total ventral scutes usually 28-29; lower gillrakers 204-316; inner surface of oesophagus lined with narrow longitudinal mucosal folds or smooth; series of dark blotches along flanks continued onto caudal peduncle; riverine of Mekhong river .... <u>T. thibaudeaui</u>, p. 166

<u>Gudusia</u>: <u>key to the species</u>

1A. Body depth 31 - 39 % S.L.; depth of caudal peduncle 10.8 - 11.7 % S.L.; eyes 7.4 - 9.5 % S.L.; distance from snout tip to posterior end of occiput 19.2 - 20.4 % S.L.; frontoparietal striae 6-13; height of dorsal 18.4 - 22.0 % S.L., tip of depressed dorsal terminating slightly behind anal origin; first pectoral ray only slightly above ventral profile by a distance of less than an eye diameter, pectoral axillary scale single and moderate in size; pelvic length 11.5 - 12.7 % S.L., prepelvic distance 48 - 51 % S.L.; pectoral-pelvic distance 22 - 23 % S.L.; length of anal base 16.4 - 21.2 % S.L.; preanal distance 69 - 74 % S.L.; total ventral scutes 26-29; posterior edge of scales smooth, predorsal scales 21-26; a dark humeral spot, followed by a series of the same sized spots along flanks (sometimes obscure or not visible, except humeral spot); Ganges and its tributaries .... G. chapra, p.167

1B. Body depth 42 - 43 % S.L.; depth of caudal peduncle 11.7 - 12.1 % S.L.; eyes 6.8 - 7.5 % S.L.; distance from snout tip to posterior end of occiput 20.4 - 22.2 % S.L.; frontoparietal striae weakly developed; height of dorsal 17.4 - 17.5 % S.L., tip of depressed dorsal terminating a short distance before anal origin; first pectoral ray well above ventral profile by a distance of greater than eye diameter, three small and pointed pectoral axillary scales; pelvic length 9.9 - 10.7 % S.L.; prepelvic distance 52 - 55 % S.L.; pectoral-pelvic distance 24 - 26 % S.L.; length of anal base 21.4 - 21.7 %; preanal distance 74.7 - 75.0 % S.L.; total ventral scutes 29-30; posterior edge of scales toothed, predorsal scales 36-39; a dark humeral spot, followed by a series of oval dark brown blotches along upper flanks, some behind dorsal joined to that on opposite side, base of posterior dorsal rays darkish; Burma .... G. variegata, p.169

Clupanodon: monotypic, see generic key (p.37)

Konosirus: monotypic, see generic key (p.37)

Nematalosa: key to the species

1A. Posterior edge of scales untoothed 2

2A. Dorsal ray usually 14-15, rarely 16; prepelvic scutes usually 16-17; pectoral axillary scale rudimentary or absent; branchiostegal rays usually 6, sometimes 5; 2-3 epurals; no humeral spot, posterior border of scales usually dusky brown; freshwater of Australia .... N. erebi, p.173

2B. Dorsal rays usually 15-18; prepelvic scutes 17-19; pectoral axillary scale present; branchiostegal rays 5-6; 3 epurals; humeral spot present, scales without any dark markings; marine 3

3A. Third suborbital greatly expanded ventrally, its anterior edge vertical; top of head with a median adipose plate tapering posteriorly and terminating just before the occipital process, its sides bordered by a shallow but well defined groove; dorsal rays 15-17; transverse scales 15; prepelvic scutes 17; branchiostegal rays 5; a series of dark spots along flanks usually present .... N. chanpole, p.176

3B. Third suborbital with an oblique anterior edge; no adipose plate as above; dorsal rays 17-19; transverse scales usually 17-19; prepelvic scutes 18-20; branchiostegal rays 5-6; no series of spots along flanks 4

4A. Maxilla straight, its posterior expansion slightly bigger than the anterior part; premaxilla much shorter than maxilla; mandible moderately flared outwards; 3rd suborbital tapering anteriorly; frontoparietal striae 2-5; anal rays 18-20; branchiostegal rays 5-6; body shallower but with more gillrakers at a given size than in N. come; Gulf of Aden and Gulf of Oman .... N. arabica, p. 177

4B. Maxilla greatly expanded anteriorly, tapering and curved downwards posteriorly; premaxilla considerably enlarged and only slightly shorter than maxilla; mandible strongly flared outwards; 3rd suborbital greatly expanded and not tapering anteriorly; frontoparietal striae 5-10; anal rays usually 21-24; branchiostegal rays 5; body deeper but with less gillrakers; S.E. Asia and Western Australia .... N. come, p.178

1B. Posterior edge of scales toothed 5

5A. Third suborbital greatly expanded ventrally, its anterior edge vertical; frontoparietal striae 6-11; branchiostegal rays 6; 2-3 epurals; Hong Kong to N.E. coasts of Arabian Sea..N. nasus, p.179

5B. Third suborbital moderately expanded, its anterior edge oblique; frontoparietal striae 3-6; branchiostegal rays 5-6; S.E. Asia and N. China Sea 6

6A. Mouth inferior, its gape just below eye level; snout obtusely rounded; posterior edge of operculum straight; pectoral axillary scale moderately developed, circumpeduncular scales usually 18; 2 epurals; N. and S. China Seas .... <u>N. japonica</u>, p. 180

6B. Mouth subterminal, its gape opposite or just above lower border of eyes; snout more or less pointed; posterior edge of operculum rounded; pectoral axillary scale rudimentary or absent, circumpeduncular scales scales usually 16; 3 epurals; Papua New Guinea and W. Australia 7

7A. Dorsal rays 16-17, pectoral rays 15-17; lateral scales 45-48, scales above anal base normal, pectoral axillary scale rudimentary; intestine normally long; humeral spot present; marine of W. Australia .... <u>N. vlaminghi</u>, p. 181

7B. Dorsal rays 14-16, pectoral rays 13-15; lateral scales 42-47, scales above anal base small, especially in young fish, pectoral axillary scale absent; intestine very long and forming an additional small loop just behind stomach; a faint dark band along flanks usually present in young fish; freshwaters of Papua New Guinea 8

8A. Head short, usually 25 - 29 % S.L.; gillrakers 74-342 + 82-309; longest gillraker on ceratobranchial usually about 1.5-2.4 in corresponding gill filament; hemibranchs at angle of 1st gill arch slightly shorter than neighbouring ones .... <u>N. papuensis</u>, p. 182

8B. Head longer, usually 29 - 35 % S.L.; gillrakers 152-553 + 195-508; longest gillraker on ceratobranchial usually about 1.1-1.5 in corresponding gill filament; hemibranchs at angle of 1st gill arch distinctly shorter than neighbouring ones, especially in large fish .... <u>N. flyensis</u> n. sp., p. 184

Gonialosa: key to the species

1A. Maxilla straight and broadly expanded posteriorly, its length 8 % S.L.; length of 2nd supramaxilla more than half length of maxilla, premaxilla small and only about half length of maxilla; exposed portion of operculum and suboperculum broadly semicircular; body depth 45 % S.L.; gillrakers 90 + 93; freshwater, Tenasserim, Burma .... *G. whiteheadi* n. sp., p.185

1B. Maxilla broadly expanded anteriorly, its posterior part more or less tapering and curved downwards, its length 4.7 - 8.7 % S.L., length of 2nd supramaxilla shorter than half length of maxilla, premaxilla greatly enlarged and much more than half length of maxilla; exposed portion of operculum and suboperculum narrowly semicircular or rectangular; gill-rakers 87-170 + 96-181 2

2A. Body depth 34 - 38 % S.L.; maxilla tapering posteriorly; posterior edge of operculum rounded; scales small, lateral series of scales irregularly arranged more or less partially, lateral scales 51-71, transverse scales 22-27, circumpeduncular scales 18-24, predorsal scales 23-27; freshwater of Ganges system ... *G. manmina*, p.186

2B. Body depth 41 - 45 % S.L.; maxilla slightly expanded posteriorly; posterior edge of operculum vertical; scales larger, lateral series of scales horizontally arranged, lateral scales 44-50, transverse scales 17-19, circumpeduncular scales 14-18, predorsal scales 19-22; freshwaters of lower course of rivers in Burma .... *G. modesta*, p.187

Anodontostoma: key to the species

1A. Upper and lower gillrakers 52-168 + 54-166, longest gillraker on ceratobranchial about half length of corresponding gill filament in moderate size fish, or slightly shorter than half length of the same in larger fish, or only slightly shorter than full length of the same in fish smaller than 67.0 mm S.L.; hemibranches at angle of gill arch slightly shorter than neighbouring ones, outer hemibranches always longer than half length of the inner ones; maxilla tapering and gently curved downwards posteriorly, its anterior half expanded ventrally, its length 6.5 - 8.2 % S.L.; 2nd supramaxilla needle-like shape; premaxilla large and extending posteriorly beyond anterior tip of the supramaxilla; 3 epurals 2

2A. Upper and lower gillrakers 52-98 + 54-96; loop that formed by 3rd primary flexure long and reaching just a short distance before anus in adult; teeth on posterior edge of scales narrower than incisions between them; body depth usually slightly greater than the next species; no prominent longitudinal streaks along flanks; attains about 140.0 mm S.L. .... A. chacunda, p. 188

2B. Upper and lower gillrakers 129-168 + 100-166; loop that formed by 3rd primary flexure shorter; teeth on posterior edge of scales broader than incisions between them; body depth usually very slightly narrower than the preceding species; series of longitudinal streaks along flanks; attains about 180.0 mm S.L. .... A. selangkat, p. 191

1B. Upper and lower gillrakers 43-125 + 46-140, longest gillrakers on ceratobranchial about equal in length to corresponding gill filament or sometimes even longer; hemibranches at angle of gill arch much shorter than neighbouring ones, outer hemibranches usually shorter than half length of the inner ones in fish of larger than 95.0 mm S.L.; maxilla straight and slender posteriorly, its anterior part not expanded ventrally, its length 7.9 - 10.3 % S.L.; 2nd supramaxilla broadly elongated; premaxilla short, its distal end never beyond anterior tip of the supramaxilla; loop that formed by 3rd primary flexure short; teeth on posterior edge of scales broader than incisions between them; 2 epurals .... A. thailandiae n. sp., p. 193

Pellona: key to the species

1A. Vertical striae on scales slightly overlapping at centre; lower gillrakers 22-27, gillrakers on posterior face of 2nd epibranchial vestigial; pyloric caeca 40-55; anteriormost prepelvic scutes broadly enlarged; teeth on maxilla slightly spread onto outer surface of its lower margin; pyloric caeca blackish; humeral spot usually present in specimens from Papua New Guinea and Australia......... P. ditchela, p. 195

1B. Vertical striae on scales discontinuous and with a wide gap at centre; lower gillrakers 20-21, gillrakers on posterior face of 2nd epibranchial moderately developed; pyloric caeca 39; anteriormost prepelvic scutes narrower; teeth on maxilla broadly spread onto its outer surface; pyloric caeca greyish, no humeral spot...P. dayi n. sp., p. 197

Ilisha: key to the species

1A. Gas bladder with a very short median postcoelomic prolongation lying within body cavity 2

2A. Gas bladder with distinct tunica interna; pyloric caeca 24-25; body depth 32-37 % S.L., head length 25-28 % S.L., upper jaw length 12.4 - 13.9 % S.L., prepelvic length 44-49 % S.L., eyes 8.3-9.8 % S.L., pectorals short, 11.1-16.6 % S.L.; edge of maxilla with a bony laminate outgrowth; lower gillrakers 22-26; humeral spot wanting .... I. sirishai, p. 198

2B. Gas bladder without distinct tunica interna; pyloric caeca 36; body depth 22-27 % S.L., head length 22-25 % S.L., upper jaw length 10.1 - 11.9 % S.L., prepelvic length 39-44 % S.L., eyes 5.0-6.6 % S.L., pectorals longer, 19.8-22.4 % S.L.; maxilla normal; lower gillrakers 21-23; humeral spot present .... I. novacula, p. 199

1B. Gas bladder with a single long (asymmetrical, right side) or paired and symmetrical postcoelomic prolongations, which extend beyond 1st anal pterygiophore 3

3A. Gas bladder with a long postcoelomic prolongation along right side of anal pterygiophores; pyloric caeca 42-90 (not counted in I. macrogaster) 4

4A. Scutes 19-23 + 8-12, total 28-35; pyloric caeca about 73; a faint black spot on dermosphenotic .... I. megaloptera, p.201

4B. Scutes 23-27 + 10-15, total 34-42; no black spot on dermosphenotic.. 5

5A. Lower gillrakers 18-25; prepelvic scutes 23-27; pectoral rays 15-18; eyes 6.2 - 11.3 % S.L.; anal origin always behind base of 6th dorsal ray; pneumatic duct short (not studied in I. macrogaster) 6

6A. Body depth 27 - 31 % S.L.; predorsal scales 19-24; vertical distance from upper corner of pectoral base to ventral profile 5.7 - 9.7 % S.L.; pyloric caeca 42 - 47; tip of pectorals terminating well before pelvic base (but to middle of that fin in young fish) and hyaline .... I. elongata, p. 204

6B. Body depth 31 - 36 % S.L.; predorsal scales 15-20; vertical distance from upper corner of pectoral base to ventral profile 9.3 - 15.3 % S.L.; pyloric caeca about 76 (not counted in I. macrogaster); pectoral tip surpassing pelvic base and darkish 7

7A. Body depth 31 - 35 % S.L.; lower gillrakers 19-23; distance from upper corner of pectoral to ventral profile 9.3 - 12.6 % S.L.; pyloric caeca about 76 .... I. filigera, p. 206

7B. Body depth 34 - 36 % S.L.; lower gillrakers 23-25; distance from upper corner of pectoral to ventral profile 14.5 - 15.3 % S.L. .... I. macrogaster, p.207

5B. Lower gillrakers 17; prepelvic scutes 26-27; pectoral rays 14-15; eyes 6.0 - 6.6 % S.L.; anal origin always before base of 5th dorsal ray; pneumatic duct long; pyloric caeca 80-90 .... I. pristigastroides, p. 208

3B. Gas bladder with long and paired symmetrical postcoelomic prolongations on either side of anal pterygiophores; pyloric caeca 15-51 (not counted in _I. obfuscata_) 8

8A. Vertical striae of scales discontinuous and with a wide gap at centre; body depth 24 - 39 % S.L. 9

9A. Body depth 24 - 32 % S.L.; eyes 7.9 - 9.3 % S.L.; pectorals short, 15.0 - 16.9 % S.L.; predorsal scales 15-18; pyloric caeca 15-19, long .... _I. kampeni_, p. 208

9B. Body depth 32 - 39 % S.L.; eyes 9.2 - 11.1 % S.L.; pectorals longer, 18.0 - 20.4 % S.L.; predorsal scales 13-15; pyloric caeca about 38, short .... _I. striatula_ n. sp., p. 210

8B. Vertical striae of scales overlapping or continuous at centre; body depth 33 - 42 % S.L. 10

10A. Body depth 33 - 42 % S.L.; eyes 9.2 - 12.0 % S.L.; lower gillrakers 21-25; pyloric caeca about 51; postcoelomic prolongation of gas bladder reaching to above base of 18th - 23th anal rays in 68.0 - 74.0 mm S.L. fishes .... _I. melastoma_, p. 211

10B. Body depth 34.8 - 35.2 % S.L.; eyes 9.1 - 9.4 % S.L.; lower gillrakers 27-28; postcoelomic prolongation of gas bladder reaching to above base of 8th-9th anal rays in 68.0 - 74.0 mm S.L. fishes .... _I. obfuscata_ n. sp., p. 214

Opisthopterus: key to the species

1A. Body depth 24 - 29 % S.L.; pectoral with 15-17 rays, its length 14 - 17 % S.L. and reaching 18th-22nd ventral scute, its upper insertion being slightly below axis of body; lateral scales 51-56; pyloric caeca about 31; pneumatic duct shorter than eye diameter; fronto-parietal striae consist of 4-5 very thin bony ridges .... _O. valenciennesi_, p. 215

1B. Body depth 27 - 33 % S.L.; pectoral with 12-14 rays, its length 21 - 26 % S.L. and reaching 27th-30th ventral scute, its upper insertion being about at axis of body; lateral scales 46-51; pyloric caeca about 22; pneumatic duct longer than eye diameter; frontoparietal striae consist of 2-3 thick bony ridges .... O. tardoore, p.216

Raconda: monotypic, see generic key (p.39)

FAMILY ENGRAULIDAE

Engraulinae: key to the genera

1A. Two supramaxillae (1st supramaxilla sometimes greatly reduced in size and absent in some species of Thryssa); gas bladder at least sack-like posteriorly, pneumatic duct variously emerging from upper surface of cadiac stomach; anal rays 14-60; predorsal scute present or absent; pseudobranchial filaments present or concealed by skin; oesophagus normally short; urohyal knife-like, in cross-section rod-like or normal Y-shaped 2

2A. Postpelvic scutes absent, prepelvic scutes, if present, spike-like; maxilla short, 2 large supramaxillae, anterior end of 1st supramaxilla lying before that of the 2nd; pseudobranchial filaments exposed well developed; pneumatic duct emerging from just behind oesophagus; 2-3 epurals 3

3A. Body cylindrical to moderately compressed; dorsal rays 12-18, anal rays 14-25; first pectoral ray normally ossified; predorsal scute wanting (except for some species of Stolephorus); mouth inferior; lateral scales 33-45, posterior interpelvic scale median, alar scales usually present; gas bladder not open to outside at anus; pyloric caeca 7-31; branchiostegal rays 9-16; 2 epurals; a silvery band along flanks 4

4A. No ventral scutes (except pelvic scute); posterior frontal fontanelles only slightly developed; anal originating well behind last dorsal ray; posterior tip of maxilla bluntly rounded and scarcely projecting beyond 2nd supramaxilla; gas bladder sack-like throughout its course; intestine forming a characteristic coiling a short distance before anus, pyloric caeca 20-31; cross-section of urohyal rod-shaped; lower gillrakers 26-39 (single Indo-Pacific species, E. japonicus) ....
.... Engraulis, p. 219

4B. Ventral scutes present (but usually absent in <u>Stolephorus purpureus</u>); posterior frontal fontanelles large; anal usually originating before last dorsal ray; posterior tip of maxilla more or less projecting beyond 2nd supramaxilla; gas bladder constricted at middle and forming a thread-like tube anteriorly; intestine more or less straight; pyloric caeca 7-20; cross-section of urohyal pin-shaped; lower gillrakers 18-35 .... <u>Stolephorus</u>, p. 64

3B. Body strongly compressed; dorsal small, with only 5-6 rays; anal rays 54-60; first pectoral ray greatly ossified; predorsal scute present; mouth greatly upturned; lateral scales 50-51, interpelvic scales paired, no alar scales; gas bladder large and open to outside at anus; pyloric caeca 13; cross-section of urohyal Y-shaped; branchiostegal rays 10-11; 3 epurals; lower gillrakers 25-27; no silvery band along flanks (monotypic, <u>P. micropinna</u>) .... <u>Papuengraulis</u>, p. 296

2B. Pre- and postpelvic scutes fully developed and with lateral arms; maxilla usually extending to gill opening or beyond, 2 supramaxillae, 1st supramaxilla lying within length of 2nd one or greatly reduced or missing; pseudobranchial filaments present, usually concealed under skin; pneumatic duct emerging from various parts of upper surface of cadiac stomach; predorsal scute present; 3 epurals; no silvery band along flanks .... <u>Thryssa</u>, p. 69

1B. Only 2nd supramaxilla present, enlarged and incompletely fused with maxilla; gas bladder transformed into thread-like tube, pneumatic duct emerging from posterior end of fundus of stomach or very nearly so; anal rays 47-81; predorsal scute present; pseudobranchial filaments absent; oesophagus long; posterior half of urohyal usually thin and slender (except <u>Setipinna brevifilis</u>, <u>S. phasa</u> and <u>S. wheeleri</u>), its cross-section rod-shaped 5

5A. Jaw teeth large, caniniform; upper pectoral ray not filamentous; anal rays 47-52; scutes 7-9 + 8-11; transverse scales 9-10; lower gillrakers

8-10; branchiostegal rays 12-15; pneumatic duct emerging from a short distance above posterior end of fundus of stomach; pyloric caeca 43; 2 epurals; body rounded, its depth 19.0 - 23.4 % S.L. (monotypic, L. crocodilus) .... Lycothrissa, p. 298

5B. Jaw teeth villiform; upper pectoral ray filamentous; anal rays 48-81; scutes 15-29 + 6-14; transverse scales 11-16; lower gillrakers 9-22; branchiostegal rays 12-20; pneumatic duct emerging from posterior end of stomach; pyloric caeca 12-40; body more compressed, its depth 22.0 - 34.5 % S.L. 6

6A. Mouth moderately oblique, lower jaw somewhat included under upper jaw; branchiostegal rays 12-16; lower gillrakers 9-22; dorsal rays usually 13-15; 1st and 3rd suborbitals moderately expanded posteriorly; 2-3 epurals; pyloric caeca 12-36 .... Setipinna, p. 76

6B. Mouth greatly upturned, lower jaw projecting slightly; branchiostegal rays 20; lower gillrakers 11-12; dorsal rays 17-18; 1st and 3rd suborbitals exceedingly expanded posteroventrally; 2 epurals; pyloric caeca 35-40 (monotypic, H. breviceps)... Heterothrissa, p. 310

Coiliinae: a single genus, Coilia (see p. 78)

Engraulis: monotypic in area, see generic key (p. 62)

Stolephorus: key to the species

1A. Body more or less cylindrical, depth 14 - 22 % S.L., ii unbranched dorsal and anal rays (but both iii in S. devisi), anal with usually 14-20 rays, its origin usually behind base of 11th dorsal ray; maxilla hardly reaching beyond posterior border of preoperculum; muscular portion of isthmus terminating a short distance behind hind border of branchiostegal membrane, leaving portion of urohyal exposed and forming a fleshy or bony plate-like structure; lateral scales 39-43; branchiostegal rays usually 12-15, 2 on posterior ceratohyal; fundus of stomach long; distal end of gas bladder close to anus; pigmented stripe along flanks dark in most museum specimens; pyloric caeca darkish 2

2A. Anal with ii 12-15 rays, its origin behind dorsal base; pectoral rays 13-17; maxilla bluntly rounded posteriorly and scarcely projecting beyond 2nd supramaxilla; posterior frontal fontanelles oval; urohyal plate fleshy; teeth evenly small; scales vertically oval 3

3A. Gillrakers usually 19-22 + 26-29, 6 gillrakers on posterior face of 3rd epibranchial; 1-5 thin prepelvic scutes, but usually wanting; pyloric caeca 12-15; Hawaiian islands... S. purpureus, p. 223

3B. Gillrakers usually 15-20 + 23-26, 4 gillrakers on posterior face of 3rd epibranchial; 2-6 moderately developed prepelvic scutes; pyloric caeca 14-18; widespread in Indo Pacific..S. buccaneeri, p. 224

2B. Anal with ii-iii 14-17 rays, its origin below base of 12th-16th dorsal rays; pectoral rays 12-14; maxilla pointed posteriorly and projecting beyond anterior border of preoperculum; posterior frontal fontanelles more or less tapering anteriorly; urohyal plate bony; some teeth on posterior half of maxilla enlarged (but small and even in some populations of S. heterolobus); scales hexagonal 4

4A. Unbranched dorsal and anal rays ii; portion of maxilla behind 2nd supramaxilla longer than deep; gillrakers 20-25 + 23-29, 7-9 gillrakers on posterior face of 3rd epibranchial; tip of depressed pelvics just reaching below dorsal origin or very slightly behind it; band along flanks dark, posterior frontal fontanelles blackish ....
.... S. heterolobus, p. 226

4B. Unbranched dorsal and anal rays iii; portion of maxilla behind 2nd supramaxilla about as long as broad; gillrakers 19-21 + 21-26, 6-7 gillrakers on posterior face of 3rd epibranchial; tip of depressed pelvics reaching slightly beyond dorsal origin; band along flanks lighter, posterior frontal fontanelles mottled with small dark patches .... S. devisi, p. 228

1B. Body often a little more compressed, depth 14 - 26 % S.L.; iii unbranched dorsal and anal rays, anal with usually 20-23 rays, its origin usually before base of 12th dorsal ray; maxilla pointed and reaching beyond posterior border of pre-operculum (or nearly so in S. indicus); isthmus entirely covered with muscle, no urohyal plate; lateral scales usually 34-39 (to 42 in S. indicus); branchiostegal rays usually 10-12 or 11-14, 2-3 on posterior ceratohyal; fundus of stomach short (except in S. indicus), anus and distal end of gas bladder far apart; band along flanks more or less silvery in most museum specimens; pyloric caeca not dark 5

5A. Body depth 14 - 23 % S.L.; no predorsal spine (except in some specimens or populations of S. insularis), no spine on pelvic scute; dorsal rays usually 15-17; 3 or 2 branchiostegal rays on posterior ceratohyal; striae on scales not reticulated; distal end of 1st suborbital bone terminating a short distance before hind border of 3rd suborbital (except in S. insularis) 6

6A. Posteroventral edge of preoperculum evenly rounded; 3 branchiostegal rays on posterior ceratohyal 7

7A. Maxilla tip reaching to or slightly beyond anterior border of pre-operculum; lateral scales usually 38-42; branchiostegal rays usually 13-14; gas bladder without constriction at middle; pelvic tip terminating well before dorsal origin; attains 153 mm S.L. .... S. indicus, p. 231

7B. Maxilla tip reaching to or well beyond posterior border of preoperculum; lateral scales usually 34-39; branchiostegal rays usually 10-14; gas bladder with a constriction at middle, its anterior portion transformed into a thread-like tube; attains 99 mm S.L. 8

8A. Pelvic tip reaching to below 1st to 3rd dorsal rays; teeth on palatine and pterygoids slightly developed 9

9A. Branchiostegal rays usually 12-13; anal rays usually 21-23; prepelvic scutes usually 2-3; lateral scales usually 36-37; predorsal scales usually 18-19; pectoral rays usually 13-15; 1st and 3rd suborbital bones with a short and blunt posterior extension; snout dusky black, tip of lower jaw without dark markings, a dusky patch just behind occiput and continuing as a dusky band to dorsal origin; widespread in Indo-Pacific .... S. commersonii, p.236

9B. Branchiostegal rays 10-11; anal rays usually 23-24; prepelvic scutes usually 4-5; lateral scales 34-35; predorsal scales 16-17; pectoral rays usually 12-13; 1st and 3rd suborbital bones with a produced posterior extension; snout, tip of lower jaw and back without dark markings; Gulf of Papua .... S. brachycephalus n.sp., p.239

8B. Pelvic tip terminating at least a quarter of eye diameter before dorsal origin, very rarely to front dorsal rays; teeth on palatine and pterygoids fairly well developed 10

10A. Gillrakers 18-19 + 26-27; anal origin usually below base of 6th-7th dorsal rays; dorsal rays usually 16-17; pectoral rays usually 12-13; branchiostegal rays 11-12; posterior frontal fontanelles moderate, slightly tapering and bluntly pointed anteriorly; 1st and 3rd suborbital bones with a blunt, short posterior extension; snout slightly dotted with dark, lower jaw, back and roof of mouth unspotted; Hong Kong and S. China Sea .... S. chinensis, p.240

10B. Gillrakers 14-17 + 19-24; anal origin usually below base of 8th-9th dorsal rays; dorsal rays usually 16; pectoral rays usually 13-14; branchiostegal rays usually 12-13; posterior frontal fontanelles small, especially in larger fish, greatly tapering and pointed anteriorly; 1st and 3rd suborbital bones with a produced posterior extension; snout, and usually front half of lower jaw and roof of mouth spotted with dusky black; a very faint dusky patch just behind occiput; Indo-Pacific ... . S. waitei, p. 242

6B. Posteroventral edge of preoperculum concave; 2 branchiostegal rays on posterior ceratohyal (except 3 in S. tysoni) 11

11A. No double pigment line along midline of back; prepelvic scutes usually 6-7; 4-5 gillrakers on posterior face of 3rd epibranchial 12

12A. Anal rays 19-23, originating below base of 7th-9th dorsal rays; tip of pelvics reaching to below dorsal origin or about half eye diameter before it; pseudobranchial filaments usually 14-19; no teeth on anterior ceratohyal or dorsal hypohyal; 1st and 3rd suborbital bones with blunt short posterior extension 13

13A. Gillrakers 17-22 + 24-29; head length 23-26, mean 24.7 % S.L.; posterior frontal fontanelles blackish; S.E. coast of Africa .... S. holodon, p.245

13B. Gillrakers 14-15 + 20-21; head length 22-25, mean 23.5 % S.L.; posterior frontal fontanelles without any dark markings; Bay of Bengal, Singapore and Gulf of Papua .... S. andhraensis, p.246

12B. Anal rays 21-24, originating below base of 2nd-6th dorsal rays; tip of pelvics about three-fourths to one eye diameter before dorsal origin; pseudobranchial filaments 11-14; teeth present on upper edge of anterior ceratohyal and dorsal hypohyal; 1st and 3rd suborbital bones with produced posterior extension; gillrakers 15-18 + 21-25; posterior frontal fontanelles blackish; Gulf of Papua .... S. tysoni n. sp., p.247

11B. Double pigment line along midline of back behind dorsal; prepelvic scutes usually 5-7; 5-6 gillrakers on posterior face of 3rd epibranchial 14

14A. Gillrakers usually 20-21 + 28-30; tip of pelvics about half eye diameter or nearly so before dorsal origin; pectoral axillary scale about 57 - 60 % S.L. pectoral length; no predorsal spine; posterior end of 1st suborbital bone terminating well before hind border of 3rd suborbital; isthmus spotted with a few or many dark dots; Philippines .... S. ronquilloi n. sp., p.248

14B. Gillrakers usually 16-20 + 22-28; tip of pelvics about a quarter of eye diameter before dorsal origin; pectoral axillary scale about 60 - 65 % S.L. of pectoral length; predorsal spine small or absent; posterior end of 1st suborbital bone opposite hind border of 3rd suborbital; isthmus without markings; Indo-Pacific .... S. insularis, p. 250

5B. Body depth 21 - 26 % S.L.; predorsal spine present and also spine on pelvic scute; dorsal rays usually 14-15; 2 branchiostegal rays on posterior ceratohyal; striae on scales reticulated; distal end of 1st suborbital bone produced and about opposite hind border of 3rd suborbital 15

15A. Gillrakers 19-24 + 25-31, about 5-7 short gillrakers on posterior face of 3rd epibranchial; pyloric caeca 7-12; a double pigment line along midline of back from behind dorsal .... S. duboisus n. sp., p. 253

15B. Gillrakers 14-19 + 18-24, about 3-6 gillrakers on posterior face of 3rd epibranchial; pyloric caeca 11-16 16

16A. Gillrakers usually 16-19 + 20-24, about 3-6 gillrakers on posterior face of 3rd epibranchial; scales greatly reticulated; pyloric caeca 11-13; granular teeth on palatine and pterygoids forming a narrow patch; a double pigment line along midline of back from behind dorsal; posterior frontal fontanelles blotched with black; hind edge of caudal dusky .... S. baganensis, p. 256

16B. Gillrakers usually 15-17 + 19-22, about 5-6 short gillrakers on posterior face of 3rd epibranchial; scales moderately reticulated; pyloric caeca 15-16; granular teeth on palatine and pterygoids forming a large patch; a double pigment line along midline of back extending from occiput to caudal; posterior frontal fontanelles blackish, hind edge of caudal dark .... S. tri, p. 257

Papuengraulis: monotypic, see generic key (p. 63)

Thryssa: key to the subgenera

1A. Maxilla short to long, but never reaching pelvic base; lower jaw normally slender; snout more or less pointed; lower gillrakers 11-61; posterior branchiostegal rays slender or only slightly larger than others; 1st and 3rd suborbitals moderately produced posteriorly 2

2A. No pre-pectoral scutes or only 1-2 followed by a gap, prepelvic scutes 4-9; a ring of cephalic sensory line surrounding tip of snout; lower gill-rakers 19-26; pseudobranchial filaments well developed; gas bladder open to outside at anus (monotypic, T. (T.) baelama) .... Thryssa (Thrissina), p. 258

2B. Prepectoral scutes present, prepelvic scutes 14-20; lower gillrakers 11-61; no cephalic sensory line as above; pseudobranchial filaments often concealed under skin; gas bladder either open or not to outside at anus .... Thryssa (Scutengraulis), p.70

1B. Maxilla greatly produced and reaching pelvic base or further; lower jaw with high coronoid process; snout bluntly rounded; lower gillrakers 10-12; posterior branchiostegal rays enlarged; 1st and 3rd suborbitals short; gas bladder open to outside at anus (monotypic, T. (T.) setirostris) .... Thryssa (Thryssa), p. 293

Thryssa (Scutengraulis): key to the species

1A. First supramaxilla large, at least half length of 2nd supramaxilla, maxilla not reaching beyond posterior border of interoperculum; mouth more or less inferior; snout fairly pointed; eyes situated well above gape of mouth; gillrakers not clumped; pseudobranch more or less developed, filaments 4-22; anal rays 30-38; cross-section of urohyal pin-shaped; gas bladder not open to outside at anus (except for T. (S.) chefuensis); W. Pacific 2

2A. Anal with 29-34 rays, its origin well behind tip of last dorsal ray; lateral scales 30-33; pyloric caeca about 13; gas bladder open to outside at anus; oesophagus very pale greyish; N. China Sea .... T. (S.) chefuensis, p. 262

2B. Anal with 32-38 rays, its origin below base of last dorsal ray or just behind it; lateral scales 34-44; pyloric caeca 12-21; gas bladder not open to outside at anus 3

3A. Scutes 17-19 + 10-12, total 27-31; lateral scales 40-44, predorsal scales 19-21; branchiostegal rays 12-14; pseudobranchial filaments 12-14; predorsal distance slightly longer or about equal to postdorsal distance (49.4-51.5 cf. 48.4-52.0 % S.L.); anterior striae of scales vertical and continuous or overlapping at centre; pneumatic duct emerging from upper surface of fundus of stomach and forming a U-shape before joining gas bladder; no darkish saddle blotch on nape, digestive tract without dark markings; freshwaters of Papua New Guinea 4

4A. Anal rays 33-35; scutes 17-19 + 10-11, total 27-29; lateral scales 40-41; predorsal distance slightly longer than postdorsal distance (49.4-51.5; cf. 48.4-49.9 % S.L.); gillrakers 39-45 + 55-61; no gillrakers on posterior face of 3rd epibranchial; pyloric caeca about 12; pneumatic duct short; attains 116 mm S.L. ....
.... _T._ (_S._) _rastrosa_, p. 263

4B. Anal rays 38; scutes 19 + 12, total 31; lateral scales 43-44; predorsal distance about equal to postdorsal distance (51.1-51.2; cf. 51.5-52.0 % S.L.); gillrakers 15-18 + 18-20; several rudimentary gillrakers on posterior face of 3rd epibranchial; pyloric caeca about 21; pneumatic duct very long; attains 371 mm S.L. ....
.... _T._ (_S._) _scratchleyi_, p. 264

3B. Scutes 14-17 + 7-9, total 22-26; lateral scales 34-41, predorsal scales 13-18; branchiostegal rays 10-12; pseudobranchial filaments 4-22; predorsal distance shorter than postdorsal distance 46.9-52.2; cf. 49.3-53.9 % S.L.); anterior striae of scales forming reticulations; pyloric caeca 14-15; pneumatic duct emerging from just behind oesophagus; a dark saddle blotch on nape; oesophagus and front part of stomach dark greyish; marine 5

5A. Gillrakers 22-25 + 27-29; pectoral rays 12-13, tip of pelvics reaching to below base of 6th-9th dorsal ray; pseudobranchial filaments 14-22; pneumatic duct very short, its ends about opposite each other; Gulf of Papua and Queensland .... _T._ (_S._) _aestuaria_, p. 265

5B. Gillrakers 22-27 + 26-32; pectoral rays 10-12; tip of pelvics reaching to below base of 1st-4th dorsal ray or nearly so; pseudobranchial filaments 4-10; pneumatic duct very long and joining gas bladder above pelvic base; S.E. Asia .... T. (S.) kammalensis, p. 267

1B. First supramaxilla very small, shorter than pupil or absent; maxilla projecting beyond posterior border of interoperculum (or only to it in T. (S.) kammalensoides); mouth subterminal, with lower jaw slightly produced or slightly inferior; gillrakers sometimes clumped; snout usually obtusely pointed; pseudobranch usually concealed by skin, only tips of longest filaments sometimes exposed; anal rays 32-49; cross-section of urohyal rod-shape or Y-shaped; gas bladder open to outside at anus; Indo-Pacific; (remainder of key highly artificial and both parts of each dichotomy should be checked carefully) 6

6A. Mouth inferior, symphysis of lower jaw scarcely above lower border of eye with closed mouth; tip of snout level with or just above centre of eye; maxilla greatly produced (except T. (S.) kammalensoides) and reaching almost to pectoral base or to pelvic base 7

7A. Maxilla just reaching posterior border of interoperculum; gillrakers 18 + 24-25; pyloric caeca about 17; a dark saddle blotch on nape ... . T. (S.) kammalensoides n.sp., p. 268

7B. Maxilla greatly produced and reaching almost to pectoral base or beyond it to pelvic base; gillrakers usually 9-17 + 14-23; no dark saddle blotch on nape (except for oblique humeral spot in T. (S.) dussumieri, which sometimes looks like saddle blotch) 8

8A. Lower gillrakers usually 20-23; maxilla reaching to pectoral base or very nearly so; predorsal distance longer than postdorsal distance; tip of depressed pelvic distinctly before dorsal origin; vertical striae of scales usually overlapping at centre 9

9A. Serrae of gillrakers clumped in large fish; pyloric caeca about 19; lateral scales 40-44; pneumatic duct emerging from a short distance above posterior end of fundus of stomach; Indian Ocean .... T. (S.) vitrirostris, p. 269

9B. Serrae of gillrakers even; pyloric caeca about 14; lateral scales 43-45; pneumatic duct emerging from just behind oesophagus; N. China Sea .... T. (S.) adelae, p. 271

8B. Lower gillrakers usually 14-19; maxilla variable, reaching to or almost to pectoral base or beyond it to pelvic base; pyloric caeca 17 - 20 10

10A. Maxilla very long, reaching pectoral base (at 24 mm S.L.) or further to pelvic base in large adults (32 - 42 % S.L.); 1st supramaxilla wanting; predorsal distance shorter than postdorsal distance; pectoral rays usually 11-12; tip of pelvics below base of 3rd to 8th dorsal ray; vertical striae of scales continuous, lateral scales 35-40; scutes 14-16 + 6-9, total 21-24; branchiostegal rays usually 12-13; gillrakers usually 13-16 + 17-19, their serrae distinctly clumped; pneumatic duct emerging from just above posterior end of fundus of stomach .... T. (S.) dussumieri, p. 273

10B. Maxilla reaching at most to base of pectoral, 24 - 29 % S.L.; 1st supramaxilla very small and pea-shaped; predorsal longer than postdorsal length; pectoral rays usually 12-13; tip of pelvics reaching at a short distance before dorsal origin; vertical striae of scales interrupted at centre, lateral scales 40-48; scutes 16-20 + 8-13, total 24-32; branchiostegal rays usually 13-15; gillrakers usually 9-11 + 13-16, their serrae not clumped but uneven in large fish; pneumatic duct emerging from anterior half of fundus of stomach .... T. (S.) mystax, p. 275

6B. Mouth subterminal, symphysis of lower jaw slightly produced beyond tip of snout and more or less above lower border of eye when mouth closed; tip of snout well above centre of eye; maxilla usually slightly produced, but at most reaching to pectoral base; serrae of gillrakers not clumped 11

11A. Anal rays usually 35-41; predorsal slightly but distinctly longer than postdorsal distance (except in T. (S.) malabarica) 12

12A. Gillrakers 18-21 + 25-27; cross-section of urohyal pin-shaped; pyloric caeca 13-14; maxilla reaching to or just beyond hind border of interoperculum, 21 - 23 % S.L.; no dark band or lines on midline of back; east and west coasts of India .... T. (S.) polybranchialis n.sp., p. 278

12B. Gillrakers 7-16 + 11-19; cross-section of urohyal Y-shaped; pyloric caeca 13-19 13

13A. Gillrakers 11-16 + 17-19; pelvic length 8.9 - 10.4 % S.L.; pyloric caeca about 13; Indian coasts 14

14A. Body depth 23 - 28 % S.L.; maxilla reaching slightly beyond hind border of interoperculum, 21 - 25 % S.L., teeth in jaws large; predorsal longer than postdorsal distance (50.8-54.9; cf. 44.9-50.8 % S.L.); gillrakers 11-13 + 17-19; gas bladder without posterior median prolongation; sides of head, jaws, pectorals, pelvics and anal unspotted, midline of back with a dark band from head to caudal .... T. (S.) gautamiensis, p. 279

14B. Body depth 34-37 % S.L.; maxilla reaching hind border of interoperculum or just beyond it, 21 - 23 % S.L., teeth in jaws small; predorsal shorter than postdorsal distance (48.9-50.4; cf. 49.6-53.3 % S.L.); gillrakers 14-16 + 17-19; gas bladder with a short posterior median prolongation; sides of head, jaws, pectorals, pelvics and anal dusky, midline of back without dark band ..... T. (S.) malabarica, p. 281

13B. Gillrakers 7-10 + 11-15; pelvics short, 6.4 - 8.3 % S.L.; pyloric caeca about 19; maxilla reaching just beyond hind border of interoperculum, 20.3 - 24.2 % S.L.; midline of back with dark bands or lines from head to caudal; Indo-Pacific .... T. (S.) hamiltonii, p. 282

11B. Anal rays usually 42-47; predorsal about equal to postdorsal (except longer T. (S.) spinidens) 15

15A. Gillrakers 11-16 + 15-21; pyloric caeca 12-18; pneumatic duct short and variously inserting to gas bladder at a point before pelvic base; back with dusky bands or lines from occiput to caudal (except for T. (S.) whiteheadi and probably also T. (S.) purava) 16

16A. Maxilla reaching about one fourth to half the distance between hind border of interoperculum and base of pectoral; pectoral length 15.6 - 19.3 % S.L.; serrae of gillrakers small and not clumped 17

17A. Branchiostegal rays 11-12; 1st supramaxilla absent; teeth in jaws enlarged; pneumatic duct very short, emerging from just behind oesophagus and promptly inserting into gas bladder just opposite; pyloric caeca about 8 (?); 3 epurals; no dusky band or lines along midline of back; Persian Gulf .... T. (S.) whiteheadi n. sp., p.285

17B. Branchiostegal rays usually 13; 1st supramaxilla present but very small; teeth in jaws smaller; pneumatic duct long, emerging from just behind oesophagus and inserting to gas bladder at some distance posteriorly; pyloric caeca 11-12; 2-3 epurals; back with faint dusky band or lines from occiput to caudal; east coast of India .... T. (S.) purava, p.286

16B. Maxilla reaching to pectoral base or very nearly so in smaller fish; pectoral length 16.9 - 23.9 % S.L.; serrae of gillrakers large and not clumped 18

18A. Body thicker and shallower, 23 - 26 % S.L.; depth of caudal peduncle 8.2 - 9.7 % S.L.; maxilla 20.4 - 24.5 % S.L., teeth in jaws smaller; upper pectoral rays not produced, 16.9 - 18.8 % S.L.; gillrakers usually 13-15 + 17.19; pyloric caeca 12-13; Bay of Bengal .... T. (S.) stenosoma n. sp., p.289

18B. Body more compressed and deeper, 26 - 28 % S.L.; depth of caudal peduncle 9.2 - 13.1 % S.L.; maxilla 23.0 - 26.5 % S.L., teeth in jaws larger; upper pectoral rays produced into a short filament, 18.7 - 23.9 % S.L. (or 16.7 - 18.4 if broken); gillrakers usually 11-13 +

15-17; pyloric caeca 16; Pakistan and west coast of India .... T. (S.) dayi n. sp., p. 290

15B. Gillrakers usually 9-10 + 14-15; maxilla reaching slightly beyond hind border of interoperculum, 19.2 - 21.8 % S.L., teeth in jaws large; predorsal longer than postdorsal distance (52.1 - 55.2; cf. 46.3-49.6 % S.L.); pneumatic duct long, joining gas bladder at a point behind pelvic base; pyloric caeca 11-12; no dark band or lines along midline of back; Bay of Bengal .... T. (S.) spinidens, p. 292

Lycothrissa: monotypic, see generic key (p. 64)

Setipinna: key to the species

1A. Anal rays 48-59; lateral scales 40-51; scutes 17-29 + 7-14, total 24-40; maxilla bluntly pointed, 2nd supramaxilla more or less semicircular; posterior face of 3rd epibranchial naked or with very rudiment gillrakers; posterior half of urohyal transformed into rod-shaped process; upper lobe of caudal normally pointed (or only slightly truncate in S. taty); oesophagus and stomach black (except in S. melanochir); marine (but some populations of S. melanochir also riverine) 2

2A. Dorsal and anal scaleless, scales hardly forming polygonal reticulations at middle; gillrakers 7-12 + 9-17, upper edges of gillrakers not wavy, serrae even or slightly clumped; scutes 17-26 + 7-10, total 24-35; anal origin before that of dorsal; pyloric caeca 21-36 3

3A. Gillrakers 10-12 + 13-17; anterior striae of scales connected to each other and forming a web-like structure, lateral scales 42-46, transverse scales 11-13; predorsal scales 17-20, circumpeduncular scales 12; scutes 17-21 + 7-8, total 24-28; pectoral with 11-13 rays, its filament reaching well beyond anal origin; 3 epurals; oesophagus and stomach jet black 4

4A. Body depths 27 - 33 % S.L., back gently convex or moderately elevated; height of dorsal 16.5 - 20.7 % S.L. (but not known in S. tenuifilis gilberti); tip of 2nd pectoral ray reaching anterior half of pelvics, filament extending to 9th-21st anal rays; pelvics short, 5.6 - 7.7 % S.L., tips well in front of anus; serrae of gillrakers large; dorsal, pectorals and pyloric caeca without dark markings; Bay of Bengal, N. and S. China Seas .... S. tenuifilis 5

5A. Upper and lower gillrakers 12 + 16-17; pectoral rays 13, its filament reaching 9th anal ray; body depth 27.2 - 30.0 % S.L., back gently convex; N. China Sea .... S. tenuifilis gilberti, p. 301

5B. Upper and lower gillrakers 10-11 + 13-14; pectoral rays usually 12, its filament reaching 11th-21st anal rays; body depth 28 - 33 % S.L., back moderately elevated; Bay of Bengal and S. China Sea .... S. tenuifilis tenuifilis, p. 299

4B. Body depth 33 - 35 % S.L., back humpy convex; height of dorsal 21.0 - 23.4 % S.L.; tip of 2nd pectoral ray reaching anal origin or nearly so, its filament extending to 27th-41st anal rays; pelvics long, 9.0 - 9.7 % S.L., tips reaching anus; serrae of gillrakers small; outer half of dorsal and pectorals and pyloric caeca darkish; Gulf of Papua and North coast of Australia .... S. papuensis, p. 302

3B. Gillrakers 7-10 + 9-12; anterior striae of scales free from each other, lateral scales 45-51, transverse scales 15-16, predorsal scales 21-27, circumpeduncular scales 14-16; scutes 21-26 + 8-10, total 30-35; pectoral with 13-15 rays, its filament short and failing to reach anal origin; 2 epurals; pectoral either black or hyaline, oesophagus and stomach not dark .... S. melanochir, p. 303

2B. Dorsal and anal only exceptionally scales, scales with many distinctive polygonal reticulations at middle; gillrakers usually 13-17 + 18-20, upper edges of gillrakers wavy and with distinctly clumped serrae; scutes 20-29 + 9-14, total 32-40; anal origin below base of 1st-6th dorsal rays, pyloric caeca 12; 3 epurals; oesophagus and cardiac stomach dusky black .... *S. taty*, p. 304

1B. Anal rays 68-81; lateral scales 52-57; scutes 15-17 + 6-7, total 21-23; maxilla slightly produced into a sharp point, 2nd supramaxilla narrower and tapering anteriorly; posterior face of 3rd epibranchial with more prominent gillrakers; urohyal more or less knife-shaped; upper lobe of caudal truncate posteriorly; digestive tract not black; riverine 6

6A. Gillrakers 14-16 + 17-19, upper edges not or very slightly wavy, serrae even or moderately clumped; pectoral filament reaching 1st-39th anal rays; scales with many anterior striae; riverine, Ganges system and neighbouring waters 7

7A. Head length 18.0 - 19.7 % S.L.; gillrakers usually 14-15 + 17; total ventral scutes 22-23; pectoral filament short, extending only to 1st-15th anal rays; eyes 3.8 - 4.6 % S.L.; branchiostegal rays 12-13; pectorals hyaline .... *S. brevifilis*, p. 309

7B. Head length 15.6 - 18.1 % S.L.; gillrakers usually 15-16 + 18-19; total ventral scutes 21-22; pectoral filament moderate, extending to 15th-39th anal rays; eyes 2.8 - 4.2 % S.L.; branchiostegal rays 13-15; pectorals hyaline (at 136 mm S.L. or smaller) but dark in larger fishes .... *S. phasa*, p. 308

6B. Gillrakers 16-18 + 21-22, upper edges wavy, serrae distinctly clumped; pectoral filament long and extending to 45th-51st anal rays; scales with very few anterior striae; pectorals hyaline; Burma .... *S. wheeleri* n. sp., p. 307

Heterothrissa: monotypic, see generic key (p. 64)

Coilia: key to the species

1A. Scutes 0-1-12 + 7-12, total 11-23; maxilla not reaching beyond gill opening 2

2A. Non-filamentous pectoral rays usually 5-8, reaching a short distance before pelvic base and much shorter than that fin, filamentous pectoral rays 10-19 (except 6 in C. ramcarati); gillrakers 18-27 + 25-36; pseudobranchial filaments 12-23; at least anterior quarter of isthmus scaleless 3

3A. Pelvic rays 9-10; gillrakers 21-23 + 29-30; anterior quarter of isthmus naked; pneumatic duct long and emerging a short distance above posterior end of fundus of stomach .... C. ramcarati, p. 311

3B. Pelvic rays 7; gillrakers 18-27 + 25-36; at least anterior third of isthmus naked; pneumatic duct long and emerging from just behind oesophagus 4

4A. Pectoral filaments 10-14; gillrakers 20-27 + 28-36; scutes 4-12 + 7-11, total 11-23; at least anterior half of isthmus naked 5

5A. Scutes 4-9 + 7-11, total 11-19; pectoral filaments 10-14 6

6A. Scutes 4-5 + 7-8, total 11-13; pectoral filaments 13-14; gillrakers 21-23 +32; isthmus naked or with 1-2 scales at its base; anterior striae of scales not forming a web-like structure .... C. borneensis, p. 313

6B. Scutes 6-9 + 7-11, total 13-19; pectoral filaments 10-13; gillrakers 20-27 + 28-36; about anterior half of isthmus naked; anterior striae of scales forming a web-like structure...C. reynaldi, p. 314

5B. Scutes 11-12 + 9-12, total 20-23; pectoral filaments 10-11; gillrakers 21-24 + 31-33; anterior two-thirds of isthmus naked; anterior striae of scales not forming a web-like structure .... C. coomansi, p. 316

4B. Pectoral filaments 16-19; gillrakers 18-21 + 25-27; scutes 0-1 + 10-12, total 11-13; anterior third of isthmus naked .... C. rebentischii, p. 317

2B. Non-filamentous pectoral rays usually 9-11, reaching beyond pelvic base and much longer than that fin, filamentous pectoral rays 6; gillrakers 15-20 + 22-27; pseudobranchial filaments 7-17; isthmus entirely scaled; pneumatic duct short and emerging from just behind oesophagus 7

7A. No pearly spots along flanks or isthmus..*C. neglecta*, p. 318

7B. Longitudinal rows of pearly spots along lower half of flanks and isthmus .... *C. dussumieri*, p. 320

1B. Scutes 12-26 + 20-39, total 34-61; maxilla reaching well beyond gill opening (except in *C. rendahli*); non-filamentous pectoral rays 9-14, reaching beyond pelvic base and more or less longer than that fin, filamentous pectoral rays 6-7 8

8A. Maxilla not reaching beyond gill opening; scutes 18-20 + 34-36, total 54-55; branchiostegal rays 12; predorsal scales 15-17; isthmus naked; digestive tract without dark markings... *C. rendahli*, p. 323

8B. Maxilla reaching well beyond gill opening; isthmus with about 3 scales at its base 9

9A. Pectoral filaments 7; scutes 12-15 + 22-29, total 36-44; digestive tract without dark markings .... *C. grayii*, p. 324

9B. Pectoral filaments 6 10

10A. Non-filamentous pectoral rays very long, 15.3 - 21.9 % S.L., and reaching beyond pelvic tip or nearly so 11

11A. Gillrakers 18-25 + 29-34; scutes 13-15 + 20-25, total 34-40; teeth in jaws even; pyloric caeca 14-16; digestive tract without dark markings .... *C. lindmani*, p. 325

11B. Gillrakers 15-16 + 22-24; scutes 14-16 + 31-39, total 47-54; teeth in jaws uneven; pyloric caeca 9-10; oesophagus and stomach dotted with dark markings .... *C. macrognathos*, p. 327

10B. Non-filamentous pectoral rays shorter, 10.6 - 16.8 % S.L., reaching midway along pelvics, sometimes to tip of that fin; oesophagus and stomach dusky 12

12A. Predorsal scales 10-14, lateral scales 59-68; scutes 16-19 + 24-32, total 41-50; gillrakers 17-22 + 25-29; anal rays 79-89; branchiostegal rays 10; teeth in jaws small .... *C. mystus*, p. 327

12B. Predorsal scales 17-24, lateral scales 70-81; scutes 16-26 + 25-36, total 43-61; gillrakers 16-20 + 23-26; anal rays 87-117; branchiostegal rays usually 11-12; teeth in jaws larger .... *C. nasus*, p. 330

Descriptions of species

In this part of the work, some 355 nominal species have been considered. For 189 of these (except for just a few cases) all of the type specimens have been re-examined. A number of the earlier nominal species lack types or their types have long been a source of irritation and confusion. Often there is no indication which specimens were used in the original description or in which institution the types are deposited (Whitehead 1967a, 1973a; Talwar & Whitehead, 1971). In recent years Dr P.J.P. Whitehead of the British Museum has thrown a considerable light on these problems. His primary purpose was to "fix" the types, mainly through designation and full description of a lectotype. In certain cases stability has been bolstered by designation of a neotype, or a suitable specimen has been suggested and is described as a putative neotype. These extremely important pieces of work have been done, mainly for the clupeoid species of Richardson (Whitehead, 1966a), Bleeker (Whitehead, Boeseman & Wheeler, 1966), Lacepède, Cuvier & Valanciennes (Whitehead, 1967a), Bloch & Schneider (Whitehead, 1969a), Steindachner (Whitehead, 1970) and Day (Talwar & Whitehead, 1971). A neotype of Platygaster macrophthalma has also been designed by Seshagiri Rao (1977).

In the present work the types of many other authors have been examined, namely those of Bennett, Boulenger, Cantor, Castelnau, Chan, Chaudhuri, Berry & Whitehead, Day, Deraniyagala, Dutt & Babu Rao, Fowler, Fowler & Bean, Gray, Guichenot, Herre, Hyrtl, Jordan & Seale, Jordan & Starks, Macleay, Munro, Nelson & Rothman, Ogilby, Peters, Ramsay & Ogilby, Babu Rao, Seshagiri Rao, Regan, Roberts, Rüppell, Rutter, Sauvage, Schlegel, Schultz, Whitehead, Whitley and Zeitz. Unfortunately, although all the type specimens of the above authors and others need to be examined for comparison, it was often only possible to study perhaps the holotype or a paratype.

Familial, subfamilial, generic and subgeneric diagnoses are not given here as they have been discussed and revised by Whitehead (1962b, 1963a, 1963b, 1964a, 1964b, 1964c, 1965a, 1965b, 1967a, 1973a, 1973b), Chan (1965), Whitehead, Boeseman & Wheeler (1966), McAllister (1968), Talwar & Whitehead (1971), Nelson & Rothman (1973) and other authors. Nevertheless information on meristics and the morphology of many characters have been redefined here but in the form of figures, tables and illustrations (which I believe to be much easier to use). On the other hand the keys to higher taxa in the present study can (at least partially) serve as descriptive diagnoses.

Family Clupeidae

Subfamily Dussumieriinae

1. Etrumeus teres (DeKay, 1842)

(Plates 5a-f, 6a-e, 306a, 312a, 317a, 326a; Figures 17A, 36; Tables 2, 2.1)

Alosa teres DeKay, 1842, Nat. Hist. New York, pt.4 - Fishes : 262, pl.40 (128) (New York region).

Clupea micropus Schlegel, 1846, Fauna Japonica, pts.10-14 : 236, pl.107 (2) (S.E. Japan).

Etrumeus jacksoniensis Macleay, 1879, Proc. Linn. Soc. N.S. W. , 3 : 36, pl.4 (1) (Port Jackson).

Etrumeus acuminatus Gilbert, 1891, Proc. U.S. natn. Mus., 13 : 56 (Gulf of California).

Perkinsia othonops Eigenmann, 1891, Amer. Nat. Philad., 25 : 153 (Point Lona, California).

Etrumeus sadina Hildebrand, 1964, Fishes W.N. Atlantic, No. 1 (3) : 263 (not Clupea sadina Mitchill, 1814).

Specimens examined (182 : 26.0-195.0 mm S.L.)

1. BMNH 1867.11.28.265 (1 : 129.0 mm S.L.), E. Indies.
2. 1897.10.27.49-50 (2 : 108.0-125.0 mm S.L.), Botany Bay.
3. 1903.2.6.11-18 (8 : 124.0-152.0 mm S.L.), Natal, S. Africa.
4. 1907.12.23.91 (1 : 141.0 mm S.L.), Kobe, Japan.
5. 1923.2.26.73-78 (79 : 60.0-80.0 mm S.L.), Nagasaki, Japan.
6. 1939.3.23.6 (1 : 86.0 mm S.L.), Hong Kong.

7. BMNH 1965.4.1.1-34 (36 : 33.5-54.0 mm S.L.), Hong Kong.

8. 1965.7.5.76-79 (5 : 54.0-64.0 mm S.L.), Hong Kong.

9. 1969.1.10.2-14 (13 : 110.0-160.0 mm S.L.), Gulf of Aden.

10. 1976.4.27.109-142 (33 : 26.0-46.5 mm S.L.), Hong Kong; mixed with 1 specimen of Dussumieria acuta, 1 specimen of Sardinella sp. and 1 specimen of Engraulis japonicus.

11. 1978.8.16.5 (1 : 195.0 mm S.L.), Koshi, Japan.

12. RUSI uncat. (2 : 140.0-147.0 mm S.L.), S. Africa.

Diagnosis:- Whitehead (1962) recognised only a single species of Etrumeus, but at a given standard length E. teres has a relatively lower gillraker count than E. whiteheadi n.sp. (fig. 36). Total dorsal rays are usually 20-22, anal rays 10-12, pelvic base behind base of last dorsal ray (or below it in very young fish; pl. 5a-d); lateral scales 52-58, predorsal scales 16-18, transverse scales 12-15 (tbl. 2.1).

Remarks:- As shown by the scatter diagram (fig. 36), the count of upper and lower gillrakers in E. teres is fairly constant in fishes over about 50-60 mm S.L. The largest studied specimen, BMNH. 1978.8.16.5, 195 mm S.L. from Japan, also had 13 + 34 gillrakers.

Distribution:- Cosmopolitan; in the Indo-Pacific region, it has not been recorded from N.E. Arabian Sea, Bay of Bengal, S.E. Asia and Australia (except east coast).

2. Etrumeus whiteheadi n.sp.

(Plates 7a-g, 8a-d, 321a; Figures 17A, 36; Tables 2, 2.1.)

Specimen examined (79 : 22.0-166.0 mm S.L.)

Types:

1. BMNH 1890.6.27.24 (1: 166.0 mm S.L.), Algoa Bay, Port Elizabeth, S. Africa; J.M. Leslie. Holotype.

2. 1965.11.26.1-3 (3 : 39.5-46.0 mm S.L.), Knysna estuary, S. Africa; J.L.B. Smith. Paratypes.

3. RUSI 3844-2 (2 : 43.0-45.0 mm S.L.), S. Africa; unknown collector. Paratypes.

4. 5706-2 (2 : 143.0-153.0 mm S.L.), Walvis Bay, S. Africa; Schulein. Paratypes.

Other specimens:

5. BMNH 1965.4.5.1-4 (4 : 44.0-61.0 mm S.L.), Saldanha Bay, S. Africa; G.R. Robinson.

6. 1965.4.5.5-18 (14 : 24.0-41.0 mm S.L.), same data as in 5.

7. 1965.4.5.19-58 (53 : 22.0-34.0 mm S.L.), same data as in 5.

Diagnosis:-A second species of Etrumeus, with a higher gillraker count(16-18+36-39 cf. 12-15+30-35 in post juveniles and adults) than E. teres (fig.36). Total dorsal rays 18-20, anal rays 12-13, pelvic base below base of last dorsal ray in adults (but before dorsal origin in very young fish; pl. 7a-e); lateral scales 48-51, predorsal scales 15, transverse scales 11 (tbl. 2.1).

Remarks:-As shown by the Figures and Tables, E. whiteheadi n.sp. has consistently higher meristic counts than E. teres, although there is usually some overlap. The only morphometric distinction is in position. Although the meristic difference hints at exogenous factors (E. whiteheadi n.sp. is found in the southern and cooler part of the Etrumeus range), I consider this to be a distinct species because it occurs sympatrically with E. teres in Natal.

A large specimen, 7 ins., which was the basis of Smith's (1961) drawing of E. micropus (fig. 106) is referrable to this species. This is largely on the basis of its pelvic base, which is just below the last dorsal ray.

Named for Dr. P.J.P. Whitehead of the British Museum (Natural History), London, whose useful revision of the genus Etrumeus led me to the discovery of this new species.

Distribution:-Southern coast of Africa.

3. Dussumieria elopsoides Bleeker, 1849
(Plates 9a-f, 10a-e, 321b; Figures 17B, 37, 38, 39; Tables 2, 2.1)

Dussumieria elopsoides Bleeker, 1849, Verh. batav. Genoot. Kunst. Wet., 22 : 12 (Madura Strait, Java Sea, etc.).

Dussumieria hasseltii Bleeker, 1850, Natuurk Tijdschr. Ned.-Indië, 1 : 422 (Batavia, Cheribon, Samarang, Surabaya).

Dussumieria productissima Chabanaud, 1933, Bull. Inst. océanogr. Monaco, No. 627 : 4, figs 3-6 (Gulf and Isthmus of Suez).

Specimens examined (194 : 39.0-183.0 mm S.L.)

Types:

1. BMNH 1867.11.28.17 (1 : 125.0 mm S.L.), Java. Lectotype of D. elopsoides.
2. 1867.11.28.21 (1 : 135.0 mm S.L.), Java. Putative neotype of D. hasseltii.

Other specimens:

3. BMNH 1852.0.13 ? (1 : 118.0 mm S.L.), N.E. Arabian Sea.
4. 1858.4.21.360 (1 : 90.0 mm S.L.), Amboina.
5. 1860.3.19.469 (1 : 118.0 mm S.L.), locality unknown.
6. 1860.7.20.88 (1 : 106.0 mm S.L.), Amoy, China.
7. 1868.10.28.39 (1 : 138.0 mm S.L.), Visakhapatnam, India.
8. 1889.2.1.2041 (1 : 87.5 mm S.L.), Malabar.
9. 1889.2.1.2042-2045 (3 : 94.0-142.0 mm S.L.), Madras; mixed with a headless specimen of D. acuta, its skull in BMNH collection (prepared by Dr W.G. Ridewood).
10. 1889.2.1.2046 (1 : 99.5 mm S.L.), Port Blair, Andaman Sea.
11. 1889.2.1.2049 (1 : 48.0 mm S.L.), Malabar; F. Day. Formerly mixed among Ehirava fluviatilis, Dayella malabarica and Stolephorus insularis (originally BMNH. 1889.2.1.2048-2051).
12. 1934.8.18.17-19 (5 : 83.0-122.0 mm S.L.), Batavia.
13. 1934.8.18.20-22 (5 : 91.0-102.0 mm S.L.), Batavia.
14. 1936.10.7.21 (1 : 120.0 mm S.L.), Foochow, China.
15. 1939.3.23.5 (1 : 118.0 mm S.L.), Hong Kong.
16. 1962.3.26.211-216 (6 : 124.0-150.0 mm S.L.), Gulf of Aden.
17. 1962.3.26.217-221 (5 : 108.0-113.0 mm S.L.), Gulf of Aden;

with a head fragment of a larger fish.

18. 1962.6.13.4-8 (5 : 64.0-115.0 mm S.L.), Haifa, Israel.

19. 1964.2.2.6 (1 : 86.0 + ? mm S.L.), Palau, Caroline Is.

20. 1964.12.14.1-24 (25 : 70.0-145.0 mm S.L.), Zanzibar.

21. 1965.4.2.30-32 (3 : 81.0-97.0 mm S.L.), Lebanon.

22. 1965.4.2.33-42 (10 : 112.0-142.0 mm S.L.), Lebanon.

23. 1965.7.5.71-72 (2 : 178.0-183.0 mm S.L.), Hong Kong.

24. 1965.7.5.73 (1 : 143.0 mm S.L.), Hong Kong.

25. 1965.7.5.74-75 (2 : 75.0-85.0 mm S.L.), Hong Kong.

26. 1966.2.28.3 (1 : 80.0 mm S.L.), Chumporn, Thailand.

27. 1966.2.28.4 (1 : 88.5 mm S.L.), Chantaburi, Thailand.

28. 1966.2.28.5-6 (2 : 60.0-78.0 mm S.L.), Chantaburi, Thailand.

29. 1966.2.28.8. (1 : 91.5 mm S.L.), Samutsakorn, Gulf of Thailand.

30. 1966.11.16.426-438 (12 : 131.0-142.0 mm S.L.), Zanzibar.

31. 1967.2.1.20-24 (5 : 106.0-133.5 mm S.L.), Lebanon.

32. 1969.8.19.44 (1 : 48.0 mm S.L.), Vighingium, India.

33. 1969.8.19.45-54 (35 : 40.5-62.0 mm S.L.), Waltair, India.

34. 1969.8.19.67-68 (2 : 39.0-39.5 mm S.L.), Songkhla, Thailand.

35. 1970.4.24.62 (1 : 155.0 mm S.L.), locality unknown.

36. 1970.6.15.2 (1 : 43.0 mm S.L.), Dubai, Persian Gulf.

37. 1970.10.2.9 (1 : 126.0 mm S.L.), Trucial States.

38. 1970.10.2.17 (1 : 109.0 mm S.L.), Trucial States.

39. 1971.2.8.147-150 (4 : 121.5-155.0 mm S.L.), Persian Gulf.

40. 1972.9.7.25-27 (3 : 57.0-100.0 mm S.L.), Gasmata I.

41. 1972.9.7.28-31 (4 : 53.0-67.0 mm S.L.), Madang.

42. 1978.8.17.5-6 (2 : 66.0-68.0 mm S.L.), Philippines.

43. 1978.8.18.171-172 (2 : 167.0-176.0 mm S.L.), Philippines.

44. 1979.3.21.342 (1 : 65.5 mm S.L.), Amboina.

45. 1979.7.5.21-23 (3 : 90.0-93.5 mm S.L.), Penang.

46. 1979.8.16.832-839 (8 : 46.0-50.5 mm S.L.), Singapore.

47. NIOA uncat. (1 : 70.5 mm S.L.), Amboina.

48. RMNH 7128 (2 : 132.0-132.1 mm S.L.), E. Indies.

49. 7129 (15 : 58.5-121.0 mm S.L.), E. Indies, mixed with a specimen of D. acuta, 87.5 mm S.L.

Diagnosis:- One of the two species of the formerly monotypic Dussumieria, it differs significantly from D. acuta in the absence of horizontal apical marginal lines on the exposed portion of the scales (pl. 10c, d). Other but overlapping characters are its slender body, which is usually 16-22 % S.L. (fig. 38); lower gillrakers usually 22-32 (fig. 37); branchiostegal rays usually 13-17 and pyloric caeca usually 41-60 (fig. 39). There is a dark hind margin to the caudal (margin more broadly dark in D. acuta).

Distribution:- Indo-Pacific and (as an immigrant) the east coast of the Mediterranean (Haifa) (BMNH. 1962.6.13.4-8).

4. Dussumieria acuta Valenciennes, 1847
(Plates 11a-d, 12a-e, 304a, 312b, 317b, 326b; Figures 17B, 37, 38, 39; Tables 2, 2.1)

Clupea flosmaris Richardson, 1846, Ichthyol. China Japan : 305 (Canton, on Reeves drawing No. 64) (name suppressed by International Commission in 1970, Opinion 901, Bull. zool. Nomencl., 26 : 217).

? Elops javanicus Valenciennes, 1847, Hist. Nat. Poiss., 20 : 271 (on coloured, unpublished drawing of Kuhl & van Hasselt bearing this name).

Dussumieria acuta Valenciennes, ibid. : 467, pl. 606 (Bombay, Coromandel).

Etrumeus (Montalbania) albulina Fowler, 1934, Proc. Acad. nat. Sci. Philad., 85 : 244, fig. 7 (Iloilo, Philippines).

Specimens examined (77 : 34.0-133.0 mm S.L.)

Types:

1. MNHN 3697 (2 : 90.0-109.0 mm S.L.), Coromandel. The largest specimen was selected as lectotype of D. acuta.

2. 3217 (9 : 68.0-123.5 mm S.L.), Malabar. Syntypes of D. acuta.

3. MNHN 3694 (4 : 114.0-133.0 mm S.L.), Malabar. Syntypes of *D. acuta*

4. USNM 93136 (1 : 118.0 mm S.L.), Iloilo, Philippines. Holotype of *Etrumeus (Montalbania) albulina*.

Other specimens:

5. BMNH 1860.3.19.956 (1 : 98.0 mm S.L.), Penang.

6. 1868.1.28.8 (1 : 120.0 mm S.L.), Borneo.

7. 1868.10.28.38 (1 : 120.0 mm S.L.), Visakhapatnam, India.

8. 1889.2.1.2037 (1 : 125.5 mm S.L.), Bombay.

9. 1889.2.1.2039-2040 (2 : 70.0-78.0 mm S.L.), Malabar.

10. 1889.2.1.2047 (1 : 119.0 mm S.L.), Andaman Is.

11. 1920.7.13.4-5 (2 : 116.0-117.0 mm S.L.), Thailand.

12. 1934.8.18.12-13 (2 : 108.0-110.0 mm S.L.), Djambi, Sumatra.

13. 1934.8.18.14-16 (5 : 93.0-102.0 mm S.L.), Panitan, Sumatra.

14. 1935.4.12.3-12 (13 : 105.0-124.0 mm S.L.), Singapore.

15. 1935.9.20.1-8 (12 : 110.0-120.0 mm S.L.), Calicut, India.

16. 1966.2.28.1-2 (2 : 92.0-80.0 mm S.L.), Chumporn, Thailand.

17. 1966.2.28.7 (1 : 55.0 mm S.L.), Pakpoon, Thailand.

18. 1966.11.20.5 (1 : 88.0 mm S.L.), Thailand.

19. 1969.8.20.1-5 (6 : 34.0-38.0 mm S.L.), Singapore.

20. 1977.9.9.13-17 (5 : 110.0-121.0 mm S.L.), Pakistan.

21. 1979.8.16.840 (1 : 52.5 mm S.L.), Singapore.

22. RMNH 7129 (1 : 87.5 mm S.L.), E. Indies.

23. UZMK CN. 5-7 (3 : 90.0-112.0 mm S.L.), Persiske, Persian Gulf.

Diagnosis:- A species of *Dussumieria* with many horizontal apical marginal lines on exposed portion of scales (pl. 12d); body depth usually 22-29 % S.L. (fig. 38); lower gillrakers usually 19-26 (fig. 37); branchiostegal rays usually 12-15; pyloric caeca usually 27-41 (fig. 39); with posterior part of caudal broadly dark and scales usually with submarginal dusky edge posteriorly.

Remarks:- The branchiostegal ray count of 14 for Elops javanicus, on the basis of which it was believed to be D. elopsoides by Bleeker (1846) or D. acuta Valenciennes by Whitehead, Boeseman & Wheeler (1966), is not a useful character to identify the species; it applies equally to Etrumeus (tbl. 2).

Weber & DeBeaufort (1913), Roxas (1934), Fowler (1941), Bertin (1943), Blegvad & Løppenthin (1944), Munro (1955) and Qureshi (1957) give the lateral scale counts for D. acuta as 40-42 or 42-44. These counts are well outside the range of my counts (52-59) for 35 specimens from different part of the Indo-Pacific (except for the Red Sea); however, Fowler (1956) later gave a count of 48 for specimens from the Red Sea. My count of scale pockets of Blegvad & Løppenthin's specimens (UZMK. CN. 5-7) was 52-54. I therefore think that the low lateral scale counts of previous authors were not made with sufficient care.

Distribution:- Persian Gulf to S. China Sea.

Subfamily Pellonulinae

5. Ehirava fluviatilis Deraniyagala, 1929

(Plates 13a-d, 14a-e, 314f, 319c, 323g, 330a; Figures 26C, 44, 51; Tables 3, 3.1)

Ehirava fluviatilis Deraniyagala, 1929, Spolia zeylan., 15 : 34, pl. 14 (western Province, Ceylon).

Specimens examined (18 : 32.0-48.0 mm S.L.)

Types:

1. BMNH 1929.7.1.1 (1 : 48.0 mm S.L.), estuaries and rivers of Ceylon. Holotype.

2. 1929.7.1.2-9 (15 : 32.0-47.0 mm S.L.), estuaries and rivers of Ceylon. Paratypes.

Other specimens:

3. BMNH 1889.2.1.2050 (1 : 40.5 mm S.L.), Malabar.

4. BMNH 1889.2.1.2051 (1 : 48.0 mm S.L.), Malabar; F. Day. Formerly mixed among Dussumieria elopsoides, Dayella malabarica, and Stolephorus insularis (originally BMNH. 1889.2.1.2048-2051).

Diagnosis:- A monotypic pellonuline with weakly developed teeth in jaws; 2nd supramaxilla much shorter than half length of maxilla (pl. 13c); belly rounded; prepelvic scutes 5-8, lacking keels, postpelvic scutes absent; pelvic base just before dorsal origin; posterior interpelvic scale median (pl. 319c); anal without two separated rays; lower gillrakers 24-30 (fig.44), no gillrakers on posterior face of 3rd epibranchial; branchiostegal rays 5-6.

Remarks:- Day's collection of the present species (BMNH. 1889.2.1.2048-2051) originally included specimens of Dussumieria elopsoides, Dayella malabarica and Stolephorus insularis, well indicates the habitat of the fish as estuarine or brackish water and not exclusively freshwater.

Distribution:- Western province of Ceylon to Malabar, India.

6. Dayella malabarica (Day, 1873)
(Plates 15a-g, 16a-b, 323h, 330b; Figures 26C, 44; Tables 3, 3.1)

Spratelloides malabaricus Day, 1873, Proc. zool. Soc. Lond. : 240 (Malabar).

Specimens examined (1 : 46.9 mm S.L.)

1. BMNH 1889.2.1.2048 (1 : 46.9 mm S.L.), Malabar. F. Day. Paralectotype. Formerly with specimens of Dussumieria elopsoides, Ehirava fluviatilis and Stolephorus insularis (originally registered as BMNH. 1889.2.1.2048-2051).

Diagnosis:- A monotypic pellonuline, closest to Ehirava fluviatilis but differ from that species chiefly in the presence of gillrakers on the posterior face of the 3rd epibranchial; teeth in jaws moderately developed; 2rd supramaxilla slightly longer than half length of maxilla; prepelvic scutes 1-4; pelvic base just behind origin and branchiostegal rays 5.

Remarks:- Habitat as for Ehirava fluviatilis.

Distribution:- Malabar and Canara (fide Talwar & Whitehead, 1971), India.

7. Clupeoides borneensis Bleeker, 1851
(Plates 17a-f, 18a-e, 310d, 324a, 330c; Figures 26D, 45, 46, 51; Tables 3, 3.1)

Clupeoides borneensis Bleeker, 1851, Natuurk. Tijdschr. Ned.-Indië, 1 : 275 (Bandjermassing).

Clupeoides exilis Fowler, 1935, Proc. Acad. nat. Sci. Philad., 87 : 92, fig. 12 (Bangkok).

Specimens examined (102 : 36.0-68.0 mm S.L.)

Types:

1. RMNH 7115 (1 : 58.5 mm S.L.), Bandjermassing. Putative neotype of C. borneensis.
2. ANSP 60508 (1 : 50.0 mm S.L.), Bangkok. Holotype of C. exilis.
3. 60509-60518, 61476-61487 (9 : 36.0-44.0 mm S.L.), Bangkok. Paratypes of C. exilis; mixed with a specimen of Corica laciniata, 39.0 mm S.L.

Other specimens:

4. BMNH 1867.11.28.33 (1 : 52.0 mm S.L.), Borneo.
5. 1979.5.24.10 (1 : 65.5 mm S.L.), Bueng-borapet (lake), Nakornsawan, Thailand.
6. 1979.7.5.7. (1 : 44.7 mm S.L.), locality unknown, Haslar coll.
7. 1979.8.17.4-5 (2 : 48.0-48.2), no data.
8. 1979.8.24.39-106 (68 : 51.0-63.0 mm S.L.), Aluhaluh, Barito river, Borneo.
9. NIFI uncat. (7 : 61.0-68.0 mm S.L.), Bueng-borapet (lake),

Nakornswan, Thailand.

10. NIFI uncat. (11 : 39.5-47.0 mm S.L.), Puangklong-nongmor, Aydhya, Thailand.

Diagnosis:- A species of Clupeoides, with the 2nd supramaxilla longer than half length of maxilla, premaxilla elongated and minutely toothed, teeth on symphysis of lower jaw villiform; ventral scutes 9-12+6-9; scales without posterior striae (pl. 18d, e), lateral scales 35-39, predorsal scales 12-14, transverse scales usually 10, pectoral axillary scale about 40-50 % of pectoral length; upper and lower procurrent caudal rays distinctly spinose (pl. 17b); depth of caudal peduncle 11.3-12.5 % S.L.; gillrakers 9-12+18-24 (fig. 45); 2 branchiostegal rays on posterior ceratohyal; pneumatic duct not forming a V-shaped turn (pl. 17c); head and body without dark dots or prominent silvery band, a double pigment line behind dorsal.

Remarks:- Body depth in this species considerably increases with growth (fig. 46); it varies from 21 to 34 % S.L. Although this fish was previously recorded from the lower courses of rivers in Borneo and Thailand its recent collection from Ayudhya and Nakornswan, Thailand, indicates its riverine habitat, i.e. some 100-260 km from the sea. From the Mekhong river in Cambodia, this species was recorded by Chevey & Poulain (1940) and recently Taki (1975) collected a number of specimens from the southern part of Vietnam.

Distribution:- Borneo, Thailand, Cambodia and Vietnam.

8. Clupeoides hypselosoma Bleeker, 1866
(Plate 16c-f; Figures 27A, 45, 46; Tables 3, 3.1)

Clupeoides hypselosoma Bleeker, 1866, Ned. Tijdschr. Dierk., 3 : 293 (Bandjermassing).

Clupea (Clupeoides) potamophilus Bleeker, 1872, Atlas Ichth. Ind. Nèerland., 6 : 101 (on Clupeoides hypselosoma Bleeker, 1866).

Specimens examined (2 : 24.0-42.0 mm S.L.)

Types:

1. BMNH 1867.11.28.35 (1 : 42.0 mm S.L.), Bandjermassing Barito river, Borneo. Holotype of Clupeoides hypselosoma and Clupea (Clupeoides) potamophilus.

Other specimens:

2. ZMBI uncat. 76-14 (1 : 24.0 mm S.L.), Kapuas river, Borneo.

Diagnosis:- A species of Clupeoides, nearest to C. borneensis. On the basis of two very different sized specimens, it differs from that species in having ventral scutes 7+6, lateral scales 33-35, depth of caudal peduncle 14 % S.L., gillrakers 6-10+12-19; tip of snout, lower jaw and back dotted with dark melanophores and prominent silvery band along flanks.

Remarks:- Prepelvic scutes are entirely absent in the 24 mm S.L. specimen but there are 6 postpelvic scutes, the latter are very pungent and spike-like in the adult (holotype).

Distribution:- Riverine; Bandjermassingon the Barito river, also Kapuas river, Borneo.

9. Clupeoides papuensis (Ramsay & Ogilby, 1886)
(Plates 19a-e, 20a-d, 324b, 330d; Figures 26D, 45, 46, 51; Tables 3, 3.1)

Clupea papuensis Ramsay & Ogilby, 1886, Proc. Linn. Soc. N.S. W., (2) 1 : 19 (Strickland river, New Guinea).

Clupeoides multispinus Hardenberg, 1941, Treubia, 18 (2) : 219 (lower course of Digoel river, New Guinea).

Specimens examined (24 : 25.0-77.0 mm S.L.)

Types:

1. AMS B. 9955 (1 : 77.0 mm S.L.), Strickland river, New Guinea. Holotype of Clupea papuensis.

2. AMS B. 9956 (3 : 43.0-59.0 mm S.L.), Strickland river, New Guinea. Paratypes of Clupea papuensis.

Other specimens:

3. BMNH 1977.11.17.1-19 (20 : 25.0-46.5 mm S.L.), Fly river, New Guinea.

Diagnosis:- A species of Clupeoides with the 2nd supramaxilla shorter than half length of maxilla, premaxilla bluntly short and toothless, teeth on symphysis of lower jaw caniniform (pl. 19d); scales with several posterior striae (pl. 20d), lateral scales 39-42, predorsal scales 17-19, transverse scales 11-12, pectoral axillary scale rudimentary or absent; body depth 17-22 % S.L., depth of caudal peduncle 7.9-10.2 % S.L., head length 23.0-26.7 % S.L., eyes 5.5-9.5 % S.L., upper jaw length 7.5-10.6 % S.L. (fig. 46); gillrakers 9-11+15-19 (fig. 45); 1 branchiostegal ray on posterior cerato-branchial; pneumatic duct forming a V-shaped turn (pl. 19b); a silver band along flanks, broadest posteriorly and a double pigment line on back from head to caudal present.

Remarks:- The type of Clupeoides multispinus was believed lost, but its original description by Hardenberg (1941) perfectly agrees with specimens of the present species rather than with C. venulosus (of the same distributional range). Hardenberg's record of 16 for its transverse scales was possibly a misprint of 10. The occurrence of C. papuensis in the Digoel river in New Guinea, as well as in the Strickland, would not be unexpected. Whitley (1938) clearly states that "the freshwater fishes of the Fly river are allied to those of other rivers along the southern coastline of New Guinea and also to the fluviatile species of Aru Islands, Port Esslington, and the Northern Territory generally, and the rivers of the Gulf of Carpentaria. The northern New Guinea freshwater fauna is quite distinct from the southern".

The selection of a specimen as neotype for Clupeoides multispinus is impossible at present because of the lack of suitable specimen from type locality.

Distribution:- Riverine; southern Papua New Guinea (Strickland, Fly and Digoel rivers).

10. Clupeoides venulosus Weber & DeBeaufort, 1912

(Plates 21a-d, 22a-e, 314g, 319d; Figures 27A, 45, 46, 51; Tables 3, 3.1)

Clupeoides venulosus Weber & DeBeaufort, 1912, Verhand. Akad. Wet. Amst., 17 : 3 (Lorentz river, New Guinea).

Specimens examined (4 : 64.0-86.0 mm S.L.)

1. BMNH 1913.12.15.1, 30 (2 : 77.0-86.0 mm S.L.), Lorentz river, Papua New Guinea.
2. 1977.11.17.20-21 (2 : 64.0-71.0 mm S.L.), Fly river, New Guinea.

Diagnosis:- A species of Clupeoides which shares many important characters with C. papuensis. It is, however, separable from that species in its deeper body, 26-29 % S.L., depth of caudal peduncle 10.7-12.8 % S.L., head length 22.0-22.9 % S.L., eyes 5.5-6.9 % S.L., upper jaw length 5.8-7.2 % S.L. (fig. 46); predorsal scales 14-15; a very broad band along flanks, greatly tapering anteriorly; it has also a double pigment line on the back, from head to caudal.

Distribution:- Riverine; Lorentz river and Fly river, Papua New Guinea.

11. Corica laciniata Fowler, 1935

(Plates 23a-e, 24a-e, 311a, 314h, 319e, 324c, 330e; Figures 27B, 47, 50, 51; Tables 3, 3.1).

Corica laciniata Fowler, 1935, Proc. Acad. nat. Sci. Philad., 87 : 92, fig. 11 (Bangkok, Paknam).

Specimens examined (36 : 36.0-50.0 mm S.L.)

Types:

1. ANSP 61415 (1 : 50.0 mm S.L.), Bangkok, Thailand. Holotype of C. laciniata.
2. 61416-61457, 60519-60551 (10 : 39.0-42.0 mm S.L.), Bangkok, Paknam, Thailand. Paratypes of C. laciniata.
3. 60509-60518, 61476-61487 (1 : 39.0 mm S.L.), Bangkok; mixed among nine paratypes of Clupeoides exilis.
4. BMNH 1867.11.28.45 (1 : 36.0 mm S.L.), Pamangkat, S.W. Borneo. Paralectotype of Spratella pseudopterus.

Other specimens:

5. BMNH 1979.8.16.850 (1 : 39.0 mm S.L.), Songkhla Lake, Thailand.
6. 1979.8.24.144-153 (10 : 43.0-51.5 mm S.L.), Bandjermassing.
7. 1979.8.24.157-168 (12 : 41.0-50.0 mm S.L.), Aluhaluh, Barito river, Borneo.

Diagnosis:- One of the two species of Corica characterized by the presence of two posterior separated anal rays; teeth in jaws very small, no teeth on posterior face of premaxilla; 1 large epural. It is chiefly distinguishable from C. soborna on its higher gillraker count (10-13+23-27, cf. 9-11+19-21) (fig. 47); pyloric caeca 4; predorsal bones about 9.

Remarks:- The single paralectotype of Spratella pseudopterus (BMNH. 1867.11. 28.45), which was chosen by Whitehead, Boeseman & Wheeler (1966), is identical in many characters with the 11 type specimens of C. laciniata Fowler (although the lectotype (RMNH. 7116) is clearly C. sorborna). This is especially evident in the gillraker count (fig. 47). Although Bleeker had mixed material, the name pseudopterus must remain with the holotype and Fowler's name is retained for the present fish. Taki's (1975) specimens of C. soborna from the southern part of Vietnam may be this species.

Distribution:- Estuarine; S.W. Borneo and Gulf of Thailand.

12. Corica soborna Hamilton-Buchanan, 1822

(Plates 25a-e, 26a-d, 319f, 324d; Figures 27B, 47, 50, 51; Tables 3, 3.1)

Corica soborna Hamilton-Buchanan, 1822, Fishes of the Ganges : 253; 383 (Mahanadi river).

Corica argentata Swainson, 1839, Nat. Hist. Anim., Fishes, 2 : 294 (on Corica soborna Hamilton-Buchanan, 1822).

Spratella pseudopterus (part) Bleeker, 1852, Natuurk. Tijdschr. Ned.-Indië, 3 : 432 (Pamangkat, S.W. Borneo).

Specimens examined (6 : 32.0-41.0 mm S.L.)

Types:

1. RMNH 7116 (1 : 38.0 mm S.L.), Pamangkat, S.W. Borneo. Lectotype of S. pseudopterus.

Other specimens:

2. BMNH 1870.6.14.54 (1 : 36.0 mm S.L.), Orissa.
3. 1889.2.1.4219-4222 (4 : 32.0-41.0 mm S.L.), Orissa.

Diagnosis:- A species of Corica which, although very similar to C. laciniata, is clearly separable from that species in its lower gillraker count of 9-11+19-21 (cf. 10-13+23-27) (fig. 47); pyloric caeca 5 and predorsal bones about 12.

Remarks:- Due to damage and loss of gillrakers on the hypobranchial and in part on the anterior half of the ceratobranchial of the 1st gill arch on both sides in the lectotype of S. pseudopterus (RMNH. 7116), an accurate count of gillrakers in this specimen is impossible. However, the count on the 1st epibranchial is 9, and on the lower arm of the 2nd gill arch is 15. By comparison with similar counts from other specimens of both species (fig. 47), I consider the lectotype (RMNH. 7116) of S. pseudopterus to be C. soborna, but its paralectotype (BMNH. 1867.11.28.45) to be C. laciniata. The presence of only one branchiostegal ray on the posterior ceratohyal must be confirmed for this species.

In the absence of strictly topotypical material, it would be unwise to select as neotype one of the Orissa specimens of C. soborna.

Distribution:- Orissa, India and Pamangkat, S.W. Borneo.

13. Clupeichthys bleekeri (Hardenberg, 1936)

(Plates 27a-e, 28a-e; Figures 27C, 48, 49, 50, 51; Tables 3, 3.1)

Corica bleekeri Hardenberg, 1936, Treubia, 15 (3) : 229 (Kapuas river, S.W. Borneo).

Specimens examined (8 : 42.5-58.0 mm S.L.)

1. BMNH 1979.3.21.145-151 (7 : 42.5-58.0 mm S.L.), Kapuas river, Borneo.

2. 1979.3.21.152 (1 : 50.0 mm S.L.), data as in 1.

Diagnosis:- A species of Clupeichthys, with 8 pelvic rays; total anal rays 16-18+2, pectoral rays usually 12; gillrakers 8-9+16-18 (fig. 48); predorsal scales 15-18, pectoral axillary scale 51-61 % of pectoral length (fig. 49); ventral scutes usually 10+7; pseudobranchial filaments usually 12-15; a faint dusky band usually present along posterior part of alanks and a pair of prominent pigment lines from dorsal to caudal.

Remarks:- The British Museum specimens, which were collected by Dr T. Roberts from the type locality (Kapuas river), are suitable for selection of a neotype for Corica bleekeri. The largest fish, 58.0 mm S.L., from BMNH. 1979.3.21.145-151, which was also basis of my drawing, is probably the most suitable specimen for this purpose.

Distribution:- Kapuas river, S.W. Borneo.

14. Clupeichthys aesarnensis n.sp.

(Plates 29a-e, 30a-d, 314i, 324e, 330f; Figures 27C, 48, 49, 50, 51; Tables 3, 3.1)

Specimens examined (580 : 16.0-46.0 mm S.L.)

Types:

1. KUMF 2844a (1 : 43.5 mm S.L.), Ubonrat reservoir, Konkhan, Thailand; student coll. Holotype.
2. BMNH 1979.8.17.15-21 (7 : 32.0-38.5 mm S.L.), Ubonrat reservoir, Konkhan, Thailand; L. Wongrat. Paratypes.
3. CTNRC uncat. (48 : 27.0-45.0 mm S.L.), data as in 2. Paratypes.
4. KUMF 2844b (9 : 24.0-34.0 mm S.L.), data as in 1. Paratypes.
5. NIFI uncat. (5 : 38.0-45.0 mm S.L.), Hualuang, Udontanee, Thailand; National Inland Fisheries Institute. Paratypes.
6. uncat. (32 : 27.0-41.0 mm S.L.), Ubonrat reservoir, Konkhan, Thailand; National Inland Fisheries Institute. Paratypes.
7. uncat. (55 : 16.0-46.0 mm S.L.), Lampao reservoir, Karasint, Thailand; National Inland Fisheries Institute. Paratypes.

Other specimens:

8. BMNH 1979.8.16.80-502 (423 : 17.0-37.0 mm S.L.), Ubonrat reservoir, Konkhan, Thailand; L. Wongrat and T. Chukachorn.

Diagnosis:- A species of Clupeichthys, with 8 pelvic rays; total anal rays usually 14-16+2; pectoral rays usually 10-12; gillrakers 8-10+17-19 (fig. 48); predorsal scales 12-15; pectoral axillary scale 22.7-52.6 % of pectoral length (fig. 49); ventral scutes usually 9-10+6-7; pseudobranchial filaments 10-13; a dusky band along flanks, fading anteriorly, scattered dark dots sometimes present on head, a pair of thin pigment line on back from head to caudal.

Remarks:- Clupeichthys aesarnensis is clearly distinguished from C. bleekeri by its much shorter pectoral axillary scale (fig. 49), and its trends of lower counts of anal rays, pectoral rays, predorsal scales, pseudobranchial filaments and ventral scutes (tbls. 3, 3.1); circumpeduncular scales are 14 (cf. 12). From C. goniognathus it differs in its higher gillraker count (fig. 48), and its incomplete band along the flanks.

Body depth in this fish varies considerably (fig. 48), with no relation to length groups but possibly to degree of gonadial maturation.

Distribution:- Riverine of N.E. Thailand, about 1,000 km from the mouth of Mekhong river.

15. Clupeichthys goniognathus Bleeker, 1855

(Plates 31a-d, 32a-e, 314j; Figures 27D, 48, 49, 50, 51; Tables 3, 3.1)

Clupeichthys goniognathus Bleeker, 1855, Natuurk. Tijdschr. Ned.-Indië, 9 : 275 (Lahat, Sumatra).

Specimens examined (3 : 31.5-65.2 mm S.L.)

Types :

1. BMNH 1867.11.28.36 (1 : 65.2 mm S.L.), Lahat, Sumatra. Holotype.

Other specimens:

2. NIFI uncat. (2 : 31.5-33.5 mm S.L.), Puangklong-nongmor, Ayudhya, Thailand.

Diagnosis:- A species of Clupeichthys with 8 pelvic rays; total anal rays 15-17+2; pectoral rays usually 12; gillrakers 8+15-16 (fig. 48); lateral scales 33-34, predorsal scales 12-13; pectoral axillary scale 35-39 % of pectoral length (fig. 49); ventral scutes 9-10+7-8; a well defined and distinct silvery band along flanks, head without dark dots, a faint band of microscopic dots on back from dorsal to caudal, not forming a double line.

Remarks:- Apart from its lower count of gillrakers, the present species is easily separated from other eight pelvic-rayed Clupeichthys by its distinct and evenly defined silvery band along flanks. In C. bleekeri and C. aesarnensis n.sp., the lateral band is usually dusky, greatly tapering and fading anteriorly.

Most or all specimens recorded as this species by Taki (1975) from many places along the Mekhong river are possibly referrable to C. aesarnensis n.sp.

Distribution:- Riverine; Lahat, Sumatra and Ayudhya, Thailand.

16. Clupeichthys perakensis (Herre, 1936)

(Plates 33a-d, 34a-e, 324f; Figures 27D, 48, 49, 50, 51; Tables 3, 3.1)

Corica perakensis Herre, 1936, Bull. Raffles Mus., No. 12 : 5, pl. 1 (Perak river, Malaya).

Specimens examined (26 : 21.0-28.2 mm S.L.)

Types:

1. SU 30976 (1 : 28.1 mm S.L.), Perak river, Malaya. Holotype

Other specimens:

2. BMNH 1935.4.12.13-22 (20 : 21.0-26.0 mm S.L.), Perak river, Malaya.
3. 1979.8.16.845-849 (5 : 22.3-28.2 mm S.L.), locality unknown.

Diagnosis:- A species of Clupeichthys which is unique in having only 7 pelvic rays and only 5 branchiostegal rays; predorsal scales 10-11, transverse scales 11, pectoral axillary scale rudimentary or absent; ventral scutes 7-9+4-6; a broad light band along flanks from head to caudal and a series of longitudinal black dots usually present at middle of its posterior part.

Remarks:- The holotype figured by Herre (1936) is erroneously shown with scales on the operculum; but re-examination of the specimen (SU. 30976) reveals no such scales; otherwise it is a good drawing of the fish.

Distribution:- Perak river, Malaya.

Subfamily Spratelloidinae

17. Spratelloides gracilis (Schlegel, 1846)

(Plates 35a-d, 36a-e, 326c, 334a; Figures 17C, 40, 41, 42, 43; Tables 2, 2.1)

Clupea gracilis Schlegel, 1846, Fauna Japonica, pts. 10-14 : 238, pl. 108 (2) (S.E. coast of Nagasaki).

Clupea argyrotaeniata Bleeker, 1849, J. Ind. Arch., 3 : 72 (Macassar).

Spratelloides atrofasciatus Schultz, 1943, Bull. U.S. natn. Mus., No. 180 : 8, fig. 1 (Samoa).

Specimens examined (1525 : 0.7-95.0 mm S.L.)

Types:

1. BMNH 7127 (1 : 62.0 mm S.L.), Macassar. Putative neotype of C. argyrotaeniata.

2. USNM 115099 (1 : 32.5 mm S.L.), Samoa. Holotype of S. atrofasciatus.

Other specimens:

3. BMNH 1867.11.28.47 (1 : 67.0 mm S.L.), E. Indies.

4. 1907.12.23.96-99 (4 : 68.0-81.0 mm S.L.), Goto I., Japan.

5. 1923.2.26.41-45 (14 : 80.0-95.0 mm S.L.), Wakanoura, Japan.

6. 1924.4.30.8 (1 : 48.5 mm S.L.), N.S. Wales.

7. 1934.8.18.1-3 (3 : 56.0-70.0 mm S.L.), Taiwan.

8. 1934.8.18.9-11 (3 : 47.0-48.0 mm S.L.), Sumatra.

9. 1935.9.30.10-11 (2 : 46.0-48.5 mm S.L.), Ghadaga, Red Sea.

10. 1951.1.16.36-60 (381 : 0.7-39.0 mm S.L.), Gulf of Aqaba.

11. 1963.10.19.51-100 (141 : 15.0-52.0 mm S.L.), Eilat, Gulf of Aqaba

12. 1965.4.1.35-53 (17 : 27.0-63.0 mm S.L.), Hong Kong; mixed with 2 specimens of Stolephorus sp.

13. 1965.4.1.54.-83 (28 : 49.0-59.0 mm S.L.), Hong Kong.

14. 1965.7.5.49-50 (2 : 45.5-55.0 mm S.L.), Hong Kong.

15. 1965.7.5.51-70 (20 : 34.0-60.0 mm S.L.), Hong Kong.

16. 1966.1.17.42-61 (20 : 33.5-42.0 mm S.L.), Riukiu I., Japan.

17. 1966.11.16.375-424 (702 : 24.5-56.0 mm S.L.), Wasin I., Africa.

18. 1966.11.16.425 (1 : 56.0 mm S.L.), Mafia Channel, Tanzania.

19. 1968.4.4.97-103 (7 : 40.0-52.0 mm S.L.), Zanzibar.

20. 1969.8.19.55 (1 : 62.0 mm S.L.), Cebu, Philippines.

21. 1969.8.19.56-66 (55 : 49.5-64.0 mm S.L.), Sulu, Philippines.

22. 1969.8.20.6-15 (44 : 10.0-41.0 mm S.L.), Romblon I., Philippines.

23. 1969.8.20.16-18 (3 : 62.0-67.0 mm S.L.), Cebu, Philippines.

24. 1974.2.20.1-25 (25 : 51.0-62.5 mm S.L.), Lord Howe I.

25. 1974.8.19.13-17 (5 : 42.0-55.5 mm S.L.), Tsoi Boto.

26. 1977.4.4.1-30 (29 : 47.0-60.5 mm S.L.), Rabbit I., mixed with a specimen of Hypoatherina tropicalis, 34.0 mm S.L.

27. RMNH 24956 (14 : 41.0-65.0 mm S.L.), E. Indies.

Diagnosis:- A species of Spratelloides with interrupted vertical striae on scales (pl. 36d); maxilla toothed, posterior lower portion of 2nd supra-maxilla longer than upper portion (pl. 35c); total anal rays usually 12-13; lateral scales usually 42-47; gillrakers usually 10-12+27-37 (figs 42, 43); pyloric caeca 11-14; a complete prominent silvery grey band along flanks from head to caudal, the caudal without dark markings.

Remarks:- This fish is readily separable from other Spratelloides by its complete band on the flanks, as wide as eye from head to caudal. Good descriptions of live colour were given by Whitehead (1965a) and Losse (1968). Gill-raker counts in species of Spratelloides vary considerably, as was well demonstrated by Whitehead (loc. cit.).

Re-examination of the holotype of S. atrofasciatus shows that its gillraker count is 7+21. In comparison with counts from other specimens of about the same size from different areas (figs 42, 43) I cannot regard the Samoan population as subspecifically distinct (as proposed by Whitehead, loc. cit.).

Distribution:- Indo-Pacific, widespread from east coast of Africa to Japan, Somoa and Australia.

18. Spratelloides lewisi n.sp.

(Plates 37a-d, 38a-e, 321c, 326d; Figures 17C, 40, 41, 42, 43; Tables 2, 2.1)

Specimens examined (36 : 31.0-60.0 mm S.L.)

Types:

1. BMNH 1979.8.16.503 (1 : 58.0 mm S.L.), Kolokofa, Santa Ysabel I., Solomon Is. (7°42'S : 58°34'E); A.D. Lewis. Holotype.

2. BMNH 1974.8.19.18-28 (11 : 31.0-44.0 mm S.L.), Port Moresby, New Guinea; A.D. Lewis. Paratypes.

3. 1978.8.15.128-152 (23 : 42.0-60.0 mm S.L.), data as in 1. Paratypes.

Other specimens:

4. BMNH 1979.8.16.504 (1 : 55.0 mm S.L.), data as in 1.

Diagnosis:- A new species of Spratelloides, closely related to S. gracilis but separated by having a slightly lower count of total anal rays, usually 11-12 (cf. 12-13); a lower count of lateral scales, usually 40-43 (cf. 42-45); a lower count of pyloric caeca, 8-10 (cf. 11-14) and particularly its incomplete greyish band along the flanks, which fades anteriorly.

Remarks:- It was only after a detailed comparison of 36 specimens of this fish with many S. gracilis from the whole of its range that I came to regard the present fish as distinct. Apart from the above characters, it appears to differ also from S. gracilis in its slightly more elongate body (fig. 43), gillraker counts are only slightly different (9-11+28-32) and greatly overlap with S. gracilis (7-13+19-37) (figs 42, 43).

Named for Mr A.D. Lewis who collected the specimens.

Distribution:- Santa Ysabel I. and Port Moresby, New Guinea.

19. Spratelloides delicatulus (Bennett, 1831)
(Plates 39a-d, 40a-e, 306b, 312c, 317c; Figures 17D, 40, 41, 42, 43; Tables 2, 2.1)

Clupea delicatulus Bennett, 1831, Proc. zool. Soc. Lond., 1 : 168 (Mauritius).

Clupea macassariensis Bleeker, 1849, J. Ind. Arch., 3 : 72 (Macassar).

Alausa alburnus Kner & Steindachnder, 1866, Sitzb, K. Akad. Wiss. Wien, 54 : 387, pl. 1 (16) ('Valparaiso' - in fact, Samoa).

Specimens examined (1019 : 14.0-67.0 mm S.L.)

Types:

1. RMNH 7126 (1 : 59.0 mm S.L.), Macassar. Putative neotype of *C. macassariensis*.

2. NMW 4282 (2 : 40.0-43.0 mm S.L.), Samoa. The largest specimen was selected as lectotype of *A. alburnus*, the smaller one being its paralectotype.

3. 4283 (2 : 47.0-51.0 mm S.L.), Samoa. Paralectotypes of *A. alburnus*.

Other specimens:

4. BMNH 1867.11.28.34 (1 : 63.5 mm S.L.), Macassar.
5. 1872.4.6.54 (1 : 67.0 mm S.L.), W. Celebes.
6. 1874.11.19.65 (1 : 53.0 mm S.L.), Bonham I., China.
7. 1883.3.11.33-35 (3 : 37.0-57.0 mm S.L.), New Britain.
8. 1906.11.19.27 (1 : 26.5 mm S.L.), Kosi Bay, Zululand.
9. 1927.4.14.13-22 (29 : 32.0-44.0 mm S.L.), Seychelles.
10. 1933.3.11.25-34 (16 : 29.5-35.5 mm S.L.), Sulu, Philippines.
11. 1934.8.18.4-8 (5 : 33.0-50.5 mm S.L.), Thousand Is.
12. 1949.11.29.5-26 (22 : 26.0-36.0 mm S.L.), Cocos Keeling.
13. 1951.1.16.14-23 (10 : 21.0-48.0 mm S.L.), Gulf of Aqaba.
14. 1951.1.16.24-35 (12 : 40.0-46.0 mm S.L.), Gulf of Aqaba.
15. 1960.3.15.16-31 (16 : 14.0-40.0 mm S.L.), Red Sea.
16. 1960.3.15.33-39 (8 : 35.0-39.0 mm S.L.), Red Sea.
17. 1962.1.22.2-3 (2 : 49.5-52.0 mm S.L.), Maldives.
18. 1962.6.19.1-16 (16 : 35.0-43.0 mm S.L.), Gulf of Aden.
19. 1963.10.19.1-50 (465 : 19.0-38.0 mm S.L.), Eilat, Gulf of Aqaba.
20. 1964.1.1.12-63 (53 : 31.0-45.0 mm S.L.), Eilat, Gulf of Aqaba.
21. 1964.3.17.1-32 (28 : 36.0-53.0 mm S.L.), Palau, Caroline Is.
22. 1966.1.17.62-81 (19 : 34.0-45.5 mm S.L.), Riukiu I.
23. 1966.11.16.346-374 (29 : 29.0-46.0 mm S.L.), Mkokotoni Mangrove Creek.

24. BMNH 1966.11.16.322-345 (24 : 45.0-51.0 mm S.L.), Kilifer, Mnarani Beach, Kenya.

25. 1966.11.20.13-20 (8 : 41.0-51.0 mm S.L.), Palau, Caroline Is.

26. 1967.7.10.5 (1 : 38.5 mm S.L.), Palau, Caroline Is.

27. 1968.4.4.39-51 (14 : 22.0-49.0 mm S.L.), Wasin I.

28. 1972.9.7.23-24 (2 : 42.0-43.0 mm S.L.), Beagle Bay.

29. 1974.5.25.15-20 (6 : 41.0-55.0 mm S.L.), Madang Harbour.

30. 1974.5.25.28-53 (26 : 21.0-45.0 mm S.L.), Madang Harbour.

31. 1974.5.25.116 (1 : 31.5 mm S.L.), Kapa Kapa, New Guinea.

32. 1974.5.25.117 (1 : 45.5 mm S.L.), Madang Harbour.

33. 1974,5.25.118-141 (24 : 30.5-42.0 mm S.L.), Madang Harbour.

34. 1974.6.24.65-139 (69 : 39.0-56.0 mm S.L.), Queensland.

35. 1975.5.25.54-114 (63 : 23.0-50.0 mm S.L.), Madang Harbour.

36. 1975.5.25.115 (1 : 47.0 mm S.L.), Madang Harbour.

37. 1979.3.21.343-345 (3 : 54.0-59.0 mm S.L.), Pombo I.

38. MNHN 3715 (1 : 61.0 mm S.L.), Ternate.

39. NIOA uncat. (3 : 55.0-61.5 mm S.L.), Pombo I.

40. RMNH 24957 (30 : 28.5-66.0 mm S.L.), Macassar.

Diagnosis:- A species of Spratelloides, with continuous vertical striae on scales (pl. 40d); maxilla toothless, posterior lower portion of 2nd supra-maxilla about the same size as the upper part (pl. 39c); total anal rays usually 10; lateral scales usually 36-39, predorsal scales usually 10-12, transverse scales usually 6 (tbls. 2, 21.), pectoral axillary scale usually 60-81 % of pectoral length (fig. 41). It is immediately distinguished from S. gracilis and S. lewisi by the absence of markings along the flanks and the presence of two prominent dark streaks on the caudal. From C. robustus it differs in its untoothed scales (pls. 40d).

Remarks:- Whitehead (1963a, 1973b)did not notice the teeth on the posterior edge of the scales in S. robustus, as well as the other distinguishing characters used in this study. He therefore retained S. robustus in the synonymy of S. delicatus, although separating it subspecifically on its gillraker count.

Distribution:- Indo-Pacific from east coast of Africa to Japan, Samoa and Australia.

20. Spratelloides robustus Ogilby, 1897

(Plates 41a-e, 42a-e; Figures 17D, 40, 41, 42, 43; Tables 2, 2.1)

Spratelloides robustus Ogilby, 1897, Proc. Linn. Soc. N.S. W., 22 : 64 (N.S. Wales).

Specimens examined (89 : 34.5-75.0 mm S.L.)

1. BMNH 1855.9.19.1153-1158 (6 : 53.5-70.0 mm S.L.), locality unknown.
2. 1857.2.20.14 (1 : 75.0 mm S.L.), Australia.
3. 1897.10.27.43-47 (5 : 34.5-68.0 mm S.L.), Port Jackson.
4. 1924.4.30.1-7 (77 : 45.5-74.0 mm S.L.), N.S. Wales.

Diagnosis:- A species of Spratelloides, closely allied to S. delicatulus. It is readily distinguishable, however, by having a toothed posterior edge to the scales; lateral scales 42-46, predorsal scales usually 13-15, transverse scales 8-9 (tbls. 2.1), pectoral axillary scale usually 49-63 % of pectoral length.

Distribution:- S.E. coast of Australia.

Subfamily Clupeinae

21. Sardinella (Sardinella) longiceps Valenciennes, 1847

(Plates 43a-e, 44a-e, 321d; Figures 18A, 52, 54, 55; Tables 4, 4.1, 4.2)

Sardinella longiceps Valenciennes, 1847, Hist. Nat. Poiss., 20 : 273 (Pondicherry).

Sardinella neohowii Valenciennes, ibid. : 274 (Cannanore or Mahé, Malabar coast).

Alausa scombrina Valenciennes, ibid.: 442 (Cannanore).

Specimens examined (132 : 80.0-151.0 mm S.L.)

Types:

1. MNHN 3743 (6 : 109.0-125.0 mm S.L.), Pondicherry. The largest, a tagged fish, was selected as lectotype of S. longiceps, the remainder being paralectotypes.

2. 3744 (2 : 122.0-125.0 mm S.L.), Malabar coast. The largest fish, was selected as lectotype of S. neohowii, the smaller one being a paralectotype.

3. 3748 (7 : 105.0-151.0 mm S.L.), Malabar. The largest, a tagged fish, was selected as lectotype of A. scombrina, the remainder being paralectotypes.

Other specimens:

4. BMNH 1870.5.2.1 (1 : 161.0 mm S.L.), Calicut.
5. 1887.11.11.314-316 (3 : 111.0-119.0 mm S.L.), Muscat.
6. 1889.2.1.1887-1892 (7 : 91.0-110.0 mm S.L.), Madras.
7. 1889.2.1.1893-1895 (3 : 117.0-122.0 mm S.L.), Sind.
8. 1889.2.1.1897-1900 (4 : 95.0-131.0 mm S.L.), Malabar.
9. 1889.2.1.1901-1904 (4 : 84.0-119.0 mm S.L.), Madras.
10. 1889.2.1.1905-1906 (2 : 90.0-91.5 mm S.L.), Canara.
11. 1945.12.31.13 (6 : 115.0-124.0 mm S.L.), Mukalla.
12. 1962.3.26.10-18 (9 : 119.0-137.0 mm S.L.), Ruqub.
13. 1962.3.26.19-36 (18 : 99.0-139.0 mm S.L.), Mukalla.
14. 1962.3.26.37-48 (12 : 84.0-137.0 mm S.L.), Gulf of Aden.
15. 1962.3.26.49-62 (14 : 80.0-104.0 mm S.L.), Gulf of Aden.
16. 1962.3.26.69 (1 : 141.0 mm S.L.), Abo, Somaria.
17. 1962.3.26.70-88 (19 : 125.0-139.0 mm S.L.), Abyan, Gulf of Aden.
18. 1962.3.26.89-95 (7 : 83.0-110.0 mm S.L.), Gulf of Aden.
19. 1966.11.17.138-143 (6 : 131.0-139.0 mm S.L.), Gulf of Aden.
20. 1971.5.21.7 (1 : 140.0 mm S.L.), Gulf of Masira.

Diagnosis:- A nine pelvic-rayed Sardinella, the species with the longest head, 29-35 % S.L. (fig. 54) and at any given size, the highest gillraker count, 117-241+150-253 (fig. 52), those on the 3rd and 4th gill arches slightly curled outward; pyloric caeca 152-186 (fig. 55).

Remarks:- Clupea mauritiana of Bennett (1833) is problematic. Fowler (1941) thought it was Anodontostoma chacunda, but Whitehead (1973b) tentatively considered its 9 pelvic ray count and its type locality (Mauritius) as an indicator of S. (S.) longiceps. A future study of clupeoid fishes from this island, from which few clupeoid collections exist, may solve the problem. Mason (1882) virtually extended the range of this fish to the Anadaman Islands.

Distribution:- Somalia to Madras, possibly to the Andamans.

22. Sardinella (Sardinella) neglecta n. sp.

(Plates 45a-d, 46a-e, 312d, 317d; Figures 18A, 52, 54, 55; Tables 4, 4.1, 4.2)

Specimens examined (28 : 97.0-132.0 mm S.L.)

Types:

1. BMNH 1966.11.16.106 (1 : 116.0 mm S.L.), Formosa Bay (2°59'S : 40°19'E); G.F. Losse. Holotype.

2. 1966.11.16.80-81 (2 : 114.0-120.0 mm S.L.), Dar-es-Salaam; G.F. Losse. Paratypes.

3. 1966.11.16.92-93 (2 : 110.0-112.0 mm S.L.), Zanzibar channel; G.F. Losse. Paratypes.

4. 1966.11.16.94-105 (11 : 106.0-132.0 mm S.L.), data as in 1. Paratypes.

Other specimens:

5. 1913.4.7.2 (1 : 112.0 mm S.L.), Mombasa; R.J. Cuningham.

6. 1966.11.16.82-91 (10 : 105.0-125.0 mm S.L.), Mombasa; G.F. Losse.

7. 1966.11.17.1 (1 : 97.0 mm S.L.), Shimoni, Kenya; G.F. Losse.

Diagnosis:- A new species of nine pelvic-rayed Sardinella, being intermediate between S.(S.) longiceps and S.(S.) lemuru; it is closer to the latter fish in its shorter head, 27-29 % S.L. (fig. 54), but easily distinguished from it by its higher gillraker count at any given size, 108-166+143-188 (cf. 51-153+ 77-188) (figs 52, 53); also a higher count of pyloric caeca, 160-205 (cf. 133-151) (fig. 55).

Remarks:- The allopatric distribution of S.(S.) longiceps, S.(S.) neglecta n.sp. and S.((S.)lemuru provides the easiest means of separating them. This is particularly useful in identification of very young individuals. All the present specimens collected by Mr G.F. Losse were described as S. longiceps in Losse (1968).

Distribution:- Kenya and Tanzania.

23. Sardinella (Sardinella) lemuru Bleeker, 1853
(Plates 47a-f, 48a-e, 49a-f, 326e; Figures 18A, 53, 54, 55; Tables 4, 4.1, 4.2)

Clupea nymphaea Richardson, 1846, Ichth. China Japan : 304 (China Sea) (name suppressed by International Commission in 1970, Opinion 901, Bull. zool. Nomencl., 26 (5/6) : 217).

Sardinella lemuru Bleeker, 1853, Natuurk. Tijdschr. Ned.-Indië, 4 : 500 (Batavia)

Amblygaster posterus Whitley, 1931, Rec. Aust. Mus., 18 (4) : 144 (Fremantle District, W. Australia).

Sardinella samarensis Roxas, 1934, Philipp. J. Sci., 55 : 275, pl. 2, fig. 11 (scale) (Samar, Philippines).

Specimens examined (33 : 63.0-229.0 mm S.L.)

Types:

1. BMNH 1867.11.28.41 (1 : 133.0 mm S.L.), Batavia. Lectotype of S. lemuru.

2. MNHN 3226 (1 : 115.0 mm S.L.), Java. Paralectotype of S. lemuru.

3. RMNH 7103 (9 : 104.0-130.0 mm S.L.), Batavia. Paralectotypes of *S. lemuru*.

4. AMS I. 12826 (1 : 177.0 mm S.L.), Fremantle District, W. Australia. Holotype of *A. posterus*.

Other specimens:

5. BMNH 1851.12.27.202 (1 : 63.0 mm S.L.), China Sea.

6. 1939.1.17.3 (1 : 229.0 mm S.L.), Hong Kong.

7. 1960.4.7.42-51 (9 : 100.0-109.0 mm S.L.), Palawan, Philippines.

8. 1964.11.6.6-7 (2 : 164.0-165.0 mm S.L.), China.

9. 1979.3.21.334-336 (3 : 92.0-118.0 mm S.L.), Keelung, Taiwan.

10. 1979.3.21.338 (1 : 147.0 mm S.L.), Ambonia.

11. 1979.3.21.339 (1 : 157.0 mm S.L.), Ambonia.

12. 1979.8.15.36 (1 : 149.0 mm S.L.), Phuket I., Thailand.

13. NIOA uncat. (1 : 155.0 mm S.L.), Ambonia.

14. uncat. (1 : 171.0 mm S.L.), Ambonia.

Specimens of *Sardinella* (*Sardinella*) *aurita*/*brasiliensis* complex, for comparison (66 : 85.0-232.0 mm S.L.)

Types:

1. MNHN A. 9824 (2 : 168.0-197,0 mm S.L.), Messina, Italy. The smaller fish was selected as lectotype of *Sardinella aurita*.

2. 663 (2 : 205.0-232.0 mm S.L.), Messina, Italy. Paralectotypes of *Sardinella aurita*.

3. NMW 1159 (2 : 115.0-147.0 mm S.L.), Rio de Janeiro. Paralectotypes of *Clupea brasiliensis*.

Other specimens:

4. BMNH 1868.4.30.7-10 (6 : 98.0-112.0 mm S.L.), Algiers.

5. 1921.9.12.3-4 (2 : 136.0-146.0 mm S.L.), Egypt.

6. 1924.1.31.17 (1 : 143.0 mm S.L.), Mossarnnedes, W. Africa.

7. 1934.10.6.9-11 (3 : 135.0-141.0 mm S.L.), Jaffa, Palestine.

8. 1935.3.28.25-29 (14 : 131.0-165.0 mm S.L.), Haifa, Palestine.

9. BMNH 1938.11.15.9 (1 : 153.0 mm S.L.), Algiers.

10. 1953.7.10.39-40 (2 : 201.0-212.0 mm S.L.), Apese Beach.

11. 1963.6.17.2-3 (2 : 85.0-99.0 mm S.L.), Ivory coast.

12. 1965.4.2.16-20 (5 : 85.0-123.0 mm S.L.), Lebanon.

13. 1965.4.2.21-29 (9 : 91.0-145.0 mm S.L.), Lebanon.

14. 1970.10.21-62-64 (3 : 88.0-155.0 mm S.L.), Alexandria.

15. uncat. (12 : 94.0-140.0 mm S.L.), Dakar, Senegal.

Diagnosis:- A species of nine pelvic-rayed *Sardinella* from the N. China Sea, Indochina and the Indo-Australian archipelago, with head length 26-29 % S.L. (fig. 54); gillrakers 51-153+77-188 (figs 52, 53), those on the inner gill arches straight in smaller fishes but slightly curled outward in larger fishes; exposed portion of scales usually without circulii (pl. 48c, d); pyloric caeca 133-151 (fig. 55).

Remarks:- *C. nymphaea*, *S. lemuru* and *A. posterus* all have 9 pelvic rays. A re-examination of the type specimens of the last two fishes shows that they are *S.* (*S.*) *lemuru*. Unfortunately, Roxas's (1934) type material of *S. samarensis* is said to have been lost (*in litt.*, Dr P.J.P. Whitehead and Mr I.A. Ronquillo) and no count of pelvic rays, was made for the original description. However, the gillraker count (96-102 in fishes of 104-114 mm S.L.) and the description of the scales agree perfectly with *S. lemuru*, but not with other clupeid fishes of the area. Prior to this work Chu & Tsai (1958) and Chan (1965) had already equated *S. samarensis* with *S. lemuru*. Moreover, though the type of *nymphaea* is now known not to exist, geographically, I have no doubt that Richardson's species was also *S.* (*S.*) *lemuru*.

The name *S. nymphaea* is not given priority here because it was suppressed by the International Commission (see also Whitehead, 1966a).

Due to the lack of specimens from Samar, Philippines, the selection of a neotype of *S. samarensis* has to be postponed. Although *S.* (*S.*) *lemuru* (or the Indo-Pacific *S. aurita* of authors) has not hitherto been recorded from the

Andaman Sea, the collection of a stray specimen from Phuket I., Thailand, now extends its range to that area.

Regan (1917b) and subsequent authors have recognised S. aurita as the most widespread species of Sardinella, recording it from both sides of the tropical Atlantic, the Mediterranean and the western part of the Pacific; in the Indian Ocean it is apparently replaced by S. longiceps.

In this study, initial work on certain characters (e.g. number and degree of curling of gillrakers on the inner gillarches, number of pyloric caeca and the presence or absence or degree of development of circulii on the exposed portion of the scales) has already shown the extent to which the present taxonomy of S. aurita (Form A), S. brasiliensis (Form B) and S. lemuru is based on assumptions rather than on comparative anatomical work. In my opinion much more information is needed before the three forms can be treated as species or as merely different variations of a single widespread species. From the present work it seems likely that S. (S.) lemuru is an intermediate form of the other two fishes, but it is isolated geographically. It also differs greatly from S. (S.) brasiliensis in having none or only slightly developed circulii on the exposed portion of the scales. The curling of the gill rakers in these three forms of fish (which is being studied by Dr P.J.P. Whitehead) seems to vary greatly. I have found that the degree of curling is more or less directly correlated with the number of gill rakers and also the size of the fish. At a given size in any form, the gill rakers are distinctly curved outward and downward in specimens (or species) which have more gill rakers (and vice versa).

Distribution:- N. China Sea and Incochina - Australian archipelago.

24. Sardinella (Clupeonia) jussieui (Valenciennes, 1847)
(Plates 50a-e, 51a-h; Figures 18B, 56, 57, 58; Tables 4, 4.1, 4.2)

Clupeonia jussieui Valenciennes, 1847, Hist. Nat. Poiss., 20 : 346, pl. 599
(Ile de France).

Specimens examined (5 : 90.5-144.0 mm S.L.)

Types:

1. MNHN A. 2208 (1 : 144.0 mm S.L.), Mauritius. Holotype of C. jussieui.

2. 3753 (2 : 122.0-123.0 mm S.L.), Mauritius. Formerly syntypes of A. argyrochloris (= Tenualosa toli).

Other specimens:

3. BMNH 1937.5.26.1-2 (2 : 90.5-94.5 mm S.L.), Mauritius.

Diagnosis:- An eight pelvic-rayed Sardinella, with unperforated scales, their vertical striae interrupted at centre; (pl. 51d, e, f); gillrakers 52-61+88-101 (fig. 56), slender and without asperities (pl. 51g, h).

Remarks:- With its characteristic high gillraker count and unperforated scales, this fish is near to the nine pelvic-rayed Sardinella spp. It could therefore be a possible transitional form between those fishes and the rest of Sardinella. Geographically, S. (C.) jussieui is restricted to Mauritius. Specimens hitherto identified as the present fish are in fact the widely distributed and commercially important S. (C.) gibbosa.

Distribution:- Mauritius only.

25. Sardinella (Clupeonia) sindensis (Day, 1878)
(Plates 52a-d, 53a-f; Figures 18B, 56, 57, 58; Tables 4, 4.1, 4.2)

Clupea sindensis Day, 1878, Fishes of India, pt. 4 : 638, pl. 163 (2) (Kurrachee).

Specimens examined (183 : 33.0-170.0 mm S.L.)

1. BMNH 1852.9.13.178 (1 : 83.5 mm S.L.), N.E. Arabian Sea.
2. 1889.2.1.1883 (1 : 100.0 mm S.L.), Sind.
3. 1889.2.1.1908-1911 (4 : 83.0-103.0 mm S.L.), Bombay.
4. 1889.2.1.1919-1924 (5 : 79.0-104.0 mm S.L.), Sind.
5. 1962.3.26.107 (1 : 118.0 mm S.L.), Mukalla, Burum.
6. 1962.10.20.1-41 (41 : 89.0-120.0 mm S.L.), Persian Gulf.

7. BMNH 1970.6.2.1-7 (7 : 99.0-110.0 mm S.L.), Dubai, Persian Gulf.
8. 1970.6.15.3-6 (4 : 33.0-38.0 mm S.L.), Dubai, Persian Gulf.
9. 1970.10.2.24-33 (10 : 60.0-72.0 mm S.L.), Trucial States.
10. 1971.2.8.118-127 (10 : 95.0-100.0 mm S.L.), Persian Gulf.
11. 1971.2.8.128-132 (5 : 108.0-120.0 mm S.L.), Persian Gulf
12. 1971.2.8.133-141 (9 : 99.0-118.0 mm S.L.), Persian Gulf.
13. 1971.2.8.142-145 (4 : 111.0-122.0 mm S.L.), Persian Gulf.
14. 1971.2.17.1-11 (52 : 81.0-116.0 mm S.L.), ? Gulf of Masira.
15. 1971.5.21.2-6 (5 : 124.0-139.0 mm S.L.), Salala, Oman.
16. 1971.5.21.8-10 (3 : 119.0-127.0 mm S.L.), Gulf of Masira.
17. 1971.5.21.11.14 (4 : 112.0-133.0 mm S.L.), Truical States.
18. 1971.5.21.15-18 (4 : 111.0-116.0 mm S.L.), Trucial States.
19. 1977.6.17.4-5 (2 : 101.5-103.0 mm S.L.), Persian Gulf.
20. 1977.9.9.1-9 (9 : 118.0-145.0 mm S.L.), Pakistan.
21. UZMK CN. 2-3 (2 : 114.0-115.0 mm S.L.), Fort Dilana, Persian Gulf.

Diagnosis:- An eight pelvic-rayed Sardinella, with perforated scales, its vertical striae interrupted at centre, predorsal scales paired and overlapping in midline; It is closest to S. (C.) gibbosa in having ventral scutes 17-19+13-16, lateral scales 42-47 (tbls. 4, 4.1), but separatable from that species at a given standard length, its higher gillraker count 16-46+38-77 (cf. 16-36+38-66) (fig. 56) and in having fewer scale perforations which are usually concentric posteriorly (pl. 53d, e).

Remarks:- I have not been able to examine the lectotype (ZSI. 2630, 95.5 mm S.L.) or paralectotype (ZSI. 2614, 90.0 mm S.L.) of Clupea sindensis Day, which were chosen and studied by Talwar & Whitehead (1971). My present work therefore follows these authors and is also based on other Day specimens in the British Museum (BMNH. 1889.2.1.1919-1924). The body depth of this fish varies considerably but is only slightly related to its growth (fig. 57). In specimens of about 100 mm S.L. the perforations on the scales are poorly developed and sparse; they are completely absent in specimens of about 60-70 mm S.L. or smaller.

Chan's (1965) record of this species from the Philippines was probably a misidentification of a variant form of S. (C.) albella. His specimens (SU. 32915 and 38369) should, however, be re-examined in the future.

Distribution:- Gulf of Aden to Persian Gulf and Bombay.

26. Sardinella (Clupeonia) gibbosa (Bleeker, 1849)
(Plates 54a-e, 55a-e; Figures 18C, 56, 57, 58; Tables 4, 4.1, 4.2)

Clupea gibbosa Bleeker, 1849, J. Ind. Arch., 3 : 72 (Macassar).
Spratella tembang Bleeker, 1851, Natuurk. Tijdschr. Ned.-Indië, 2 : 214 (name only, to replace Clupea gibbosa Bleeker, 1849).
Clupea immaculata Kishinouye, 1907, J. Imp. Fish Bur. Tokyo, 14 (3) : 96, pls. 19 (1), 21 (4) (Saga, Kyushu, Amoy, Swatow, China).
Fimbriclupea dactylolepis Whitley, 1940, Aust. Zool., 9 (4) : 399, fig. 5 (Point Sampson, N.W. Australia).
Sardinella taiwanensis Raja & Hiyama, 1969, Rec. Oceanogr. Japan, 10 (1) : 90, pl. 2b (Taiwan).

Specimens examined (163 : 30.0-170.0 mm S.L.)

Types:

1. BMNH 1867.11.28.46 (1 : 152.0 mm S.L.), Macassar. Putative neotype of C. gibbosa and also lectotype of Spratella tembang.
2. AMS I. 13254 (1 : 99.0 mm S.L.), Point Sampson, N.W. Australia. Holotype of F. dactylolepis.

Other specimens:

3. BMNH 1858.4.21.410 (1 : 118.0 mm S.L.), Amboina.
4. 1864.12.12.22 (1 : 92.0 mm S.L.), Java.
5. 1867.11.28.43 (1 : 146.0 mm S.L.), E. Indies.
6. 1872.4.6.53 (1 : 101.0 mm S.L.), N. Celebes.
7. 1889.2.1.193-194 (2 : 81.0-84.0 mm S.L.), Madras.
8. 1889.2.1.1776-1777 (2 : 92.0-105.0 mm S.L.), Madras.

9. BMNH 1889.2.1.1907 (1 : 148.0 mm S.L.), Orissa.

10. 1889.2.1.1918 (1 : 103.0 mm S.L.), Amboina.

11. 1898.4.2.253 (1 : 111.0 mm S.L.), Menam river (= Chao Phraya river), Thailand.

12. 1913.4.7.2. (1 : 125.0 mm S.L.), Mombasa.

13. 1915.7.6.1. (1 : 129.0 mm S.L.), Durban.

14. 1936.8.7.29 (1 : 90.0 mm S.L.), Mombasa.

15. 1947.10.2.4-6 (3 : 65.0-77.0 mm S.L.), Tanga, Tanzania.

16. 1960.4.7.1-25 (27 : 58.0-90.0 mm S.L.), Manila Bay.

17. 1962.3.26.102-106 (5 : 100.0-111.0 mm S.L.), Mukalla, Burum.

18. 1962.3.26.111-116 (6 : 101.0-119.0 mm S.L.), Mukalla.

19. 1962.3.26.117 (1 : 118.0 mm S.L.), Candala, Somalia.

20. 1962.3.26.139-140 (2 : 68.0-69.0 mm S.L.), Ras Imran, Red Sea.

21. 1963.5.6.8-9 (2 : 84.0-100.0 mm S.L.), Zanzibar.

22. 1964.12.14.186 (1 : 91.0 mm S.L.), Zanzibar channel.

23. 1964.12.14.187-221 (29 : 93.0-125.0 mm S.L.), Zanzibar.

24. 1964.12.14.222-224 (3 : 30.0-40.0 mm S.L.), Zanzibar.

25. 1965.7.5.17-22 (6 : 48.0-56.0 mm S.L.), Hong Kong.

26. 1966.2.28.15-16 (2 : 111.0-112.0 mm S.L.), Samutprakarn, Thailand.

27. 1966.2.28.18-19 (2 : 106.0-123.0 mm S.L.), Samutprakarn, Thailand.

28. 1966.11.16.8-13 (7 : 111.0-142.0 mm S.L.), Zanzibar.

29. 1966.11.16.14-19 (10 : 54.0-141.0 mm S.L.), Port Tudor, Mombasa.

30. 1966.11.16.20-27 (11 : 100.0-144.0 mm S.L.), Formosa Bay, Kenya.

31. 1971.2.8.146 (1 : 119.0 mm S.L.), Persian Gulf.

32. 1972.9.5.23-24 (2 : 99.0-100.0 mm S.L.), Cape Lambert.

33. 1973.4.5.10 (1 : 141.0 mm S.L.), Phuket I., Thailand.

34. 1978.8.18.173-176 (4 : 106.0-115.0 mm S.L.), Philippines.

35. 1979.3.21.312 (1 : 112.0 mm S.L.), Tainan, Taiwan.

36. 1979.3.21.313-314 (2 : 126.0-135.0 mm S.L.), Tainan, Taiwan.

37. 1979.3.21.315-317 (3 : 70.0-85.0 mm S.L.), Tainan, Taiwan.

38. 1979.3.21.318-320 (3 : 87.0-96.0 mm S.L.), Kaohsiung, Taiwan.

39. BMNH 1979.7.5.1. (1 : 122.0 mm S.L.), locality unknown.

40. MNHN 2040 (1 : 112.0 mm S.L.), E. Indies.

41. uncat. (1 : 170.0 mm S.L.), Passe Nord, Madagascar.

42. RMNH 27712 (8 : 61.0-118.0 mm S.L.), E. Indies.

43. USNM uncat. (1 : 125.0 mm S.L.), Palawan, Philippines.

Diagnosis:- An eight pelvic-rayed *Sardinella*, with perforated scales, their vertical striae interrupted at centre, predorsal scales paired and overlapping in midline. It is closely related to *S.* (*C.*) *sindensis* in having a high count of ventral scutes 17-19+14-16, lateral scales 43-47 and predorsal scales usually 14-16 (tbls. 4, 4.1), but it can be distinguished from that species at a given standard length by its gillraker count 16-36+38-66 (cf. 16-46+38-77) (fig. 56) and in having more perforations on scales which are evenly scattered throughout the exposed portion (pl. 55c, d).

Remarks:- According to Dr O. Okamura (pers. comm.) the type specimens of *Clupea immaculata* and other species of Kishinouye are said to have been destroyed during the war. On the basis of its illustration (Kishinouye, 1907, pl. 19, fig. 1) and fairly good description, I have tentatively considered it identical to the present species. Although Raja & Hiyama (1969) pointed out six characters to differentiate their *S. taiwanensis* from *S. gibbosa*, I have been unable to examine the type specimens but have found that their description lies within the ranges of my own *S.* (*C.*) *gibbosa* material. It is one of the most abundant species of *Sardinella* of the Indo-Pacific.

Distribution:- Indo-Pacific from the east coast of Africa to S.E. Asia, Taiwan and N.W. Australia.

27. *Sardinella* (*Clupeonia*) *fimbriata* (Valenciennes, 1847)
(Plates 56a-e, 57a-g; Figures 18B, 59, 60, 61; Tables 4, 4.1, 4.2)

Spratella fimbriata (part) Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 359 (Malabar - one specimen *S.* (*C.*) *albella*).

Specimens examined (32 : 54.0-123.0 mm S.L.)

Types:

1. MNHN 3227 (4 : 119.0-123.0 mm S.L.), Malabar. A tagged fish, 120.0 mm S.L.) was selected as lectotype of S. fimbriata, the remainder being paralectotypes. The fifth specimen 109.0 mm S.L. has been herein considered as S. (C.) albella.

Other specimens:

2. BMNH 1865.7.17.15 (1 : 113.0 mm S.L.), locality unknown.
3. 1889.2.1.1778 (1 : 117.0 mm S.L.), Madras.
4. 1889.2.1.1912 (1 : 104.0 mm S.L.), Malabar.
5. 1889.2.1.1915-1916 (2 : 54.0-101.0 mm S.L.), Orissa.
6. 1889.2.1.1917 (1 : 102.0 mm S.L.), Akyab, Burma.
7. 1960.4.7.52 (1 : 92.0 mm S.L.), Palawan, Philippines.
8. 1966.2.28.10-11 (2 : 101.0-109.0 mm S.L.), Samutprakarn, Thailand
9. 1966.2.28.12 (1 : 95.0 mm S.L.), Samutprakarn, Thailand.
10. 1972.9.5.25 (1 : 100.5 mm S.L.), Gasmata I.
11. 1972.9.5.29 (1 : 58.5 mm S.L.), Ablingi Harbour.
12. 1972.9.5.30 (1 : 59.0 mm S.L.), Gasmata I.
13. 1974.5.25.2.7. (6 : 59.5-79.5 mm S.L.), Trobriand I., New Guinea.
14. 1974.5.25.8-14 (7 : 55.0-90.0 mm S.L.), Trobriand I., New Guinea.
15. 1978.8.18.153-154 (2 : 122.0-123.0 mm S.L.), Bangladesh.

Diagnosis:- An eight pelvic-rayed Sardinella, with perforated scales, its vertical striae interrupted at centre, predorsal scales paired and overlapping in midline. It is closer to S. (C.) albella than to S. (C.) sindensis and S. (C.) gibbosa in lower count of ventral scutes, usually 18+12-14 and lower count of lateral scales, usually 42-44 (tbls. 4, 4.1). From S. (C.) albella, it is differentiated at a given standard length by a higher count of gill-rakers, 27-47+54-82 (cf. 20-36+41-68) (fig. 59) and fewer perforations on the scales (pl. 57c-f).

Remarks:- Specimens of this species from the Indian Ocean have a very well-developed posterior median extension of the scales (pl. 57c-f), but this is not the case in specimens from the S. China Sea and New Guinea.

Distribution:- Malabar, Bay of Bengal, S. China Sea and New Guinea.

28. Sardinella (Clupeonia) albella (Valenciennes, 1847)
(Plates 58a-e, 59a-g, 321e; Figures 18D, 59, 60, 61; Tables 4, 4.1, 4.2)

Kowala albella Valenciennes, 1847, Hist. Nat. Poiss., 20 : 362 (Pondicherry).

Clupalosa bulan Bleeker, 1849, Verh. batav. Genoot. Kunst. Wet., 22 : 12 (Madura Strait, Kamel, Surabaya, Batavia, Samarang).

Kowala lauta Cantor, 1850, J. Asiatic Soc. Bengal, 18 : 297 (Penang).

Clupea perforata Cantor, ibid.: 1276 (Penang sea, Malay Peninsula, Singapore, Sumatra).

Spratella kowala Bleeker, 1851, Natuurk. Tijdschr. Ned.-Indië, 2 : 492 (Rio, Batavia).

Clupea (Harengula) sundaica Bleeker, 1872, Atlas Ichth. Ind. Nèerland., 6 : 105 (Batavia, Anjer, Djunkulon, Bonthain).

Harengula dollfusi Chabanaud, 1933, Bull. Inst. Oceanogr. Monaco, No. 627 : 1, figs 1-2 (Gulf of Suez).

Specimens examined (387 : 36.5-133.0 mm S.L.)

Types:

1. MNHN 3227 (1 : 109.0 mm S.L.), Malabar. Formerly one of the four paralectotypes of Spratella fimbriata.

2. 665 (1 : 71.0 mm S.L.), Pondicherry. Lectotype of K. albella.
3231 (1 : 71.5 mm S.L.), Pondicherry. Paralectotype of K. albella.

3. BMNH 1867.11.28.37 (1 : 113.5 mm S.L.), Malay Archipelago. Lectotype of Clupalosa bulan.

4. 1860.3.19.442.443 (2 : 123.0-124.0 mm S.L.), Penang. Syntypes of

K. lauta (left side, dried skins).

5. BMNH 1860.3.19.845 (1 : 94.0 mm S.L.), Penang. Holotype of Clupea perforata.

6. RMNH 7091 (1 : 109.0 mm S.L.), Batavia. Lectotype of Spratella kowala.

7. 23479 (17 : 68.0-104.0 mm S.L.), Rio, Batavia. Paralectotypes of Spratella kowala.

8. 7099 (1 : 132.5 mm S.L.), E. Indies. Lectotype of Clupea (Harengula) sundaica.

Other specimens:

9. BMNH 1858.4.21.406 (1 : 105.0 mm S.L.), Amboina.

10. 1860.3.12.445 (1 : 102.0 mm S.L.), Penang, (left side, dried skin).

11. 1867.3.9.372 (1 : 113.0 mm S.L.), Zanzibar, (right side, dried skin).

12. 1867.11.28.44 (1 : 110.0 mm S.L.), Malay Archipelago.

13. 1868.6.9.6. (1 : 89.9 mm S.L.), Sarawak.

14. 1868.6.9.7 (1 : 47.0 mm S.L.), Sarawak.

15. 1969.1.29.39-40 (2 : 53.0-53.5 mm S.L.), Zanzibar.

16. 1869.3.4.31-33 (3 : 78.0-82.0 mm S.L.), Persian Gulf.

17. 1880.2.2.98 (7 : 85.0-89.0 mm S.L.), Malayan seas.

18. 1884.5.15.27-28 (2 : 86.0-94.0 mm S.L.), Taiwan.

19. 1894.1.19.77 (1 : 110.0 mm S.L.), Santubong, Sarawak.

20. 1936.8.7.28 (1 : 103.0 mm S.L.), Mombasa.

21. 1947.10.2.12 (2 : 59.0-63.0 mm S.L.), Tansa, Tanzania.

22. 1960.4.7.52 (1 : 92.0 mm S.L.), Palawan, Philippines.

23. 1962.3.26.96-98 (3 : 91.0-101.0 mm S.L.), Rugub, Aden.

24. 1962.3.26.99-100 (2 : 92.0-92.5 mm S.L.), Aden.

25. 1962.3.26.101 (1 : 78.0 mm S.L.), Abyan, Gulf of Aden.

26. 1962.3.26.108-110 (3 : 54.0-57.5 mm S.L.), Gulf of Aden.

27. 1963.5.6.6-7 (2 : 88.0-96.0 mm S.L.), Zanzibar.

28. 1964.12.14.91 (1 : 76.0 mm S.L.), Pangani estuary, Tanzania.

29. BMNH 1964.12.14.92-124 (32 : 80.0-112.0 mm S.L.), Zanzibar.

30. 1964.12.14.125 (1 : 51.0 mm S.L.), Zanzibar.

31. 1964.12.14.126-179 (90 : 53.0-59.0 mm S.L.), Zanzibar

32. 1965.7.5.11-13 (3 : 81.0-112.0 mm S.L.), Hong Kong.

33. 1965.7.5.14 (1 : 96.5 mm S.L.), Hong Kong.

34. 1965.7.5.15-16 (2 : 95.0-103.0 mm S.L.), Hong Kong.

35. 1965.7.5.25-28 (3 : 36.5-39.0 mm S.L.), Hong Kong.

36. 1966.2.28.13-14 (2 : 53.0-56.0 mm S.L.), Chantaburi, Thailand.

37. 1966.2.28.17 (1 : 71.0 mm S.L.), Pakpoon, Thailand.

38. 1966.2.28.20 (1 : 81.0 mm S.L.), Thailand.

39. 1966.11.16.28-33 (9 : 93.0-118.0 mm S.L.), Zanzibar.

40. 1966.11.16.34-48 (24 : 112.0-132.0 mm S.L.), Nosy Bay, Madagascar.

41. 1966.11.16.50-51 (2 : 109.0-115.0 mm S.L.), Dar-es-Salaam.

42. 1966.11.16.52-54 (3 : 112.0-124.0 mm S.L.), Mombasa.

43. 1966.11.16.56-70 (17 : 104.0-118.0 mm S.L.), Nosy Bay, Madagascar.

44. 1966.11.16.71-74 (18 : 84.0-102.0 mm S.L.), Chulutage.

45. 1966.11.16.78-79 (3 : 88.0-105.0 mm S.L.), Kama.

46. 1966.11.16.179 (1 : 88.5 mm S.L.), Lorenco Marques.

47. 1966.11.20.1 (1 : 73.0 mm S.L.), Chantaburi, Thailand.

48. 1966.11.20.2 (1 : 98.5 mm S.L.), Thailand.

49. 1970.4.24.1-20 (20 : 84.0-100.0 mm S.L.), Jaffna, Ceylon.

50. 1972.9.5.22 (1 : 105.0 mm S.L.), Gemo I., Port Moresby.

51. 1972.9.5.26-28 (3 : 84.0-90.0 mm S.L.), Gemo I., Port Moresby.

52. 1973.4.5.2-3 (2 : 80.0-85.0 mm S.L.), Bahrain.

53. 1973.4.5.8-9 (2 : 118.0-119.0 mm S.L.), Phuket I., Thailand.

54. 1977.6.17.1-3 (3 : 70.5-78.0 mm S.L.), Bahrain.

55. 1978.8.15.104-127 (33 : 53.0-74.0 mm S.L.), Tonolei.

56. 1979.3.21.333 (1 : 112.0 mm S.L.), Tainan, Taiwan.

57. MNHN 1960.286a (2 : 128.0-129.0 mm S.L.), Madagascar.

58. 1966.797 (6 : 96.0-122.0 mm S.L.), Madagascar.

59. 1966.817 (5 : 96.0-120.0 mm S.L.), Madagascar.

60. MNHN uncat. (8 : 52.0-83.0 mm S.L.), Tuléar; mixed with a specimen of Herklotsichthys quadrimaculatus, 70.0 mm S.L.)

61. RMNH 23362 (25 : 71.0-133.0 mm S.L.), E. Indies.

62. SMF 560 (1 : 78.0 mm S.L.), Red Sea (= Clupea kowala Rüppell, 1837).

63. USNM uncat. (1 : 119.0 mm S.L.), Palawan, Philippines.

Diagnosis:- An eight pelvic-rayed Sardinella, with perforated scales, their vertical striae interrupted at centre, predorsal scales paired and overlapping in midline. Although closely allied to S. (C.) fimbriata and S. (C.) dayi, it is immediately separable from them in its lower count of gillrakers , 20-36+ 41-68 (cf. 27-47+54-82 and 54-78+88-126) (figs 59, 62). From S. (C.) gibbosa it differs in having a lower count of ventral scutes, of about 18+12-14 (cf. 18+14-16), lateral scales usually 41-44 (cf. 43-47) (tbls. 4, 4.1) and slightly deeper body 24.5-39.2 (cf. 24.0-30.0) % S.L. (fig. 61).

Remarks:- With the absence of type specimens of H. dollufsi, I have tentatively considered that Chabanaud's (1933) species is the present fish on the basis of his description and drawings. It's perforated scales and a dark spot at origin of dorsal make his fish a member of Sardinella. With the description of 53-56 gillrakers , 40-44 lateral scales, 12 transverse scales, 17-18+14 ventral scutes, size 100-136 mm S.L. and locality of Suez, I prefer to regard it as S. (C.) albella rather than gibbosa as supposed by Whitehead (1973b).

Apart from the above diagnostic characters, its earlier development of perforations on the scales (at about 50 mm S.L. or smaller) is also helpful in distinguishing young specimens from those of S. (C.) gibbosa or others. The body depth of this fish varies considerably according to sex and degree of maturation of the gonad (fig. 61).

Distribution:- Indo-Pacific from the east coast of Africa, Red Sea and Persian Gulf to S.E. Asia, Taiwan and Papua New Guinea.

29. Sardinella (Clupeonia) dayi Regan, 1917

(Plates 60a-d, 317e; Figures 18D, 62, 64; Tables 4, 4.1, 4.2)

Sardinella dayi Regan, 1917, Ann. Mag. nat. Hist., (8) 19 : 381 (Kinnear, Karwar, India).

Specimens examined (2 : 104.0-112.0 mm S.L.)

Types:

1. BMNH 1912.5.2.2 (1 : 112.0 mm S.L.), Kinnear, Karwar, India. Holotype.

Other specimens:

2. SU 22866 (1 : 104.0 mm S.L.), Colombo, Ceylon.

Diagnosis:- An eight pelvic-rayed Sardinella, with perforated scales, their vertical striae interrupted at centre or some of the posterior ones may exceptionally be continuous (pl. 60b, c), predorsal scales paired and overlapping in midline. It is closest to S. (C.) albella and S. (C.) fimbriata but distinguished from them by its much higher count of gillrakers, 54-88+88-126 (cf. 20-36+41-68 and 27-47+54-82 respectively) (figs 59, 62).

Remarks:- Examination of two of Fowler's (1941) specimens (ANSP. 74860, 80.5-81.0 mm S.L.) from Calicut showed that they are in fact not S. dayi but Hilsa kelee.

Distribution:- Kinnear, Karwar, India and Colombo, Ceylon.

30. Sardinella (Clupeonia) fijiense (Fowler & Bean, 1923)
(Plates 61a-e, 62a-e; Figures 19A, 62, 64; Tables 4, 4.1, 4.2)

Harengula fijiense Fowler & Bean, 1923, Proc. U.S. natn. Mus., 63 : 63 (Fiji).

Specimens examined (3 : 62.0-114.0 mm S.L.)

Types:

1. USNM 82799 (1 : 62.0 mm S.L.), Fiji. Holotype.

Other specimens:

2. BMNH 1979.3.20.7-8 (2 : 100.5-114.0 mm S.L.), New Guinea.

Diagnosis:- An eight pelvic-rayed Sardinella, with neither perforated nor fimbriated scales, their vertical striae overlapping or continuous at centre, predorsal scales paired and overlapping in midline; gillrakers 51-103+87-134 (fig. 62); tips of dorsal and caudal lobes usually darkish, origin of dorsal without a dark spot.

Remarks:- This species of eight pelvic-rayed Indo-Pacific Sardinella has the highest count of gillrakers. Fowler (1928) slightly altered the original name H. fijiense to H. fijiensis, but gave no hint why he was proposing a new name. There seems to be no question of homonym and I therefore retain the original name.

Distribution:- Fiji, New Guinea.

31. Sardinella (Clupeonia) tawilis (Herre, 1927)
(Plates 63a-d, 64a-e; Figures 19A, 62, 63, 64; Tables 4, 4.1, 4.2)

Harengula tawilis Herre, 1927, Philipp. J. Sci., 34 : 273, 296, pl. 3(1-6) (Lake Bombon, Luzon).

Specimens examined (8 : 71.5-98.5 mm S.L.)

1. BMNH 1933.3.11.5-12 (8 : 71.5-111.5 mm S.L.), Lake Bombon, Luzon.

Diagnosis:- A species of Sardinella closest to S. (C.) fijiense. It differs in having a much lower gillraker count, 33-40+61-74 (cf. 51-103+87-134) (fig. 62); dorsal and caudal without dark markings.

Remarks:- It is the only species of Sardinella which has so far been recorded only from exclusive freshwater.

Distribution:- Lake Bombon (Taal), Batangas, Luzon, Philippines.

32. Sardinella (Clupeonia) hualiensis (Chu & Tsai, 1958)
(Plates 65a-e, 66a-e; Figures 19B, 62, 63, 64; Tables 4, 4.1, 4.2)

Harengula hualiensis Chu & Tsai, 1958, Quart. J. Taiwan Mus., 11 (1-2) :

116, pl. 3 (2, 3, 4) (Hualien, Taitung, east coast of Taiwan).

Specimens examined (12 : 66.0-124.0 mm S.L.)

1. BMNH 1979.3.21.321-322 (2 : 95.0-119.0 mm S.L.), Tung-kang, Taiwan.
2. 1979.3.21.323-325 (3 : 73.5-85.5 mm S.L.), Tainan, Taiwan.
3. 1979.3.21.326 (1 : 88.0 mm S.L.), Tainan, Taiwan.
4. 1979.3.21.327 (1 : 83.0 mm S.L.), Tung-kang, Taiwan.
5. 1979.3.21.328-330 (3 : 66.0-86.0 mm S.L.), Hualien, Taiwan.
6. 1979.3.21.331 (1 : 78.5 mm S.L.), Hualien, Taiwan.
7. 1979.3.21.332 (1 : 124.0 mm S.L.), Taitung, Taiwan.

Diagnosis:- An eight pelvic-rayed *Sardinella*, with perforated scales, vertical striae overlapping or continuous at centre, predorsal scales paired and overlapping in midline. It resembles *S.* (*C.*) *brachysoma*, but is readily separated from it by its more slender body, 28.9-33.5 (cf. 29.8-39.3) % S.L. (fig. 64) and in having brackish tips to the dorsal and the caudal lobes.

Remarks:- Shen (*in litt.* to P.J.P. Whitehead, 1978) says that the type specimens of Chu & Tsai are presumed lost. Several specimens sent by him at our request are suitable for neotype designation if necessary; a specimen BMNH. 1979.3.21.332, 124 mm S.L. from Taitung, which is the largest, is preferable since it was also chosen as the basis for Plate 65a in the present work.

The differences separating *S.* (*C.*) *hualiensis* from *S.* (*C.*) *brachysoma* are small, as shown above. For the present it seems best to recognise *S.* (*C.*) *hualiensis* as a distinct species.

Distribution:- Taiwan.

33. *Sardinella* (*Clupeonia*) *brachysoma* Bleeker, 1852
(Plates 67a-f, 68a-f, 306c, 326f; Figures 19B, 62, 63, 64; Tables 4, 4.1, 4.2)

Sardinella brachysoma Bleeker, 1852, *Verh. batav. Genoot. Kunst. Wet.*, **24** : 19 (Batavia).

Harengula hypselosoma Bleeker, 1855, Natuurk. Tijdschr. Ned.-Indië, 8 : 427 (Amboina).

Meletta schlegelii Castelnau, 1873, Proc. zool. acclim. Soc. Vict., 2 : 93 (Port Darwin).

Specimens examined (25 : 40.5-130.5 mm S.L.)

Types:

1. BMNH 1867.11.28.38 (1 : 114.0 mm S.L.), Batavia. Lectotype of S. brachysoma.
2. RMNH 7089 (14 : 93.0-113.0 mm S.L.), Batavia. Paralectotype of S. brachysoma.
3. BMNH 1867.11.28.29 (1 : 124.0 mm S.L.), Amboina. Lectotype of H. hypselosoma.
4. RMNH 7114 (1 : 123.0 mm S.L.), Amboina. Paralectotype of H. hypselosoma.
5. MNHN 3716 (1 : 58.6 mm S.L.), Port Darwin. Holotype of M. schlegelii.

Other specimens:

6. BMNH 1864.12.12.23 (1 : 90.5 mm S.L.), Java.
7. 1870.6.7.9.10 (2 : 126.0-130.5 mm S.L.), Java.
8. 1889.2.1.1983 (1 : 112.0 mm S.L.), Madras.
9. 1963.11.12.1 (1 : 121.0 mm S.L.), Frank's coll., locality unknown.
10. MNHN uncat. (2 : 40.5-42.0 mm S.L.), Basse Mahavary, Madagascar.

Diagnosis:- An eight pelvic-rayed Sardinella, with perforated scales, their vertical striae overlapping or sometimes continuous at centre, predorsal scales paired and overlapping in midline; body depth 30-39 % S.L. (fig. 64); gill-rakers 25-39+48-67 (fig. 62); a dark spot at origin of dorsal, no dark markings at tips of dorsal and caudal lobes.

Remarks:- Castelnau's Meletta schlegelii is here identified as this species, chiefly on the basis of gillraker counts (29+56), its overlapping striae on scale (pl. 68d) and the presence of a black spot at dorsal origin. At 42 mm S.L., no perforations have been observed for this species (pl. 68c), but one overlapping vertical stria is clearly developed.

Distribution:- Madagascar, Madras, S.E. Asia to Port Darwin, Australia.

34. Sardinella (Clupeonia) richardsoni n. sp.

(Plates 69a-d, 70a-e, 321f; Figures 19C, 62, 63, 64; Tables 4, 4.1, 4.2)

Clupea isingleena Richardson, 1846, Ichth. China Japan : 304 (China Sea) (name suppressed by International Commission in 1970, Opinion 901, Bull. zool. Nomencl., 26 (5/6) : 217).

Specimens examined (12 : 102.0-121.0 mm S.L.)

Types:

1. BMNH 1963.6.17.1 (1 : 113.0 mm S.L.), China; J. Reeves. Holotype of C. isingleena and also of the present name S. (C.) richardsoni n. sp.
2. 1935.4.18.9 (1 : 121.0 mm S.L.), Hainan I., Kwangtung, China; S-Y. Lin. Paratype.
3. 1965.7.5.1-10 (10 : 102.0-116.0 mm S.L.), Pearl river mouth, Hong Kong; W. L. Chan. Paratypes.

Diagnosis:- An eight pelvic-rayed Sardinella, with perforated scales, their vertical striae continuous or overlapping at centre (pl. 70d), predorsal scales paired and overlapping in midline. It resemble greatly S. (C.) zunasi in the absence of a dark spot at origin of dorsal and in the lower count of pyloric caeca 40-44 (cf. 38-43) (fig. 63), but is easily distinguished from that species at a given standard length by its higher gillraker count 36-42+63-74 (cf. 21-31+42-58) (fig. 62), deeper body, 32-36 (cf. 24-33) % S.L. (fig. 64) and also more perforations on the scales (pls. 70d).

Remarks:- Re-examination of the holotype of C. isingleena and eleven other fishes identical to it has shown that this is a distinct species and not

S. fimbriata or S. brachysoma as believed by Whitehead (1966a, 1966b, 1973b) and Chan (1966). The holotype of C. isingleena had been described under S. nymphaea by Chan (1965). The name isingleena cannot be used under Article 79b iii of the Code because it was rejected by Whitehead (1970) and officially suppressed. The new name richardsoni is therefore proposed.

Distribution:- Hainan I., China and Hong Kong.

35. Sardinella (Clupeonia) zunasi (Bleeker, 1854)
(Plates 71a-d, 72a-e; Figures 19C, 62, 63, 64; Tables 4, 4.1, 4.2)

Harengula zunasi Bleeker, 1854, Natuurk. Tijdschr. Ned.-Indië, 6 : 417 (Nagasaki).

Specimens examined (54 : 73.5-130.0 mm S.L.)

Types:

1. BMNH 1867.11.28.182 (1 : 73.5 mm S.L.), Nagasaki. Holotype of H. zunasi.

Other specimens:

2. BMNH 1860.7.20.33 (1 : 112.0 mm S.L.), Amoy, China.
3. 1905.6.6.13.22 (8 : 79.0-123.0 mm S.L.), Inland Sea, Japan.
4. 1923.2.26.116-118 (3 : 118.5-120.0 mm S.L.), Port Arthur, China.
5. 1928.6.22.2 (1 : 88.5 mm S.L.), Amoy, China.
6. 1936.10.7.19-20 (2 : 80.0-86.5 mm S.L.), Foochow, China.
7. 1971.2.8.251-253 (3 : 95.0-101.0 mm S.L.), Japan.
8. 1977.9.6.1-9 (9 : 82.5-130.0 mm S.L.), Nagasaki.
9. 1977.9.6.10-31 (23 : 73.5-98.0 mm S.L.), Nagasaki.
10. 1977.9.6.32-34 (3 : 100.0-120.0 mm S.L.), Nagasaki.

Diagnosis:- An eight pelvic-rayed Sardinella, characterized by having few perforations on scales, vertical striae continuous or overlapping at centre (pl. 72d), predorsal scales paired and overlapping in midline; gillrakers 21-23+42-58 (fig. 62); body depth 24-33 % S.L. (fig. 64) and no dark spot at the origin of dorsal.

Remarks:- Judging by the British Museum specimens, this fish has been misidentified as Clupea kowal , Sardinella bulan, S. jussieui or S. sindensis.

Distribution:- Southern coasts of Japan and N. China Sea.

36. Sardinella (Clupeonia) marquesensis Berry & Whitehead, 1968
(Plates 73a-e, 74a-d, 306d; Figures 19D, 65, 66, 67; Tables 4, 4.1, 4.2)

Sardinella marquesensis Berry & Whitehead, 1968, Proc. biol. Soc. Wash., 81 : 209-222, figs 1-6 (Marquesas Is.).

Specimens examined (141 : 32.0-125.0 mm S.L.)

Types:

1. BMNH 1967.11.4.1-2 (2 : 93.5-101.0 mm S.L.), Taiohae Bay, Marquesas Is. Paratypes.

2. 1967.11.4.3. (4 : 51.0-66.0 mm S.L.), Hiva Oa, Atuona, Marquesas Is. Paratypes.

3. RMNH 25824 (2 : 57.0-63.0 mm S.L.), data as in 1. Paratypes.

4. 25825 (1 : 92.0 mm S.L.), data as in 2. Paratypes.

Other specimens:

5. BMNH 1965.1.25.21-22 (2 : 79.5-83.5 mm S.L.), Taiohae Bay, Marquesas Is.

6. 1978.8.15.103 (130 : 32.0-125.0 mm S.L.), Taiohae Bay, Marquesas Is.

Diagnosis:- An eight pelvic-rayed species of Sardinella, with scales neither perforated nor fimbriated, vertical striae discontinuous at centre (pl. 74c), predorsal scales unevenly median (pl. 306d) or partially paired and overlapping in midline. It is allied to S. (C.) melanura, but is immediately distinguished from it by having no dark tips to the caudal fin lobes and no dark spot at origin of dorsal. Gillrakers 15-58+27-81 (fig. 65).

Remarks:- Berry & Whitehead (1968), in their diagnosis of this species, specified "overlapping scales on median predorsal ridge (not a single median row)". On the other hand I have found them arranged in an uneven median pattern (pl. 306d) or partially paired and overlapping in midline, as was later noted by Berry & Whitehead (loc. cit.) in their detailed description of the species.

Distribution:- Marquesas Is. only.

37. Sardinella (Clupeonia) melanura (Cuvier, 1929)

(Plates 75a-d, 76a-g, 327a; Figures 19D, 65, 66, 67; Tables 4, 4.1, 4.2)

Clupea melanura Cuvier, 1829, Régne animal, 2nd ed., 2 : 318 (footnote : "Cl melanura, N., Lacép., V xl, 3, sous le nom de Clupanodon Jussieu, mais la description se rapporte à la fig. xl, 3, nommée variête du Clupanodon chinois").

Clupeonia commersoni Valenciennes, 1847, Hist. Nat. Poiss., 20 : 350 (coasts near Bombay).

Clupea otaitensis Valenciennes, ibid. : 351 (on Solander MS. name, in synonymy of Clupeonia commersoni, nomen nudum).

Clupeonia vittata Valenciennes, ibid. : 352 (Vanikoro).

Harengula vanicoris Jordan & Seale, 1906, Bull. U.S. Bur. Fish., 25 : 187 (on Alausa melanura Valenciennes).

Sardinella nigricaudata Chan, 1965, Jap. J. Ichth., 13 : 7, fig. 19. (Mallkula I.)

Specimens examined (76 : 52.0-122.0 mm S.L.)

Types:

1. MNHN 3233 (3 : 91.5-99.0 mm S.L.), Vanikoro. The largest fish was selected as putative neotype of Clupea melanura and also lectotype of Clupeonia vittata, the two smaller ones being paralectotypes of the latter species.

2. A. 2206-2958 (3 : 103.0-115.0 mm S.L.), Bombay. The tagged fish No. 2206 was selected as lectotype of Clupeonia commersoni,

the remainder being paralectotypes.

3. SU 25031 (1 : 102.0 mm S.L.), Bushman's Bay, New Hebrides. Holotype of S. nigricaudata.

Other specimens:

4. BMNH 1872.4.6.52 (1 : 80.5 mm S.L.), N. Celebes.
5. 1874.11.19.73 (1 : 71.0 mm S.L.), Raidjua, Indonesia.
6. 1875.10.23.9 (1 : 45.5 mm S.L.), New Hebrides.
7. 1941.4.58.2 (1 : 69.0 mm S.L.), Black river, Mauritius.
8. 1962.3.26.160-197 (38 : 70.0-102.0 mm S.L.), Alayu, Gulf of Aden.
9. 1970.4.9.11-20 (10 : 91.0-102.0 mm S.L.), Guadal canal, Solomon Is.
10. 1970.5.27.14 (1 : 93.0 mm S.L.), Pago Pago Harbour, Samoa.
11. 1979.8.16,841 (2 : 101.0-106.0 mm S.L.), Nosy Bay, Madagascar.
12. MNHN 3737 (3 : 73.5-109.0 mm S.L.), Amboina, mixed with a tagged specimen of S. (C.) atricauda, 110.0 mm S.L.
13. 3738 (2 : 77.0-82.0 mm S.L.), Tonga.
14. uncat. (4 : 108.0-122.0 mm S.L.), Batterie. A. Maugé.
15. uncat. (4 : 52.0-65.0 mm S.L.), Sarodrano. A. Maugé.
16. RUSI 1321-6 (1 : 114.0 mm S.L.), S.E. Africa; mixed among five specimens of Herklotsichthys quadrimaculatus, 96.0-129.0 mm S.L.

Diagnosis:- An eight pelvic-rayed species of Sardinella, superficially like S. (C.) marquesensis in most characters, but differing from that species in its black caudal tips. Gillrakers 20-41+38-74 (fig. 65).

Remarks:- Chan (1965) described S. nigricaudata based on a single specimen, 102.0 mm S.L. from New Hebrides, and distinguished it from S. melanura (including S. atricauda) on the basis of 63 (my count 72) gillrakers on the lower gill arch. I have examined a specimen, 93. 0 mm S.L. (BMNH. 1970.5.27.14) from Samoa and it has 74 lower gillrakers , but I found no further characters that can separate these from other specimens. I therefore, consider Chan's species as only an extreme variant of S. (C.) melanura.

According to my material it is likely that the Indian Ocean specimens have deeper bodies than the Pacific specimens.

Distribution:- Indo-Pacific, from Madagascar to S.E. Asia and Samoa (except N. China Sea).

38. Sardinella (Clupeonia) atricauda (Günther, 1868)

(Plates 77a-e, 78a-d, 304b; Figures 19D, 65, 66, 67; Tables 4, 4.1, 4.2)

Harengula melanurus Bleeker, 1853, Natuurk. Tijdschr. Ned.-Indië, 5 : 245 (Ceram) (name preoccupied by Clupea melanura Cuvier, 1829).

Clupea atricauda Günther, 1868 (14 March), Cat. Fishes Brit. Mus., 7 : 426 (Ceram; on specimen of Bleeker's Harengula melanurus).

Herengula (Paralosa) valenciennesi Bleeker, 1868, Versl. Meded. K. Akad. Wet. Amst., (2) 2 : 300 (Waigou, replacement name for Harengula melanurus Bleeker, 1853).

Specimens examined (12 : 93.5-126.0 mm S.L.)

Types:

1. BMNH 1867.11.28.31 (1 : 104.0 mm S.L.), Ceram. Lectotype of H. melanura and also holotype of C. atricauda.
2. RMNH 7095 (6 : 93.5-102.0 mm S.L.), Ceram. The smallest fish was selected as paralectotype of H. melanura, the remainder unspecified.

Other specimens:

3. BMNH 1858.4.21.290-291 (2 : 117.0-126.0 mm S.L.), Amboina.
4. 1979.8.17.14 (1 : 125.0 mm S.L.), Amboina.
5. MNHN 3737 (1 : 110.0 mm S.L.), Amboina; mixed among three untagged specimens of S. (C.) melanura, 73.5-109.5 mm S.L.
6. A. 7660 (1 : 104.0 mm S.L.), Batavia.

Diagnosis:- An eight pelvic-rayed Sardinella, closely allied to S. (C.) marquesensis and S. (C.) melanura in the low count of frontoparietal striae, 8-9 (tbl. 4.1); posterior lower portion of 2nd supramaxilla longer than upper portion (pl. 77c); last two anal rays very slightly enlarged, vertical striae on scales discontinuous at centre and no dark spot at dorsal origin. From them it is unmistakably differentiated by its perforated scales (pl. 78d) and overlapping predorsal scales. Ventral scutes 18-20+14-15 (tbl. 4); gill-rakers 20-26+39-43 and tip of caudal lobes dark.

Remarks:- On the basis of the perforated scales, overlapping predorsal scales and high count of ventral scutes, S. (C.) atricauda could be grouped with S. (C.) sindensis and S. (C.) gibbosa, but it is even closer to S. (C.) marquesensis and S. (C.) melanura in many other important features and I prefer to place it with these last two species.

I have assumed that Bleeker's valenciennesi was published after March 1868 and therefore Günther's atricauda has priority.

Distribution:- S.E. Asia.

39. Amblygaster sirm (Walbaum, 1792)
(Plates 79a-e, 80a-e, 312e, 317f; Figures 20A, 68, 69, 70; Tables 5, 5.1, 5.2)

Clupea sirm Walbaum, 1792, Artedi, Pisc., 3 : 38 (on Forsskål, 1775, Descript. Anim. 17; Arabia).

Sardinella leiogastroides Bleeker, 1854, Natuurk. Tijdschr. Ned.-Indië, 7 : 255 (Manado, Celebes).

Clupea pinquis Günther, 1872, Ann. Mag. nat. Hist., (4) 10 : 425 (Misol).

Specimens examined (357 : 35.0-190.0 mm S.L.)

Types:

1. RMNH 7093 (1 : 122.0 mm S.L.), Manado, Celebes. Holotype of S. leiogastroides.
2. BMNH 1870.8.31.49-50 (2 : 103.0-108.5 mm S.L.), Misol. Syntypes of C. pinquis.
3. 1870.8.31.58 (1 : 114.0 mm S.L.), Misol. One of the syntypes

of *C. pinquis*.

Other specimens:

4. BMNH 1867.11.28.40 (1 : 176.0 mm S.L.), Batavia.

5. 1867.11.28.42 (1 : 100.0 mm S.L.), Manado, Celebes.

6. 1868.5.30.118 (1 : 65.0 mm S.L.), Zanzibar.

7. 1927.4.14.2-3 (2 : 176.0-181.0 mm S.L.), Seychelles.

8. 1960.4.7.26-41 (16 : 161.0-181.0 mm S.L.), Palawan, Philippines.

9. 1962.3.26.118 (1 : 121.0 mm S.L.), Abo, Somalia.

10. 1962.3.26.119-122 (4 : 107.0-132.0 mm S.L.), Mukalla, Gulf of Aden

11. 1963.5.6.5 (1 : 116.0 mm S.L.), Zanzibar.

12. 1964.2.2.1-5 (5 : 70.5-97.0 mm S.L.), Palau, Caroline Is.

13. 1964.12.14.180-185 (6 : 72.0-94.0 mm S.L.), Zanzibar.

14. 1966.11.16.107-118 (12 : 70.0-85.0 mm S.L.), Zanzibar Channel.

15. 1966.11.16.119-168 (213 : 35.0-73.0 mm S.L.), Mombasa.

16. 1966.11.16.169-177 (10 : 50.0-165.0 mm S.L.), Zanzibar.

17. 1966.11.16.178 (1 : 175.0 mm S.L.), Mahé, Seychelles.

18. 1966.11.16.180-184 (5 : 160.0-193.0 mm S.L.), Nosy Bay, Madagascar.

19. 1966.11.16.185-203 (19 : 44.5-63.0 mm S.L.), Mombasa.

20. 1966.11.16.204-213 (10 : 115.0-155.0 mm S.L.), Fumba, Zanzibar.

21. 1970.4.24.21-40 (39 : 100.0-115.0 mm S.L.), Jaffna, Ceylon.

22. 1972.9.5.31-32 (2 : 54.0-60.0 mm S.L.), Nausen I.

23. 1973.4.5.20-21 (2 : 189.0-190.0 mm S.L.), Phuket I., Thailand.

24. 1979.3.21.337 (1 : 94.0 mm S.L.), Amboina.

25. 1979.7.4.10 (1 : 134.0 mm S.L.), Bali.

Diagnosis:- A species of *Amblygaster*, with total anal rays usually 18-20, ventral scutes usually 17-18+14-15, pelvic base opposite 6th to 10th dorsal ray. It is principally separated from its two congeners *A. clupeoides* and *A. leiogaster* by the presence of a series of dark spots along the flanks, lower gillrakers 33-42 (fig. 69), pyloric caeca 140-234 (fig. 70) and predorsal length usually 44-47 % S.L. (fig. 68).

Remarks:- Whitehead (1973b) equated Sardinops dakini Whitley with Clupea sirm Walbaum in his synonymy of genera of Sardinella, but did not include this name in his Sardinella sirm. I have been unable to examine the type of Sardinops dakini and therefore hesitate to identify it with any species in this study.

Distribution:- Indo-Pacific, from the east coasts of Africa to the S. China Sea and Papua New Guinea.

40. Amblygaster clupeoides Bleeker, 1849

(Plates 81a-d, 82a-e, 327b; Figures 20B, 68, 69, 70; Tables 5, 5.1, 5.2)

Amblygaster clupeoides Bleeker, 1849, J. Ind. Arch., 3 : 73 (Macassar).

Specimens examined (11 : 91.0-162.0 mm S.L.)

Types:

1. RMNH 7094 (1 : 162.0 mm S.L.), Macassar. Putative neotype.

Other specimens:

2. BMNH 1889.2.1.1987 (1 : 150.0 mm S.L.), Malaya Archipelago.
3. 1936.10.21.1 (1 : 102.0 mm S.L.), Fiji.
4. RMNH 23307 (8 : 91.0-131.0 mm S.L.), E. Indies. The ninth specimen, 107.0 mm S.L., has been here described as Herklotsichthys quadrimaculatus.

Diagnosis:- A species of Amblygaster, differing from A. sirm in details given in the diagnosis of that species. It resembles that species in many morphometric characters (tbls. 5, 5.1, 5.2). From its still closer relative A. leiogaster, it is distinguished by having the body depth 24-27 (cf. 21-25) % S.L.; predorsal length 48-50 (cf. usually 50-53) % S.L.; postdorsal length 50-53 (cf. 47-50.) % S.L., eye diameter 6.8-7.6 (cf. 6.0-6.9) % S.L.; base of pelvics below 5th-9th (cf. 1st-3rd) dorsal ray and lower gillrakers, 26-31 (cf. 31-33) (fig. 69).

Distribution:- S.E. Asia to Fiji.

41. Amblygaster leiogaster (Valenciennes, 1847)

(Plates 83a-e, 84a-e, 307a, 321g; Figures 20B, 68, 69, 70; Tables 5, 5.1, 5.2)

Sardinella leiogaster Valenciennes, 1847, Hist. Nat. Poiss., 20 : 270 (Indian Ocean and Trincomalee).

Clupea (Sardinella) clupeoides Bleeker, 1872, Atlas Ichth. Ind. Nèerland., 6 : pl. 14 (1), 272 (fig. only, not descr., which is based on a Bleeker specimen of Amblygaster clupeoides in Rijksmuseum van Natuurlijke).

Clupea okinawensis Kishinouye, 1907, J. Imp. Fish Bur. Tokyo, 14 (3) : 96, pls. 19 (2), 21 (5) (Riukiu Is, Okinawa).

Specimens examined (13 : 194.0-218.0 mm S.L.)

Types:

1. MNHN 3742 (1 : 202.0 mm S.L.), Trincomalee. Holotype of S. leiogaster.
2. BMNH 1867.11.28.39 (1 : 215.0 mm S.L.), E. Indies. Bearing a label indicating it as type and basis of Bleeker's figure of A. clupeoides by P.J.P. Whitehead. It is in fact A. leiogaster.

Other specimens:

3. BMNH 1966.11.16.75-77 (2 : 199.0-210.0 mm S.L.), Malinda, Kenya.
4. 1973.4.5.11 (1 : 206.0 mm S.L.), Phuket I., Thailand.
5. 1973.4.5.12-19 (8 : 194.0-218.0 mm S.L.), same data as in 4.

Diagnosis:- A species of Amblygaster, differing from A. clupeoides in the characters discussed in the diagnosis of that species.

Remarks:- The types of C. okinawensis are believed to have been destroyed during the war. Whitehead (1973b) tentatively synonymized it with Sardinella clupeoides, but for the time being I consider it to be identical with the present species on the basis of its "ventrals inserted just before the origin of the dorsal fin ... Intestine short, there is no bending between the duodenum and the anus", as stated by Kishinouye (1907).

Distribution:- Indo-Pacific, from the east coast of Africa to Okinawa, Japan.

42. Herklotsichthys quadrimaculatus (Rüppell, 1837)
(Plates 85a-d, 86a-e, 307b, 317g, 327c; Figures 21A, 73, 74; Tables 5, 5.1, 5.2)

Clupea quadrimaculata Rüppell, 1837, Neue Wirbelth., Fische : 78, pl. 21 (3) (Bay of Massawa, Red Sea).

Harengula bipunctata Valenciennes, 1847, Hist. Nat. Poiss., 20 : 98 (on MS. descr. of Clupea bipunctata by Ehrenberg, ex Massawa).

Sardinella lineolata Valenciennes, ibid. : 272 (Trincomalee, Bourou I.).

Clupea fasciata Valenciennes, ibid.: 349 (Saint-Denis de Bourbon).

Meletta obtusirostris Valenciennes, ibid. : 375 (Seychelles).

Meletta venenosa Valenciennes, ibid. : 377 (Seychelles).

Alausa schrammi Bleeker, 1849, Verh. batav. Genoot. Kunst. Wet., 22 : 11 (Boleling, Bali).

Harengula moluccensis Bleeker, 1853, Natuurk. Tijdschr. Ned.-Indië, 4 : 609 (Ternate, Amboina, Ceram).

Harengula kunzei Bleeker, 1856, ibid. : 12 : 209 (Ternate).

Clupea (Harengula) dubia Bleeker, 1872, Atlas Ichth. Ind. Nèerland., 6 : 108 (on Sardinella lineolata Valenciennes).

Harengula stereolepis Ogilby, 1897, Proc. Linn. Soc. N.S. W. , 22 : 759 (Torres Straits, Darnley I., S.E. New Guinea).

Clupea mizun Kishinouye, 1907, J. Imp. Fish Bur. Tokyo, 14 (3) : 98, pl. 20 (3) (Okinawa).

Clupea rechingeri Steindachner, 1908, Sitzb. K. Akad. Wiss. Wien, 115 (1) : 1424 (Upolu, Samoa).

Harengula lippa Whitley, 1931, Rec. Aust. Mus., 18 (4) : 142, fig. 1 (Port Hedland, N.W. Australia).

Specimens examined (241 : 38.0-129.0 mm S.L.)

Types:

1. SMF 4648 (1 : 85.0 mm S.L.), Masswana. Type of C. quadrimaculata, it was claimed as one of the three paratypes by Whitehead (1965a)

but the other two specimens are here recognised as paratypes of C. punctata.

2. MNHN 662 (2 : 75.0-83.0 mm S.L.), Trincomalee. The largest fish was selected as lectotype of S. lineolata, the smaller one being one of its syntypes.

3. 3106 (1 : 105.0 mm S.L.), Mollucas. Syntype of S. lineolata.

4. 895 (1 : 129.0 mm S.L.), Saint-Denis de Bourbon. Holotype of C. fasciata.

5. 900 (11 : 86.0-118.0 mm S.L.), Seychelles. The largest of these syntypes was selected as lectotype of M. obtusirostris.

6. RMNH 7083 (1 : 83.0 mm S.L.), Bali. Lectotype of A. schrammi.

7. 23302 (2 : 59.0-65.0 mm S.L.), Bali. Syntypes of A. schrammi.

8. BMNH 1867.11.28.32 (1 : 62.0 mm S.L.), Bali. Syntype of A. schrammi.

9. RMNH 7098 (1 : 101.5 mm S.L.), Ternate. Lectotype of H. moluccensis.

10. 7097 (1 : 111.0 mm S.L.), Ternate. Lectotype of H. kunzei.

11. AMS I. 12828 (1 : 129.0 mm S.L.), Port Hedland, N.W. Australia. Holotype of H. lippa.

Other specimens:

12. BMNH 1858.4.21.100 (1 : 44.0 mm S.L.), Amboina.

13. 1865.8.18.14 (1 : 105.0 mm S.L.), Zanzibar.

14. 1866.1.19.45-47 (3 : 68.2-82.0 mm S.L.), Zanzibar.

15. 1866.1.24.26 (1 : 93.5 mm S.L.), Ceylon.

16. 1867.3.7.378 (1 : 88.5 mm S.L.), Zanzibar.

17. 1867.3.9.374 (1 : 92.0 mm S.L.), Zanzibar, (left side dried skin).

18. 1867.11.28.27 (1 : 112.0 mm S.L.), E. Indies.

19. 1867.11.28.30 (1 : 108.0 mm S.L.), E. Indies.

20. 1870.6.14-19 (1 : 105.0 mm S.L.), Andaman Is.

21. 1870.8.31.45-46 (2 : 83.0-98.5 mm S.L.), Misol.

22. 1870.8.31.47-48 (2 : 98.5-102.5 mm S.L.), Misol.

23. 1871.4.13.30 (5 : 38.0-50.0 mm S.L.), Red Sea; mixed among

fourteen specimens of Herklotsichthys punctatus, 39.0-67.0 mm S.L.

24. BMNH 1871.9.13.153 (1 : 113.0 mm S.L.), Samoa.

25. 1874.11.19.74 (1 : 74.5 mm S.L.), Upolu, Samoa.

26. 1876.7.25.33 (1 : 65.0 mm S.L.), Samoa.

27. 1879.5.14.632 (1 : 101.0 mm S.L.), Admiralty I.

28. 1879.5.22.56-58 (2 : 88.5-98.0 mm S.L.), Ponape, Caroline Is.

29. 1887.11.11.317 (1 : 90.0 mm S.L.), Muscat.

30. 1889.2.1.1184-1185 (2 : 105.0-106.0 mm S.L.), Andaman Is.

31. 1889.2.1.1886 (1 : 84.0 mm S.L.), Nicobar Is.

32. 1889.4.24.1 (1 : 111.0 mm S.L.), Celebes.

33. 1890.2.26.188-190 (4 : 90.0-110.0 mm S.L.), Fiji.

34. 1913.4.7.4-6 (3 : 50.0-98.0 mm S.L.), Mombasa.

35. 1913.12.9.1-2 (2 : 89.0-90.0 mm S.L.), Goram, New Guinea.

36. 1913.12.9.3. (1 : 81.5 mm S.L.), Goram,New Guinea.

37. 1920.7.23.3 (1 : 86.0 mm S.L.), Durban.

38. 1927.4.14.4.12 (9 : 80.0-90.0 mm S.L.), Seychelles.

39. 1932.8.4.5-11 (6 : 105.0-113.0 mm S.L.), Victoria Harbour, Seychelles.

40. 1933.1.25.4 (1 : 111.0 mm S.L.), Low Isles, N. Queensland.

41. 1933.3.11.13-14 (2 : 108.5-108.7 mm S.L.), Or Negros, Philippines

42. 1933.3.11.15-16 (2 : 109.0-114.0 mm S.L.), Sulu, Philippines.

43. 1933.3.11.17-18 (2 : 78.0-78.5 mm S.L.), Sulu, Philippines.

44. 1933.3.11.19 (1 : 112.0 mm S.L.), Or Negros, Philippines.

45. 1958.6.10.31 (1 : 90.0 mm S.L.), Senioertna, Ceylon.

46. 1960.3.15.4 (1 : 70.0 mm S.L.), Suakui, Red Sea.

47. 1960.3.15.14-15 (2 : 83.5-95.0 mm S.L.), Port Sudan, Red Sea.

48. 1962.1.16.139 (1 : 73.0 mm S.L.), Mombasa.

49. 1962.1.22.1 (1 : 71.0 mm S.L.), Maldives.

50. 1962.7.19.1-2 (2 : 106.0-110.0 mm S.L.), Gulf of Aden.

51. 1963.5.6.3-4 (2 : 84.0-85.0 mm S.L.), Zanzibar.

52. BMNH 1963.11.12.2 (2 : 77.0-90.0 mm S.L.), Sudan.

53. 1964.2.2.7-10 (4 : 84.0-94.0 mm S.L.), Palau, Caroline Is.

54. 1964.5.20.2-17 (16 : 52.0-67.0 mm S.L.), Maldives.

55. 1965.4.4.39-46 (8 : 84.0-100.0 mm S.L.), Massawana.

56. 1969.1.29.52 (3 : 48.0-49.0 mm S.L.), Zanzibar.

57. 1970.4.24.41 (1 : 85.0 mm S.L.), Jaffna, Ceylon.

58. 1970.5.27.4-5 (2 : 103.0-103.5 mm S.L.), Pago Pago Harbour, Samoa.

59. 1971.2.8.25-36 (21 : 41.0-108.0 mm S.L.), Little Hope Is., Queensland.

60. 1971.2.17.12 (7 : 62.0-70.0 mm S.L.), N.E. Arabian Sea.

61. 1971.8.25.101-104 (4 : 50.0-80.0 mm S.L.), Fiji.

62. 1973.4.5.36-40 (5 : 53.5-65.0 mm S.L.), Tarawa, Gilbert Is.

63. 1974.8.19.1-12 (12 : 88.0-102.0 mm S.L.), Samurai, N. Guinea.

64. 1978.8.17.1-4 (4 : 60.5-78.5 mm S.L.), Pomona, Queensland.

65. 1979.3.21.305-307 (3 : 75.0-86.0 mm S.L.), Tung-kang, Taiwan.

66. 1979.3.21.308 (1 : 80.0 mm S.L.), Taitung, Taiwan.

67. 1979.3.21.340 (1 : 79.0 mm S.L.), Amboina.

68. MNHN 3739 (1 : 90.0 mm S.L.), Amboina.

69. 3740 (1 : 108.0 mm S.L.), Batavia.

70. 3741 (2 : 87.0-100.5 mm S.L.), Molucca.

71. 1962.186 (1 : 95.0 mm S.L.), Madagascar.

72. 1977-1077 (1 : 73.0 mm S.L.), Eilat, Gulf of Aqaba.

73. uncat. b (1 : 70.0 mm S.L.), Tuléar; mixed among eight specimens of Sardinella (Clupeonia) albella, 52.0-83.0 mm S.L.

74. RMNH 23307 (1 : 107.0 mm S.L.), E. Indies; mixed among eight specimens of Amblygaster clupeoides, 91.0-131.0 mm S.L.

75. 24955 (29 : 48.0-112.0 mm S.L.), E. Indies.

76. 27713 (6 : 71.0-105.0 mm S.L.), E. Indies.

77. RUSI 1321-6 (5 : 96.0-129.0 mm S.L.), S.E. African coast.

78. USNM uncat. (1 : 91.5 mm S.L.), Palawan, Philippines.

Diagnosis:- A hitherto problematic species of Herklotsichthys, it can be now unmistakably identified by its possession of wing - shaped median predorsal scales which are hidden under the normal paired and overlapping scales (pl. 307b), scales toothed posteriorly; no prominent ridge of teeth on palatine and pterygoids. It is closely allied to H. koningsbergeri but can be distinguished from that species by its slender body, the depth 18-30 (cf. 32-41) % S.L.; eye diameter 6.2-10.2 (CF. 9.6-11.9) % S.L.; toothed scales (pl. 86d) and no series of dark spots along flanks.

Remarks:- I have synonymized Harengula bipunctata Valenciennes with this species, principally on the basis of Klunzinger's (1870) description of Clupea venenosa, which is as follows : "Hinter dem oberen Winkel des Kiemendeckels 2 orangefarbene Flecken, einer über allen andern und zwischen ihren beginnt eine gelbliche bis matt grünliche Längslinie, die sich bis zur Schwangflosse zieht". The specific name must be derived from this character. Fortunately, this agrees perfectly with Rüppell's (1837) colour plate 21 (3) of the present species. This assumption is reinforced by its abundance in the Massawa area (fide Whitehead, 1965a).

Clupea latulus (not Cuvier) of Montrouzer (1857 : 207) from Woodlark I. may prove to be this species. According to Whitehead (1967a), Cuvier's C. latulus is probably Sprattus sprattus of European waters, while Harengula latulus of Valenciennes is a Harengula sp.

Kent (1889) provided only names for his Clupea profundus, C. torresiensis and C. ranelayi from Queensland, and these new names were tentatively referred to H. punctatus by Whitehead (1973b). On the basis of their localities I follow Whitehead (loc. cit.), but now equate them with H. quadrimaculatus.

H. stereolepis Ogilby has been here synonymized with the present species, as proposed by McCulloch (1929, 1930) and Whitley (1931). However, future re-examination of its type specimens is needed.

The original description and drawing (pl. 20, fig. 3) of C. mizun Kishinouye are fairly good and I have no doubt that this is also H. quadrimaculatus.

As in most of widely distributed clupeid fishes, the body depth varies somewhat and this caused some problems in the early phase of this study before the scale diagnosis had been discovered. Bleeker's A. schrammi is likely the slender and young of his H. moluccensis and H. kunzei, whereas Valenciennes's S. lineolata is the slender and young of his C. fasciata, M. obtusirostris and M. venenosa.

Losse's (1968) and Whitehead's (1973b) Herklotsichthys Form B is clearly this species.

Distribution:- Indo-Pacific, from entire east coast of Africa to Japan, Samoa and Australia, not entering estuarine or brackish waters.

43. Herklotsichthys koningsbergeri (Weber & DeBeaufort, 1912)
(Plates 87a-d, 88a-f, 304c, 312f; Figures 21A, 73, 74; Tables 5, 5.1, 5.2)

Clupea (Harengula) koningsbergeri Weber & DeBeaufort, 1912, Verhand. Akad. Wet. Amst., 17 : 14 (Aru. I).

Harengula maccullochi Whitley, 1931, Rec. Aust. Mus., 18 (4) : 143, fig. 2 (Port Hedland, N.W. Australia).

Specimens examined (5 : 75.0-125.0 mm S.L.)

Types:

1. AMS I. 12827 (P. 17) (1 : 125.0 mm S.L.), Port Hedland, N.W. Australia.. Type of Harengula maccullochi.

Other specimens:

2. BMNH 1887.5.16.8 (1 : 95.0 mm S.L.), N.W. Australia.
3. 1935.9.14.1 (1 : 75.0 mm S.L.), Augustus I., N.W. Australia.
4. 1979.3.21.341 (1 : 100.0 mm S.L.), Amboina.
5. NIOA P. 1378 (1 : 101.0 mm S.L.), Amboina.

Diagnosis:- A species of Herklotsichthys, with a number of characters that suggest a close relationship to H. quadrimaculatus, especially the presence of winged-shaped median predorsal scales. It is, however, unqiue in its deeper body 32-41 (cf. 18-30) % S.L.; larger eye diameter 9.6-11.9 (cf. 6.2-10.2) % S.L.; smooth posterior margins of scales (pl. 88f) and the presence of one or two series of dark spots along the flanks (pl. 87a, b).

Remarks:- Apart from the two series of dark spots along the flanks in H. maccullochi, but only a single row in C. (H.) koningsbergeri, I have found no other characters to separate the two nominal species. Two further specimens (BMNH. 1979.3.2.341 and NIOA.P. 1378) from Amboina resemble the type of H. maccullochi in markings along the flanks and probably could be recognised as representatives of a western population of H. koningsbergeri, as pointed out by Whitley (1931). More field work is required before any geographic variation can be stated with certainty, but I have no doubt that they are the same fish.

Distribution:- Banda Sea, Arafura Sea and N.W. coast of Australia.

44. Herklotsichthys castelnaui (Ogilby, 1897)
(Plates 89a-d, 90a-e; Figures 20D, 73, 74; Tables 5, 5.1, 5.2)

Kowala castelnaui Ogilby, 1897, Proc. Linn. Soc. N.S. W. , 22 : 66 (N.S. Wales).

Macrura blackburni Whitley, 1948, Aust. Zool., 11 : 266 (Port Hedland, W. Australia).

Specimens examined (29 : 29.5-152.0 mm S.L.)

Types:

1. USNM 48801 (2 : 140.0-141.0 mm S.L.), Port Jackson. Cotypes of K. castelnaui.
2. AMS IB. 2010 (1 : 102.0 mm S.L.), Port Hedland, W. Australia. Holotype of M. blackburni.

Other specimens:

3. BMNH 1890.9.23.262-266 (5 : 137.0-148.0 mm S.L.), Port Jackson.
4. 1897.10.2741-2742 (2 : 150.0-152.0 mm S.L.), Port Jackson.
5. 1914.8.20.15-16 (2 : 107.0-111.0 mm S.L.), Port Stephens.

N.S. Wales.

6. 1927.2.10.5-7 (3 : 80.0-93.0 mm S.L.), Paradice, Townsville, Queensland.

7. QM I. 11057 (10 : 78.0-97.0 mm S.L.), Bloomfield River, N. Queensland.

8. I. 11980 (3: 98.0-107.0 mm S.L.), locality unknown.

9. USNM 217020 (1 : 29.5 mm S.L.), Fly river, Gulf of Papua.

Diagnosis:- A species of Herklotsichthys strongly resembling H. quadrimaculatus and H. koningsbergeri in having no prominent ridge of teeth on the palatine and pterygoids and the intestine long and forming an anterior simple loop below stomach. However, it is nearer to H. gotoi n. sp. in having somewhat rounded predorsal scales. From the latter species it is separated by a shallower body, 30-40 (cf. 40.5) % S.L. (fig. 74), a higher gillraker count (usually) 18-22+ 39-52 (cf. 16+34) (fig. 73) and dark tips to the dorsal and caudal lobes.

Remarks:- This fish has usually been called Harengula abbreviata Valenciennes, but the latter is likely to have been a member of Sardinella according to Whitehead (1967a). Geographically, I believe that H. abbreviata was probably Amblygaster (the strong scutes rule out Etrumeus teres). However, for the time being, I agree with Whitehead (loc. cit.) in considering it so doubtful that the name should be dropped from the literature; no type exists.

Phyletically, H. castelnaui is possibly an intermediate form between H. quadrimaculatus and H. koningsbergeri on the one hand, and H. gotoi n. sp., H. lossei n.sp., H. spilura, H. punctata and H. dispilonotus on the other. This is principally based on the high count of total anal rays 14-19 (tbl. 5) and the series of simple rounded predorsal scales which are partly diagnostic characters of most species of the second group. Conversely, it shares the characteristic simple coiling of the intestinal tract (pl. 89b), the small group of teeth on the palatine and pterygoids, a high count of pyloric caeca, 46-80 (fig. 74) and the great extension of the ventroanterior edge of 3rd suborbital bone (pl. 90a) which are the common characters of the first group.

Distribution:- N.E. to N.W. coasts of Australia to Gulf of Papua.

45. Herklotsichthys gotoi n. sp.

(Plate 91a-c; Figures 20D, 73, 74; Tables 5, 5.1, 5.2)

Specimens examined (1 : 63.0 mm S.L.)

Types:

1. BMNH 1913.12.9.179 (1 : 63.0 mm S.L.), Mimiko river, New Guinea; British Oxford University Expedition. Holotype.

Diagnosis:- A species of Herklotsichthys, closely related to H. castelnaui in having an additional series of somewhat rounded median predorsal scales hidden almost completely under the normal paired and overlapping predorsal scales. It is, however, significantly different from that species in its deeper body 41 (cf. 30-40) % S.L. (fig. 74); lower gillraker count, 16+34 (cf. 18-22+39-52) (fig. 73); postdorsal scales with a median posterior prolongation (except a few scales just behind the last dorsal ray); humeral spot present and distinct, but no prominent markings on dorsal and caudal.

Remarks:- Named for my director of study Mr H.E. Goto of the Division of Life Sciences, Imperical College of Science and Technology, University of London.

Distribution:- Mimiko river, New Guinea.

46. Herklotsichthys lossei n. sp.

(Plates 92a-d, 93a-e; Figures 21B, 75, 76; Tables 5, 5.1, 5.2)

Specimens examined (39 : 65.0-78.0 mm S.L.)

Types:

1. BMNH 1976.8.19.78 (1 : 69.0 mm S.L.), Persian Gulf (30°08'N : 46°54'E; G.F. Losse. Holotype.

2. 1976.8.19.51-63 (13 : 63.0-69.0 mm S.L.), data as in 1. Paratypes.

3. 1976.8.19.64-77 (21 : 63.0-71.0 mm S.L.), data as in 1.

Paratypes.

4. UZMK C.1 (1 : 78.0 mm S.L.), Bushire, Persian Gulf; H. Blegvad. Paratype.

5. C. 2-4 (3 : 65.0-66.0 mm S.L.), Bender Shahpur, Persian Gulf; H. Blegvad. Paratypes.

Diagnosis:- A new species of Herklotsichthys, differs from previous four species in having prominent ridges of teeth on the palatine and pterygoids; intestine without a simple loop anteriorly; no extension on the antero-ventral edge of the 3rd suborbital and predorsal scales simply median. It agrees with H. spilura in the above characters and also in its prominent dark patch on the middle of the dorsal. From H. spilura it is distinguished by having a more slender body 26-28 (cf. 28-35) % S.L. (fig. 76), pyloric caeca 36-43 (cf. 27-35) (fig. 76) and a series of dark spots along the flanks (absent in that species). The two species are allopatric.

Remarks:- Named in honour of Mr G.F. Losse in recognition of his work on the East African clupeid fishes and the collector of most of the present specimens of this new species.

Four specimens of this species from two localities in the Persian Gulf (UZMK. C.1-4) were misidentified as Sardinella melanura by Blegvad & Løppenthin (1944).

Distribution:- Persian Gulf.

47. Herklotsichthys spilura (Guichenot, 1863)
(Plates 94a-d, 95a-e; Figures 21B, 75, 76; Tables 5, 5.1, 5.2)

Harengula spilura Guichenot, 1863, in Maillard. Ile de Rèunion Poiss., : 16 (Bourbon).

Specimens examined (49 : 48.0-84.0 mm S.L.)

Types:

1. MNHN 1324 (2 : 78.0-82.0 mm S.L.), Rèunion Is. Syntypes of

Harengula spilura.

Other specimens:

2. BMNH 1963.5.6.1-2 (2 : 59.0-62.0 mm S.L.), Zanzibar.
3. 1964.12.14.25-54 (30 : 48.0-84.0 mm S.L.), Zanzibar.
4. 1966.11.16.214-221 (8 : 52.0-72.0 mm S.L.), Fumba, Zanzibar.
5. 1966.11.16.222-229 (7 : 66.0-83.0 mm S.L.), Seagull Shoal, Zanzibar.

Diagnosis:- A species of Herklotsichthys, closely related to H. lossei but distinguished from that species by its deeper body, usually 28-35 (cf. 26-28) % S.L. (fig. 76), pyloric caeca 27-35 (cf. 36-43) (fig. 76) and absence of dark spots along the flanks; also, it appears to be restricted to Zanzibar and Rèunion Is.

Remarks:- Whitehead (1967a, 1973a) reported that Dr F.H. Berry, who had examined the type specimens of H. spilura, had claimed (in litt.) that they had a toothed hypomaxilla; Whitehead presumed that probably they were mis-labelled Western Atlantic Harengula. I have had the opportunity to clarify this problem; they possess no such bone in the jaw and are a good species of Herklotsichthys from Rèunion Is.

H. punctatus Form A of Losse (1968) and Whitehead (1973b) is this species.

Distribution:- Zanzibar to Rèunion Is.

48. Herklotsichthys punctatus (Rüppell, 1837)
(Plates 96a-d, 97a-e, 308a; Figures 21C, 75, 76; Tables 5, 5.1, 5.2)

Clupea punctata Rüppell, 1837, Neue Wirbelth., Fische : 78, pl. 21 (2) (Red Sea).

Harengula arabica Valenciennes, 1847, Hist. Nat. Poiss., 20 : 298 (Mohila, Red Sea, on MS. descr. of Clupea arabica Ehrenberg).

Spratella erythraea Klunzinger, 1870, Verh. zool. bot. Ges. Wien, 21 : 599 (Red Sea, on Rüppell name in synonymy of Clupea venenosa).

Specimens examined (82 : 36.5-83.0 mm S.L.)

Types:

1. SMF 567 (1 : 58.0 mm S.L.), Red Sea. Lectotype of C. punctata.

2. 6649-6650 (2 : 59.0-62.0 mm S.L.), Red Sea. Paratypes of C. punctata.

3. 4649 (1 : 73.0 mm S.L.), Masswana. Paratype of C. punctata, being formerly claimed as a paratype of C. quadrimaculata by Whitehead (1965a).

4. 4651 (1 : 58.0 mm S.L.), Masswana. Paratype of C. punctata, being formerly claimed as a paratype of C. quadrimaculata by Whitehead (1965a).

Other specimens:

6. BMNH 1871.4.13.30 (14 : 39.0-67.0 mm S.L.), Red Sea; mixed with five specimensof H. quadrimaculatus, 38.0-50.0 mm S.L.

7. 1871.7.15.27 (2 : 70.0-75.0 mm S.L.), Red Sea.

8. 1925.9.19.5 (1 : 60.0 mm S.L.), Great Bitter Lake, Suez Canal.

9. 1960.3.15.1-3 (3 : 49.0-53.5 mm S.L.), Sukui, Red Sea.

10. 1960.3.15.5-13 (9 : 36.5-52.0 mm S.L.), Mersa Sheileh Ibrahim Coral reef, Red Sea.

11. 1962.3.26.133-138 (6 : 54.0-64.0 mm S.L.), Ras Imran, Red Sea.

12. 1965.4.4.1-38 (38 : 53.5-70.0 mm S.L.), Massawa.

13. 1978.4.20.1 (1 : 82.0 mm S.L.), El Bilain, Gulf of Suez.

14. MNHN 1977-1078 (3 : 77.0-83.0 mm S.L.), Gulf of Suez.

Diagnosis:- A species of Herklotsichthys, greatly resembling H. lossei and also H. spilura in the presence of a large ridge of teeth on the palatine and pterygoids; intestine without a simple loop at front (pl. 96b); antero-ventral edge of 3rd suborbital not produced (pl. 97a) and predorsal scales median (pl. 308a). It is, however, easily separated from them by the absence of a dark patch on the dorsal and by having many scattered, small but distinct dark brown spots near or on midline of the back. From H. dispilonotus, it chiefly differs in having a more slender body, 24-30 (cf. 30-35) % S.L. (fig. 76); more ventral scutes 16-19+9-14 (cf. 14-15+11-13) (tbl. 5.1), and more pyloric caeca 29-34 (cf. 17-19) (fig. 76); in addition, H. dispilonotus is characterized by two large black saddle spots on the back. Furthermore, H. punctatus is restricted to the Red Sea.

Remarks:- A specimen (BMNH. 1925.9.19.5) from the Great Britter Lake and another (MNHN. 1977-1078) from the Gulf of Suez, have much higher counts of gillrakers , e.g. 16+39 and 17+39, respectively. It is likely that specimens from this area have higher gillraker counts than in other parts of the Red Sea.

H. arabica is the second species of Harengula described by Ehrenberg from the Red Sea. Presumably he noticed the differences between his specimens of H. arabica and H. bipunctata. The latter species is here recognised as H. quadrimaculatus, which species is as common in the Red Sea as the endemic H. punctatus. I assume therefore, that H. arabica is a junior synonym of the present species.

"Spratella erythraea Rp. (Catal. Mus. Senkenb.)" of Klunzinger (1870), the species name presumably referring to the Red Sea and not the colour of the fish, might be either H. quadrimaculatus or H. punctatus. In view of the brownish colour of most preserved specimens of H. punctatus, I have decided to identify S. erythraea as H. punctatus and not the more colourful H. quadrimaculatus.

Distribution:- Red Sea (enters eastern Mediterranean, fide Figure 14a by Ben-Tuvia, 1976).

49. Herklotsichthys dispilonotus (Bleeker, 1852)
(Plates 98a-d, 99a-e, 308b, 321h, 327d; Figures 21C, 75, 76; Tables 5, 5.1, 5.2)

Harengula dispilonotus Bleeker, 1852, Natuurk. Tijdschr. Ned.-Indië, 3 : 456 (Banka).

Specimens examined (34 : 25.0-84.0 mm S.L.)

Types:

1. BMNH 1867.11.28.28 (1 : 68.5 mm S.L.), Banka. Lectotype of Harengula dispilonotus.

2. RMNH 7101 (2 : 58.0-62.0 mm S.L.), Banka. Paralectotypes of Harengula dispilonotus.

Other specimens:

3. BMNH 1966.2.28.21-23 (3 : 65.0-73.0 mm S.L.), Bangkok.
4. 1966.11.20.3 (1 : 73.5 mm S.L.), Bangkok.
5. 1967.11.13.1-9 (19 : 25.0-44.0 mm S.L.), Singapore.
6. 1979.7.5.2-6 (5 : 77.0-84.0 mm S.L.), locality unknown.
7. USNM uncat. (1 : 74.0 mm S.L.), Palawan, Philippines.
8. uncat. (1 : 76.0 mm S.L.), Palawan, Philippines.
9. uncat. (1 : 80.5 mm S.L.), Palawan, Philippines.

Diagnosis:- A species of Herklotsichthys, with a well developed ridge of teeth on the palatine and pterygoids; predorsal scales unevenly median (pl. 308b); fundus of stomach very short and with a more or less straight intestine (pl. 98b); body depth 30-35 % S.L. (fig. 76), and ventral scutes only 14-15+11-13 (tbl. 5.1). In addition to this combination of distinctive characters, it is strikingly different from other species in having a large dark saddle-like spot on the back at the posterior part of the dorsal base and another one a short distant behind it.

Remarks:- The two dark saddle-like spots are very well developed and easily seen even in very small alcohol preserved specimens of 25 mm S.L.

The report of this fish in freshwater by Weber & DeBeaufort (1913) was certainly erroneous, although it may ascend brackish water as far as tidal influence.

Distribution:- S.E. Asia.

50. Escualosa elongata n. sp.

(Plate 100a-b; Figures 20C, 71, 72; Tables 5, 5.1, 5.2)

Specimens examined (1 : 64.5 mm S.L.)

Types:

1. BMNH 1973.1.18.1 (1 : 64.5 mm S.L.), Bangkok, Sunday Market, Thailand; P.J.P. Whitehead. Holotype.

Diagnosis:- This second species of Escualosa is separated from E. thoracata by its more slender body, the depth 24.6 (cf. 27.3-37.0) % S.L. (fig. 71); depth of caudal peduncle 8.3 (cf. 10.7-13.2) % S.L.; pelvic base further back, below 3rd dorsal ray; slightly higher count of gillrakers 26+41 (cf. 16-25 +27-40) (fig. 72); ventral scutes 18+12 (cf. usually 18+11) (tbl. 5.1), and with silvery band along flanks only as broad as about half eye diameter (cf. equals eye diameter in E. thoracata).

Remarks:- The discovery of this specimen, with its slender body and slightly higher count of gillrakers and other minor but significant differences, cannot be lightly dismissed. Since it is not juvenile nor excessively large, the differences cannot be ontogenetic. There was no malformation or unusual development of any part of the body which would indicate an aberrant individual, and the differences seem too numerous for mere phenotypic variation; so many specimens of E. thoracata have been examined from so many different localities, that the present specimen must surely be genetically distinct. Possibly it is a freshwater form, but there is no information on the exact locality.

Whitley's (1940) sketch of the holotype of Clupea macrolepis (Staatliches Museum für Naturkunde, Stuutgart. No. 2292), resembles closely the present species, but the full description given by Whitehead (1964b) is perfectly consistent with E. thoracata.

Named for its characteristic elongate body.

Distribution:- Thailand (Bangkok Sunday Market, but no exact locality; ? freshwater).

51. Escualosa thoracata (Valenciennes, 1847)

(Plates 100c-d, 101a-g, 308c, 313a, 318a, 322a, 327e; Figures 20C, 71, 72; Tables 5, 5.1, 5.2)

? Clupea coval Cuvier, 1829, Règne Animal, 2nd ed., 2 : 318 (footnote : on kowal of Russell, 1803, Fishes of Coromandel : pl. 186) (nomen dubium by Whitehead, 1967).

Kowala thoracata Valenciennes, 1847, Hist. Nat. Poiss., 20 : 363 (Pondicherry).

Meletta lile Valenciennes, ibid. : 378 (Pondicherry, Coromandel).

Alausa champil Cantor, 1850, J. Asiatic Soc. Bengal, 18 (2) : 1284 (Penang).

Rogenia argyrotaenia Bleeker, 1852, Natuurk. Tijdschr. Ned.-Indië, 3 : 457 (Muntok, Batavia).

Clupea macrolepis Steindachner, 1879, Denkschr. Akad. Wiss. Wien, 41 (2) : 13 (Townsville, Queensland).

? Clupea huae Tirant, 1929, Serv. océanogr. Pêches Indochine, 6e note : 29 (Huê, Vietnam).

Specimens examined (172 : 28.0-95.0 mm S.L.)

Types:

1. MNHN 3712 (3 : 80.0-95.0 mm S.L.), Pondicherry. The largest fish was selected as lectotype of K. thoracata, the remainder being paralectotypes.

2. 3173 (2 : 75.5-76.0 mm S.L.), Pondicherry. The largest fish was selected as lectotype of M. lile, the remainder being paralectotype.

3. 3229 (10 : 80.0-91.0 mm S.L.), Coromandel. Paralectotypes of M. lile.

4. BMNH 1860.3.19.446-447 (2 : 61.0-61.5 mm S.L.), Penang. Syntypes of A. champil, (left side dried skins).

5. RMNH 7088 (1 : 64.0 mm S.L.), Muntok, Batavia. Lectotype of R. argyrotaenia.

Other specimens:

6. BMNH 1867.11.28.18 (1 : 69.0 mm S.L.), E. Indies.

7. 1870.5.18.5 (1 : 90.0 mm S.L.), Malabar.

8. 1889.2.1.1925-1932 (8 : 57.0-87.0 mm S.L.), Bombay.

9. 1889.2.1.1933-1936 (4 : 84.0-92.0 mm S.L.), Malabar.

10. 1889.2.1.1937-1939 (3 : 58.5-79.0 mm S.L.), Canara.

11. 1889.2.1.1940-1945 (6 : 47.0-62.0 mm S.L.), Madras.

12. 1889.2.1.1946-1949 (4 : 55.0-74.5 mm S.L.), Orissa.

13. 1889.2.1.1950-1951 (2 : 59.0-63.0 mm S.L.), Burma.

14. 1889.8.17.25 (1 : 61.0 mm S.L.), Batavia.

15. 1898.12.24.57-58 (2 : 65.0-66.0 mm S.L.), Kurrachee.

16. 1913.12.9.180 (1 : 61.0 mm S.L.), Mimiko river, New Guinea.

17. 1965.10.20.48-55 (8 : 39.0-60.0 mm S.L.), Singapore.

18. 1967.11.13.20 (1 : 69.5 mm S.L.), Singapore.

19. 1967.11.13.21-23 (3 : 66.0-66.5 mm S.L.), Siglap.

20. 1967.11.13.24-25 (2 : 69.0-79.0 mm S.L.), Pony, Singapore.

21. 1967.11.13.26 (1 : 59.0 mm S.L.), Batumaney, Penang.

22. 1967.11.13.27-28 (2 : 55.0-56.5 mm S.L.), Alor Star.

23. 1967.11.13.29-34 (6 : 48.0-62.0 mm S.L.), Ponygod.

24. 1967.11.13.35-44 (10 : 44.0-56.0 mm S.L.), Singapore.

25. 1967.11.13.45-46 (2 : 36.0-42.5 mm S.L.), Singapore.

26. 1967.11.13.47 (1 : 34.5 mm S.L.), Krangi.

27. 1967.11.13.48-53 (6 : 29.0-40.0 mm S.L.), Penang.

28. 1967.11.13.54-55 (2 : 28.0-34.0 mm S.L.), Siglap.

29. 1967.11.13.995 (1 : 73.0 mm S.L.), Singapore.

30. 1969.8.20.31-40 (11 : 51.0-69.0 mm S.L.), San Minguel Bay, Philippines.

31. 1969.8.20.41-43 (3 : 35.5-48.5 mm S.L.), Bombay.

32. 1969.8.20.44-53 (57 : 29.0-59.0 mm S.L.), Waltair.

33. 1977.6.17.24-26 (3 : 53.0-68.0 mm S.L.), Porto Novo, India.

34. 1979.7.5.8 (1 : 65.0 mm S.L.), Penang.

35. BMNH 1979.8.16.36 (1 : 68.0 mm S.L.), Singapore.

Diagnosis:- Formerly the only species of Escualosa, characterized by its deep body 27.3-37.0 % S.L. (fig. 71); depth of caudal peduncle 10.7-13.2 % S.L.; pelvic base usually below dorsal origin or just before it; gillrakers 16-25+ 27-40 (fig. 72); silvery band along flanks as broad as eye diameter, inner caudal edges broadly darkish.

Remarks:- The name Clupea coval is not given priority here because of the doubts that have surrounded it. Whitehead (1967a) considered it either one of the deep-bodied species of Sardinella, or else a young specimen of Hilsa kelee; Sardinella gibbosa was later suggested by Whitehead (1973b). To prevent any more problems, Whitehead (loc. cit.) concluded that C. coval is best considered a nomen dubium.

As I have not been able to see the types of C. macrolepis and C. huae, I have followed the recent works of Whitehead (loc. cit.) in synonymizing them with the present species. The original description of C. huae lacked most of the appropriate characters but it was amended by Tirant (1929b). With the benefit of the present extensive numerical data I tentatively conclude that it is E. thoracata, which deeper-bodied and more abundant than E. elongata, the other possible identification. Chevey (1934) altered the original name of Tirant (1929a) to Clupeoides hueensis.

Distribution:- N.E. coast of Arabian Sea to S.E. Asia and N.E. coast of Australia.

Subfamily Alosinae

52. Hilsa kelee (Cuvier, 1829)

(Plates 102a-e, 103a-e, 117a, 154c-d, 313b, 318b, 322b, 327f; Figures 23D, 89, 90, 91, 92; Tables 8, 8.1)

? Clupea sinensis Bloch, 1795, Naturg. ausl. Fische, 9 : 38 Pl. 405 (on Tranquebar specimen sent by the Rev. John, not Clupea sinensis Linnaeus, 1758).

? Clupea chinensis Cuvier, 1816, Règne Animal, 1st ed. : 174 (on Clupea sinensis Bloch, 1795, but name probably an emendation of Clupea sinensis Linnaeus; not repeated in 2nd ed.).

Clupea kelee Cuvier, 1829, ibid. 2nd ed., 2 : 320 (on kelee of Russell, 1803 Fishes of Coromandel, 2 : 75, pl. 195, upper figure, ex Vizagapatnam).

? Clupea ovalis Bennett, 1830, Mem. Life of Raffles : 690 (Sumatra).

? Clupeonia blochii Valenciennes, 1847, Hist. Nat. Poiss., 20 : 353 (om Clupea sinensis Bloch, 1795).

? Alosa brevis Bleeker, 1848, J. Ind. Arch., 2 : 638 (Bima, Sumbawa I.).

Alausa kanagurta Bleeker, 1851, Natuurk. Tijdschr. Ned.-Indië, 1 : 160 (Banka, name only); Bleeker, 1852, ibid., 3 : 445 (Banka, name only); Bleeker, 1852, Verh. batav. Genoot. Kunst. Wet., 24 : 34 (Batavia, Muntok).

Alausa brachysoma Bleeker, 1853, ibid., 5 : 527 (Padang, Sumatra) (not Sardinella brachysoma Bleeker, 1852).

Alosa malayana Bleeker, 1866, Ned. Tijdschr. Dierk., 3 : 294 (Java, Sumatra, on Alausa ilisha Bleeker, 1852).

Clupea platygaster Günther, 1868, Cat. Fishes Brit. Mus., 7 : 448 (replacement name for Alausa brachysoma Bleeker, 1853).

Harengula (Paralosa) zeylanica Hubrecht, 1879, Sale Catalogue (of Bleeker specimens) : 46 (nomen nudum).

Clupea durbanensis Regan, 1906, Ann. Natal Govt. Mus., 1 (4) : 4, pl. 4 (Durban Bay).

Specimens examined (88 : 47.0-244.0 mm S.L.)

Types:

1. BMNH 1867.11.28.26 (1 : 135.0 mm S.L.), Banka. Lectotype of Alausa kanagurta.
2. 1867.11.28.24 (1 : 104.0 mm S.L.), Padang. Holotype of Alausa brachysoma and also Clupea platygaster.

3. RMNH 7108 (1 : 115.0 mm S.L.), Batavia. Lectotype of *Alosa malayana*.

4. 23481 (1 : 86.0 mm S.L.), Batavia. Paralectotype of *Alosa malayana*.

5. BMNH 1905.6.8.19-20 (2 : 173.0-183.0 mm S.L.), Durban. Types of *Clupea durbanensis*.

Other specimens:

6. ANSP 74860 (2 : 80.5-81.0 mm S.L.), Calicut. As *Sardinella dayi* by Fowler (1941).

7. BMNH 1860.3.19.439 (1 : 103.0 mm S.L.), Penang, (left side dried skin).

8. 1862.2.4.10 (1 : 135.0 mm S.L.), Amboina.

9. 1866.8.14.109 (1 : 137.0 mm S.L.), locality unknown.

10. 1867.3.9.371 (1 : 131.0 mm S.L.), Zanzibar, (dried specimen). Bearing label *Alosa chapra* and *Alosa zanzibarensis*.

11. 1867.3.9.580 (1 : 54.0 mm S.L.), Zanzibar. Bearing label *Clupea altior*.

12. 1889.2.1.1979-1983 (5 : 86.0-121.0 mm S.L.), Madras.

13. 1889.2.1.1986 (1 : 122.0 mm S.L.), Orissa.

14. 1889.2.1.1993 (1 : 102.0 mm S.L.), Batavia.

15. 1898.12.24.59 (1 : 93.5 mm S.L.), Kurrachee.

16. 1899.5.8.7-10 (4 : 173.0-183.0 mm S.L.), Mekran coast, Pakistan.

17. 1915.7.6.2 (1 : 124.0 mm S.L.), Durban.

18. 1919.4.1.1 (1 : 76.0 mm S.L.), Durban.

19. 1919.9.12.1-2 (2 : 58.0-184.0 mm S.L.), Durban.

20. 1920.7.23.4 (1 : 59.0 mm S.L.), Durban.

21. 1955.1.18.1 (1 : 47.0 mm S.L.), Sabaki lagoon, Kenya.

22. 1962.3.26.202-205 (4 : 136.0-138.0 mm S.L.), Aden.

23. 1962.3.26.206-209 (4 : 67.0-94.0 mm S.L.), Jibuti.

24. 1964.12.14.225 (1 : 149.0 mm S.L.), Portuguese East Africa.

25. BMNH 1966.2.28.24-25 (2 : 120.0-130.0 mm S.L.), Petchaburi, Thailand.

26. 1966.11.16.276-279 (4 : 94.0-125.0 mm S.L.), Chalutage Bay.

27. 1966.11.16.280 (1 : 78.0 mm S.L.), Sabaki river, Kenya.

28. 1966.11.16.281-282 (2 : 77.5-91.0 mm S.L.), Portuguese East Africa.

29. 1966.11.16.283-287 (5 : 73.5-99.0 mm S.L.), Malindi, Kenya.

30. 1966.11.16.288-289 (1 : 54.5 mm S.L.), Pangani estuary, Zanzibar.

31. 1966.11.16.290-292 (3 : 83.5-244.0 mm S.L.), Natal.

32. 1966.11.17.135-137 (3 : 160.0-170.0 mm S.L.), Mombasa.

33. 1973.6.4.15-19 (5 : 128.0-141.0 mm S.L.), Calcutta.

34. 1974.7.26.106-115 (10 : 143.0-161.0 mm S.L.), Ceylon.

35. 1976.6.17.15-19 (5 : 53.0-65.0 mm S.L.), Porto Novo.

36. KUMF 2845a (1 : 130.0 mm S.L.), Bangkok; mixed with a specimen of Tenualosa thibaudeaui, 129.0 mm S.L. Locality of the latter is possibly not Bangkok but probably N.E. of Thailand.

37. MNHN 1960-286 (2 : 105.0-113.0 mm S.L.), Madagascar; mixed with two specimens of Sardinella albella, 128.0-129.0 mm S.L.

38. RMNH 3693 (1 : 136.0 mm S.L.), Batavia.

39. 7110 (4 : 123.0-136.0 mm S.L.), Java, Sumatra, Banka.

Diagnosis:- A monotypic species of Hilsa, immediately separable from members of the closely related Tenualosa in having perforated scales, pectoral axillary scales constituting a series of pointed scales (pl. 102a); frontoparietal ridges 8-14 and of the Sardinella pattern (pl. 102e); cleithral lobe prominent (pl. 313b); gillrakers on inner arches curled outward (pl. 154d), gill filaments of outer hemibranch of 1st gill arch not more than half length of the corresponding inner ones (pl. 154c); pyloric caeca long and finger-like.

Remarks:- Of the British Museum specimens, a number of bottles have been labelled Clupea ilisha, a species which is quite distinct from H. kelee. The series of 4-6 dark spots along the flanks of H. kelee may or may not be present, or may be very obscure, but the one of the scapula is usually present and more distinctive. It occurs in both male and female fishes, hence not a sexual colour dimorphism.

Although Whitehead (1965b) recorded "No alar scales on caudal fin" for Indo-Pacific Alosinae, I have found weakly developed ones in H. kelee. Regan (1917b) also reported no alar scales for Hilsa (but present in all genera allied to Alosa, including Pomolobus). The presence of these scales and their configuration in some genera of the Alosinae were illustrated very clearly by Svetovidov (1964). This finding provides another clue to relating H. kelee, and thus also species of Tenualosa, with Sardinella.

Whitehead (1973b) tentatively identified C. ovalis Bennett with this species. On their geographical distribution and abundance, only H. kelee and a few species of Tenualosa (e.g. T. toli, T. macrura, T. reevesii) can qualify as C. ovalis from Sumatra. On the basis of the presence of a black humeral spot, T. toli and T. macrura can be ruled out because they have only an obscure spot and even this is absent in the smaller specimens, while T. reevesii is apparently very rare in this area and has several distinct spots along the flanks. However, Anodontostoma chacunda, which is very common in Sumatra, is also a possible candidate for C. ovalis as it has a similarly oval body shape and a prominent black shoulder spot, but it has a few more anal rays (17-22, but usually 19-21; cf. 17). Unfortunately, most previous authors have identified specimens of Herklotsichthys quadrimaculatus (which has much slender body) as C. ovalis. The name is best regarded as a nomen dubium.

In the case of A. brevis Bleeker, its imperfect account gives no evidence of its true identity. My pectoral ray counts for Hilsa and Tenualosa are i 11-15 and not the i 16 given by Bleeker for A. brevis. However, in his Atlas Ichth. Ind.Nèerland., Bleeker indicated its resemblance to his A. brachysoma. I feel forced to follow Whitehead, Boeseman & Wheeler (1966) and Whitehead (1973b) in synonymizing it with the present species, although this will be the fourth name given for the same fish by Bleeker.

Distribution:- East coast of Africa, Madagascar to India and S.E. Asia.

53. Tenualosa toli (Valenciennes, 1847)

(Plates 104a-d, 105a-f, 117b, 305a; Figures 24A, 89, 90, 91, 92; Tables 8, 8.1)

Alausa toli Valenciennes, 1847, Hist. Nat. Poiss., 20 : 435 (Pondicherry, Bombay).

Alausa argyrochloris (part) Valenciennes, ibid. : 440 (Bombay).

? Chatoessus tampo Valenciennes, 1848, ibid., 21 : 117 (Malaya; on drawing by Major Farquhar).

Alausa ctenolepis Bleeker, 1852, Verh. batav. Genoot. Kunst. Wet., 24 : 32 (Batavia, Muntok).

Specimens examined (16 : 85.0-44.0 mm S.L.)

Types:

1. MNHN 3939 (1 : 440.0 mm S.L.), Pondicherry. Lectotype of A. toli, (dried specimen).
2. 2738 (1 : 124.0 mm S.L.), Bombay. Holotype of A. argyrochloris. Formerly mixed with two specimens of Sardinella (Clupeonia) jussieui, 122.0-123.0 mm S.L., now MNHN. 3753.
3. BMNH 1867.11.28.23 (1 : 315.0 mm S.L.), Batavia. Lectotype of A. ctenolepis.

Other specimens:

4. BMNH 1858.8.15.68-69 (2 : 85.0-109.0 mm S.L.), India.
5. 1860.3.19.438 (1 : 225.0 mm S.L.), locality unknown; India House coll. (right side dried skin).
6. 1889.2.1.1984-1985 (2 : 125.5-127.0 mm S.L.), Orissa.
7. 1889.2.1.2018-2019 (2 : 280.0-410.0 mm S.L.), Bombay.
8. 1889.2.1.2020-2021 (2 : 111.0-167.0 mm S.L.), Bombay.
9. MNHN 3684 (1 : 314.0 mm S.L.), Bombay.
10. 3687 (1 : 220.0 mm S.L.), Pondicherry.

11. MNHN 3940 (1 : 428.0 mm S.L.), Bombay, (dried specimen).

12. RMNH 7111 (1 : 233.0 mm S.L.), E. Indies.

Diagnosis:- A species of Tenualosa, closely allied to T. macrura in the key (1A), but greatly differ from it in having a longer head, 25-27 (cf. 22-25)% S.L. (fig. 92); shorter caudal, 31-34, (cf. 40-42) % S.L.; longer maxilla 10.5-12.1 (cf. 7.0-8.1) % S.L. (fig. 91); lateral scales usually 38-41 (cf. 43-44) (tbl. 8), predorsal scales 14-15 (cf. 18-20) and ventral scutes 17+12-13 (cf. 17+13-14) (tbl. 8.1). Suboperculum with rounded posterior margin; cleithral lobe barely apparent; inner surface of oesophagus lined with longitudinal mucosal epithelial folds, which are broken into small buds posteriorly (pl. 305a) and the gas bladder open to the outside at anus (pl. 104b). A black spot on shoulder, sometimes absent. From the rest of Tenualosa, it differs in a number of characters (see key).

Remarks:- Records of this fish ascending the Chao Phraya river to spawn about 20-25 km from the Gulf of Thailand are given by Smith (1945).

Distribution:- Entire coast of India to S. China Sea and Java Sea.

54. Tenualosa macrura (Bleeker, 1852)
(Plates 106a-e, 107a-e, 117c; Figures 24A, 89, 90, 91, 92; Tables 8, 8.1)

Alausa macrura Bleeker, 1852, Verh. batav. Genoot. Kunst. Wet., 24 : 31 (Batavia).

Specimens examined (5 : 146.0-339.0 mm S.L.)

Types:

1. BMNH 1867.11.28.22 (1 : 339.0 mm S.L.), Batavia. Rediscovered lectotype of A. macrura, designated by Günther (1868). This specimen was recorded as lost by Whitehead, Boeseman & Wheeler (1966) and a neotype was selected from RMNH. 7112.

2. RMNH 7112 (1 : 238.0 mm S.L.), Batavia. Neotype of A. macrura

Other specimens:

3. BMNH 1868.6.9.2 (1 : 158.0 mm S.L.), Sarawak.

4. 1895.2.28.72 (1 : 146.0 mm S.L.), Sarawak.

5. MNHN 2039 (1 : 184.0 mm S.L.), E. Indies.

Diagnosis:- A species of Tenualosa, which differs markedly from the closely related T. toli and other congeners, as shown by their diagnosis and in the key.

Distribution:- Java Sea and Sarawak.

55. Tenualosa reevesii (Richardson, 1846)

(Plates 108a-f, 109a-e, 117d; Figures 24B, 89, 90, 91, 92; Tables 8, 8.1)

? Clupea sinensis Linnaeus, 1758, Syst. Nat., 10th ed., 1 : 319 (China).

Alosa reevesii Richardson, 1846, Ichth. China Japan : 305 (China Sea).

Specimens examined (11 : 59.5-509.0 mm S.L.)

Types:

1. BMNH 1963.8.20.2 (1 : 295.0 mm S.L.), China. Holotype of A. reevesii, (mounted left side skin on wood).

Other specimens:

2. BMNH 1884.2.26.75 (1 : 375.0 mm S.L.), China.

3. 1895.5.31.24 (1 : 509.0 mm S.L.), Shanghai, China.

4. 1928.6.22.1 (1 : 65.0 mm S.L.), Amoy, China.

5. 1939.3.23.4 (1 : 239.0 mm S.L.), Hong Kong.

6. 1963.8.20.1 (1 : 141.5 mm S.L.), China.

7. 1963.8.20.3 (1 : 148.0 mm S.L.), China, (mounted skin).

8. 1965.7.5.23-24 (2 : 145.0-192.0 mm S.L.),Pearl river mouth, Hong Kong.

9. 1979.8.15.31-32 (2 : 59.5-122.0 mm S.L.), Phuket I., Thailand.

Diagnosis:- A species of Tenualosa, with the gill cover forming a somewhat rounded edge posteriorly; lower edge of operculum about 37° to horizontal; pseudobranch attenuated and with a grove below it; head 27-33 % S.L. (fig. 92); caudal 26-31 % S.L.; pyloric stomach semigizzard-like, but without fundus (pl. 108b) and intestine with well-developed 3rd primary flexure (pl. 108b). It is chiefly distinguished from its relatives T. ilisha and T. thibaudeaui at a given size in having fewer gillrakers, 53-131+80-248 (cf. 46-248+62-316) (figs 89-90), which are scattered with asperities (pl. 109e) instead of having mucosal buds on the upper edge. A series of dark spots along flanks.

Remarks:- The identity of Clupea sinensis Linnaeus, C. sinensis Bloch and Clupanodon sinensis Lacepède is still problematic. C. sinensis Linnaeus has often been referred to or synonymized with T. toli. Whitehead (1965b, 1967a, 1969a) failed to find a final solution and later (Whitehead, 1973b) he stated that "Clupea sinensis Linnaeus lacks a type and the original description could apply to several clupeids"; also "sinensis of Bloch = kelee; sinensis of Linnaeus should be rejected as nomen dubium". Bearing in mind the distribution of Indo-Pacific clupeoids, if C. sinensis Linnaeus is a species of Alosinae, then it could well be T. reevesii. It may have been collected near the Chinese coast, as were Linnaeus' Clupea thrissa (= Clupanodon thrissa) and Clupea mystus (= Coilia mystus).

The finding of two specimens of T. reevesii (BMNH. 1979.8.15.31-32), from Phuket I. off the Andaman coast of Thailand considerably extends the recorded range westward from N. China Sea.

Distribution:- N. China Sea, Hong Kong to Phuket I. of Andaman Sea.

56. Tenualosa ilisha (Hamilton-Buchanan, 1822)

(Plates 110a-d, 111a-g, 117e, 113c, 318c, 322c, 328a; Figures 24B, 89, 90, 91, 92; Tables 8, 8.1)

Clupanodon ilisha Hamilton-Buchanan, 1822, Fishes of the Ganges : 243, 382, pl. 19 (73, 75) (Ganges estuaries).

Clupea palasah Cuvier, 1829, Règne Animal, 2nd ed., 2 : 320 (on Palasah of Russell, 1803, Fishes of Coromandel, 2 : 77, pl. 198, ex Vizagapatnam).

Specimens examined (76 : 31.0-365.0 mm S.L.)

1. BMNH 1848.2.1.65-66 (2 : 302.0-332.0 mm S.L.), Ganges, (stuffed, dried specimens).
2. 1861.4.2.2 (1 : 365.0 mm S.L.), India, (stuffed, dried specimen).
3. 1875.1.14.11-13 (3 : 119.0-135.0 mm S.L.), Tigris.
4. 1875.1.14.14-15 (2 : 350.0-361.0 mm S.L.), Tigris river, (stuffed, dried specimens). Bearing label Clupea tigris.
5. 1889.2.1.1962-1963 (2 : 214.0-293.0 mm S.L.), Calcutta.
6. 1889.2.1.1964-1969 (9 : 31.0-117.0 mm S.L.), Orissa.
7. 1889.2.1.1970-1975 (5 : 54.0-104.0 mm S.L.), Madras.
8. 1889.2.1.1976 (1 : 215.0 mm S.L.), Canara.
9. 1889.2.1.1977-1978 (3 : 68.0-81.0 mm S.L.), Sind.
10. 1889.2.1.2022 (1 : 332.0 mm S.L.), Bombay.
11. 1891.11.30.396-401 (6 : 101.5-146.0 mm S.L.), Sittang river, Burma.
12. 1899.5.8.11 (1 : 335.0 mm S.L.), Mekran coast, Pakistan.
13. 1920.3.3.178-182 (6 : 101.0-129.0 mm S.L.), Basra, Persian Gulf.
14. 1923.6.30.1-10 (25 : 65.5-140.0 mm S.L.), Padma river, Bengal.
15. 1934.10.17.11 (1 : 111.0 mm S.L.), Bengal.
16. 1973.6.4.10-14 (5 : 164.0-238.0 mm S.L.), Calcutta.
17. MNHN 3685-3686 (2 : 300.0-327.0 mm S.L.), Ganges river.
18. 4976 (1 : 202.0 mm S.L.), Malabar.

Diagnosis:- A species of Tenualosa, closely allied to T. thibaudeaui in having rows of mucosal buds on the upper edges of the gillrakers (pl. 111e, f, g) and with a slender urohyal (pl. 111c). From that species it is widely separated by its occurrence in coastal waters and rivers of Arabia to Burma, instead of the freshwaters of the Mekhong river; frontoparietal striae 4-7 (cf. 3); total dorsal rays usually 19-20 (cf. 16-17), pectoral rays 14-16 (cf. 12-14), lateral scales 44-47 (cf. 40-42); total ventral scutes 30-33 (cf. usually 28-29) (tbls. 8. 8.1); fewer gillrakers 46-196+62-272 (cf. 168-248+204-316) (figs 89, 90), gas bladder forming a blind end above anus instead of opening to outside at anus; and a series of dark spots along flanks terminating before origin of anal, instead of continuing on to caudal peduncle.

Remarks:- It would be an advantage to designate a neotype for *Clupanodon ilisha* and a number of the studied specimens, especially in the British Museum, are possible. The largest specimen, 238 mm S.L. in BMNH. 1973.6.4.10-14, from Calcutta, collected by Dr P.J.P. Whitehead, is the most suitable.

The record of this fish from China by Pillay & Rosa (1963) is probably a misidentification of *T. reevesii*.

Distribution:- Coastal waters and rivers from Persian Gulf to Burma.

57. *Tenualosa thibaudeaui* (Durand, 1940)

(Plates 112a-e, 113a-e, 117f, 308d; Figures 24B, 89, 90, 91, 92; Tables 8, 8.1)

Clupea (Alosa) thibaudeaui Durand, 1940, *Inst. océanogr. Indochine*, 36 note : 6, pl. 1 (Phnompenh).

Specimens examined (7 : 85.0-217.0 mm S.L.)

1. BMNH 1979.5.24.11 (1 : 153.0 mm S.L.), Mekhong river, Nongkai, Thailand.
2. KUMF 2845b (1 : 129.0 mm S.L.), ? Bangkok; mixed with a specimen of *Hilsa kelee*, 130.0 mm S.L.
3. NIFI uncat. (2 : 127.0-160.0 mm S.L.), data as in 1.
4. uncat. (3 : 85.0-217.0 mm S.L.), Mool river, Ubon-rajthani, Thailand.

Diagnosis:- A very distinctive species of Tenualosa, especially in being permanently in freshwaters (Mekhong river) and having the highest count of gillrakers (figs 89, 90). It is closest to *T. ilisha*, but is separated from it as discussed in the diagnosis of that species.

Remarks:- I have been unable to obtain the type of this fish, nor Taki's (1974) specimens of his *Hilsa kanagurta* from 3 different localities in Laos for comparison. Its original description and figure by Durand (1940) match very well with my specimens from Thailand. In the absence of other alosinine fishes from the same area, I have tentatively referred Taki's fish to the present species. The collection of Taki (*loc. cit.*), which contained a small specimen of 30.8 mm from about 2,000 km from the sea, is evidence enough for a purely freshwater habit. Moreover, the dissection of a specimen of 127 mm (NIFI. uncat.) from Nongkai, Thailand, revealed a large pair of ripe testes. According to Durand (*loc. cit.*) the fish grows to a length of 260.0 mm S.L.

A series of dark blotches along the flanks is very well developed in all of my specimens, but it is not observable in the photograph (fig. 48A) of a specimen, 166.5 mm S.L., of Taki (*loc. cit.*), except for a very obscure humeral blotch. Conversely, there are five distinct dark spots along the flanks in his 43 mm specimen (fig. 48B).

Zoogeographically, the freshwater fish faunas of the Malay Peninsula, Indochina and Borneo are similar. Therefore, it is likely that this fish may also occur in the large rivers off the west coasts of Sarawak or Borneo.

Whitehead (1965b) tentatively placed the present species with the Chinese *T. reevesii*. It may prove to be an intermediate form between *Tenualosa* and *Gudasia*, for it is similar to the latter in the shape of the opercular bones, long intestine, high gillraker count and freshwater habit.

Distribution:- Mekhong river.

58. *Gudusia chapra* (Hamilton-Buchanan, 1822)

(Plates 114a-d, 115a-e, 117g, 313d, 322d, 328b; Figures 24C, 93, 94; Tables 8, 8.1)

Clupanodon chapra Hamilton-Buchanan, 1822, Fishes of the Ganges : 248, 383 (Upper Ganges).

Clupanodon cagius Hamilton-Buchanan, ibid. : 250, 383 (Northern Bihar, Ganges).

Clupea indica Gray, 1834, Illustr. Ind. Zool., Hardwicke, 2 : pl. 91 (1-2) (India).

Clupea champil Gray, ibid. : pl. 91 (5-6) (India).

Alausa microlepis Valenciennes, 1847, Hist. Nat. Poiss., 20 : 439 (Bengal).

Clupea suhia Chaudhuri, 1912, Rec. Ind. Mus., 7 : 436, pl. 38 (1) (Gandak river, Saran, Bihar).

Gudusia godanahiai Srivastava, 1968, Fishes Eastern Uttar Pradesh : 6, fig. 4a, b (Gorakhpur, Uttar Pradesh).

Specimens examined (36 : 36.5-151.0 mm S.L.)

Types:

1. MNHN 3696 (2 : 73.5-143.0 mm S.L.), Bengal. The largest fish was selected as lectotype of Alausa microlepis.

Other specimens:

2. BMNH 1848.2.1.67 (1 : 150.0 mm S.L.), locality unknown, (mounted on stand).
3. 1860.3.19.676 (1 : 151.0 mm S.L.), locality unknown; India House coll. (dried skin).
4. 1867.2.14.36 (1 : 88.5 mm S.L.), Chacar.
5. 1889.2.1.1952 (1 : 123.0 mm S.L.), Gowhatty.
6. 1889.2.1.1953 (1 : 104.0 mm S.L.), Lahore, Pakistan.
7. 1889.2.1.1954 (1 : 78.5 mm S.L.), Goalpara.
8. 1889.2.1.1955-1956 (2 : 70.5-78.0 mm S.L.), Brahmaputra.
9. 1889.2.1.1957-1961 (5 : 36.5-108.5 mm S.L.), Orissa.
10. 1934.10.17.1-6 (11 : 92.0-141.0 mm S.L.), Alahabad.
11. 1963.8.23.1-2 (1 : 42.5 mm S.L.), Assam.
12. 1963.8.23.3-4 (2 : 100.5-115.0 mm S.L.), India.
13. 1973.6.4.20-24 (5 : 104.0-135.0 mm S.L.), Calcutta.

14. BMNH 1978.8.18.155-156 (2 : 76.0-83.0 mm S.L.), Bangladesh.

Diagnosis:- One of the two known species of Gudusia, differing from G. variegata in the several characters listed in the key.

Remarks:- Whitehead (1973b) tentatively synonymized Clupea suhia and G. godanahiai with the present fish, but I have been unable to see the type specimens of these species. However, the data in their original descriptions and figures agree in most important respects with my thirty-six studied specimens. The series of dark spots along the flanks, which Chaudhuri (1912) and Srivastava (1968) used for separating their specimens from G. chapra, is merely a normal variant pattern. In British Museum specimens alone I found 14 fishes possessing a series of obscure spots along the flanks, but none in the rest of the specimens. The spots are usually not developed in specimens of smaller than 90 mm S.L., except for the humeral spot. Surprisingly, Srivastava (loc. cit.) did not recognise the spotted Clupanodon cagius of Hamilton-Buchanan, nor G. godanahiai of Chaudhuri as his fish, which locally is known as "Godanahia Suhia". By chance, both Chaudhuri and Srivastava latinised a part of the vernacular name for their fishes.

The British Museum has several specimens in good condition from the upper Ganges tributaries, but none from Chapra and Northern Bihar that have the colouration for both forms described by Hamilton-Buchanan (1822). The selection of specimens for neotypes of Clupanodon chapra and C. cagius is therefore postponed until more suitable specimens are available.

Recently Menon (1974) gave the distribution of this fish an also Malaya and Philippines, but I have no means of checking his determination. Prior to this record, Fowler (1941) claimed also Penang.

Distribution:- Freshwaters of Pakistan rivers to Ganges and Orissa.

59. Gudusia variegata (Day, 1869)

(Plates 116a-d, 117h; Figures 24C, 93, 94; Tables 8, 8.1)

Clupea variegata Day, 1869, Proc. zool. Soc. Lond., 623 (Irrawaddy river and its branches).

Specimens examined (3 : 152.0-157.0 mm S.L.)

Types:

1. ZSI 2245 (1 : 152.0 mm S.L.), Irrawaddy river. Lectotype of C. variegata.

Other specimens:

2. BMNH 1870.6.14.38 (1 : 154.0 mm S.L.), Bassein, Burma.
3. ZSI Dup. cat. 43 (1 : 157.0 mm S.L.), Bassein, Burma. Being registered as Clupea burmanicus.

Diagnosis:- A second species of Gudusia, known only from freshwaters of Burmese rivers. It is easily distinguished from G. chapra of India and Pakistan in characters indicated in the key.

Remarks:- Because of the rarity of specimens for the present study, the anatomy of many characters could not be explored. However, the available data are probably sufficient to recognise it as a species distinct from G. chapra, although Whitehead (1965b) suggested the possibility of "an eastern form or subspecies of G. chapra".

Distribution:- Freshwaters in rivers of Burma.

Subfamily Dorosomatinae

60. Clupanodon thrissa (Linnaeus, 1758)
(Plates 118a-e, 119a-e, 313f, 318e, 322f, 328d; Figures 24D, 95, 96; Tables 9, 9.1, 9.2)

Clupea thrissa Linnaeus, 1758, Syst. Nat., 10th ed., 1 : 318 (China).
Chatoessus maculatus Richardson, 1846, Ichth. China Japan : 308 (Canton).
Chatoessus osbeckii Valenciennes, 1848, Hist. Nat. Poiss., 21 : 106 (coasts of China).

Clupanodon haihoensis Oshima, 1926, Annot. zool. Japanese, 11 : 3 (Hainan).

Specimens examined (9 : 70.0-168.0 mm S.L.)

Types:

1. MNHN 3675 (2 : 73.0-76.0 mm S.L.), China. The largest fish was selected as lectotype of Chatoessus osbeckii.

Other specimens:

2. BMNH 1851.12.27.200-201 (1 : 70.0 mm S.L.), China.
3. 1862.12.6.14-15 (3 : 132.0-168.0 mm S.L.), Taiwan.
4. 1979.8.15.33-35 (3 : 112.0-147.0 mm S.L.), Phuket I., Thailand.

Diagnosis:- A monotypic species of Clupanodon, superfically related to Konosirus in its paired but not overlapping predorsal scales; 2 branchiostegal rays on posterior ceratobranchial (pl. 119b); gas bladder open to outside at anus and with a short posterior prolongation (pl. 118b); and in various other characters shown in the key. From K. punctatus, it is readily separable in having a deeper body 33-37 (cf. 28-33) % S.L. (fig. 96); premaxilla shorter than half length of maxilla and toothless (pl. 118c); lateral scales 45-50 (cf. 51-55), circumpeduncular scales 18 (cf. 18-24), predorsal scales 21-25 (cf. 26-31), predorsal bones slightly exposed and forming scute-like bones, a single small pectoral axillary scale; higher count of gillrakers at a given standard length, 203-474+203-415 (cf. 105-250+118-251) (fig. 96); intestinal loop formed by 3rd flexure bending downwards and backwards (pl. 118b) instead of coiling (pl. 120b); a humeral spot followed by a few dark spots along flanks, instead of a humeral spot and several rows of dark lines (formed by series of small dark spots at the middle of scales) on or near the back.

Remarks:- I have been unable to re-examine the type of C. thrissa in the Linnean collection, Uppsala University, and have therefore followed Nelson & Rothman (1973) in the identification of the species and also agree with Whitehead (1966a) and Nelson & Rothman (loc. cit.) in synonymising C. maculatus and C. haihoensis with it.

Both C. thrissa and K. punctatus, although clearly members of the Dorosomatinae, also closely resemble the Alosinae in their general shape of jaws; the presence of a median notch at symphysis of upper jaw; the incomplete dorsal scaly sheath and 2 branchiostegal rays on posterior ceratobranchial. These characters hint strongly at their possible intermediate status between the two subfamilies. The presence of predorsal scutes as observed by Nelson (1970b) is merely an exposure of the predorsal bones.

C. thrissa has not hitherto been known from the Andaman Sea. On the basis of the three specimens from Phuket I., Thailand, they do not seem to me to differ from specimens from China. The locality of the Linnaean type specimen as 'Indian Ocean' should not be taken literally; probably China was meant.

Distribution:- China to Phuket I. (Andaman Sea).

61. Konosirus punctatus (Schlegel, 1846)
(Plates 120a-e, 121a-e, 308e, 313e, 318d, 322e, 328c; Figures 24D, 95, 96; Tables 9, 9.1, 9.2)

Chatoessus punctatus Schlegel, 1846, Fauna Japonica, pts. 10-14 : 240, pl. 109 (1) (S.W. Japan).

Chatoessus aquosus Richardson, 1868, Ichth. China Japan : 307 (China Sea) (nomen oblitum).

Specimens examined (22 : 40.0-200.0 mm S.L.)

Types:

1. BMNH 3315 (2 : 183.0-188.0 mm S.L.), S.W. Japan. The largest fish was selected as lectotype of C. punctatus, the other being a paralectotype.

2. BMNH 1964.11.6.5 (1 : 195.0 mm S.L.), China. Holotype of C. aquosus, (left side dried skin).

Other specimens:

3. BMNH 1860.7.20.61 (1 : 169.0 mm S.L.), Amoy, China.

4. BMNH 1874.1.16.48 (5 : 130.0-184.0 mm S.L.), Chefoo.

5. 1878.4.5.48-49 (2 : 182.0-188.0 mm S.L.), Tokei, Japan.

6. 1893.4.21.38 (1 : 127.0 mm S.L.), Hae-yoe, Chikiang.

7. 1898.2.28.19 (1 : 183.0 mm S.L.), Lia-ho, China.

8. 1924.10.9.1 (1 : 95.5 mm S.L.), Wenchow, China.

9. 1927.3.26.1 (1 : 91.5 mm S.L.), China.

10. 1971.2.8.161-163 (3 : 40.0-52.0 mm S.L.), Japan.

11. 1974.2.2.78-80 (3 : 189.0-200.0 mm S.L.), Plover cove, Hong Kong.

12. 1979.7.5.9 (1 : 173.0 mm S.L.), locality unknown, Bleeker's coll.

Diagnosis:- A monotypic species of Konosirus, resembling Clupanodon thrissa in many important characters, but distinguished from it as shown in the key and the diagnosis of that species.

Remarks:- I have followed Whitehead (1962b, 1973b) in recognising Konosirus as a genus distinct from Clupanodon. The two genera are, however, very similar in many respects. A close examination shows the predorsal scutes of C. thrissa, as diagnosed by Nelson (1970b) and Nelson & Rothman (1973), to be merely the exposed upper ends of the predorsal bones (pl . 322e, f). Further study may prove that Nelson & Rothman (loc. cit.) are right in finding no generic distinction between the two forms. The presence of villiform teeth in the large premaxilla of the present fish may merely be a curious adaptive feature toward a carnivorous feeding habit.

Distribution:- N. China Sea to Hong Kong.

62. Nematalosa erebi (Günther, 1868)

(Plates 122a-d, 123a-e; Figures 25A, 97, 98, 99, 100; Tables 9, 9.1, 9.2)

Chatoessus erebi Günther, 1868, Cat. Fishes Brit. Mus., 7 : 407 (Mary river, Australia).

? Chatoessus richardsoni Castelnau, 1873, Proc. zool acclim. Soc. Vict., 2 : 144 (Murray river, Australia).

Chatoessus elongatus Macleay, 1883, Proc. Linn. Soc. N.S. W. , 8 : 209 (Mary river, Australia).

Chatoessus horni Zeitz, 1896, Horn, Sci. Exped., 2 : 180, pl. 16 (6) (McDonnell Ranges, Australia).

Fluvialosa paracome Whitley, 1948, Aust. Zool., 11 : 267 (Fitzroy river, W. Australia).

Fluvialosa bulleri Whitley, ibid.: 267 (Ord river, W. Australia).

Specimens examined (71 : 27.0-325.0 mm S.L.)

Types:

1. BMNH 1866.6.19.6 (1 : 325.0 mm S.L.), Mary river, Australia. Holotype of C. erebi.
2. 1846.3.24.12 (2 : 82.0-103.0 mm S.L.), Bowman's creek, N.W. Wales. Paratypes of C. erebi (right side dried skins).
3. AMS I. 6018 (1 : 215.0 mm S.L.), Mary river, Australia. Holotype of C. elongatus.
4. BMNH 1897.1.20.59-63 (4 : 93.0-159.0 mm S.L.), McDonnell Ranges, Australia. Types of C. horni.
5. WAM P. 2619 (1 : 96.0 mm S.L.), Noonkanbah, Fitzroy river, Australia. Holotype of F. paracome.
6. P. 2945 (1 : 115.0 mm S.L.), Ord river, Australia. Holotype of F. bulleri.

Other specimens:

7. BMNH 1846.3.24.2 (1 : 265.0 mm S.L.), N.S. Wales, (stuffed dried specimen).
8. 1867.5.6.4 (1 : 203.0 mm S.L.), Cape York, N. Australia.
9. 1867.5.13.6 (1 : 242.0 mm S.L.), Cape York, N. Australia.
10. 1871.9.2. ? (1 : 165.0 mm S.L.), Burnett's river.
11. 1879.5.14.621-622 (2 : 235.0-281.0 mm S.L.), Mary river, Australia.

12. BMNH 1879.5.14.623-630 (12 : 37.0-95.0 mm S.L.), Bulloo creek, 27°9'S : 144°E, Australia.

13. 1912.11.28.38-42 (4 : 54.0-145.0 mm S.L.), Mary river, Australia.

14. 1912.11.28.43-52 (30 : 27.0-87.0 mm S.L.), Bulloo creek, 27°9'S : 144°E, Australia.

15. 1914.8.20.22-27 (6 : 30.0-120.0 mm S.L.), Barwon river, Australia.

16. 1927.2.11.1-2 (2 : 210.0-256.0 mm S.L.), Mount Driven, Moonie river, Australia.

17. 1927.2.11.3 (1 : 145.0 mm S.L.), Thomby, Queensland, Australia.

Diagnosis:- A freshwater species of *Nematalosa*, with an oblique anterior edge to the 3rd suborbital (pl. 123a); scales without teeth posteriorly (pl. 123d), no pectoral axillary scale or only a very short one, ventral scutes usually 16-17+11-13 (tbl. 9.2); usual count of dorsal rays 14-15, rarely 16; branchiostegal rays 6 but sometimes 5; an additional flexure of intestine just behind stomach (pl. 122b); no humeral dark spots, posterior edges of scales usually dusky brown.

Remarks:- In this work a considerable attempt has been made to re-examine *Nematalosa* from Australia and Papua New Guinea. *N. papuensis*, which was tentatively treated as a synonym of *N. erebi* by Nelson & Rothman (1973), has now been satisfactorily separated from that species through re-examination of the type and other specimens. *N. richardsoni* of Castelnau is here tentatively referred to the present species, following Nelson & Rothman (*loc. cit.*), until its types have been located and throughly studied.

Distribution:- Freshwaters of rivers of Australia.

63. Nematalosa chanpole (Hamilton-Buchanan, 1822)

(Plates 124a-e, 125a-e, 328f; Figures 25B, 97, 98, 99; Tables 9, 9.1, 9.2)

Clupanodon chanpole Hamilton-Buchanan, 1822, Fishes of the Ganges : 249, 383, pl. 18 (74) (ponds and ditches of Bengal).

Nematalosa galatheae Nelson & Rothman, 1973, Bull. Amer. Mus. nat. Hist., 150 : 158, figs 1A, 8B, 9, 13D (India, Malaya, Thailand, Vietnam).

Specimens examined (6 : 118.0-145.0 mm S.L.)

Types:

1. ANSP 76824 (4 : 135.0-145.0 mm S.L.), Krabi, Thailand. Paratypes of N. galatheae.
2. BMNH 1971.10.4.1 (1 : 118.0 mm S.L.), Ranong, Thailand. Paratypes of N. galatheae.

Other specimens:

3. BMNH 1889.2.1.1877 (1 : 124.0 mm S.L.), Canara, India.

Diagnosis:- A species of Nematalosa, with a vertical anterior edge to the 3rd suborbital (pl. 125a); scales without teeth posteriorly (pl. 125d), transverse scales 15, pectoral axillary scale of 2-3 pointed scales; ventral scutes 17+10-11; total dorsal rays 15-17; branchiostegal rays 5; a median adipose plate on top of head bordered laterally by a shallow but distinct groove (pl. 124e) and a series of dark spots along flanks.

Remarks:- Examination of the five paratypes and a single other specimen of N. galatheae has confirmed much of the information contained in the original description of C. chanpole, especially the lateral and top view figures of Hamilton-Buchanan (1822) which are identical to the specimens examined here. However, there is a problem that must be noted, namely the absence of a dorsal filament in Hamilton's species. This has undoubtedly been the major source of confusion surrounding C. chanpole. My immediate impression in examining the specimens of N. galatheae was that it is the only species of dorosomatid fish which possesses a series of spots along the flanks and also a gelatineous plate on top of the head (pl. 124e). This combination of characters is not found in any described species of Alosinae or Dorosomatinae, but occurs in Clupanodon chanpole Hamilton-Buchanan (1822) pl. 18 (74). For the time being, I believe that the original drawings of C. chanpole were made from a specimen with broken-off dorsal filament or a young fish.

A stuffed specimen listed as Chatoessus chanpole by Günther (1868), BMNH. 1852.1.10.8, 124.0 mm S.L., is in fact N. arabica.

Distribution:- India, Malaya, Thailand and Vietnam (fide Nelson & Rothman, loc. cit.).

64. Nematalosa arabica Regan, 1917
(Plates 126a-d, 127a-e; Figures 25B, 97, 98, 99; Tables 9, 9.1, 9.2)

Nematalosa arabica Regan, 1917, Ann. Mag. nat. Hist., (8) 19 : 313 (Muscat).

Specimens examined (12 : 52.5-153.0 mm S.L.)

Types:

1. BMNH 1887.11.11.312 (1 : 134.0 mm S.L.), Jayakar, Muscat. Type of N. arabica.

Other specimens:

2. BMNH 1852.1.10.8 (1 : 124.0 mm S.L.), locality unknown, (stuffed, dried specimen). This is the specimen labelled and listed as Chatoessus chanpole by Günther (1868).

3. 1945.12.31.14 (1 : 153.0 mm S.L.), Mukalla.

4. 1962.3.13.1-6 (6 : 97.0-104.0 mm S.L.), Jibuti, Somalia.

5. 1962.3.13.7-8 (2 : 52.5-53.0 mm S.L.), Alayar, Gulf of Aden.

6. 1962.3.13.9 (1 : 53.5 mm S.L.), Kassim, Somalia.

Diagnosis:- A species of Nematalosa, with depth of body 34-40 % S.L. (fig. 99); maxilla straight, its posterior part greatly expanded, premaxilla much shorter than maxilla (pl. 126c); frontoparietal striae 2-5; an oblique anterior edge to the third suborbital (pl. 127a); scales without teeth posteriorly (pl. 127d), transverse scales 18-19, pectoral axillary scale made up of 1-2 elongated scales; usual ventral scutes 19+13-14; total dorsal rays 17-18, usual anal rays 18-20; branchiostegal rays 5-6; a dark humeral spot present.

Remarks:- Close to *N. come*, but differing from it in the combination of the above characters and allopatric in distribution.

Distribution:- Gulf of Aden to Gulf of Oman.

65. *Nematalosa come* (Richardson, 1846)

(Plate 128a-e, 129a-e; Figures 25B, 97, 98, 99; Tables 9, 9.1, 9.2)

Chatoesus come Richardson, 1846, *Ichth. Voy. Erebus and Terror* : 62, pl. 38 (7-10) (W. Australia).

Specimens examined (15 : 47.0-162.0 mm S.L.)

Types:

1. BMNH 1971.4.26.1 (1 : 91.5 mm S.L.), W. Australia; Haslar coll. Type of *C. come*.

Other specimens:

2. BMNH 1844.2.21.69 (1 : 130.0 mm S.L.), Java.
3. 1858.4.24.469 (3 : 47.0-48.5 mm S.L.), Amboina.
4. 1858.4.24.470 (1 : 75.0 mm S.L.), Amboina.
5. 1867.11.28.65 (1 : 162.0 mm S.L.), E. Indies.
6. 1974.5.25.21-26 (6 : 75.0-86.0 mm S.L.), Trobrian I., New Guinea.
7. 1974.5.25.27 (1 : 90.0 mm S.L.), Trobrian I., New Guinea.
8. 1979.7.5.10 (1 : 132.0 mm S.L.), Philippines.

Diagnosis:- A species of *Nematalosa*, with depth of body 36-45 % S.L. (fig. 99); maxilla tapering and curved downward posteriorly, premaxilla considerably enlarged and slightly shorter than maxilla (pl. 128c); frontoparietal striae

5-10; 3rd suborbital greatly expanded ventrally (pl. 129a); scales without teeth posteriorly (pl. 129d), transverse scales usually 17-18, pectoral axillary scale made up of 2 elongate scales; usual ventral scutes 18-19+10-12; usual total anal rays 21-24; branchiostegal rays 5; a humeral spot present.

Distribution:- S.E. Asia to Gulf of Papua and W. coast of Australia.

66. Nematalosa nasus (Bloch, 1795)
(Plates 130a-e, 131a-e, 132, 309a-b, 318f, 322g; Figures 25A, 97, 98, 99; Tables 9, 91., 9.2)

Clupea nasus Bloch, 1795, Naturg. ausl. Fische, 9 : 116, pl. 429 (1) (Malabar).

Clupanodon nasica Lacepède, 1803, Hist. Nat. Poiss., 5 : 468, 472 (Malabar, on Clupea nasus Bloch, 1795).

? Chatoessus altus Gray, 1834, Illustr. Indian Zool., Hardwicke, 2 : 91, fig. 2(India).

Chatoessus chrysopterus Richardson, 1846, Ichth. China Japan : 308 (Canton or Macao, on Reeves' drawing).

Specimens examined (37 : 46.0-210.0 mm S.L.)

1. BMNH 1881.2.1.1880 (1 : 139.5 mm S.L.), Calicut.
2. 1889.2.1.1865-1870 (5 : 46.0-61.0 mm S.L.), Assam.
3. 1889.2.1.1871 (1 : 141.0 mm S.L.), Sind.
4. 1889.2.1.1872-1874 (3 : 97.0-145.0 mm S.L.), Bombay.
5. 1889.2.1.1875-1876 (2 : 156.0-162.0 mm S.L.), Canara.
6. 1889.2.1.1878 (1 : 118.0 mm S.L.), Madras.
7. 1889.2.1.1881-1882 (2 : 59.0-69.0 mm S.L.), Burma.
8. 1939.3.23.8 (1 : 146.5 mm S.L.), Hong Kong.
9. 1965.7.5.29-34 (6 : 65.0-102.0 mm S.L.), Taipo, Hong Kong.
10. 1970.4.24.42-43 (2 : 205.0-210.0 mm S.L.), Jaffna, Ceylon.
11. 1973.6.4.25-29 (5 : 112.0-161.0 mm S.L.), Calcutta.
12. 1974.2.2.72-73 (2 : 145.0-161.0 mm S.L.), Plover cove, Hong Kong.

13. BMNH 1977.11.7.1-2 (2 : 113.0-128.0 mm S.L.), Pakistan.

14. 1977.11.7.3 (1 : 134.0 mm S.L.), Kurrachee.

15. 1979.8.15.37-38 (2 : 96.5-101.0 mm S.L.), Phuket I., Thailand.

16. ZSI F. 8023/1 (1 : 60.0 mm S.L.), Bassein river, Burma. Its accompanying specimen (ZSI. F. 8022/1, 103.0 mm S.L.) is Gonialosa modesta.

Diagnosis:- A species of Nematalosa, clearly distinguished from other known species by the combination of toothed scales (pl. 131d), lateral scales 46-49, transverse scales usually 17-19, pectorals with 1-2 moderately developed axillary scales; ventral scutes 17-19+11-13; frontoparietal striae 6-11 (pl. 130e); anterior edge of 3rd suborbital vertical (pl. 131a); branchiostegal rays always 6; a dark humeral spot present.

Distribution:- N.E. coast of Arabian Sea to Hong Kong.

67. Nematalosa japonica Regan, 1917
(Plates 133a-d, 134a-e, 328e; Figures 25C, 97, 98, 99; Tables 9, 9.1, 9.2)

Nematalosa japonica Regan, 1917, Ann. Mag. nat. Hist., (8) 19 : 313 (inland Sea of Japan).

Specimens examined (18 : 55.0-183.0 mm S.L.)

Types:

1. BMNH 1905.2.7.2-4 (3 : 180.0-183.0 mm S.L.), inland Sea of Japan. Types of N. japonica.

Other specimens:

2. BMNH 1965.7.5.35-44 (10 : 55.0-74.0 mm S.L.), Hong Kong.

3. 1974.2.2.74-77 (4 : 135.0-152.0 mm S.L.), Plover cove, Hong Kong.

4. NMW 2921 (1 : 153.0 mm S.L.), Thailand.

Diagnosis:- A species of Nematalosa, with toothed scales (pl. 134d), pectoral axillary scales moderately developed; mouth distinctly inferior, with its gape just below eye level; posterior edge of operculum more or less straight (pl. 133a), anterior edge of 3rd suborbital oblique (pl. 134a); branchiostegal rays usually 6 or sometimes 5; body depth 33-38 % S.L. (fig. 99); gillrakers 149-205+156-193 (figs 97, 98); a humeral spot present.

Remarks:- On the basis of my material, N. japonica is probably the most slender species and has the most inferior mouth.

Distribution:- Japan to Gulf of Thailand.

68. Nematalosa vlaminghi (Munro, 1956)

(Plates 135a-e; Figures 25C, 97, 98, 99; Tables 9, 9.1, 9.2)

Fluvialosa vlaminghi Munro, 1956, Fish Newsletter, 25 (12) : 25, fig. 177 (Swan river, W. Australia).

Specimens examined (10 : 138.0-183.0 mm S.L.)

Types:

1. AMS IB. 1836-1837 (5 : 150.0-183.0 mm S.L.), Collie river, W. Australia. Paratypes of F. vlaminghi.

Other specimens:

2. WAM P. 4169 (1 : 138.0 mm S.L.), Neptune submarines, Rocky Bay, Australia.

3. P. 12831-12832 (2 : 149.0-156.0 mm S.L.), Mosman's Bay, Swan river, Australia.

4. P. 19198-19199 (2 : 150.0-151.0 mm S.L.), Broome, Australia.

Diagnosis:- A species of Nematalosa, closely allied to N. papuensis and N. flyensis in its toothed scales (pl. 135b. c); posterior edge of operculum rounded, anterior edge of 3rd suborbital oblique (fide Nelson & Rothman, 1973); branchiostegal rays 6 or 5. However, it differs from them in having a small pectoral axillary scale, a dark humeral spot and a distribution which is confined to the west coast of Australia (instead of New Guinea). On gill-rakers alone, it is readily distinguished from N. flyensis in having significantly fewer count of 216-300+239-328 (cf. 152-553+195-508) (figs 97, 98).

Remarks:- In studying the number of gillrakers of this fish, two different forms seem to exist. The count made from three specimens of the paratypes of F. vlaminghi (AMS. IB. 1836-1837) from the Collie river seemed to be identical with a specimen (WAM. P. 4169) from Neptune Submarines, Rocky Bay, being a low count of 216-244+239-248 (figs 97, 98). A much higher gillraker counts, 280-300+316-328 (figs 97, 98), is found in about the same sized specimens from Mosman's Bay, Swan river (WAM. P. 12831-12832) and Broome (WAM. P. 19198-19199). For the time being, and lacking a good series of specimens for anatomical comparison, I can draw no conclusion. The collection of more material may reveal the existence of two distinct populations or subspecies in the N. vlaminghi complex.

Distribution:- West coast of Australia.

69. Nematalosa papuensis (Munro, 1964)
(Plates 136a-d, 137a-f, 154f, 305c; Figures 25A, 97, 98, 99, 100; Tables 9, 9.1, 9.2)

Fluvialosa papuensis (part) Munro, 1964, Papua New Guinea agric. J., 16 : 152, fig. 3 (Strickland river, New Guinea).

Specimens examined (245 : 19.0-207.0 mm S.L.)

Types:

1. AMS B. 9953 (1 : 95.0 mm S.L.), Strickland river, New Guinea. Holotype of F. papuensis.

Other specimens:

2. BMNH 1977.11.17.38-40 (3 : 56.5-77.0 mm S.L.), 450 km up from Toro Pass, Fly river, New Guinea.

3. USNM 217021 (8 : 49.0-201.0 mm S.L.), Fly river, New Guinea. Two specimens 57.0, 57.5 mm S.L. might possibly be N. flyensis.

4. 217022a (13 : 154.0-193.0 mm S.L.), Fly river, New Guinea. Mixed with twelve specimens of N. flyensis, USNM. 217022b, 152.0-222.0 mm S.L.

5. 217023 (10 : 33.0-207.0 mm S.L.), Fly river, New Guinea.

6. 217024a (28 : 19.0-77.0 mm S.L.), Fly river, New Guinea. Mixed with three specimens of N. flyensis, USNM. 217024b, 34.0-51.0 mm S.L.

7. 217025a (9 : 26.5-48.5 mm S.L.), Fly river, New Guinea. Mixed with a specimen of N. flyensis, USNM. 217025b, 48.5 mm S.L.

8. 217026a (164 : 25.0-101.0 mm S.L.), Fly river, New Guinea. Mixed with 76 specimens of N. flyensis, USNM. 217026b, 31.5-102.0 mm S.L.

9. 217027 (9 : 33.0-82.0 mm S.L.), Fly river, New Guinea.

Diagnosis:- A species of Nematalosa, characterized by having toothed scales (pl. 137d, e), scales above anal base of small and half grown fishes smaller than those on other parts of body, pectoral axillary scales absent; posterior edge of operculum rounded, anterior edge of 3rd suborbital oblique (pl. 137a); gillrakerss 74-342+82-309 (figs 97, 98), longest ggillraker on ceratobranchial 1.5-2.4 in corresponding gill filament (pl. 154f, fig. 100); head 25-31 % S.L. (fig. 100), and no dark humeral spot.

Remarks:- This species is very close to N. flyensis but differs from it as stated in diagnosis and remarks that species. The single paratype of F. papuensis (AMS. B. 9954) is clearly a new species, N. flyensis.

Distribution:- Strickland river and Fly river, New Guinea.

70. Nematalosa flyensis n. sp.

(Plates 138a-d, 139a-f, 154e; Figures 25C, 97, 98, 99, 100; Tables 9, 9.1, 9.2)

Specimens examined (98 : 31.5-222.0 mm S.L.)

Types:

1. BMNH 1979.8.17.1 (1 : 76.0 mm S.L.), 450 km up from Toro Pass, Fly river, New Guinea; T. Roberts. Holotype.
2. AMS B. 9954 (1 : 70.0 mm S.L.), Strickland river, New Guinea. Formerly paratype of Fluvialosa papuensis, now a paratype of N. flyensis.
3. BMNH 1977.11.17.22-25 (4 : 51.0-75.0 mm S.L.), data as in 1. Paratypes.
4. USNM 217022b (12 : 152.0-222.0 mm S.L.), Fly river, New Guinea; T. Roberts. Paratypes.
5. 217024b (3 : 34.0-51.0 mm S.L.), Fly river, New Guinea; T. Roberts. Paratypes.
6. 217025b (1 : 48.5 mm S.L.), Fly river, New Guinea; T. Roberts. Paratype.
7. 217026b (76 : 31.5-102.0 mm S.L.), Fly river, New Guinea; T. Roberts. Paratypes.

Diagnosis:- A species of Nematalosa, closely related to N. papuensis in having toothed scales (pl. 139d, e), scales above anal base smaller than on other parts of the body, no pectoral axillary scales; posterior edge of operculum rounded; anterior edge of 3rd suborbital oblique (pl. 139a); humeral spot absent, but sympatric in its distribution in rivers of New Guinea. From that species it is, at a given size, easily separated by having a much higher count of gillrakers, 152-553+195-508 (cf. 74-342+82-309) (figs 97, 98), longest gillraker on ceratobranchial 1.0-1.5 (cf. 1.5-2.4) in corresponding gill filament (fig. 100); hemibranch at angle of gill arch relatively shorter, especially in large fish (pl. 154e); a slightly longer head 29-35 (cf. 25-31)

% S.L. (fig. 100); and shorter intestine (pl. 138b).

Remarks:- Specimens of this new species (except AMS. B. 9954) were formerly mixed in the material described as N. cf. papuensis by Roberts (1978), which is now seen to include two species, N. papuensis and N. flyensis. According to Roberts (loc. cit.) the two kinds "were first distinguished in the field not by the gillrakers, but by the lower jaw, which is longer and more up-turned in those with long gillrakers". Unfortunately, I have found this character unreliable in separating the two forms from each other, but it is a fair diagnosis that differentiates both species from the rest of Nematalosa. However, N. flyensis has thinner upper jaw than does N. papuensis (pl. 138c).

Young individuals of this fish are also identical with N. papuensis in having usually a darkish band along flanks.

Re-examination of the paratype of F. papuensis (AMS. B. 9954, 70.0 mm S.L.) from the Strickland river showed that it resembles in all important characters to the present new species from Fly river, e.g. its gillrakers 281+275, and the longest gillraker is about 1.5 in the corresponding gill filament. The holotype of N. papuensis (AMS. B. 9953, 95.0 mm S.L.) has a gillraker count of only 143+156, and the longest gillraker is about 1.9 in the corresponding gill filament.

Named for its locality, Fly river, New Guinea.

Distribution:- Fly river and Strickland river, New Guinea.

71. Gonialosa whiteheadi n. sp.

(Plates 140a-d, 141a-c, 313g; Figures 25D, 101, 102; Tables 10, 10.1)

Specimens examined (1 : 68.5 mm S.L.)

Types:

1. BMNH 1893.2.16.75 (1 : 68.5 mm S.L.), Kokariet, Tenasserim, Burma; L. Fea. Holotype.

Diagnosis:- A third species of Gonialosa, superficially resembling G. modesta in its general external appearance, body depth 44.6 (cf. 41-45) % S.L. (fig. 102) and its sympatric distribution in the rivers of Burma. From that species G. whiteheadi is significantly different in its somewhat straight maxilla, which is broadly expanded posteriorly instead of only slightly expanded, and greatly curved downward posteriorly, its length 8.1 (cf. 54.-6.3) % S.L. (fig. 102), premaxilla only about half length of maxilla instead of much more than half its length, 2nd supramaxilla relatively larger and more than half length of maxilla, instead of very small and shorter than half length of maxilla (pl. 140c); operculum broader and with rounded posterior edge, instead of narrower and somewhat truncate posteriorly; and gillrakers only 90-93 (cf. 126-170+142-181) (fig. 101).

Remarks:- Named for Dr P.J.P. Whitehead of the British Museum (Natural History), London, who kindly arranged numerous loans of valuable specimens from many museums throughout the world, thus making possible this study of the Indo-Pacific clupeoid fishes.

Distribution:- Kokariet, Tenasserim, Burma.

72. Gonialosa manmina (Hamilton-Buchanan, 1822)
(Plates 142a-d, 143a-e, 313h, 318g, 329a; Figures 25D, 101, 102; Tables 10, 10.1)

Clupanodon manmina Hamilton-Buchanan, 1822, Fishes of the Ganges : 247, 249, 383 (freshwater branches of Ganges).

Clupanodon cortius Hamilton-Buchanan, ibid. : 249 (Bramaputra river near Goyalpara).

Specimens examined (14 : 46.5-115.0 mm S.L.)

1. BMNH 1858.8.15.60 (4 : 84.0-95.0 mm S.L.), India.
2. 1867.2.14.42 (1 : 88.0 mm S.L.), Chacar.
3. 1872.4.17.40 (4 : 90.0-115.0 mm S.L.), N.E. Bengal.

4. BMNH 1889.2.1.1864 (1 : 102.0 mm S.L.), Lower Assam.

5. 1934.10.17.7-10 (4 : 46.5-63.0 mm S.L.), Allahabad.

Diagnosis:- A species of Gonialosa, unique in its very elongate body, depth 34-38 % S.L. (fig. 102); scales small and irregularly arranged on flanks, lateral scales 51-71, predorsal scales 23-27, transverse scales 22-27, circumpeduncular scales 18-24 (tbl. 10); maxilla greatly tapering and gently curved downward posteriorly (pl. 142c), its length 4.7-8.7 % S.L. (fig. 102); posterior edge of operculum rounded, and gillrakers 87-160+96-166 (fig. 101).

Remarks:- Herre's (1940a) record of this species, based on a typical specimen of 65 mm S.L., taken at Viper I. (one of the Andaman Is.) is very interesting. It provides the first record of G. manmina beyond the mainland. However, I have had no opportunity to reidentify this specimen and feel at present reluctant to extend its range to that island.

The British Museum holds several well-preserved specimens and it would be possible to choose one of those fishes for a neotype of C. manmina if necessary.

Distribution:- Freshwaters of Ganges.

73. Gonialosa modesta (Day, 1869)
(Plates 144a-d, 145a-e, 323a; Figures 25D, 101, 102; Tables 10, 10.1)

Chatoessus modestus Day, 1869, Proc. zool. Soc. Lond. : 622 (Bassein river as high as Een-gay-gyee Lake).

Specimens examined (9 : 62.5-103.0 mm S.L.)

Types:

1. ZSI 2695 (1 : 101.0 mm S.L.), Bassein river, Burma. Lectotype of C. modestus.

Other specimens:

2. BMNH 1889.2.1.1879 (1 : 81.5 mm S.L.), Burma.

3. 1891.11.30.391-395 (5 : 62.5-80.0 mm S.L.), Sittang river, Burma.

4. RMNH 8617 (1 : 95.0 mm S.L.), Tenassarim, Burma.

5. ZSI F. 8022/1 (1 : 103.0 mm S.L.), Bassein river, Burma. Its accompanying specimen ZSI. F. 8023/1, 60.0 mm S.L., has been herein described as Nematalosa nasus.

Diagnosis:- A species of Gonialosa, closely related to G. manmina as pointed out in the key, but quite easily distinguished from that fish in having a greater body depth 41-45 (cf. 34-38) % S.L. (fig. 102); scales large and regularly arranged on sides instead of small and irregularly arranged, lateral scales 44-50 (cf. 51-71), predorsal scales 19-22 (cf. 23-27), transverse scales 17-19 (cf. 22-27), circumpeduncular scales 14-18 (cf. 18-24), maxilla slightly expanded posteriorly, instead of evenly tapering (pl. 144c); and the posterior margin of operculum vertical instead of rounded.

Distribution:- Freshwaters, in rivers of Burma.

74. Anodontostoma chacunda (Hamilton-Buchanan, 1822)
(Plates 146a-e, 147a-e, 152f-h, 153d-f, 154b; Figures 26A, 103, 104, 105, 106; Tables 10, 10.1)

Clupanodon chacunda Hamilton-Buchanan, 1822, Fishes of the Ganges : 246, 383 (Ganges estuaries).

Anodontostoma hasseltii Bleeker, 1849, Verh. batav. Genoot. kunst. Wet., 22 : 15 (Madura straits, Java Sea).

Gonostoma javanicum Hyrtl, 1855, Denkschr. Akad. Wiss. Wien, 10 (1) : 49 (Java).

Specimens examined (139 : 39.0-140.0 mm S.L.)

Types:

1. RMNH 7082 (1 : 101.0 mm S.L.), Madura Straits, Batavia, Semarang. Putative neotype of A. hasseltii.

2. 2685 (2 : 84.0-117.0 mm S.L.), Java. Bearing registeration as presumed syntypes of G. javanicum.

Other specimens:

3. BMNH 1858.8.15.88 (1 : 73.5 mm S.L.), India.

4. 1862.11.1.201-202 (2 : 111.0-120.0 mm S.L.), Siam.

5. 1866.8.14.117 (1 : 123.0 mm S.L.), locality unknown.

6. 1867.11.28.66 (1 : 120.0 mm S.L.), E. Indies.

7. 1868.1.28.10 (1 : 73.0 mm S.L.), Borneo.

8. 1888.11.6.51-52 (2 : 135.0-136.0 mm S.L.), Madras.

9. 1889.2.1.1858 (1 : 119.0 mm S.L.), Malabar.

10. 1889.2.1.1859-1861 (3 : 70.0-140.0 mm S.L.), Madras.

11. 1898.4.2.251-252 (2 : 96.0-110.0 mm S.L.), Menam river (= Chao Phraya river), Thailand.

12. 1899.1.24.16-18 (5 : 76.0-122.0 mm S.L.), Kurrachee.

13. 1966.2.28.26 (1 : 50.5 mm S.L.), Pakpoon, Thailand.

14. 1977.9.8.1-3 (3 : 111.0-131.0 mm S.L.), Java Sea.

15. 1979.7.5.11 (1 : 110.-0 mm S.L.), Sumatra.

16. 1979.7.5.12 (1 : 115.0 mm S.L.), Singapore.

17. 1979.8.16.44-50 (7 : 100.0-121.0 mm S.L.), Gulf of Thailand.

18. 1979.8.16.51-53 (3 : 102.0-109.0 mm S.L.), Gulf of Thailand.

19. RMNH 3312 (2 : 114.0-124.0 mm S.L.), Macassar, Celebes. Two fishes, both 102.0 mm S.L. have been removed, being _Anodontostoma selangkat_, now RMNH. 27665.

20. 3319 (2 : 117.0-118.0 mm S.L.), Batavia.

21. 8033 (7 : 114.0-125.0 mm S.L.), Batavia.

22. 8616 (1 : 104.0 mm S.L.), Madras.

23. 10497 (1 : 123.0 mm S.L.), Tiworo on Muna.

24. 17021 (3 : 58.5-102.0 mm S.L.), Bulong, Java.

25. 17022 (4 : 98.0-105.0 mm S.L.), Tandjung, Petjinan, Java.

26. 17548 (7 : 48.0-68.0 mm S.L.), Belawan, Deli, Sumatra. Mixed with a specimen of _Anodontostoma thailandiae_, 42.0 mm S.L.

27. 17549 (15 : 39.0-114.0 mm S.L.), Batavia, Java.

28. 17550 (1 : 57.0 mm S.L.), Trand Priok, Java.

29. RMNH 17551 (1 : 58.0 mm S.L.), Surabaya, Java.

30. 17649 (8 : 52.0-89.0 mm S.L.), Belawan, Deli, Sumatra. Mixed with two specimens of Anodontostoma thailandiae, 40.5-43.0 mm S.L.

31. 17650 (2 : 77.0-124.0 mm S.L.), Java Sea.

32. 17651 (21 : 56.0-115.0 mm S.L.), Batavia.

33. 17652 (2 : 67.0-74.0 mm S.L.), Surabaya, Java.

34. 17681 (1 : 115.0 mm S.L.), Macassar, Celebes.

35. 17682 (2 : 115.0-116.0 mm S.L.), Java.

36. 17683 (3 : 39.0-43.0 mm S.L.), E. Indies.

37. 17775 (18 : 49.0-121.0 mm S.L.), E. Indies. A specimen, 118.0 mm S.L. has been herein removed, being Anodontostoma selangkat, now RMNH. 27664.

Diagnosis:- The most common species of Anodontostoma, closely allied to A. selangkat mainly in having a tapering maxilla which is 7.0-8.2 (cf. 6.6-8.0; but 7.9-10.3 in A. thailandiae)% S.L. (pl. 154a, b) and curves downward posteriorly (pl. 146c), premaxilla large and more or less overlapping anterior tip of 2nd supramaxilla (pls. 146c, 152f, g,h); longest gillraker on ceratobranchial slightly shorter than corresponding gill filament (or about half or slightly shorter than half length of the same in larger fishes) (pl. 153d, e, f). It is, however, distinguished from that species at a given size in its fewer gillrakers , 52-98+54-96 (cf. 129-168+100-166) (figs 103, 104); the individual teeth on the posterior edge of the scales are narrower than the incision between them (pl. 147d); the humeral spot very prominent and no distinctive lateral streaks along flanks.

Remarks:- C. chanpole of Hamilton-Buchanan, which from time to time has been regarded as a second species of Anodontostoma, e.g. by Fowler (1941) and recently by Whitehead (1973b), is here considered a valid species of Nematalosa. C. chanpole of Günther (1868), based on a British Museum specimen (BMNH. 1852.1.10.8, 124.0 mm S.L.), is now proved to be N. arabica.

Günther (loc. cit.) recognised three varieties in his Chatoessus chacunda complex (viz. altior, chacunda and selangkat) on the basis of differences in body depth, but I can find no evidence to support this. Thus, the scatter diagram of body depth against standard length for A. chacunda, A. selangkat and A. thailandiae (fig. 106) offers no evidence for separating the species on this character.

Distribution:- N.E. coast of Arabian Sea to S.E. Asia.

75. Anodontostoma selangkat (Bleeker, 1852)

(Plates 148a-d, 149a-f, 152e, 153g-h; Figures 26B, 103, 104, 105, 106; Tables 10, 10.1)

Chatoessus selangkat Bleeker, 1852, Natuurk. Tijdschr. Ned.-Indië, 3 : 458 (Muntok, Batavia).

Chatoessus breviceps Peters, 1876, Mber. K. preuss. Akad. Wiss. : 838 (New Hanover).

Specimens examined (9 : 90.5-180.0 mm S.L.)

Types:

1. ZMB 9818 (1 : 180.0 mm S.L.), New Hanover. Holotype of C. breviceps.

Other specimens:

2. BMNH 1867.11.28.64 (1 : 119.0 mm S.L.), E. Indies; P. Bleeker.
3. 1889.2.1.1863 (1 : 90.5 mm S.L.), Andaman Is.; F. Day.
4. FMNH 72259 (2 : 106.0-170.0 mm S.L.), Palawan, Philippines; Naval Medical Research.
5. RMNH 27764 (1 : 118.0 mm S.L.), E. Indies; P. Bleeker, from eighteen specimens of Anodontostoma chacunda, 49.0-121.0 mm S.L., RMNH. 17775.
6. 27765 (2 : 102.0-102.0 mm S.L.), Macassar, Celebes; D.M. Piller, from two specimens of Anodontostoma chacunda, 114.0-124.0 mm S.L. RMNH. 3312.

7. USNM uncat. (1 : 179.0 mm S.L.), Palawan, Philippines.

Diagnosis:- The second species of Anodontostoma, with tapering maxilla which is curved downward posteriorly (pl. 148c), premaxilla large and slightly overlapping anterior tip of 2nd supramaxilla (pls. 148c, 152e); longest gill-raker on ceratobranchial about half length of corresponding gill filament in small and moderate size fishes but only one-third of the same in larger fish (pl. 153g, h). It closely resembles A. chacunda but can be unmistakably separated from that species in having much higher count of gillrakers 129-168+100-166 (cf. 52-98+54-96) (figs 103, 104); individual of teeth on posterior edge of scale much broader than the incision between them (pl 149c); and with many distinctive bands along middle of scale rows on flanks.

Remarks:- Bleeker first described C. selangkat on the basis of a single fish, 147 mm S.L. from Batavia, but his second description, based on the Batavia fish and three further Muntok specimens, was published first (Whitehead, Boeseman & Wheeler, 1966). The species was treated as a variety of C. chacunda by Günther (1868) and later Bleeker (1881) himself in his Atlas ranked it as a synonym of his Dorosoma chacunda. Due to the great superficial similarity of A. chacunda and A. selangkat and the poor original description of C. selangkat, Whitehead Boeseman & Wheeler (1966) failed to find Bleeker's specimens of C. selangkat; they presumed that all the C. selangkat material had been included among the C. chacunda collected by Bleeker.

In late 1975, I examined a fish, 119.0 mm S.L. (BMNH. 1867.11.28.64) listed as "one of the typical specimens of Ch. selangkat" by Günther (1868) under the name Chatoessus chacunda var. selangkat. I found that it had a much higher count of gillrakers, 142+130, when compared with specimens of A. chacunda of the same size. On this basis, the only other Bleeker's "selangkat" (now RMNH. 27764, 118.0 mm S.L.) turned out to be a specimen found among C. chacunda (or 'hasseltii'), RMNH. 17775; its gillraker count is 153+123 (figs 103, 104).

Apart from the above two original specimens of C. selangkat, the holotype of C. breviceps and six more fishes of different sizes and localities have been found to possess this remarkably high count of gillrakers. When reinforced by the scale and other characters, they were clearly a distinct species and presumably that originally proposed by Bleeker (1852).

As the British Museum specimen is the only Bleeker's fish labelled "Chatoessus selangkat", it must therefore be one of the specimens originally noticed as a different fish from C. hasseltii by Bleeker himself. It has no cut on the head or any pencil marks on the body or fins, thus not illustrated (nor was RMNH. 27764). The designation of lectotype of C. selangkat is best made from the British Museum specimen since it was also claimed by Günther (loc. cit.).

Distribution:- Andaman Is., S.E. Asia and New Hanover.

76. Anodontostoma thailandiae n. sp.

(Plates 150a-d, 151a-e, 152a-d, 153a-c, 154a, 305c, 310a, 314a, 318h, 323b, 329b; Figures 26B, 103, 104, 105, 106; Tables 10, 10.1)

Specimens examined (39 : 40.5-141.0 mm S.L.)

Types:

1. MFLB uncat. (1 : 99.0 mm S.L.), Songkhla, Gulf of Thailand; S. Timkrab. Holotype.

2. BMNH 1858.8.15.97-98 (3 : 83.0-91.0 mm S.L.), India; G.R. Waterhouse. Paratypes.

3. 1894.1.19.76 (1 : 110.0 mm S.L.), Malatabas, Sarawak; H.H. Rajah Brooke. Paratype.

4. 1978.8.18.157 (1 : 125.0 mm S.L.), Bangladesh; M.A. Quddus. Paratype.

5. 1979.8.16.37-39 (3 : 124.0-134.0 mm S.L.), Calcutta; P.K. Talwar. Paratypes.

6. 1979.8.16.40-43 (4 : 121.0-132.0 mm S.L.), Calcutta; P.K. Talwar. Paratypes.

Other specimens:

7. BMNH 1967.11.13.56-57 (2 : 41.5-45.5 mm S.L.), Alor Star; unknown collector.

8. 1973.6.4.30-36 (7 : 116.0-141.0 mm S.L.), Gariahat market, Calcutta; P.J.P. Whitehead.

9. 1973.6.4.37-47 (11 : 48.0-65.0 mm S.L.), Gariahat market, Calcutta; P.J.P. Whitehead.

10. MFLB uncat. (2 : 128.0-138.0 mm S.L.), Songkhala, Thailand; T. Wongratana.

11. uncat. (1 : 118.0 mm S.L.), Trad, Thailand; T. Wongratana.

12. RMNH 17548 (1 : 42.0 mm S.L.), Belawan, Deli, Sumatra; P. Buitendijk. Mixed among seven specimens of Anodontostoma chacunda of the same registered number.

13. 17649 (2 : 40.5-43.0 mm S.L.), Belawan, Deli, Sumatra; P. Buitendijk. Mixed among eight specimens of Anodontostoma chacunda of the same registered number.

Diagnosis:- The third species of Anodontostoma, distinguished from A. chacunda and A. selangkat in having a slender and straight maxilla which is 7.9-10.3 % S.L. (pls. 150c, 154a), premaxilla moderate and not overlapping 2nd supra-maxilla (pls. 150c, 152a-d); gillraker count 43-125+46-140 (figs 103, 104), longest gillraker on ceratobranchial about equal to corresponding gill filament or sometimes slightly longer (pl. 153a-d, fig. 105); hemibranch at angle of gill arches relatively shorter, the outer hemibranch usually shorter than half of inner hemibranch in adult (pl. 153a-c); teeth on posterior edge of scale broader than incision between them (pl. 151d).

Remarks:- This fish was first recognised as a different species from A. chacunda on the basis of three specimens collected from two different localities by myself in the Gulf of Thailand in 1965-1966. However, they were tentatively identified as A. chanpole in Banasopit & Wongratana (1967). Nelson & Rothman (1973), who had examined my two specimens, failed to differentiate them from

A. chacunda and listed them under that species. The new name A. thailandiae n. sp. for this fish was proposed in my unpublished original description in 1974. Since then many more specimens have been found among collections in the British Museum, London, Rijksmuseum van Natuurlijke Historie, Leiden, and new collections from Bangladesh, Calcutta and Thailand. A. thailandiae is now known to be not uncommon in the Ganges estuaries and it is likely that at least some previous records and biology of A. chacunda from the Bay of Bengal were based on A. thailandiae or mixed material (e.g. Jacob 1948; Jones & Sujansingani, 1954; Babu Rao, 1965).

Distribution:- Upper part of the Bay of Bengal to S. China Sea.

Subfamily Pristigasterinae

77. Pellona ditchela Valenciennes, 1847

(Plates 155a-e, 156a-e, 323c, 329c; Figures 21D, 77, 79; Tables 6, 6.1, 6.2)

Pellona ditchela Valenciennes, 1847, Hist. Nat. Poiss., 20 : 314 (on Ditchelee of Russell, 1803, Fishes of Coromandel, 2 : 72, pl. 88).

Pellona hoevenii Bleeker, 1852, Verh. batav. Genoot Kunst. Wet., 24 : 21 (Batavia).

Pellona natalensis Gilchrist & Thompson, 1908, Ann. S. Afr. Mus., 6 : 202 (Natal coast).

Specimens examined (99 : 30.0-153.0 mm S.L.)

Types:

1. RMNH 7118 (1 : 129.0 mm S.L.), Batavia. Putative neotype of Pellona hoevenii.

Other specimens:

2. AMS I. 15557-022 (1 : 104.0 mm S.L.), Gulf of Carpenteria, Australia.
3. I. 16664-003 (1 : 126.0 mm S.L.), Madang Harbour, New Guinea.
4. BMNH 1858.4.21.288 (1 : 137.0 mm S.L.), Amboina.
5. 1867.11.28.15 (1 : 130.0 mm S.L.), E. Indies.

6. BMNH 1867.3.7.579 (1 : 129.0 mm S.L.), Zanzibar.

7. 1889.2.1.2009 (2 : 50.5-53.5 mm S.L.), Nicobar Is.

8. 1913.4.7.8 (1 : 116.0 mm S.L.), Mombasa.

9. 1920.7.23.2 (1 : 153.0 mm S.L.), Durban.

10. 1922.2.9.3 (1 : 110.0 mm S.L.), Delagoa Bay.

11. 1936.8.7.30-31 (2 : 96.0-98.0 mm S.L.), Mombasa.

12. 1964.12.14.226-260 (33 : 30.0-74.0 mm S.L.), Pangani Bay, Tanzania.

13. 1966.1.16.293-294 (2 : 45.0-100.0 mm S.L.), Mombasa.

14. 1966.11.16.295-311 (17 : 57.0-123.0 mm S.L.), Formosa Bay, Kenya.

15. 1966.11.16.312-318 (7 : 31.0-96.5 mm S.L.), Bagamayo river estuary, Tanzania.

16. 1966.11.16.319-321 (3 : 97.0-123.0 mm S.L.), Nosy Bay, Madagascar.

17. 1972.9.7.15-18 (4 : 50.5-56.5 mm S.L.), Gasmata I.

18. 1979.8.16.842 (1 : 48.0 mm S.L.), S.E. coast of Africa.

19. RMNH 24959 (15 : 52.0-123.0 mm S.L.), Batavia.

20. WAM 13385 (1 : 110.0 mm S.L.), Exmouth Gulf, Australia.

21. P. 23738 (1 : 133.0 mm S.L.), Exmouth Gulf, Australia.

22. P. 24243 (1 : 80.0 mm S.L.), Napier Broome Bay, Australia.

23. USNM uncat. (1 : 142.0 mm S.L.), Palawan, Philippines.

Diagnosis:- Formerly the only species of Pellona, it is simply characterized by the presence of slightly overlapping vertical striae at the centre of the scales (pl. 156d) and gillrakers 10-14+22-27 (fig. 77).

Remarks:- This wide ranging species has from time to time been recorded as P. hoevenii. I follow Whitehead (1973a) in recognising P. ditchela Valenciennes, which was based on Russell's (1803) drawing (pl. 88) of Ditchelee from Coromandel, as the present species and not Bleeker's P. hoevenii.

It is possible that some records of this fish from the Bay of Bengal and especially from the east coast of India may be misidentifications of P. dayi, or mixed material. Further collections of Pellona from this area are needed to resolve this.

Specimens of this fish from Papua New Guinea and Australia bear a more prominent humeral black spot than those from the S. China Sea and Indian Ocean.

A small holotype of Meletta schlegelii of Castelnau (1873) (MNHN. 3716, 58.6 mm S.L.), which was hitherto recognised as the present species by Whitley (1940), Munro (1967) and Whitehead (1973b), has been re-examined and it is now found to be Sardinella (Clupeonia) brachysoma. Its original count of anal rays as 28 or 29 was errorneous; my count is iii 18. Its gillraker count is 29+56; and with several perforations on scales (pl. 68d). Whitley's (1940) figure 13 of Neosteus schlegelii from Gulf of Carpentaria is by all means P. ditchela.

Distribution:- East coasts of Africa to S.E. Asia, Papua New Guinea and north and west coasts of Australia.

78. Pellona dayi n. sp.

(Plates 157a-d, 158a-e, 314b, 319a; Figures 21D, 77, 79; Tables 6, 6.1, 6.2)

Specimens examined (8 : 77.0-135.0 mm S.L.)

Types:

1. BMNH 1969.11.6.17 (1 : 115.0 mm S.L.), Porto Novo, S. India; R.V. Seshaiya. Holotype.
2. 1889.2.1.2002-2006 (5 : 77.0-96.0 mm S.L.), Madras; F. Day. Paratypes.
3. 1969.11.6.15-16 (2 : 121.0-135.0 mm S.L.), Porto Novo, S. India; R.V. Seshaiya. Paratypes.

Diagnosis:- A second species of Pellona, chiefly differing from P. ditchela in having discontinuous vertical striae on the scales (pl. 158d); gillrakers 9-10+20-21 (cf. 10-14+22-27)(fig. 77).

Remarks:- Named for Dr F. Day (1829-89) who collected the first five specimens and was author of the "Fishes of India". This fine book and especially the drawings has impressed me greatly ever since I was a student in ichthyology at Kasetsart University in Bangkok.

Distribution:- Madras to Porto Novo, India.

79. *Ilisha sirishai* Seshagiri Rao, 1975
(Plates 159a-d, 160a-e, 183a; Figures 22A, 82, 83; Tables 6, 6.1, 6.2)

Ilisha sirishai Seshagiri Rao, 1975, Hydrobiologia, 47 : 463 , figs 1-2 (Visakhapatnam, India).

Specimens examined (27 : 39.5-172.0 mm S.L.)

Types:

1. BMNH 1975.9.24.48 (1 : 160.0 mm S.L.), Visakhapatnam, India. Holotype.
2. 1975.9.24.49-60 (12 : 96.0-166.0 mm S.L.), Visakhapatnam, India. Paratypes.

Other specimens:

3. BMNH 1960.8.20.25-29 (5 : 39.5-45.0 mm S.L.), Songkhla Lake, Thailand.
4. 1975.3.20.819 (1 : 61.0 mm S.L.), Porto Novo, India.
5. 1975.3.20.820-821 (2 : 61.0-71.0 mm S.L.), Bombay.
6. 1975.3.20.822 (1 : 163.0 mm S.L.), Tuticorin.
7. 1975.3.20.823-826 (4 : 160.0-172.0 mm S.L.), Bolar, Mangalore (west coast), India.
8. 1979.7.5.13 (1 : 120.0 mm S.L.), Penang (old collection formerly unregistered).

Diagnosis:- A species of *Ilisha*, closely related only to *I. novacula* in having an extremely short median prolongation at the posterior end of the gas bladder (pl. 159b) which never reaches beyond the 1st anal pterygophore. It is clearly separated from that species by its characteristic tunica interna of the gas bladder (pl. 159b); pyloric caeca 24-25 (cf. 26); body depth 32-37 (cf. 22-27) % S.L. (fig. 82); head length 25-28 (cf. 22-25) % S.L.; upper jaw 12.4-13.9 (cf. 10.1-11.9) % S.L.; predorsal length 47-51 (cf. 59-62) % S.L.; prepelvic length 44-49 (cf. 39-44) % S.L.; eye diameter 8.3-9.8 (cf. 5.0-6.6) % S.L. (figs 82, 83); pectorals 11.1-16.6 (cf. 19.8-22.4) % S.L.; anteroventral edge of maxilla with a bony laminate outgrowth (pl. 159c); and the absence of a humeral spot.

Remarks:- In the absence of a very long postcoelomic extension to the gas bladder and in its similarity in other general characters, this fish is near to Pellona, the genus which possesses a toothed hypomaxillary bone in the upper jaw. It may prove to be a transitional form between Pellona and the rest of Ilisha. This is more likely because, although lacking a toothed hypomaxilla I. sirishai is the only species of the genus which has a laminate outgrowth on the anteroventral edge of the maxilla. This circumstance suggests that the hypomaxilla may originally have split from the bony lamina, or vice versa in the case of I. sirishai. However, the former is more likely and it supports the contention of Berry (1964b). On the basis of my specimens, the laminate outgrowth on the maxilla is rather well developed in the smallest fish, but becomes indistinct or incomplete in some larger fishes.

Dehadrai (1960) was the first to notice and name the characteristic inner capsule of the gas bladder of this fish as tunica interna, but he never realized that his I. indica was a new species. Seshagiri Rao (1975), on the other hand, made dissections of several specimens of his type material and thoroughly opened the tunica externa but failed to diagnose what he had found or compare it with that of other species or to consult the work of Dehadrai (loc. cit.).

Distribution:- West and east coasts of India to Songkhla in the Gulf of Thailand.

80. Ilisha novacula (Valenciennes, 1847)

(Plates 161a-e, 162a-d, 183b; Figures 22A, 82, 83; Tables 6, 6.1, 6.2)

Pellona novacula Valenciennes, 1847, Hist. Nat. Poiss. , 20 : 319 (Rangoon).

Pellona sladeni Day, 1869, Proc. zool. Soc. Lond. : 623 (Irrawaddy river at Mandalay).

Specimens examined (4 : 133.0-317.0 mm S.L.)

Types:

1. MNHN 3704 (1 : 133.0 mm S.L.), Rangoon. Holotype of P. novacula.

Other specimens:

2. BMNH 1870.6.14.36 (1 : 209.0 mm S.L.), Mandalay.

3. 1891.11.30.402-403 (2 : 206.0-317.0 mm S.L.), Sittang river, Burma.

Diagnosis:- A species of Ilisha, without any prominent postcoelomic extension of the gas bladder, thus closely allied to I. sirishai, from which it can easily be separated by many characters, as shown in the diagnosis of that species.

Remarks:- I have been unable to examine Day's type specimens of his P. sladeni (ZSI. 2672, 298) and therefore followed Talwar & Whitehead (1971) in the detailed description of the fishes. Study of the swimbladder of the single type specimen of P. novacula (MNHN. 3704) has shown that this fish is identical to the British Museum specimens of P. sladeni of Day (BMNH. 1870.6.14.36 and 1891.11.30.402-403) and not to I. elongata, as was thought by Whitehead (1967a). Thus, Valenciennes's name must take priority.

I have seen no Bleeker specimen of this fish (230 mm T.L.?) from Batavia in the British Museum as claimed by Weber & DeBeaufort (1913). Their records of P. novacula from Batavia and China are probably erroneous.

Distribution:- Rivers of Burma.

81. Ilisha megaloptera (Swainson, 1839)

(Plates 163a-e, 164a-e, 183c, 314c; Figures 22B, 84, 85, 86; Tables 6, 6.1, 6.2)

? Clupanodon motius Hamilton-Buchanan, 1822, Fishes of the Ganges : 251, 383 (Brahmaputra) (nomen dubium).

Platygaster macrophthalma Swainson, 1838, Nat. Hist. Anim., 1 : 278 (on Jangarloo of Russell, 1803, Fishes of Coromandel, 2 : 73, pl. 191 (nomen oblitum).

Platygaster megalopterus Swainson, 1839, ibid., 2 : 294 (on Jangarloo).

? Platygaster parva Swainson, ibid. : 294 (on Gray, 1834, Illustr. Ind. Zool. Hardwicke, 2 : pl. 109 (3), Clupea motius).

Pellona dussumieri Valenciennes, 1847, Nat. Hist. Poiss., 20 : 316, pl. 516 (Bombay, Malabar, Coromandel).

Pellona russellii Bleeker, 1852, Natuurk. Tijdschr. Ned.-Indië, 3 : 72 (Java, Madura, Pasuruan, Singapore).

Specimens examined (150 : 30.0-274.0 mm S.L.)

Types:

1. BMNH 1972.5.12.25 (1 : 143.0 mm S.L.), Visakhapatnam. Neotype of Platygaster macrophthalma.
2. MNHN 3708 (1 : 264.0 mm S.L.), Coromandel coast. Lectotype of Pellona dussumieri.
3. BMNH 1867.11.28.13 (1 : 165.0 mm S.L.), East Indies. Lectotype of Pellona russellii.

Other specimens:

4. BMNH 1858.8.15.18 (1 : 121.0 mm S.L.), India.
5. 1860.3.19.677 (1 : 90.0 mm S.L.), Sumatra, (dried specimen).
6. 1888.11.6.63 (1 : 247.0 mm S.L.), Madras.
7. 1889.2.1.1988-1989 (2 : 49.0-130.0 mm S.L.), Bombay.
8. 1889.2.1.1990 (1 : 46.0 mm S.L.), Sunderbunds.
9. 1889.2.1.1991 (1 : 78.5 mm S.L.), Madras.

10. BMNH 1889.2.1.1998 (1 : 66.5 mm S.L.), Madras.

11. 1889.2.1.2008 (2 : 43.5-47.0 mm S.L.), Calcutta.

12. 1889.2.1.2010-2017 (7: 49.0-225.0 mm S.L.), Madras.

13. 1889.2.1.4215-4218 (4 : 42.0-46.5 mm S.L.), Assam.

14. 1894.1.19.78-79 (2 : 99.5-130.0 mm S.L.), Santubong, Sarawak.

15. 1934.10.17.12-21 (12 : 33.0-48.0 mm S.L.), Allahabad, Ganges.

16. 1967.11.13.58-61 (6 : 43.0-103.0 mm S.L.), Singapore.

17. 1967.11.13.228-230 (3 : 33.0-33.5 mm S.L.), Singapore.

18. 1968.8.26.3 (1 : 140.0 mm S.L.), Madras.

19. 1969.2.27.1 (2 : 45.0-48.0 mm S.L.), Ganges.

20. 1969.8.20.24 (1 : 30.0 mm S.L.), Vizhingium, India.

21. 1969.11.6.1-2 (2 : 216.0-222.0 mm S.L.), Porto Novo.

22. 1969.11.6.4. (1 : 145.0 mm S.L.), Porto Novo.

23. 1970.4.24.44-51 (7 : 172.0-225.0 mm S.L.), Jaffna, Ceylon.

24. 1970.10.21.11-17 (7 : 153.0-195.0 mm S.L.), Porto Novo.

25. 1973.6.4.48-55 (10 : 100.0-166.0 mm S.L.), Calcutta.

26. 1975.3.20.204-229 (26 : 75.0-184.0 mm S.L.), Bombay.

27. 1975.3.20.230-237 (8 : 68.5-93.0 mm S.L.), Porto Novo.

28. 1975.3.20.808 (1 : 68.0 mm S.L.), Porto Novo.

29. 1975.3.20.818 (1 : 69.0 mm S.L.), Porto Novo.

30. 1977.9.8.4-5 (2 : 111.0-130.0 mm S.L.), Java Sea.

31. 1977.9.8.7 (1 : 169.0 mm S.L.), Java Sea.

32. 1977.9.8.8-10 (3 : 151.0-176.0 mm S.L.), Java Sea.

33. 1977.9.8.11-12 (2 : 165.0-173.0 mm S.L.), Java Sea.

34. 1977.9.8.13-15 (3 : 169.0-207.0 mm S.L.), Java Sea.

35. 1977.9.8.16 (1 : 130.0 mm S.L.), Java Sea.

36. 1977.9.8.17 (1 : 140.0 mm S.L.), Java Sea.

37. 1977.9.8.18-21 (4 : 101.0-139.0 mm S.L.), Java Sea.

38. 1978.8.18.159 (1 : 154.0 mm S.L.), Bangladesh.

39. 1978.8.18.160-161 (2 : 166.0-175.0 mm S.L.), Bangladesh.

40. 1979.7.5.14 (1 : 92.0 mm S.L.), India.

41. BMNH 1979.7.15-16 (2 : 130.0-160.0 mm S.L.), Singapore.

42. 1979.8.15.39-41 (3 : 146.0-183.0 mm S.L.), Andaman coast of Thailand.

43. 1979.8.17.22 (1 : 106.0 mm S.L.), Singapore.

44. MNHN 3707 (1 : 168.0 mm S.L.), Malabar coast.

45. 3709 (1 : 211.0 mm S.L.), Bombay.

46. 3936 (1 : 274.0 mm S.L.), Bombay, (stuffed dried specimen).

47. 7493 (4 : 131.0-194.0 mm S.L.), no data.

Diagnosis:- A common and wide ranging species of Ilisha, with a long post-coelomic prolongation of the gas bladder along the right side of the anal pterygophores (pl. 163b); ventral scutes usually 20-23+8-11 (tbl. 6.1); gillrakers usually 9-11+19-22 (fig. 84); pyloric caeca about 73 and with a faint dark spot on dermosphenotic.

Remarks:- The record of twelve small specimens of this fish (BMNH. 1934.10.17. 12-21) collected by B.K. Das from Allahabad is very interesting as they were probably collected together with Gudusia chapra (BMNH. 1934.10.17.1-6) and Gonialosa manmina (BMNH. 1934.10.17.7-10), which are exclusive freshwater species of the Ganges. Unfortunately, I have been unable to examine any of the specimens recorded as I. motius from eastern Uttar Pradesh by Srivastava (1968), but it seems likely that young specimens which have been recognised as Ilisha from freshwaters in this area will prove to be I. megaloptera. There is nothing in Hamilton-Buchanan's description of C. motius which would distinguish his species from most species of Ilisha. However, the shallow body of I. motius (93.0 mm S.L.) described by Srivastava (loc. cit.) also hints at I. kampeni. For the time being and until specimens of supposed C. motius from the Brahmaputra are compared with I. megaloptera and I. kampeni or others, I prefer tentatively to synonymize C. motius with the present species, but to regard it as a nomen dubium for nomenclature.

Although the postcoelomic prolongation of the gas bladder is a good diagnostic character in grouping species of Ilisha, it is not useful for specimens smaller than 40-50 mm S.L. (figs 86, 88).

Distribution:- Bombay to Java Sea.

82. Ilisha elongata (Bennett, 1830)

(Plates 165a-e, 166a-f, 183g; Figures 22B, 84, 85, 86; Tables 6, 6.1, 6.2)

Alosa elongata Bennett, 1830, Mem. Life of Raffles : 691 (Sumatra).

Clupea affinis Gray, 1830, Illustr. Ind. Zool. Hardwicke, 1 : pl. 96 (2) (India, on Hardwicke drawing).

Ilisha abnormis Richardson, 1846, Ichth. China Japan : 306 (China Sea).

Pellona leschenaulti Valenciennes, 1847, Hist. Nat. Poiss., 20:311 (Pondicherry).

Pellona grayana Valenciennes, ibid. : 315 (on Clupea affinis Gray, 1830).

Pellona vimbella Valenciennes, ibid. : 317 (Macao).

Pellona schlegelii Bleeker, 1854, Natuurk. Tijdschr. Ned.-Indië, 6 : 418 (Nagasaki).

Pristigaster chinensis Basilewski, 1855, Nouv. Mém. Soc. Nat. Moscow, 10 : 243 (Gulf of Tschiliensi, China).

Pristigaster (Pristigaster) sinensis Sauvage, 1881, Bull. Soc. philomath. Paris, (7) 5 : 107 (Swatow).

Specimens examined (23 : 78.0-405.0 mm S.L.)

Types:

1. BMNH 1852.9.13.107 (1 : 311.0 mm S.L.), Sumatra. Holotype of Alosa elongata.

2. 1964.11.6.4. (1 : 295.0 mm S.L.), China Sea. Holotype of I. abnormis (right side mounted skin).

3. MNHN 3435 (1 : 365.6 mm S.L.), Pondicherry. Holotype of Pellona leschenaulti.

4. 5148 (1 : 249.0 mm S.L.), Macao. Holotype of Pellona vimbella.

5. BMNH 1867.11.28.72 (1 : 286.0 mm S.L.), Nagasaki. Holotype of Pellona schlegelii.

6. MNHN A. 2948 (1 : 132.0 mm S.L.), Swatow. Holotype of Pristigaster

(Pristigaster) sinensis.

Other specimens:

7. BMNH 1851.12.27.212 (1 : 216.0 mm S.L.), China.

8. 1860.3.19.771 (1 : 78.0 mm S.L.), China. Bearing label Clupea hardwickii Gray, probably by T. Cantor.

9. 1860.3.19.954 (1 : 83.0 mm S.L.), China.

10. 1860.7.20.57 (1 : 135.0 mm S.L.), Amoy, China.

11. 1862.11.1.63 (1 : 405.0 mm S.L.), Japan.

12. 1867.11.28.11 (1 : 259.0 mm S.L.), E. Indies. Bearing original label "Pellonula affinis (type)", stated to be not a type by A. Wheeler, dated 1961.

13. 1867.11.28.19 (1 : 176.0 mm S.L.), E. Indies.

14. 1867.11.28.25 (1 : 224.0 mm S.L.), E. Indies; P. Bleeker. Neither Alausa ilisha nor Hilsa kelee as stated on label.

15. 1868.11.17.38 (1 : 180.0 mm S.L.), locality unknown.

16. 1873.7.30.108 (1 : 113.0 mm S.L.), Shanghai.

17. 1874.1.16.46 (1 : 305.0 mm S.L.), Cheefoo.

18. 1933.3.11.840 (1 : 115.0 mm S.L.), Tiping, Kwang Tung.

19. 1971.28.164-166 (3 : 69.0-98.0 mm S.L.), Japan.

20. 1979.3.21.309 (1 : 80.0 mm S.L.), Tainan, Taiwan.

21. 1979.8.16.515 (1 : 310.0 mm S.L.), Singapore.

Diagnosis:- A species of Ilisha, with a long postcoelomic prolongation of the gas bladder along the right side of the anal pterygophores (pl. 165b). It is closely related to I. filigera and I. macrogaster, but differs from them as in the key.

Remarks:- Except for the single large holotype of P. leschenaulti (365.6 mm), there is no further trustworthy record of the present species from India. However, Hardwicke's drawing of C. affinis from India, which has been shown to be the I. elongata by Whitehead (1967a), and the presence of I. elongata from Sumatra (the holotype), support its probable occurrence in the Bay of

Bengal.

The centre of occurrence of I. elongata is in the N. China Sea. According to Svetovidov (1963), the catches of this fish off the coasts of Korea contributed 6,600-14,800 centners (1 centner = 100-120 lbs) during 1937-1941.

Distribution:- East coast of India to N. China Sea.

83. Ilisha filigera (Valenciennes, 1847)

(Plates 167a-e, 168a-f, 183d; Figures 22C, 84, 85, 86; Tables 6, 6.1, 6.2)

Pellona filigera (part) Valenciennes, 1847, Hist. Nat. Poiss., 20 : 322 (Bombay, Coromandel coast).

Pellona xanthoptera Bleeker, 1851, Natuurk. Tijdschr. Ned.-Indië, 2 : 439 (Sambas, Borneo).

Specimens examined (6 : 75.0-212.0 mm S.L.)

Types:

1. MNHN 3710 (1 : 75.0 mm S.L.), Bombay. Lectotype of P. filigera. Its cosyntype, MNHN. B. 2879 (formerly MNHN. 3710), 74.0 mm S.L., has been herein described as Ilisha obfuscata n. sp.
2. BMNH 1867.11.28.14 (1 : 212.0 mm S.L.), Borneo. Holotype of P. xanthoptera.

Other specimens:

3. BMNH 1858.8.15.63 (1 : 141.0 mm S.L.), India.
4. 1895.2.28.70 (1 : 106.0 mm S.L.), Sarawak.
5. 1969.11.6.3 (1 : 179.0 mm S.L.), Porto Novo.
6. 1979.8.17.6 (1 : 189.0 mm S.L.), Singapore.

Diagnosis:- A species of Ilisha, with a long postcoelomic prolongation of the gas bladder along the right side of the anal pterygophores (pl. 167b); body depth 31-35 % S.L. (fig. 85); pectoral rays 15-18; lateral scales 49-54; ventral scutes 23-26+11-13; gillrakers 9-12+19-23 (fig. 84); distance between upper insertion of pectoral to ventral profile 9.3-12.6 % S.L. and pyloric caeca about 76.

Remarks:- Whitehead (1967a) noted that the single paratype of P. filigera was distinct from holotype and he suggested it might be the deep-bodied I. micropus. Together with the paralectotype of P. micropus (MNHN. 3712), it is here recognised as an undescribed species (I. obfuscata).

Distribution:- Bombay to Sarawak.

84. Ilisha macrogaster Bleeker, 1866

(Plates 169a-c, 183f; Figures 22C, 84, 85, 86; Tables 6, 6.1, 6.2)

Ilisha macrogaster Bleeker, 1866, Ned. Tijdschr. Dierk., 3 : 300 (Sambas, W. Borneo).

Specimens examined (2 : 111.5-117.0 mm S.L.)

Types:

1. BMNH 1867.11.28.20 (1 : 117.0 mm S.L.), Borneo. Holotype of I. macrogaster.

Other specimens:

2. BMNH 1894.1.19.80 (1 : 111.5 mm S.L.), Sarawak.

Diagnosis:- A species of Ilisha, with a long postcoelomic prolongation of the gas bladder along the right side of the anal pterygophores. It is very closely related to I. filigera, but it is distinguished from that species by the greater distance between the upper insertion of the pectorals to the ventral profile, 14.5-15.3 (cf. 9.3-12.6) % S.L.; other overlapping but important separating characters are depth of body 34-36 (cf. 31-35) % S.L. (fig. 85) and gillrakers 11-12+23-25 (cf. 9-12+19-23) (fig. 84)

Remarks:- The separation of this fish from I. filigera needs to be confirmed from more material of different sizes and localities. At present, on the basis of the differences mentioned above and elsewhere in this work, I tentatively recognise them as distinct.

Distribution:- Borneo and Sarawak.

85. Ilisha pristigastroides (Bleeker, 1852)

(Plates 170a-e, 183e; Figures 22C, 84, 85, 86; Tables 6, 6.1, 6.2)

Pellona pristigastroides Bleeker, 1852, Verh. batav. Genoot. Kunst. Wet., 24 : 20 (Batavia).

Pellona amblyuropterus Bleeker, ibid. : 21 (Batavia).

Specimens examined (3 : 145.0-295.0 mm S.L.)

Types:

1. BMNH 1867.11.28.12 (1 : 145.0 mm S.L.), Batavia. Holotype of P. pristigastroides.

2. RMNH 7120 (1 : 281.0 mm S.L.), Batavia. Holotype of P. amblyuropterus.

Other specimens:

3. BMNH 1867.11.28.9 (1 : 295.0 mm S.L.), Batavia.

Diagnosis:- One of the five species of Ilisha, with a long postcoelomic prolongation of the gas bladder along the right side of the anal pterygophores. From the other four species it is readily separated by having a gillraker count of 9-10+17 (fig. 84); anal originating before base of 5th dorsal ray (tbl. 6.2); pneumatic duct very long (pl. 170b) and with pyloric caeca 80-90.

Distribution:- Batavia, Java Sea.

86. Ilisha kampeni (Weber & DeBeaufort, 1913)

(Plates 171a-d, 172a-e, 183h; Figures 22D, 87, 88; Tables 6, 6.1, 6.2)

Pellona kampeni Weber & DeBeaufort, 1913, Fishes Indo-Australian Arch., 2 : 87 (Batavia, Java, Balikpapan, Borneo).

Ilisha whiteheadi Seshagiri Rao, 1974, Copeia, No. 4 : 861, figs 1-3 (Kakinada, Bay of Bengal).

Specimens examined (38 : 79.0-146.0 mm S.L.)

Types:

1. BMNH 1975.9.24.36 (1 : 144.0 mm S.L.), Kakinada, India. Holotype of I. whiteheadi.

2. 1975.9.24.37-47 (11 : 79.0-146.0 mm S.L.), Kakinada. India. Paratypes of I. whiteheadi.

Other specimens

3. BMNH 1889.8.17.24 (1 : 128.0 mm S.L.), Madras.

4. 1969.11.6.13-14 (2 : 103.0-123.0 mm S.L.), Porto Novo.

5. 1970.10.21.1-10 (10 : 81.0-90.0 mm S.L.), Porto Novo.

6. 1973.6.4.56-59 (4 : 96.0-100.0 mm S.L.), Calcutta.

7. 1977.6.17.20-21 (2 : 93.0-96.0 mm S.L.), Porto Novo.

8. 1979.8.24.139-142 (4 : 102.0-121.0 mm S.L.), Takisung, Kalimantan.

9. 1979.8.24.154-155 (2 : 95.0-97.0 mm S.L.), Kotabaru, Kalimantan.

10. 1979.8.24.156 (1 : 98.0 mm S.L.), Aluhaluh, Barito river, Borneo.

Diagnosis:- A species of Ilisha, with long postcoelomic prolongations of the gas bladder along both sides of the anal pterygophores (pl. 171b). It is closely related to I. striatula n. sp., chiefly in its widely discontinuous vertical striae at the centre of the scales (pl. 172d). From that species it unmistakably differs in its more slender body 24-32 (cf. 32-39) % S.L. (fig. 87); eye diameter 7.9-9.3 (cf. 9.2-11.1) % S.L. (fig. 88); pectoral length 15.0-16.9 (cf. 18.0-20.4) % S.L.; predorsal scales 15-18 (cf. 13-15); and pyloric caeca 15-19 (cf. about 38).

Remarks:- I have not been able to examine the type material of P. kampeni (ZMA. 112-594, 1-5; 100.0-118.5 mm S.L.), but its original description differs in no pertinent respect from my available material. However, to confirm this opinion, the types should be examined for the characters used here.

According to my specimens, the fish ranges from the Java Sea to Bay of Bengal.

Recently , Seshagiri Rao (1975) reported this species as abundant in the Arabian Sea, but I have no means to confirm its occurrence in that area. Ramaiyan & Whitehead (1975) also gave no record of this fish from Arabian Sea.

Distribution:- Bay of Bengal to Java Sea.

87. *Ilisha striatula* n. sp.

(Plates 173a-e, 174a-e, 183i, 323d, 329d; Figures 22D, 87, 88; Tables 6, 6.1, 6.2)

Specimens examined (54 : 62.0-176.0 mm S.L.)

Types:

1. BMNH 1968.8.26.2 (1 : 139.0 mm S.L.), Pakistan, 25°11'N : 66°20'E; F. Berry. Holotype.
2. 1898.6.29.184 (1 : 120.0 mm S.L.), Kurrachee; J.W. Townsend. Paratype.
3. 1969.11.6.5-6 (2 : 113.0-114.0 mm S.L.), Porto Novo; R.V. Seshaiya. Paratypes.
4. 1975.3.20.696-699 (4 : 110.0-176.0 mm S.L.), Madras; V. Ramaiyan. Paratypes.
5. 1975.3.20.700-709 (10 : 114.0-140.0 mm S.L.), Tuticorin; V. Ramaiyan. Paratypes.

Other specimens:

6. BMNH 1852.9.13.175 (1 : 151.0 mm S.L.), N.E. Arabian Sea; Zool. Soc. coll.
7. 1889.2.1.1999 (1 : 62.0 mm S.L.), Madras; F. Day.
8. 1969.11.6.10-12 (3 : 146.0-153.0 mm S.L.), Porto Novo; R.V. Seshaiya.
9. 1970.10.21.18-27 (10 : 103.0-116.0 mm S.L.), Porto Novo; R.V. Seshaiya.
10. 1970.10.21.28-33 (6 : 143.0-168.0 mm S.L.), Porto Novo; R.V. Seshaiya.

11. BMNH 1975.3.20.673-679 (7 : 143.0-158.0 mm S.L.), Waltair; V. Ramaiyan.

12. 1975.3.20.754-760 (8 : 114.0-128.0 mm S.L.), Vizhingam; V. Ramaiyan.

Diagnosis:- A new species of Ilisha, with a long postcoelomic prolongation of the gas bladder along both sides of the anal pterygophores (pl. 173b). It is closely allied to I. kampeni in having distinctively discontinuous vertical striae at the centre of the scales. From that species it is clearly differentiated by its deeper body 32-39 (cf. 24-32) % S.L. (fig. 87); eye diameter 9.2-11.1 (cf. 7.9-9.3) % S.L. (fig. 88); pectoral length 18.0-20.4 (cf. 15.0-16.9) % S.L.; predorsal scales 13-15 (cf. 15-18) (tbl. 6.1); and pyloric caeca about 38 (cf. 15-19).

Remarks:- Among the British Museum specimens, this new species was several occasions found mixed among I. melastoma specimens of the same sizes. It is therefore likely that at least some previous works on I. melastoma have included partly or wholly data for I. striatula.

This fish was originally noticed as a different form from I. melastoma by its faint darkish band along flanks hence the latin name striatula.

Distribution:- Coasts of Pakistan to Madras.

88. Ilisha melastoma (Schneider, 1801)
(Plates 175a-e, 176a-f, 177a, 183j, 319b; Figures 23A, 87, 88; Tables 6, 6.1, 6.2)

Clupea melastoma Schneider, 1801, Syst. Ichth. Bloch : 427 (Indian Ocean, near Coromandel).

Platygaster verticalis Swainson, 1838, Nat. Hist. Anim., 1 : 278 (on Ditchoee of Russell, 1803, Fishes of Coromandel, 2 : 74, pl. 192)

Platygaster indicus Swainson, 1839, Nat. Hist. Anim., 2 : 294 (on Ditchoee).

Pellona ditchoa Valenciennes, 1847, Hist. Nat. Poiss., 20 : 313 (on Ditchoee).

Pellona micropus (part) Valenciennes, ibid. : 320 (Coromandel coast, Bengal).

Pellona brachysoma Bleeker, 1852, Verh. batav. Genoot. Kunst. Wet., 24 : 22 (Batavia).

Specimens examined (242 : 22.0-169.0 mm S.L.)

Types:

1. ZMB 3842 (1 : 120.0 mm S.L.), Coromandel. Holotype of C. melastoma.
2. MNHN 3711 (1 : 70.0 mm S.L.), Coromandel coast. Lectotype of Pellona micropus. Its paralectotype, 68.0 mm S.L., MNHN. 3712, has been here described as Ilisha obfuscata n. sp.
3. BMNH 1867.11.28.16 (1 : 128.0 mm S.L.), Java. Holotype of Pellona brachysoma.

Other specimens:

4. BMNH 1867.11.28.10 (1 : 115.0 mm S.L.), E. Indies.
5. 1868.10.25.26 (1 : 169.0 mm S.L.), Madras.
6. 1889.2.1.1994-1997 (4 : 57.0-86.0 mm S.L.), Madras.
7. 1889.2.1.2000-2001 (2 : 77.0-95.0 mm S.L.), Malabar.
8. 1939.3.23.7 (1 : 101.0 mm S.L.), Hong Kong.
9. 1965.4.1.84-125 (42 : 22.0-26.5 mm S.L.), Lantao, Hong Kong.
10. 1965.4.1.126 (1 : 25.0 mm S.L.), Lantao, Hong Kong.
11. 1965.7.5.45-47 (3 : 59.5-63.5 mm S.L.), Deep Bay, Hong Kong.
12. 1966.2.28.27-28 (2 : 95.0-114.0 mm S.L.), Samutsakorn. Thailand.
13. 1966.2.28.29.30 (2 : 75.0-76.0 mm S.L.), Gulf of Thailand.
14. 1966.11.20.4 (1 : 73.0 mm S.L.), Gulf of Thailand.
15. 1967.11.13.62 (1 : 68.5 mm S.L.), Pony, Singapore.
16. 1968.8.26.1 (1 : 131.0 mm S.L.), Porto Novo.
17. 1969.11.6.7 (1 : 111.0 mm S.L.), Porto Novo.
18. 1969.11.6.8-9 (2 : 108.0-115.0 mm S.L.), Porto Novo.
19. 1970.4.24.52 (1 : 111.0 mm S.L.), Jaffna, Ceylon.
20. 1970.10.21.34-43 (10 : 87.0-115.0 mm S.L.), Porto Novo.

21. BMNH 1975.3.20.408-492 (85 : 73.0-106.0 mm S.L.), Porto Novo.

22. 1975.3.20.680-695 (15 : 101.5-123.0 mm S.L.), Madras.

23. 1975.3.20.761-768 (7 : 101.0-110.0 mm S.L.), Vizhingam, India.

24. 1975.3.20.769-780 (33 : 101.0-128.0 mm S.L.), Balar, Mangalore (west coast), India.

25. 1975.3.20.802-817 (17 : 40.0-108.0 mm S.L.), Porto Novo.

26. 1977.9.8.5 (1 : 79.5 mm S.L.), Java Sea.

27. 1978.8.18.158 (2 : 108.5-109.0 mm S.L.), Bangladesh.

28. 1979.3.21.310-311 (2 : 66.0-94.0 mm S.L.), Taiwan.

29. 1979.8.17.7 (1 : 105.0 mm S.L.), China. Bearing tin-tag No. 28.10.

Diagnosis:- A common species of *Ilisha*, with long postcoelomic prolongations of gas bladder along both sides of the anal pterygophores (pl. 175b); vertical striae on scales overlapping or continuous at centre (pl. 176d-f); body depth 33-42 % S.L. (fig. 87) and gillrakers 10-13+21-25 (fig. 87).

Remarks:- According to the counts of anal fin rays of all known species of *Ilisha* (tbl. 6), the counts for *I. melastoma* represent the lowest in the genus.

Whitehead (1967a) noted that Russell's figure of Ditchoee "shows a short maxilla sharply bent halfway along its lower margin, a shape characteristic of *Ilisha micropus* (for example) but very different to the longer and more smoothly curved maxilla in *Pellona ditchela*". Therefore Russell's *Ditchoee*, which had 37 anal rays (possibly iii 34), must have been an *Ilisha*, not *Pellona*, and most likely the present species.

Among six fishes which have anal rays iii 34 (ZMA. 3842, 120.0 mm S.L.; BMNH. 1965.4.1.126, 25.0 mm S.L.; 1975.3.20.680-695, 2 fishes, 103.0 and 118.0 mm S.L.; 1975.3.20.761-768, 2 fishes, 100.0 and 104.0 mm S.L.) the 118.0 mm S.L. fish of BMNH. 1975.3.20.680-695 from Madras may be the most suitable specimen as a neotype for *P. indicus*, if needed. The minimum anal count for *I. melastoma* seems to be only iii, 32 in a fish, 76.0 mm S.L. from BMNH. 1975.3.20.802-817.

Like most other common species of Ilisha, specimens of this fish show a considerable variation in body depth (pls. 175a, 177a, fig. 87) and so can be identified with certainty only when a number of characters are studied.

Distribution:- Malabar coast to Java Sea and Taiwan.

89. Ilisha obfuscata n. sp.

(Plates 169d-e, 183k; Figures 23A, 84, 85, 86; Tables 6, 6.1, 6.2)

Specimens examined (2 : 68.0-74.0 mm S.L.)

Types:

1. MNHN B. 2879 (1 : 74.0 mm S.L.), Bombay; Dussumier. Formerly one of the two syntypes of Pellona filigera (MNHN. 3710), now also holotype of I. obfuscata n. sp.

2. 3712 (1 : 68.0 mm S.L.), Pondicherry; Bêlanger. Formerly one of the two syntypes of Pellona micropus, paralectotype, now also paratype of I. obfuscata n. sp.

Diagnosis:- A new species of Ilisha, closely allied to I. melastoma in having long postcoelomic prolongations of the gas bladder along both sides of the anal pterygophores and with vertical striae on scales overlapping at centre (pl. 169e). However, it differs in having gillrakers 12-13+27-28 (cf. usually 10-12+22-25) (figs 84, 87) and the prolongations of the gas bladder rather shorter (figs 86, 88).

Remarks:- The similarity of these two syntypes (of Valenciennes' Pellona filigera and his P. micropus) is striking and was noticed by Whitehead (1967a), who identified both as I. micropus but suspected this species might be part of the widespread and polymorphic I. megaloptera. He based this mainly on the apparently rather variable body depth, but the form of the gas bladder prolongations and the number of gillrakers (no overlap with other species) now separates these specimens and justifies recognition of a distinct species.

The name obfuscata reflects the former uncertainties.

Distribution:- Bombay and Pondicherry, India.

90. Opisthopterus valenciennesi Bleeker, 1872

(Plates 177b-f, 178a-e, 314d, 329e; Figures 23B, 80, 81; Table 7)

Opisthopterus tartoor Bleeker, 1872, Atlas Ichth. Ind. Nèerland., 6 : 123 (Batavia, Singapore) (name preoccupied by Pristigaster tartoor Valenciennes, 1847).

Opisthopterus valenciennesi Bleeker, ibid. , 6 : 124 (on the above).

Specimens examined (31 : 134.0-201.0 mm S.L.)

Types:

1. BMNH 1965.9.24.1 (1 : 170.0 mm S.L.), Batavia, Singapore. Lectotype of O. valenciennesi.

2. 1867.11.28.8 (1 : 173.0 mm S.L.), Batavia, Singapore. Paralectotype of O. valenciennesi.

3. RMNH 7124 (5 : 143.5-181.0 mm S.L.), Batavia, Singapore. Presumed paralectotypes of O. valenciennesi.

Other specimens:

4. BMNH 1936.10.7.41 (1 : 124.0 mm S.L.), Foochow.

5. 1965.7.5.48 (1 : 145.0 mm S.L.), Fung Bay, Hong Kong.

6. 1977.9.8.22-24 (3 : 145.0-180.0 mm S.L.), Java Sea.

7. 1977.9.8.25-34 (10 : 155.0-190.0 mm S.L.), Java Sea.

8. 1977.9.8.35-40 (6 : 170.0 201.0 mm S.L.), Java Sea.

9. 1977.9.8.41-42 (2 : 180.0-180.2 mm S.L.) Java Sea.

10. 1977.9.8.43 (1 : 134.0 mm S.L.), Java Sea.

Diagnosis:- One of the two species of Opisthopterus, differing from O. tartoore in having pectoral rays 15-17 (cf. 12-14), and the pectoral fin shorter, 14-17, (cf. 21-26) % S.L. (fig. 81) and reaching the 18th-22nd (cf. 27th-30th) central scutes (tbl. 7).

Remarks:- This species has never been recorded with certainty from the

Indian Ocean.

Distribution:- Java Sea to Foochow, China.

91. Opisthopterus tardoore (Cuvier, 1829)

(Plates 179a-f, 180a-d, 310c, 323e; Figures 23B, 80, 81; Table 7)

Pristigaster tardoore Cuvier, 1829, Règne Animal, 2nd ed., 2 : 321 (on Tartoore of Russell, 1803, Fishes of Coromandel, 2 : 74, pl. 193).

Pristigaster elongata Swainson, 1838, Nat. Hist. Anim., 1 : 278 (on Tartoore).

Pristigaster indicus Swainson, 1839, ibid., 2 : 294 (on Tartoore).

Pristigaster tartoor Valenciennes, 1847, Hist. Nat. Poiss., 20 : 328 (Pondicherry, Malabar).

Opisthopterus macrognathus Bleeker, 1866, Verh. batav. Genoot. Kunst. Wet., 24 : 25 (Batavia).

Specimens examined (84 : 28.0-179.0 mm S.L.)

Types:

1. MNHN 1688 (1 : 142.0 mm S.L.), Pondicherry. Putative neotype of P. tardoore.
2. RMNH 7125 (1 : 169.0 mm S.L.), Batavia. Lectotype of O. macrognathus.

Other specimens:

3. BMNH 1852.9.13.176 (1 : 159.5 mm S.L.), N.E. Arabian Sea.
4. 1867.11.28. 7 (1 : 166.0 mm S.L.), Batavia.
5. 1868.10.27.28 (1 : 163.0 mm S.L.), Madras.
6. 1889.2.1.2007 (1 : 89.0 mm S.L.), Sind.
7. 1889.2.1.2024-2025 (2 : 108.0-159.0 mm S.L.), Malabar.
8. 1889.2.1.4856 (1 : 164.0 mm S.L.), Bombay.
9. 1967.11.13.190-227 (38 : 32.0-70.0 mm S.L.), Singapore.
10. 1967.11.13.232-236 (5 : 28.0-32.0 mm S.L.), Batu Muang, Penang.
11. 1967.11.13.237 (1 : 30.5 mm S.L.), Than Bay, Singapore.
12. 1968.1.28.7 (1 : 107.0 mm S.L.), Borneo.

13. BMNH 1977.9.9.10-12 (3 : 123.0-155.0 mm S.L.), Pakistan.

14. 1979.8.17.1-2 (2 : 51.0-84.0 mm S.L.), Singapore.

15. MNHN 3698 (2 : 155.0-179.0 mm S.L.), Pondicherry.

16. 3701 (8 : 65.0-162.0 mm S.L.), Malabar.

17. 3702 (2 : 119.0-123.0 mm S.L.), Mahé, Malabar.

18. RMNH 24960 (13 : 66.0-166.0 mm S.L.), Batavia.

Diagnosis:- A species of Opisthopterus, readily distinguished from its congener O. valenciennesi in the characters indicated diagnosis of that species and in the key. It is the more widespread of the two.

Distribution:- Coasts of Pakistan to Borneo.

92. Raconda russeliana Gray, 1831

(Plates 181a-f, 182a-d, 314e, 323f, 329f; Figures 23C, 78; Table 7).

Raconda russeliana Gray, 1831, Zool. Miscellany, 1 : 9 (Sangar roads, India).

Apterygia ramcarata Gray, 1835 Illustr. Ind. Zool., Hardwicke, 2 : pl. 92 (1) (Sangar Rocks, India).

Apterygia hamiltoni Valenciennes, 1847, Hist. Nat. Poiss., 20 : 333 (on Apterygia ramcarata Gray, 1835; not Thrissa hamiltonii Gray, 1835).

Specimens examined (51 : 40.0-172.0 mm S.L.)

Types:

1. BMNH 1979.7.5.18 (1 : 145.0 mm S.L.), Sangar roads, India. Holotype of R. russeliana.

2. 1979.7.5.19-20 (2 : 74.0-86.5 mm S.L.), Sangar Rocks, India. Syntypes of A. ramcarata.

Other specimens:

3. BMNH 1857.6.13.80 (1 : 155.0 mm S.L.), Bay of Bengal.

4. 1858.8.15.123 (2 : 111.0-176.0 mm S.L.), India.

5. 1889.2.1.2027-2036 (12 : 40.0-57.0 mm S.L.), Sunderbunds.

6. 1967.11.13.231 (1 : 77.0 mm S.L.), Singapore.

7. BMNH 1973.6.4.60-71 (27 : 73.5-172.0 mm S.L.), Calcutta.
8. 1979.8.16.843 (1 : 168.0 mm S.L.), no data, (left side dried skin).
9. 1979.8.24.1-3 (3 : 105.0-134.0 mm S.L.), Takisung, Kalimantan.
10. 1979.8.24.4 (1 : 127.0 mm S.L.); Aluhaluh, Barito river, Borneo.

Diagnosis:- A single known species of Raconda, the absence of a dorsal makes this fish unmistakable.

Remarks:- With teeth only on the palatine, pterygoids and maxilla, one can note that this fish is presumably the final step in an Indo-Pacific lineage leading from Herklotsichthys and Escualosa to Pellona, Ilisha, Opisthopterus and finally Raconda. In all of them (except some species of Herklotsichthys) there is a well-developed ridge of teeth on each side of the roof of the mouth (pterygoids) and a very strong and large maxilla and 2nd supramaxilla. In Opisthopterus and Raconda the posterior tip of the maxilla tends to project clearly beyond the 2nd supramaxilla, as in most engraulids, and this has similarly happened but is more prominent in three species of the New World Odontognathus (fide Whitehead, 1973a). However, this is perhaps a secondary condition connected with their parallel carnivorous feeding habits. In the same way, the counts of anal rays of these fishes are also increasing, from Herklotsichthys of the open waters toward Raconda of the inshore waters. Simultaneously, there exists gradual change of colouration from metallic blue to greyish or bright silvery in these fishes.

Although Harder (1958, 1960) and Nelson (1970a) suggested the Pristigasterinae as a possible independent primitive lineage of clupeoid fish, on the basis of primitive position of the pneumatic duct, the presence of a toothed hypomaxilla bone in Harengula, which is allied to Herklotsichthys, might in some ways relate the Clupeinae with the Pristigasterinae.

Distribution:- Bay of Bengal to Java Sea.

Family Engraulidae

Subfamily Engraulinae

93. *Engraulis japonicus* Schlegel, 1846

(Plates 184a-g, 185a-e, 315a, 319g, 324g, 331a; Figures 28A, 107, 112; Tables 11)

Atherina australis Shaw, 1790, *Voy. N.S. Wales, White* : 296, pl. 64 (1) (N.S. Wales).

Engraulis japonicus Schlegel, 1846, *Fauna Japonica*, pts. 10-14 : 239, pl. 108 (3) (S.W. Japan).

Engraulis zollingeri Bleeker, 1849, *J. Ind. Arch.*, **3** : 69, 73 (Macassar, Celebes).

Engraulis encrasicholus var. *antipodum* Günther, 1868, *Cat. Fishes Brit. Mus.*, **7** : 386 (Van Diemen's Land and New Zealand).

Engraulis antarcticus Castelnau, 1872, *Proc. zool. acclim. Soc. Vict.*, **1** : 186 (Melbourne).

Engraulis capensis Gilchrist, 1913, *Mar. biol. Rep., Cape Tn* , **1** : 62, fig. p. 63 (S. Africa).

Stolephorus celebicus Hardenberg, 1933, *Natuurk. Tijdschr. Ned.-Indië*, **93** (2) : 262 (Menado, Celebes).

Specimens examined (558 : 23.5-129.0 mm S.L.)

Types:

1. BMNH 1867.11.28.61 (1 : 71.0 mm S.L.), E. Indies. Putative neotype of *E. zollingeri*.
2. 1845.8.5.46 (1 : 106.0 mm S.L.), Van Diemen's Land, Australia. Basis of *E. encrasicholus* var. *antipodum*.
3. 1855.9.19.1175 (2 : 62.0-90.0 mm S.L.), New Zealand. Basis of *E. encrasicholus* var. *antipodum*.
4. MNHN 3732 (8 : 76.0-105.0 mm S.L.), Melbourne, Australia. Types of *E. antarcticus*.

Other specimens:

5. BNHN 1871.8.18.49-50 (2 : 86.0-111.0 mm S.L.), Hobartown.

6. 1874.6.16.59 (6 : 88.0-106.0 mm S.L.), Chefoo.

7. 1879.5.14.634-637 (4 : 74.0-115.0 mm S.L.), Inland Sea, Japan.

8. 1886.11.18.94 (1 : 65.5 mm S.L.), Wellington. Misidentified as E. perfasciatus (= E. eurystole), which is an Atlantic species from east coast of S. America.

9. 1897.10.27.35-36 (2 : 47.0-60.5 mm S.L.), Maroubra.

10. 1902.5.28.11-13 (3 : 88.5-104.0 mm S.L.), False Bay, Africa.

11. 1905.6.6.23-25 (3 : 59.5-70.5 mm S.L.), Inland Sea, Japan.

12. 1911.4.1.67-71 (6 : 89.0-119.0 mm S.L.), Tasmania.

13. 1912.11.28.68-70 (4 : 70.0-102.0 mm S.L.), Inland Sea, Japan.

14. 1914.7.8.5-6 (2 : 95.0-98.5 mm S.L.), False Bay, Africa.

15. 1914.8.20.29-33 (5 : 94.0-98.0 mm S.L.), Port Hocking, N.S. Wales.

16. 1923.2.26.51-55 (6 : 70.0-71.0 mm S.L.), Hagodate, Japan.

17. 1932.8.4.22-24 (3 : 43.5-50.0 mm S.L.), Desroches Is.

18. 1932.8.4.25-34 (12 : 51.5-61.0 mm S.L.), Seychelles.

19. 1965.4.5.59-61 (3 : 59.0-70.5 mm S.L.), S. Africa.

20. 1969.2.27.3 (1 : 72.0 mm S.L.), Mahé Is., Africa.

21. 1969.4.22.1659-1663 (5 : 91.0-104.0 mm S.L.), Taiwan.

22. 1969.4.22.1664-1666 (3 : 120.0-129.0 mm S.L.), Taiwan.

23. 1969.4.22.1667-1676 (14 : 69.0-108.0 mm S.L.), Taiwan.

24. 1969.4.22.1677 (1 : 73.5 mm S.L.), Quezon, Philippines.

25. 1969.4.22.1678-1687 (12 : 68.5-96.0 mm S.L.), Quezon, Philippines.

26. 1969.4.22.1688-1697 (41 : 50.0-73.0 mm S.L.), Hong Kong.

27. 1969.4.22.1708-1717 (31 : 51.0-84.0 mm S.L.), Hong Kong.

28. 1969.4.22.1718-1722 (43 : 59.0-83.0 mm S.L.), Hong Kong.

29. 1969.4.22.1728-1737 (57 : 51.0-70.0 mm S.L.), Hong Kong.

30. 1969.4.22.1738-1747 (25 : 54.0-82.0 mm S.L.), Hong Kong.

31 BMNH 1969.4.22.1748-1757 (80 : 44.0-52.0 mm S.L.), Hong Kong.

32. 1969.4.22.1758-1767 (57 : 42.0-68.0 mm S.L.), Hong Kong.

33. 1969.4.22.1788-1789 (2 : 64.0-67.0 mm S.L.), Hong Kong.

34. 1969.4.22.1790-1799 (21 : 50.0-62.0 mm S.L.), Hong Kong.
Mixed with a specimen of Stolephorus heterolobus, 63.0 mm S.L.

35. 1969.4.22.1800 (1 : 76.0 mm S.L.), Hong Kong.

36. 1972.9.5.1-8 (8 : 33.5-42.0 mm S.L.), Durban.

37. 1976.4.27.52-67 (16 : 23.5-88.0 mm S.L.), Hong Kong.

38. 1976.8.19.1-11 (11 : 76.0-89.0 mm S.L.), N. Arabian Sea.

39. 1976.8.19.12-31 (20 : 60.0-86.0 mm S.L.), N. Arabian Sea.

40. 1976.8.19.32-35 (4 : 84.0-90.0 mm S.L.), N. Arabian Sea.

41. 1976.8.19.36-50 (15 : 48.0-65.5 mm S.L.), N. Arabian Sea.

42. 1978.8.16.6-8 (3 : 86.5-113.0 mm S.L.), Chita, Japan.

43. 1979.7.5.24 (1 : 46.0 mm S.L.), China.

44. 1979.8.16.24-35 (12 : 55.5-120.0 mm S.L.), S. Africa.

Diagnosis:- The only species of Engraulis, in the Indo-Pacific, similar in general appearance to certain members of Stolephorus, but readily distinguished by a combination of characters; absence of ventral scutes (except unkeeled pelvic scute); anal origin well behind last dorsal ray; posterior tip of maxilla bluntly rounded and scarcely projecting beyond 2nd supramaxilla (pl. 184f); gas bladder forming a single sack-like organ throughout its course (pl. 184b); intestine with a characteristic coiling a short distance before anus (pl. 184b-e); and pyloric caeca 20-31 (fig. 112).

Remarks:- Like many species of Stolephorus, the lateral stripe of this fish is very prominent even in alcohol preserved specimens, but it is only slightly apparent or undeveloped in fishes of 45 mm S.L. or smaller.

I have been unable to examine several types of nominal species of Indo-Pacific Engraulis, but on the basis of their original descriptions and specimens from type and other localities. I have found insufficient evidence to separate them specifically from E. japonicus.

On the basis of its maxilla tip alone, which projects clearly behind the tip of the 2nd supramaxilla, I consider E. maui of Fowler & Bean (1923) (USNM. 82904) as not E. japonicus or E. australis as by Fowler (1941) but probably E. mordax.

According to Gilchrist (1913), Günther (1868), Wheeler (1969) and the present specimens, the two characters that separate E. encrasicolus of the Atlantic and Mediterranean from E. japonicus are the slightly higher number of anal rays 20-26 (cf. 15-21) (tbl. 11) and more lateral scales 44-50 (cf. 38-45, usually 40-44) (tbl. 11). On the basis of these two features, a British Museum fish from Great Bitter Lake (BMNH. 1925.12.31.1, 68 mm S.L.), and two other fishes from Port Said (BMNH. 1925.9.19.6-7, 75-93 mm S.L.), which were studied by Whitehead (1965a), must be identified as E. japonicus, instead of E. encrasicolus. However, these should be closely checked with typical specimens of E. encrasicolus from the Mediterranean. Furthermore, the presence of teeth in the lower jaw of E. capensis of southern Africa cannot be used to differentiate that fish from E. encrasicolus as believed by Gilchrist (loc. cit.), for I have found equally developed villiform teeth in the jaws of both 'species'. Thus, if the Atlantic encrasicolus and the southern African capensis are conspecific, and if japonica and australis are conspecific, then it becomes dubious whether the Atlantic and Indo-Pacific forms can in the future be recognised as distinct. For the present, and until a world-wide revision is made, I have preferred to retain the name japonicus and not use the senior synonym australis, since it is so well entrenched in the literature.

In this study an attempt has been made to illustrate the effect of latitude on some external numerical characters (fig. 107, pl. 11) of this fish. It is evident that all meristic features seem to show trends to higher mean values in specimens from temperate zones of both hemispheres than in tropical specimens. Whitehead (1969b) may have had unrepresentative specimens from either the temperate or the tropical waters when he reported slightly higher meristic counts for tropical forms.

A label in BMNH. 1932.8.4.25-34 indicates that the fish is used as a bait fish in Seychelles; elsewhere it is species of Stolephorus that are commonly used.

Distribution:- East coasts of Africa to Japan, Australia and New Zealand.

94. Stolephorus purpureus (Fowler, 1900)

(Plates 186a-d, 187a-e, 220a, 324h, 331b; Figures 28B, 108, 112; Tables 12, 12.1)

Engraulis purpurea Fowler, 1900, Proc. Acad. nat. Sci. Philad. : 497, fig. 1 (Hawaiian Is.).

Specimens examined (222 : 27.5-60.0 mm S.L.)

Types:

1. ANSP 23329 (1 : 51.0 mm S.L.), Sandwich I. Holotype of E. purpurea.
2. 23330 (1 : 47.0 mm S.L.), Sandwich I. Paratype of E. purpurea.

Other specimens:

3. BMNH 1979.8.16.516-523 (8 : 38.0-55.0 mm S.L.), Hawaii.
4. 1979.8.16.524-563 (39 : 31.5-56.0 mm S.L.), Hawaii.
5. 1979.8.16.564-586 (23 : 37.0-55.0 mm S.L.), Hawaii.
6. 1979.8.16.587-694 (108 : 35.0-60.0 mm S.L.), Hawaii.
7. 1979.8.16.695-737 (42 : 27.5-54.0 mm S.L.), Kuhlia Bay, Hawaii.

Diagnosis:- A cylindrical shaped Stolephorus, with the anal origin behind the dorsal base; tip of depressed pelvics reaching to below 7th-8th dorsal ray; posterior tip of maxilla bluntly rounded and scarcely projecting beyond 2nd supramaxilla (pl. 186c). It is closely allied to S. buccaneeri in having ii unbranched dorsal and anal rays; a fleshy urohyal plate and a pair of oval-shaped posterior frontal fontanelles (pl. 220a); but differs from that fish in having usually no prepelvic scutes, but sometimes with 1-5 very thin ones (cf. 2-6) (tbl. 12.1); gillrakers usually 19-22+26-29 (cf. 15-20+23-26) (fig. 108); pyloric caeca 12-15 (cf. 14-18) (fig. 112); and a double pigment line along midline of back from head to caudal (instead of none).

Remarks:- Munro (1967) reported this fish from the British Solomon Is.; however, it could have been introduced to that area by tuna fishermen. At the present I have no means to check his reference.

Distribution:- Hawaiian Is.

95. Stolephorus buccaneeri Strasburg, 1960

(Plates 188a-f, 189a-e, 220b, 315b; Figures 28C, 108, 112; Tables 12, 12.1)

Stolephorus buccaneeri Strasburg, 1960, Pacif. Sci., 14 (4) : 396 (Hawaii).

Specimens examined (162 : 18.0-85.0 mm S.L.)

1. BMNH 1884.5.15.24-25 (2 : 60.0-61.5 mm S.L.), Taiwan.
2. 1919.9.12.6 (1 : 72.5 mm S.L.), Durban.
3. 1965.4.1.330-333 (3 : 70.0-70.5 mm S.L.), Hong Kong.
4. 1965.4.3.1-4 (4 : 52.0-61.0 mm S.L.), Kyushu, Japan.
5. 1966.1.17.4-6 (3 : 73.0-73.5 mm S.L.), Zanzibar channel.
6. 1966.11.16.556-620 (66 : 39.0-85.0 mm S.L.), Zanzibar channel.
7. 1967.11.13.405-406 (2 : 39.0-41.0 mm S.L.), Pony, Singapore.
8. 1967.11.13.407 (1 : 37.0 mm S.L.), Singapore.
9. 1967.11.20.1-3 (3 : 18.0-30.0 mm S.L.), Gulf of Aden.
10. 1968.4.4.38 (1 : 50.5 mm S.L.), Formosa Bay, Kenya.
11. 1969.4.22.1087-1092 (6 : 53.5-81.5 mm S.L.), Philippines.
12. 1969.4.22.1123-1126 (4 : 78.0-83.0 mm S.L.), Luzon, Philippines.
13. 1969.4.22.1166-1168 (3 : 70.0-72.0 mm S.L.), Batangas, Philippines.
14. 1969.4.22.1169-1177 (8 : 42.0-62.5 mm S.L.), Batangas, Philippines.
15. 1969.4.22.1190-1197 (8 : 61.0-68.5 mm S.L.), Manila Bay, Philippines.
16. 1969.4.22.1236-1238 (2 : 62.0-68.0 mm S.L.), Quezon, Philippines.
17. 1969.4.22.1240-1249 (12 : 32.0-49.0 mm S.L.), Mindanao, Philippines.

18. BMNH 1969.4.22.1250-1253 (4 : 60.0-62.0 mm S.L.), Manila Bay, Philippines.

19. 1969.4.22.1276-1286 (22 : 60.0-70.0 mm S.L.), Hong Kong.

20. 1969.4.22.1345-1354 (10 : 59.0-70.0 mm S.L.), Hong Kong.

21. 1969.4.22.1355-1358 (4 : 62.0-67.0 mm S.L.), Prachuab-Kirikhan, Thailand.

22. 1969.4.22.1359-1362 (4 : 54.0-67.0 mm S.L.), Prachuab-Kirikhan, Thailand.

23. 1969.4.22.1363 (1 : 77.0 mm S.L.), Kerala, India.

24. 1969.4.22.1364-1367 (4 : 55.0-70.0 mm S.L.), Kerala, India.

25. 1969.4.22.1368 (1 : 34.0 mm S.L.), Waltair.

26. 1969.4.22.1369 (1 : 65.0 mm S.L.), Cape Comarin, India.

27. 1969.4.22.1370-1379 (10 : 62.0-74.5 mm S.L.), Hong Kong.

28. 1969.4.22.1380-1390 (15 : 48.0-62.5 mm S.L.), Kerala, India.

29. 1970.5.27.1-3 (3 : 42.0-53.5 mm S.L.), Samoa.

30. 1970.6.2.8-32 (25 : 56.0-73.0 mm S.L.), Dubai, Persian Gulf.

31. 1970.10.2.43-53 (11 : 29.0-59.0 mm S.L.), Trucial States.

32. 1971.8.25.105-109 (4 : 42.0-48.0 mm S.L.), Fiji.

33. 1976.4.27.68-79 (12 : 51.0-60.0 mm S.L.), Hong Kong.

34. 1978.8.17.7-8 (2 : 54.0-55.0 mm S.L.), Pomona, Queensland, Australia.

Diagnosis:- A cylindrical shaped *Stolephorus*, with anal origin behind dorsal base; tip of depressed pelvics reaching to below anterior dorsal ray or nearly so; posterior tip of maxilla bluntly rounded and scarcely projecting beyond 2nd supramaxilla (pl. 188e). It is closely related to *S. purpureus* of the Hawaiian Is. chiefly in having ii unbranched dorsal and anal rays; a fleshy urohyal plate (pl. 315b); and a pair of oval-shaped posterior frontal fontaneles (pl. 220b). It principally differs from that species in having prepelvic scutes 2-6 (cf. none or only 1-5 weakly developed ones); gillrakers usually 15-20+23-26 (cf. 19-22+26-29) (fig. 108); pyloric caeca 14-18 (cf. 12-15) (fig. 112); and no pigment line on back.

Remarks:- The prominent band along the flanks of this fish is less developed or absent in preserved specimens of about 32.0 mm S.L. and smaller. In larger fish, the upper demarcation of this line is usually darker than the lower one.

Unfortunately, no specimens from type locality, Hawaii, has been examined in this study.

Distribution:- East coast of Africa, Persian Gulf to S.E. Asia, Hawaii and Samoa.

96. Stolephorus heterolobus (Rüppell, 1837)
(Plates 190a-d, 191a-e, 220c, 222i, 315c, 334b; Figures 28B, 108, 112; Tables 12, 12.1)

Engraulis heteroloba Rüppell, 1837, Neue Wirbelth., Fische : 79, pl. 21 (4) (Massawana).

Stolephorus pseudoheterolobus Hardenberg, 1933, Natuurk. Tijdschr. Ned.-Indië, 93 (2) : 261 (Riau, Ligga Archipelago).

Specimens examined (372 : 31.5-81.0 mm S.L.)

Types:

1. BMNH 1845.10.29.104 (1 : 61.0 mm S.L.), Massawana. Holotype of E. heterolobus.

Other specimens:

2. BMNH 1935.9.14.2 (1 : 40.0 mm S.L.), Augustus, I., N.W. Australia.
3. 1960.4.7.72-102 (28 : 48.5-63.5 mm S.L.), Cavite, Philippines.
4. 1964.12.14.261-268 (5 : 35.5-72.5 mm S.L.), Zanzibar.
5. 1964.12.14.269-318 (49 : 41.0-65.5 mm S.L.), Zanzibar.
6. 1965.10.19.24-38 (21 : 38.5-58.0 mm S.L.), Okinawa I.
7. 1966.1.17.12-14 (3 : 70.0-71.0 mm S.L.), Zanzibar channel.
8. 1966.1.17.102-110 (9 : 59.0-64.5 mm S.L.), Cavite, Philippines.
9. 1966.11.14.8-11 (5 : 59.0-65.0 mm S.L.), Nosy Bay, Madagascar.
10. 1966.11.16.921-922 (2 : 75.0-81.0 mm S.L.), Zanzibar channel.

11. BMNH 1966.11.19.2-3 (3 : 60.0-75.0 mm S.L.), Palau, Caroline Is.

12. 1967.11.13.238-309 (70 : 50.0-65.0 mm S.L.), Singapore.

13. 1967.11.13.310-318 (8 : 50.0-64.0 mm S.L.), Singapore.

14. 1969.4.4.27-37 (11 : 64.0-79.0 mm S.L.), Zanzibar channel.

15. 1969.4.22.1403-1406 (4 : 48.0-61.5 mm S.L.), Prachuab-kirikhan, Thailand.

16. 1969.4.22.1407-1416 (11 : 43.5-54.5 mm S.L.), Bangkok.

17. 1969.4.22.1471-1479 (8 : 59.0-64.0 mm S.L.), Manila Bay.

18. 1969.4.22.1500-1506 (7 : 63.5-70.0 mm S.L.), Manila Bay.

19. 1969.4.22.1536-1543 (8 : 52.5-63.0 mm S.L.), Pangasinan, Philippines.

20. 1969.4.22.1573-1577 (5 : 57.0-60.0 mm S.L.), Visakhapatnam, India.

21. 1969.4.22.1578 (1 : 62.5 mm S.L.), Kerala, India.

22. 1969.4.22.1579-1590 (35 : 47.5-63.0 mm S.L.), Madras.

23. 1969.4.22.1601-1609 (9 : 61.0-74.0 mm S.L.), Balticola, E. Ceylon.

24. 1971.8.26.1-2 (3 : 51.0-61.5 mm S.L.), Palau, Caroline Is.

25. 1974.8.19.29-51 (22 : 52.0-67.5 mm S.L.), N. Britain.

26. 1977.1.18.1-3 (3 : 65.5-71.0 mm S.L.), Amboina Harbour.

27. 1977.11.30.77-86 (15 : 58.0-73.0 mm S.L.), Rayong, Thailand.

28. 1977.11.30.107-128 (22 : 31.5-58.0 mm S.L.), Rayong, Thailand.

29. 1979.5.24.7-9 (3 : 63.0-65.0 mm S.L.), Cebu, Philippines. Collected on 21 April 1977, and sent upon request from Mr I.A. Ronquillo as his Stolephorus Sp. B.

Diagnosis:- A very common species of cylindrical shaped Stolephorus, with anal origin below posterior rays of dorsal or sometimes just behind it (tbl. 12.1); tip of depressed pelvics reaching a short distance before dorsal origin or sometimes to below anterior dorsal ray; urohyal plate bony (pl. 315c); some enlarged teeth may be present on posterior half of maxilla (pl. 122 i); gillrakers usually 20-25+23-29 (fig. 108). The fish is very closely related to *S. devisi* but differs from it in having only ii unbranched dorsal and anal rays (tbl. 12); and hind portion of maxilla, from posterior tip of 2nd supra-maxilla, longer than broad (pl. 222 i).

Remarks:- Judging by certain data given by Hardenberg (1933b, 1934) for *S. heterolobus* and *S. pseudoheterolobus*, and comparing my on numbers of anal rays, lateral scales, gillrakers and head length, it is quite clear that his *S. heterolobus* (A. 16-19; L.l.±36; G.R. 22-23; head 3.4-3.8) is *S. devisi* and his *S. pseudoheterolobus* (A. 16-18; L.l. 38; G.R. 23-25; head 3.8-4.2) is *S. heterolobus*. Hardenberg's types of *S. heterolobus* were searched for by Dr P.J.P. Whitehead in Jakarta (Marine Fisheries Research Institute) in middle 1979, but the condition of the collection makes it most unlikely that they have survived (Whitehead, pers. comm.).

Whitehead (1965a; 1968b, based on I.A. Ranquillo) was the first to identify *S. pseudoheterolobus* Hardenberg as *S. heterolobus* (Rüppell), and Hardenberg's *S. heterolobus* as Ronquillo's Species A. The latter species can now be identified as *Stolephorus devisi* (Whitley) and several decisive characters separate it easily from *S. heterolobus*. The differences in the proportions of head to standard length and numbers of lower gillrakers, considered to be diagnostic by Hardenberg (1933b, 1934), are in fact overlapping characters. The more trenchant characters indicated in the above diagnosis were therefore helpful in sorting out these two problematic species. The size of teeth on the maxilla is also, rather variable and cannot be relied upon in distinguishing *S. heterolobus* from *S. devisi*.

Distribution:- East coasts of Africa (Zanzibar), Madagascar, Red Sea to S.E. Asia, Japan, Papua New Guinea and northwest coast of Australia.

97. *Stolephorus devisi* (Whitley, 1940)
(Plates 192a-e, 193a-e, 220d, 222j; Figures 28D, 108, 112; Tables 12, 12.1)

Amentum devisi Whitley, 1940, *Aust. Zool.*, 9 (4) : 404 (Cape York).
Stolephorus, Species A. Whitehead, 1968, *J. mar. biol. Ass. India*, 9 (1) :

17 (Bay of Bengal, Arabian Sea) (based on I.A. Ronquillo MS.).

? Stolephorus, Species K. Kearney, Lewis & Smith, 1972, Res. Bull. DASF P. Moresby, No. 8 : 86, pl. 3.2 (Gasmata Harbour, New Britain).

Specimens examined (451 : 27.0-77.0 mm S.L.)

1. BMNH 1867.11.28.62 (1 : 70.0 mm S.L.), Indian Archipelago.
2. 1887.11.11.302-311 (12 : 46.0-54.0 mm S.L.), Muscat.
3. 1963.12.9.31-35 (5 : 27.0-28.5 mm S.L.), Gulf of Aden.
4. 1963.12.9.36-55 (34 : 33.5-57.0 mm S.L.), Gulf of Aden.
5. 1965.4.1.142 (1 : 63.0 mm S.L.), Saikong, Hong Kong.
6. 1965.4.1.159-161 (3 : 53.0-67.0 mm S.L.), Saikong, Hong Kong.
7. 1965.4.1.162-176 (14 : 51.0-63.0 mm S.L.), Taipo, Hong Kong.
8. 1965.8.12.1-12 (12 : 45.0-55.0 mm S.L.), Philippines.
9. 1965.10.20.25-29 (5 : 52.0-54.0 mm S.L.), Tegal, Java.
10. 1965.10.20.30-34 (5 : 49.0-54.0 mm S.L.), Kramad, Java.
11. 1965.10.20.35-36 (2 : 28.0-43.5 mm S.L.), Indramaju, Java.
12. 1965.10.20.37-41 (5 : 32.0-34.0 mm S.L.), Kramad, Java.
13. 1967.3.4.23-32 (10 : 36.5-51.5 mm S.L.), Waltair.
14. 1967.11.13.408-413 (6 : 28.0-44.0 mm S.L.), Singapore.
15. 1967.11.13.420 (1 : 51.5 mm S.L.), Singapore.
16. 1967.11.13.428-433 (6 : 44.5-61.0 mm S.L.), Singapore.
17. 1967.11.20.423-425 (4 : 46.0-56.0 mm S.L.), Singapore.
18. 1969.4.22.446-455 (12 : 53.0-59.0 mm S.L.), Prachuab-kirikhan, Thailand.
19. 1969.4.22.467-469 (3 : 43.0-59.0 mm S.L.), Pangna, Thailand.
20. 1969.4.22.470-478 (9 : 46.0-71.0 mm S.L.), Chumporn, Thailand.
21. 1969.4.22.479-491 (31 : 46.0-60.0 mm S.L.), Prachuab-kirikhan, Thailand.
22. 1969.4.22.492-496 (5 : 58.0-66.5 mm S.L.), Chumporn, Thailand.
23. 1969.4.22.498-502 (5 : 59.0-62.5 mm S.L.), Madras.
24. 1969.4.22.518-531 (33 : 51.0-67.0 mm S.L.), Thailand.
25. 1969.4.22.538 (1 : 54.0 mm S.L.), Prachuab-kirikhan, Thailand.

26. BMNH 1969.4.22.584-588 (5 : 56.0-66.5 mm S.L.), Manila Bay.

27. 1969.4.22.620-622 (3 : 64.0-68.5 mm S.L.), Manila Bay.

28. 1969.4.22.648-660 (24 : 61.0-75.0 mm S.L.), Lemne I., Hong Kong.

29. 1969.4.22.661-671 (16 : 59.0-76.0 mm S.L.), Hong Kong.

30. 1969.4.22.672-677 (3 : 48.0-56.0 mm S.L.), India.

31. 1969.4.22.687-693 (7 : 71.0-77.0 mm S.L.), Madras.

32. 1969.4.22.725-735 (14 : 48.0-62.0 mm S.L.), Waltair.

33. 1969.4.22.747-756 (11 : 45.5-76.0 mm S.L.), Madras.

34. 1969.4.22.780-783 (4 : 65.0-75.0 mm S.L.), Ceylon.

35. 1969.4.22.784-795 (21 : 35.0-49.0 mm S.L.), Sipitang, Sabah.

36. 1969.4.22.796-809 (29 : 42.0-50.0 mm S.L.), Sabah.

37. 1969.4.22.925 (1 : 59.5 mm S.L.), Gulf of Thailand.

38. 1970.6.2.33-39 (7 : 53.5-61.5 mm S.L.), Dubai, Persian Gulf.

39. 1970.10.2.37-39 (3 : 52.5-56.0 mm S.L.), Trucial States.

40. 1971.2.8.113-117 (6 : 50.0-56.0 mm S.L.), Bougainville.

41. 1971.8.26.3-4 (2 : 36.5-49.0 mm S.L.), New Guinea.

42. 1974.5.25.145-147 (3 : 49.0-52.0 mm S.L.), Madang Harbour, New Guinea.

43. 1977.9.8.61-71 (11 : 59.0-64.0 mm S.L.), Java Sea.

44. 1977.11.30.31-43 (13 : 50.5-60.0 mm S.L.), Rayong, Thailand.

45. 1977.11.30.44-46 (3 : 41.0-45.0 mm S.L.), Chantaburi, Thailand.

46. 1977.11.30.47-62 (16 : 30.5-48.5 mm S.L.), Prachuab-kirikhan, Thailand.

47. 1977.11.30.87-106 (17 : 30.0-41.0 mm S.L.), Rayong, Thailand.

48. 1979.8.16.738-739 (2 : 65.0-68.5 mm S.L.), Hong Kong.

49. 1979.8.16.740-743 (4 : 61.0-70.0 mm S.L.), Prachuab-kirikhan, Thailand.

50. 1979.8.16.744 (1 : 72.0 mm S.L.), Hong Kong.

Diagnosis:- Evidently the most common species of Stolephorus, sharing many important characters with S. heterolobus as indicated in the key, but principally differing from it in having iii unbranched dorsal and anal rays (tbl. 12), tip of depressed pelvics reaching slightly beyond origin of dorsal; hind portion of maxilla, from posterior tip of 2nd supramaxilla, about as long as broad (pl. 222j), and usually with some enlarged teeth on ventral edge of maxilla.

Remarks:- See also those for S. heterolobus.

It is worth recording that in counting the unbranched dorsal and anal rays of these two and other species, the sharp edge of a scalpel is the most practical tool for observing and separating the tiny first unbranched ray, which is firmly attached to the front base of the longer second one.

I have been unable to study the two syntypes of A. devisi (AMS. IB. 610, 39.3-41.5 mm S.L.), but according to unpublished data and sketch drawing supplied by Dr P.J.P. Whitehead they agree perfectly in the most important characters with my present specimens, in particular in the presence of a urohyal plate, several enlarged teeth on maxilla, dorsal iii 11-12, anal iii 15-16 and gillrakers 17-18+20-22.

Distribution:- Gulf of Oman to S. China Sea, Papua New Guinea and northern coast of Australia.

98. Stolephorus indicus (van Hasselt, 1823)
(Plates 194a-e, 195a-e, 220e-h; Figures 29A, 109, 112; Tables 12, 12.1)

Engraulis indica van Hasselt, 1823, Algemeene Konst-en Letter-bode, 1 (23) : 329 (Java, on Nattoo of Russell, 1803, Fishes of Coromandel, 2 : 71 pl. 187).

Engraulis albus Swainson, 1839, Nat. Hist. Anim., 2 : 293 (on Nattoo of Russell, 1803, Fishes of Coromandel, 2 : 71, pl. 187).

Engraulis baliensis Bleeker, 1849, Verh. batav. Genoot, Kunst. Wet., 22 : 11 (Boleling, Bali) (in synonymy of Stolephorus indicus).

Engraulis brownii Cantor, 1850, J. Asiatic Soc. Bengal, 18 : 1285 (Malay Peninsula and islands) (not Atherina brownii Gmelin).

Engraulis russellii Bleeker, 1852, Natuurk. Tijdschr. Ned.-Indië, 2 : 472 (Rio, name only); Bleeker, 1852, Verh. batav. Genoot. Kunst. Wet., 24 : 38 (Batavia, Samarang, Boleling, Bali).

Engraulis samaminan Montrouzier, 1857, Fauna Woodlark : 208 (Woodlark I. = Moiou I.).

Engraulis carpentariae (part) Devis, 1882, Proc. Linn. Soc. N.S. W. , 7 : 320 (Norman river, Gulf of Carpentaria).

Stolephorus insularum Jordan & Seale, 1926, Bull. Mus. comp. Zool. Harvard, 67 (11) : 381 (Tahiti).

Stolephorus extensus Jordan & Seale, ibid. : 382 (Mauritius).

Specimens examined (256 : 28.0-153.0 mm S.L.)

Types:

1. BMNH 1860.3.19.440-441 (2 : 63.0-120.0 mm S.L.), Malay Peninsula. Syntypes of E. brownii (left side dried skins).
2. RMNH 7076 (1 : 121.0 mm S.L.), E. Indies. Lectotype of E. russellii.
3. BMNH 1867.11.28.57 (1 : 118.0 mm S.L.), E. Indies. Syntype of E. russellii.
4. QM I. 111/113 (2 : 56.0-56.5 mm S.L.), Brisbane. Types of E. carpentariae.
5. MCZ 17936 (1 : 71.0 mm S.L.), Society Is., Tahiti. Holotype of S. insularum.
6. 6133 (1 : 82.0 mm S.L.), Mauritius. Holotype of S. extensus.
7. 31542 (2 : 72.0-85.0 mm S.L.), Mauritius. Paratypes of S. extensus.

Other specimens:

8. BMNH 1858.4.21.357 (1 : 113.0 mm S.L.), Amboina.
9. 1868.5.30.86 (1 : 43.5 mm S.L.), Zanzibar.
10. 1869.1.29.72-73 (2 : 49.0-55.5 mm S.L.), Zanzibar.
11. 1889.2.1.1814 (1 : 111.0 mm S.L.), Malabar.
12. 1889.2.1.1817-1822 (6 : 51.0-56.5 mm S.L.), Chillumbar, India.

13. BMNH 1889.8.17.23 (1 : 54.0 mm S.L.), Madras.

14. 1907.3.20.1 (1 : 77.0 mm S.L.), Bulan, Philippines.

15. 1909.2.25.6-7 (2 : 95.0-101.0 mm S.L.), Tahiti.

16. 1913.4.7.9-10 (2 : 76.0-85.0 mm S.L.), Mombasa.

17. 1922.2.9.1 (1 : 68.5 mm S.L.), Delagoa Bay.

18. 1933.3.11.21.2 (2 : 86.0-92.0 mm S.L.), Cebu, Philippines.

19. 1965.4.1.980 (1 : 28.0 mm S.L.), Saikong, Hong Kong.

20. 1965.8.12.42 (1 : 40.0 mm S.L.), Philippines.

21. 1965.10.20.13 (1 : 66.5 mm S.L.), Bali.

22. 1966.1.17.120-123 (4 : 84.0-91.0 mm S.L.), Palau, Caroline Is.

23. 1966.3.8.1 (1 : 90.0 mm S.L.), Gulf of Thailand; mixed with a specimen of S. chinensis, 78.0 mm S.L.

24. 1966.11.16.930-932 (3 : 85.5-97.0 mm S.L.), Mombasa.

25. 1967.11.13.571 (1 : 39.0 mm S.L.), Singapore.

26. 1967.11.20.98 (1 : 123.0 mm S.L.), 16°40'S : 43°41'E.

27. 1968.4.4.53-67 (15 : 18.0-31.0 mm S.L.), Nosy Bay, Madagascar.

28. 1969.4.22.7-14 (8 : 43.0-101.0 mm S.L.), Krangi, Singapore.

29. 1969.4.22.15-17 (3 : 107.0-120.0 mm S.L.), Singapore.

30. 1969.4.22.25-29 (5 : 52.0-86.0 mm S.L.), Singapore.

31. 1969.4.22.30-35 (6 : 88.0-119.0 mm S.L.), Singapore.

32. 1969.4.22.36-41 (5 : 77.0-105.0 mm S.L.), Singapore.

33. 1969.4.22.55-67 (23 : 31.0-72.0 mm S.L.), Singapore.

34. 1969.4.22.68-77 (10 : 50.0-54.0 mm S.L.), Singapore.

35. 1969.4.22.95-104 (12 : 54.0-73.0 mm S.L.), Luzon, Philippines.

36. 1969.4.22.105-107 (3 : 78.0-84.0 mm S.L.), Manila Bay.

37. 1969.4.22.127-136 (12 : 54.0-111.0 mm S.L.), Tablas, Philippines

38. 1969.4.22.168-170 (3 : 44.0-76.0 mm S.L.), Hong Kong.

39. 1969.4.22.171 (1 : 68.0 mm S.L.), Hong Kong.

40. 1969.4.22.172-173 (2 : 71.0-73.0 mm S.L.), Hong Kong.

41. 1969.4.22.174-175 (2 : 109.0-110.0 mm S.L.), Trad, Thailand.

42. 1969.4.22.176-177 (2 : 85.0-90.0 mm S.L.), Prachuab-kirikhan, Thailand.

43. BMNH 1969.4.22.178-179 (2 : 146.0-153.0 mm S.L.), Hong Kong.

44. 1969.4.22.257-262 (6 : 79.0-83.0 mm S.L.), Kerala, India.

45. 1969.4.22.274 (1 : 77.0 mm S.L.), Kerala, India.

46. 1969.4.22.308 (1 : 71.5 mm S.L.), Mindanao.

47. 1969.8.19.43 (1 : 29.0 mm S.L.), Vizhingium, India.

48. 1970.5.27.6-7 (2 : 83.0-91.0 mm S.L.), Samoa.

49. 1970.10.2.54-61 (8 : 58.0-105.0 mm S.L.), Trucial States.

50. 1971.8.25.97-100 (3 : 99.0-102.0 mm S.L.), Society Is.

51. 1972.9.7.47 (1 : 66.0 mm S.L.), Gasmata I.

52. 1974.5.25.142-143 (1 : 59.0 mm S.L.), Madang, New Guinea; another specimen, 23.0 mm S.L., is a percoid fish.

53. 1976.4.27.17 (1 : 119.0 mm S.L.), Hong Kong.

54. 1977.1.18.5-9 (5 : 80.0-102.0 mm S.L.), Pago Pago, Samoa.

55. 1977.6.17.6 (1 : 115.0 mm S.L.), Gulf of Oman.

56. 1977.9.8.72 (1 : 91.0 mm S.L.), Java Sea.

57. 1977.11.30.129-130 (2 : 55.0-59.0 mm S.L.), Chantaburi, Thailand.

58. 1977.11.30.131-142 (12 : 32.0-43.5 mm S.L.), Chantaburi, Thailand.

59. 1977.11.30.143-144 (2 : 46.5-55.0 mm S.L.), Cholburi, Thailand.

60. 1979.8.16.829 (1 : 76.0 mm S.L.), Visakhapatnam, India.

61. 1979.8.16.830-831 (2 : 77.0-78.5 mm S.L.), Penang.

62. 1979.8.17.23-24 (2 : 122.0-125.0 mm S.L.), Phuket I., Thailand.

63. MNHN 3728 (1 : 130.0 mm S.L.), Batavia.

64. RMNH 23363 (32 : 42.1-115.0 mm S.L.), E. Indies; P. Bleeker.

65. USNM uncat. (1 : 118.0 mm S.L.), Palawan, Philippines.

66. uncat. (3 : 24.5-34.0 mm S.L.), east side of Daru Wharf, Gulf of Papua.

67. uncat. (9 : 29.5-41.0 mm S.L.), west side of Daru Wharf, Gulf of Papua.

Diagnosis:- A species of subcylindrical Stolephorus, chiefly characterized by having a short maxilla which reaches to or only slightly beyond the anterior border of the preoperculum; anal origin usually below base of 8th-11th dorsal ray; pelvics entirely before origin of dorsal; lateral scales usually 38-42; and pelvic scutes 4-6.

Remarks:- The largest of all known Stolephorus, it reaches a length of 153 mm S.L.

Engraulis samaminan Montrouzier from Woodlark I. is here considered identical to S. indicus, principally on the basis of "une ligne argentée bleuâtre sur les flancs... Le ventre n'est ni tranchant ni dentelé; les pectorales placées bas; les ventrales en avant de la dorsale; l'anale, qui commence vers le milieu de la dorsale". The absence of ventral scutes was probably due to cursory examination since they are not always obvious. The pelvic position rules out Engraulis.

The two syntypes of E. carpentariae (QM. I. 111/113) are undoubtedly S. indica, since the maxilla tip is said to end before the posterior border of the preoperculum (and other minor features). Another syntype (AMS. I. 377) which was studied, figured (fig. 10) and claimed as lectotype of E. carpentariae by Whitley (1940), is probably a different species. Judging from its maxilla, which reached to the posterior edge of the suboperculum, and its six prepelvic scutes, that specimen is probably S. waitei. Whitley (loc. cit.) distinguished it from S. waitei, but also suggested the possibility of it being the adult form of that fish.

Phyletically, S. indicus may be considered to be an annectant form between the four previous species and the rest of Stolephorus. With S. purpureus, S. buccaneeri, S. heterolobus and S. devisi it shares many common characters, e.g. a cylindrical body shape, few anal rays; short maxilla, few striations on scales; high count of lateral scale series; relatively long pectoral axillary scale; long fundus of stomach; elongated pyloric stomach; close apposition of anus and posterior end of gas bladder and slightly produced posterior portions of 1st and 3rd suborbital bones. To the rest of Stolephorus it is more or less similar in, e.g. the advanced position of the anal and pelvics, 3 branchiostegal rays on posterior ceratohyal (only with S. commersonii, S. brachycephalus, S. chinensis and S. waitei); thread-like anterior half of gas bladder; uncoloured pyloric caeca; and the silvery band along flanks remains in preserved specimens (changing to dark in the four previous species).

Distribution:- East coast of Africa, Mauritius to S.E. Asia, Hong Kong, Papua New Guinea, Australia, Samoa and Tahiti.

99. Stolephorus commersonii Lacepède, 1803

(Plates 196a-d, 197a-e, 220i-k; Figures 29D, 109, 112; Tables 12, 12.1)

Stolephorus commersonii Lacepède, 1803, Hist. Nat. Poiss., 5 : 381, pl. 12 (1) (Mauritius, on Commerson's notes and drawing by Jossigny).

? Clupea vittargentea Lacepède, ibid. : 424, 458 (Mauritius, on Commerson MS).

Anchovia apiensis Jordan & Seale, 1906, Bull. Bur. Fish., 25 : 187 (Apia, Samoa).

Stolephorus rex Jordan & Seale, 1926, Bull. Mus. comp. Zool. Harvard, 67 (11) : 380 (Canara).

Specimens examined (217 : 23.4-99.0 mm S.L.)

Types:

1. USNM 51720 (1 : 62.0 mm S.L.), Apia, Samoa. Holotype of A. apiensis.
2. MCZ 4318 (1 : 106.0 mm S.L.), Canara. Holotype of S. rex.

Other specimens:

3. BMNH 1852.9.13.177 (1 : 96.5 mm S.L.), N.E. Arabian Sea.
4. 1867.3.7.611 (1 : 87.0 mm S.L.), Zanzibar.
5. 1889.2.1.1811 (1 : 91.0 mm S.L.), Madras.
6. 1889.2.1.1813 (1 : 99.0 mm S.L.), Malabar.
7. 1933.3.11.838 (1 : 93.0 mm S.L.), Hong Kong.
8. 1960.4.17.116-131 (16 : 60.0-73.0 mm S.L.), Mindanao.
9. 1964.12.14.325 (1 : 89.0 mm S.L.), Pangani estuary, Tanzania.

labelled as suitable for neotype of S. commersonii by Dr P.J.P. Whitehead.

10. BMNH 1964.12.14.326-327 (2 : 79.0-84.0 mm S.L.), Pangani estuary, Tanzania.

11. 1965.10.20.1-2 (2 : 80.5-81.0 mm S.L.), Tegal, Java.

12. 1965.10.20.3-5 (3 : 64.0-69.0 mm S.L.), Tijilatjab, Java.

13. 1966.1.17.134 (1 : 38.0 mm S.L.), Cavite, Philippines.

14. 1966.11.16.459-461 (3 : 75.0-85.0 mm S.L.), Mombasa.

15. 1967.3.4.19-22 (4 : 59.0-70.0 mm S.L.), India.

16. 1967.11.13.560-561 (2 : 63.0-92.0 mm S.L.), Singapore.

17. 1967.11.13.562-565 (2 : 81.0-84.0 mm S.L.), Singapore.

18. 1967.11.20.89 (1 : 85.0 mm S.L.), 13°22'S : 48°18'E.

19. 1967.11.20.90 (1 : 88.5 mm S.L.), Phuket I., Thailand.

20. 1969.4.22.155-167 (24 : 44.0-55.5 mm S.L.), Mindanao.

21. 1969.4.22.180 (1 : 49.0 mm S.L.), Visakhapatnam, India.

22. 1969.4.22.272 (1 : 74.0 mm S.L.), Prachuab-kirikhan, Thailand.

23. 1969.4.22.273 (1 : 70.0 mm S.L.), Kerala, India.

24. 1969.4.22.275-276 (2 : 57.0-75.0 mm S.L.), Madras.

25. 1969.4.22.277-279 (3 : 63.0-64.0 mm S.L.), Kerala.

26. 1969.4.22.280 (1 : 59.5 mm S.L.), Songkhla, Thailand.

27. 1969.4.22.289-298 (10 : 57.0-70.0 mm S.L.), Mindanao.

28. 1969.4.22.299-307 (11 : 62.0-76.0 mm S.L.), Mindanao.

29. 1969.4.22.331-332 (2 : 69.0-69.5 mm S.L.), Manila Bay.

30. 1969.4.22.1653-1657 (5 : 36.0-42.0 mm S.L.), Luzon, Philippines.

31. 1971.8.25.110-111 (2: 59.0-60.0 mm S.L.), Fiji.

32. 1972.9.7-39 (1 : 73.0 mm S.L.), Abling Harbour.

33. 1972.9.7.44 (1 : 82.0 mm S.L.), Gasmata I.

34. 1973.4.5.22-23 (2 : 90.0-91.0 mm S.L.), Phuket I., Thailand.

35. 1974.5.25.144 (1 : 75.0 mm S.L.), Port Moresby, New Guinea.

36. 1974.9.25.1-9 (9 : 53.0-59.0 mm S.L.), Ponape, Calorine Is.

37. 1977.11.30.22-24 (3 : 56.5-59.0 mm S.L.), Chantaburi, Thailand.

38. BMNH 1977.11.30.25-29 (5 : 49.0-56.0 mm S.L.), Songkhla, Thailand.

39. 1977.11.30.30 (1 : 58.0 mm S.L.), Chantaburi, Thailand.

40. 1979.7.5.27 (1 : 85.0 mm S.L.), Penang.

41. USNM uncat. (32 : 23.4-26.4 mm S.L.), Luzon, Philippines.

42. uncat. (53 : 18.0-42.0 mm S.L.), east side of Daru Wharf, Gulf of Papua.

Diagnosis:- A common species of Stolephorus, with rounded ventroposterior edge of preoperculum; maxilla tip reaching to posterior border of preoperculum or slightly beyond; tip of depressed pelvics reaching to below dorsal origin or slightly beyond; anal rays usually 21-23; pectoral rays usually 13-15, its tip clearly before pelvic base; lateral scales usually 36-37; gillrakers 12-27+21-35; branchiostegal rays usually 12-13, 3 rays on posterior ceratohyal; teeth on palatine and pterygoids slightly developed; a prominent dusky patch just behind occiput and continuing as a dusky band to dorsal origin.

Remarks:- The presence of teeth on the upper edge of the anterior ceratohyal and dorsal hypohyal is very interesting but it needs to be confirmed with more specimens. Such teeth are not unknown in clupeoid fishes. They occur on small tooth plates on the upper edge of the anterior ceratohyal in the South American freshwater anchovy Pterengraulis atherinoides (Whitehead, 1973a : 183, fig. 72) and fleshy projections are found in the same place in both Sardina and Sardinops.

In many respects, S. commersonii and S. waitei (= S. bataviensis of authors) are much alike and both are common in catches. I have found that the presence of a dusky patch just behind the occiput, followed by a dusky band to dorsal origin, in S. commersonii is a character that can be readily used to differentiate it from S. waitei. Furthermore, the portion of the maxilla behind the 2nd supra-maxilla is robust in S. commersonii (pl. 196c), but it is slender in S. waitei (pl. 202c). In addition to this, the posterior frontal fontanelles in S. waitei are relatively smaller and pointed anteriorly (pl. 221a-d) whereas at a given size they are larger and bluntly pointed anteriorly (pl. 220i-k) in S. commersonii.

The gillraker count of the fish from Ponape (BMNH. 1974.9.25.1-9) is extremely high (25-27+32-35) (fig. 109) when compared with counts (18-22+23-28) in specimens from other places. However, such an unusual count (22-23+30-31) has been observed also in two specimens from Fiji (BMNH. 1971.8.25.110-111). Among other material, two lots of specimens from Mindanao, Philippines (BMNH. 1969.4.22.155-167 and 1969.4.22.289-298) show an intermediate count of gillrakers (19-21+25-28 and 20-23+25-30). It seems likely that gillrakers in this fish show a clinal increase, graduating from the centre of its distribution in the Southeast Asia to Fiji and Ponape. Due to the paucity of specimens from many areas in between, and since the gillraker counts of Papua New Guinea specimens are normal, I cannot yet confirm this finding.

Distribution:- Mauritius, Zanzibar, India, S. China Sea, New Guinea and Samoa.

100. *Stolephorus brachycephalus* n. sp.

(Plates 198a-d, 199a-d, 221e-f; Figures 29C, 109, 112; Tables 12, 12.1)

Specimens examined (15 : 27.0-42.0 mm S.L.)

Types:

1. BMNH 1979.3.21.447 (1 : 42.0 mm S.L.), east side of Daru Wharf, Gulf of Papua; T. Roberts. Holotype.
2. 1979.3.21.448-452 (5 : 27.0-37.0 mm S.L.), same data as in 1. Paratypes.
3. USNM uncat. (8 : 27.2-29.4 mm S.L.), same data as in 1. Paratypes.

Other specimens:

4. BMNH 1979.8.16.828 (1 : 37.0 mm S.L.), same data as in 1.

Diagnosis:- A new species of *Stolephorus*, closely related to *S. commersonii* in having a rounded posteroventral edge to the preoperculum; 3 branchiostegal rays or posterior ceratohyal; tip of depressed pelvics reaching to below base of 1st to 3rd dorsal ray; and a small elongate patch of teeth on pterygoids. From that species it differs in having the maxilla tip reaching to or just beyond the posterior edge of the suboperculum; anal rays usually 23-24 (cf. 21-23); pectoral rays usually 12-13 (cf. 13-15), tip of longest ray very slightly before pelvic base; lateral scales 34-35 (cf. usually 36-37), predorsal scales 16-17 (cf. usually 18-19), prepelvic scutes usually 4-5 (cf. 2-3), branchiostegal rays 10-11 (cf. usually 12-13); no teeth on upper edge of anterior ceratohyal and dorsal hypohyal (pl. 199b); 1st and 3rd suborbital bones with longer posterior extension (pl. 199a); and no dusky band on midline of back before dorsal origin.

Remarks:- The fifteen small and presumably young specimens that form the basis for the diagnosis of this new fish came from a single collection which included young specimens of S. indicus (three fishes), S. commersonii (fifty-three fishes) and S. tysoni n. sp. (six fishes). I cannot find any difference between its gillraker count (15-17+20-22) (fig. 109) and that of S. commersonii (17-27+21-35), but I suspect that the count remains low in adults. Study of scales in this fish was impossible because all were shed.

Interestingly, S. brachycephalus is the only member of the subgroup (6A, see key) that has the tip of the maxilla (in immature fish, 31.0-42.0 mm S.L.) extending slightly beyond the posterior edge of the suboperculum and in having a tendency to a higher count of anal rays (tbl. 12).

Named for its short and relatively broader head, which struck me at first glance.

Distribution:- Gulf of Papua.

101. Stolephorus chinensis (Günther, 1880)

(Plates 200a-d, 201a-e, 221g-i; Figures 29C, 109, 112; Tables 12, 12.1)

Engraulis chinensis Günther, 1880, Rep. Voy. Challenger, 1 : 73 (Amoy).

Specimens examined (37 : 45.0-89.0 mm S.L.)

Types:

1. BMNH 1860.7.20.103-106 (3 : 84.0-89.0 mm S.L.), Swinhow, Amoy, China. Types of E. chinensis.

Other specimens:

2. BMNH 1966.3.8.1 (1 : 78.0 mm S.L.), Gulf of Thailand; mixed with a specimen of S. indicus, 90.0 mm S.L.
3. 1966.11.20.6 (1 : 62.0 mm S.L.), Chantaburi, Thailand.
4. 1967.11.13.564-566 (3 : 60.5-72.0 mm S.L.), Singapore.
5. 1967.11.13.567 (1 : 64.0 mm S.L.), Ponygod, Singapore.
6. 1967.11.13.568-569 (2 : 55.5-63.0 mm S.L.), Pony, Singapore.
7. 1967.11.13.570 (1 : 59.0 mm S.L.), Singapore.
8. 1967.11.13.572-574 (3 : 45.0-59.5 mm S.L.), Singapore.
9. 1967.11.13.575 (1 : 63.5 mm S.L.), Singapore.
10. 1967.11.13.576 (1 : 52.0 mm S.L.), Singapore.
11. 1967.11.13.577-578 (2 : 54.0-56.0 mm S.L.), Singapore.
12. 1967.11.13.579 (1 : 59.0 mm S.L.), Singapore.
13. 1967.11.13.580 (1 : 50.0 mm S.L.), Singapore.
14. 1969.4.22.351-353 (3 : 49.0-64.0 mm S.L.), Songkhla Lake, Thailand.
15. 1969.4.22.354-356 (3 : 71.0-80.0 mm S.L.), Hong Kong.
16. 1969.5.30.89-92 (4 : 49.0-59.0 mm S.L.), Gulf of Thailand.
17. 1976.4.27.19-24 (6 : 43.0-73.0 mm S.L.), Hong Kong.

Diagnosis:- A species of Stolephorus, with rounded posteroventral edge to preoperculum, 3 branchiostegal rays on posterior ceratohyal. It is close to S. waitei in having the pelvic tip reaching about half to three-fourths of eye diameter before dorsal origin; a patch of teeth on palatine and pterygoids fairly well developed; and without markings on back. However, it differs from that species especially in the higher count of gillrakers 18-19+26-27 (cf. 14-17+19-24) (fig. 109); its 1st and 3rd suborbital bones have a short posterior extension (pl. 201a); and the posterior frontal fontanelles are relatively larger and bluntly pointed anteriorly (fig. 221g-i).

Remarks:- The presence of teeth on the anterior ceratohyal (pl. 201b) should be confirmed with more specimens before it is accept as a specific character. In this, it resembles *S. commersonii*.

Distribution:- S. China Sea to Amoy, China.

102. *Stolephorus waitei* Jordan & Seale, 1926

(Plates 202a-d, 203a-e, 221a-d; Figures 29D, 109, 112; Tables 12, 12.1)

Stolephorus waitei Jordan & Seale, 1926, Bull. Mus. comp. Zool. Harvard, 67 (11) : 380 (Queensland).

Stolephorus insularis (part) Hardenberg, 1933, Natuurk. Tijdschr. Ned.-Indië, 93 (2) : 260 (Java, Lingga, Bawean, Kangean, Moluccas).

Stolephorus insularis bataviensis Hardenberg, ibid. : 261 (Batavia).

Specimens examined (276 : 34.0-94.0 mm S.L.)

Types:

1. MCZ 18254 (1 : 89.0 mm S.L.), Queensland. Holotype of *S. waitei*.

Other specimens:

2. ANSP 61756-61759 (4 : 51.0-53.0 mm S.L.), Sriracha, Thailand.
3. 61762 (1 : 67.0 mm S.L.), Paknam, Thailand.
4. BMNH 1860.3.19.845-846 (2 : 75.0-75.5 mm S.L.), Ceylon.
5. 1889.2.1.1812 (1 : 94.0 mm S.L.), Madras.
6. 1960.4.7.65-70 (6 : 68.0-69.0 mm S.L.), Cavite, Philippines.
7. 1965.8.12.24 (1 : 51.0 mm S.L.), Philippines.
8. 1965.10.20.6-10 (5 : 53.0-63.0 mm S.L.), Tegal, Java.
9. 1965.10.20.11-12 (2 : 64.0-67.0 mm S.L.), Tegal, Java.
10. 1966.1.17.135-142 (8 : 49.0-59.0 mm S.L.), Cavite, Philippines.
11. 1967.3.4.53-55 (3 : 51.0-56.0 mm S.L.), east coast of India.
12. 1967.11.13.581-583 (3 : 54.0-60.0 mm S.L.), Tambak, Singapore.
13. 1967.11.20.101-106 (6 : 56.0-65.0 mm S.L.), N.E. of the Bay of Bengal.

14. BMNH 1969.2.28.32 (1 : 71.0 mm S.L.), Pakpoon, Thailand.

15. 1969.4.22.814 (1 : 45.0 mm S.L.), India.

16. 1969.4.22.815-824 (11 : 56.0-66.0 mm S.L.), Madras.

17. 1969.4.22.825-834 (10 : 54.5-68.0 mm S.L.), Kerala, India.

18. 1969.4.22.835-847 (25 : 37.0-58.0 mm S.L.), Kerala, India.

19. 1969.4.22.848-851 (4 : 50.0-59.5 mm S.L.), Waltair.

20. 1969.4.22.887 (1 : 59.5 mm S.L.), Singapore.

21. 1969.4.22.888-893 (6 : 54.0-65.0 mm S.L.), Singapore.

22. 1969.4.22.894 (1 : 61.0 mm S.L.), Singapore.

23. 1969.4.22.895-903 (9 : 34.0-36.0 mm S.L.), Singapore.

24. 1969.4.22.909-913 (5 : 45.0-51.5 mm S.L.), Madras.

25. 1969.4.22.915 (1 : 73.0 mm S.L.), Kerala, India.

26. 1969.4.22.916-917 (2 : 44.0-49.0 mm S.L.), Prachuab-kirikhan, Thailand.

27. 1969.4.22.918-924 (7 : 54.0-68.0 mm S.L.), Gulf of Thailand.

28. 1969.4.22.926-936 (16 : 66.0-78.0 mm S.L.), Surajthani, Thailand.

29. 1969.4.22.937-949 (28 : 57.0-75.5 mm S.L.), Pangan, Thailand.

30. 1969.4.22.961-973 (25 : 55.0-77.0 mm S.L.), Surajthani, Thailand.

31. 1969.4.22.974-978 (5 : 62.0-66.0 mm S.L.), Tablas I., Philippines.

32. 1969.4.22.980-989 (13 : 57.0-65.0 mm S.L.), Manila Bay.

33. 1969.4.22.1004-1008 (5 : 54.0-63.0 mm S.L.), Cavite, Philippines.

34. 1969.4.22.1031 (1 : 59.0 mm S.L.), Philippines.

35. 1969.4.22.1071-1074 (4 : 62.0-71.0 mm S.L.), Cavite, Philippines.

36. 1969.4.22.1075-1086 (19 : 58.0-66.5 mm S.L.), Manila Bay.

37. 1969.5.30.29 (1 : 50.0 mm S.L.), Madras.

38. 1969.8.19.42 (1 : 39.0 mm S.L.), Vizhingium, India.

39. 1972.9.7.40-43 (4 : 45.0-54.0 mm S.L.), El Bay.

40. BMNH 1977.9.8.54-60 (6 : 59.5-65.0 mm S.L.), 06°03'S : 114°30'E.
41. 1977.11.30.1-3 (3 : 53.0-63.0 mm S.L.), Chantaburi, Thailand.
42. 1977.11.30.4-6 (3 : 67.5-71.0 mm S.L.), Surajthani, Thailand.
43. 1977.11.30.7-11 (5 : 75.0-79.0 mm S.L.), Cholburi, Thailand.
44. 1977.11.30.12-18 (7 : 52.0-67.0 mm S.L.), Cholburi, Thailand.
45. 1977.11.30.19-21 (3 : 48.0-55.5 mm S.L.), Cholburi, Thailand.

Diagnosis:- One of the most common species of *Stolephorus*, with rounded posteroventral edge to the preoperculum; 3 branchiostegal rays on posterior ceratohyal (pl. 103b); tip of pelvics reaching to a short distance before origin of dorsal; 1st and 3rd suborbital bones with produced posterior extension (pl. 203a); portion of maxilla from behind 2nd supramaxilla elongated (pl. 202c); posterior frontal fontanelles greatly reduced in size with age and greatly tapering anteriorly (pl. 221a-d); patch of teeth on palatine and pterygoids fairly well developed; gillrakers 14-17+19-24 (fig. 109); and no markings on midline of back (except a faint dusky patch just behind occiput) the snout and anterior half of the lower jaw spotted with dusky black.

Remarks:- It is interesting that in some specimens the posteroventral edge of the preoperculum is slightly concave. This tendency seems to relate the fish to the subgroup includes *S. holodon*, *S. andhraensis*, *S. tysoni* n. sp. and *S. ronquilloi* n. sp. Are these aberrant fishes the result of hybridization with a member of that group? Again, the tip of the pelvic fin may reach to below the anteriormost dorsal rays or the tip of the pectorals may almost reach the pelvic base, neither of which is the case in typical fishes.

These variations within the species are not, however, in the direction of Hardenberg's (1933b) *S. insularis*, but they may help to explain Hardenberg's describing several subspecies. The several names and their diagnoses that Hardenberg made for his fishes are by no means easy to interpret without his material and the former name for this species, *S. bataviensis*, is still problematic in many respects, since the types are believed to have been lost during the war. Fortunately, the type of S. waitei (MCZ. 18254) is clearly identical in most important characters with specimens hitherto accepted as S. bataviensis and it must take priority, therefore, over that name.

Distribution:- S.W. coast of India to S.E. Asia and Queensland.

103. Stolephorus holodon (Boulenger, 1900)

(Plates 204a-d, 205a-e, 222b-c; Figures 30A, 110, 112; Tables, 12, 12.1)

Engraulis holodon Boulenger, 1900, Mar. Invest. S. Afr., No. 8 : 12, fig. 3 (Zwartkops river, Algoa Bay, S. Africa).

Specimens examined (27 : 22.0-78.5 mm S.L.)

Types:

1. BMNH 1898.12.17.7-8 (2 : 40.0-42.0 mm S.L.), Algoa Bay. Syntypes of E. holodon.

Other specimens:

2. BMNH 1919.4.1.3 (1 : 56.0 mm S.L.), Durban, Natal.
3. 1919.9.12.7 (2 : 65.0-78.5 mm S.L.), Durban.
4. 1969.2.27.4-5 (2 : 65.0-70.0 mm S.L.), Durban.
5. 1970.10.22.15-22 (8 : 29.0-34.0 mm S.L.), Mozambique.
6. 1970.10.22.23-24 (2 : 29.0-40.5 mm S.L.), Mozambique.
7. 1970.10.22.25-28 (4 : 22.0-39.0 mm S.L.), Mozambique.
8. 1979.8.17.8-13 (6 : 34.0-57.0 mm S.L.), S.E. coast of Africa.

Diagnosis:- An African species of Stolephorus, characterized by having a concave posteroventral edge to the preoperculum (pl. 209e 1); pelvic tip reaching to below dorsal origin or at most two-thirds of pupil diameter before it; 1st and 3rd suborbital bones with short posterior extension (pl. 205a); lateral scales 38-40, predorsal scales 19-20; prepelvic scutes usually 7; 2 branchiostegal rays on posterior ceratohyal; gillrakers 17-22+24-29 (fig. 110); and no distinctive markings on midline of back.

Remarks:- The high gillraker count suggests that it is nearer to S. ronquillo n. sp. of the Philippines than to other members of the same subgroup (6B, see key), although zoogeographically this seems unlikely.

The original figure for this species given by Boulenger (1900) lacks the pelvic fins and has 9 ventral scutes, the last of which is placed just before the anal origin, although they were described as "extending between pectorals and ventrals" and they are as such in the type specimens.

Distribution:- S.E. coast of Africa.

104. Stolephorus andhraensis Babu Rao, 1966

(Plates 206a-d, 207a-d, 222a; Figures 30A, 110, 112; Tables 12, 12.1)

Stolephorus andhraensis Babu Rao, 1966, Ann. Mag. nat. Hist., (13) 9 : 103 (Waltair, Kakinada).

Specimens examined (25 : 29.0-48.0 mm S.L.)

1. BMNH 1969.4.22.810 (1 : 48.0 mm S.L.), Waltair.
2. 1969.4.22.904-908 (22 : 34.0-36.0 mm S.L.), Singapore.
3. USNM uncat. (2 : 29.0-31.0 mm S.L.), west side of Daru Wharf and Creek Mouth, Gulf of Papua; T. Roberts.

Diagnosis:- A species of Stolephorus, with a concave posteroventral edge preoperculum (pl. 209 e 1); pelvic tipsreaching to below dorsal origin or about half eye diameter before it; 1st and 3rd suborbital bones with short posterior extension (pl. 207a); lateral scales usually 38-39, predorsal scales 18-20; prepelvic scutes usually 6 or sometimes 7; 2 branchiostegal rays on posterior ceratohyal; gillrakers only 14-15+20-21 (fig. 110); and no markings along midline of back.

Remarks:- More specimens of this fish are needed. Observations on its scales had to be postponed due to the absence of scales in all the examined specimens.

The capture of two small specimens of this fish from the Gulf of Papua by Dr T. Roberts is very interesting as it greatly extends the range of S. andhraensis. Their low gillraker count agrees perfectly with that in specimens from India and Singapore. According to Babu Rao's (1966) original description, the species could prove to be not uncommon at Waltair and Kakinada, India. .

As I have been unable to compare my specimens with the type material; the present identification has followed Babu Rao's (1966) original description and those of Ronquillo (1970), Tiews, Ronquillo & Santos (1971) and Whitehead (1973b).

Distribution:- East coast of India, Singapore and Gulf of Papua.

105. Stolephorus tysoni n. sp.

(Plates 208a-d, 209a-e, 222j; Figures 30A, 110, 112; Tables 12, 12.1).

Specimens examined (23 : 26.1-48.0 mm S.L.)

Types:

1. BMNH 1979.3.21.493 (1 : 46.8 mm S.L.), east side of Daru Wharf, Gulf of Papua; T. Roberts. Holotype.
2. 1979.3.21.454-501 (8 : 43.8-48.0 mm S.L.), west side of Daru Wharf, Gulf of Papua; T. Roberts. Paratypes.
3. 1979.3.21.502-505 (4 : 39.0-47.4 mm S.L.), data as in 1. Paratypes.
4. USNM uncat. (1 : 45.2 mm S.L.), data as in 1. Paratypes.
5. uncat. (9 : 26.1-46.2 mm S.L.), data as in 2. Paratypes.

Diagnosis:- S. tysoni is very different from the other three members of the group with a characteristic concave posteroventral edge to the preoperculum since it has 3 branchiostegal rays on the posterior ceratohyal and the origin of the anal is advanced to below the base of the 2nd to 6th dorsal ray. Other important features are the produced posterior extensions of 1st and 3rd suborbital bones (pl. 209a) and the teeth on the anterior ceratohyal and dorsal hypohyal (pl. 209b) (which make it nearer only to S. insularis);

tip of depressed pelvic about three-fourths to one eye diameter before dorsal origin; anal rays 21-24; gillrakers 15-18+21-25 (fig. 110); prepelvic scutes usually 6 or sometimes 7; a large patch of teeth on the palatine and pterygoids; and without markings along midline of back.

Remarks:- Specimens of this fish from the west side of Daru Wharf, Gulf of Papua, were captured together with other young representatives of *S. indicus*, *S. commersonii* and *S. andhraensis*. At first glance the present species was distinguished by its advanced position of anal origin and indented preoperculum.

Named in the honour of Dr Tyson Roberts who made and published on a most valuable collection of fishes from the Fly river, Papua New Guinea, including a number of other clupeoid fishes used elsewhere in this study.

To avoid the preoccupied name *Stolephorus robertsi* (= *Cetengraulis edentulus* Cuvier) of Jordan & Rutter (1897) from Jamaica, Dr Roberts' first name is latinized instead.

Distribution:- Gulf of Papua.

106. *Stolephorus ronquillo* n. sp.

(Plates 210a-d, 211a-f, 221k-l; Figures 30A, 110, 112; Tables 12, 12.1)

Stolephorus, Species C. Whitehead, 1968, *J. mar. biol. Ass. India*, 9 (1) : 18 ('Madagascar' - in fact, Philippines) (*fide* I.A. Ronquillo).

Specimens examined (112 : 33.0-53.0 mm S.L.)

Types:

1. BMNH 1969.5.30.88 (1 : 48.7 mm S.L.), Manila Bay; I.A. Ronquillo. Holotype.
2. 1960.4.7.103-115 (14 : 43.0-54.0 mm S.L.), Manila Bay; L. Manalae. Paratypes.
3. 1966.1.17.126-133 (8 : 33.0-47.5 mm S.L.), Cavite, Luzon; T. Abe. Paratypes.

4. BMNH 1969.4.22.1620-1624 (9 : 47.0-50.0 mm S.L.), Mindanao; I.A. Ronquillo. Paratypes.

5. 1969.5.30.79-87 (21 : 45.0-48.5 mm S.L.), Manila Bay; I.A. Ronquillo. Paratypes.

Other specimens:

6. BMNH 1965.8.12.25-28 (5 : 50.0-53.0 mm S.L.), Philippines; T. Abe.

7. 1965.8.12.29-41 (13 : 36.0-46.0 mm S.L.), Philippines; T. Abe.

8. 1969.4.22.1628-1637 (26 : 36.0-46.5 mm S.L.), Manila Bay; I.A. Ronquillo.

9. 1969.4.22.1638-1652 (15 : 35.0-48.0 mm S.L.), Luzon; I.A. Ronquillo.

Diagnosis:- A new species of Stolephorus, with concave posteroventral edge to the preoperculum (pl. 209 e 1); tip of depressed pelvics about half eye diameter or shorter before origin of dorsal; posterior end of 1st suborbital bluntly short (pl. 211a); prepelvic scutes usually 5-7; 2 branchiostegal rays on posterior ceratohyal (pl. 211b); gillrakers 20-21+28-30 (fig. 110); a double pigment line present on back from behind dorsal and usually with a few or many prominent dark dots on isthmus (pl. 211c).

Remarks:- According to Whitehead (1968b), Mr I.A. Ronquillo discovered three doubtful species of Stolephorus, which were tentatively named Species A, B and C. It is now known that species A is S. devisi, Species B is a valid new species, and I have received three specimens (after finishing the writing of this work) that match the Species B described by Whitehead (loc. cit., 1973b), Ronquillo (1970) and Tiews, Ronquillo & Santos (1971). To prevent the delay, I prefer not to include it in the key and this part of the present study.* Prior to these three fishes other three specimens of Species B (BMNH. 1979. 5.24.7-9), received by Dr P.J.P. Whitehead from Mr I.A. Ronquillo were on the

* The species is described in an appendix.

other hand found to share important characters with S. heterolobus. In my opinion, Species C is also a valid species and can be identified with certainty on the basis of the characters indicated in the key and the above diagnosis. Most generously, I received personal permission from Mr I.A. Ronquillo (in litt. to Dr P.J.P. Whitehead) to describe and name it.

Three specimens (instead of five) from Madagascar (BMNH. 1967.11.20.93-97), which formed the distributional basis for Species C in Whitehead (1968b), are now considered to be S. insularis. Therefore, the range of this fish from Madagascar should be deleted.

Named for Mr I.A. Ronquillo, whose extensive collections of Stolephorus from S.E. Asia and India in the British Museum (Natural History) enabled me to extend the progress he himself had made on the genus some years previously.

Distribution:- Philippines.

107. Stolephorus insularis Hardenberg, 1933

(Plates 212a-e, 213a-e, 222d; Figures 30B, 110, 112; Tables 12, 12.1)

Stolephorus insularis (part) Hardenberg, 1933, Natuurk. Tijdschr. Ned.-Indië, 93 (2) : 260 (Java, Lingga, Bawean, Kangean, Moluccas) (at least, excluding Hardenberg's S. insularis bataviensis).

Stolephorus insularis insularis Hardenberg, ibid. : 261 (Java, Ligga, Bawean, Kangean, Moluccas).

Stolephorus insularis baweanensis Hardenberg, ibid. : 261 (Bawean, Java Sea).

Stolephorus insularis oceanicus Hardenberg, ibid. : 261 (south coast of Java).

Specimens examined (879 : 23.0-64.0 mm S.L.)

1. BMNH 1858.8.148-149 (3 : 39.5-49.0 mm S.L.), Bay of Bengal.
2. 1889.2.1.1823-1832 (10 : 37.0-56.0 mm S.L.), Bombay.
3. 1889.2.1.1833-1839 (7 : 36.0-41.0 mm S.L.), Malabar.
4. 1889.2.1.1841-1844 (4 : 37.0-64.0 mm S.L.), Burma.
5. 1936.10.7.6-8 (4 : 58.0-59.0 mm S.L.), Fukien, China.
6. 1965.4.1.658-668 (11 : 54.0-58.0 mm S.L.), Saikong, Hong Kong.

7. BMNH 1965.4.1.764-788 (25 : 49.0-54.0 mm S.L.), Taipo, Hong Kong.

8. 1965.4.1.805-854 (52 : 39.0-45.0 mm S.L.), Saikong, Kong Kong.

9. 1965.4.1.987-1018 (32 : 42.0-45.0 mm S.L.), Hong Kong.

10. 1965.4.1.1019-1025 (7 : 55.0-58.0 mm S.L.), Hong Kong.

11. 1965.4.1.1026-1032 (7 : 50.0-54.0 mm S.L.), Saikong, Hong Kong.

12. 1965.4.1.1192-1223 (35 : 46.0-49.5 mm S.L.), Cheung Chau, Hong Kong.

13. 1965.10.20.42-47 (6 : 41.0-43.0 mm S.L.), east of Tegal, Kramed, Indonesia.

14. 1965.10.20.56-59 (4 : 37.0-43.5 mm S.L.), Singapore.

15. 1966.3.8.2-46 (34 : 47.0-52.0 mm S.L.), Gulf of Thailand.

16. 1967.11.13.436-444 (9 : 43.0-47.0 mm S.L.), Than Bay, Singapore.

17. 1967.11.13.446-499 (54 : 23.0-44.0 mm S.L.), Singapore.

18. 1967.11.13.504-507 (4 : 32.0-46.0 mm S.L.), Krangi, Singapore.

19. 1967.11.13.508 (1 : 42.5 mm S.L.), Batu Muang, Penang.

20. 1967.11.13.511-512 (2 : 42.5-44.5 mm S.L.), Kuantan, Malaya.

21. 1967.11.13.515-516 (2 : 39.5-45.5 mm S.L.), Batu Muang, Penang.

22. 1967.11.13.517-518 (2 : 42.0-45.0 mm S.L.), Batu Muang, Penang.

23. 1967.11.13.584-597 (13 : 37.0-45.0 mm S.L.), Singapore.

24. 1967.11.20.93-97 (3 : 31.0-40.0 mm S.L.), 13°24'S : 48°42'E.

25. 1967.11.20.99 (1 : 33.5 mm S.L.), 13°01'S : 50°04' E.

26. 1967.11.20.100 (1 : 42.0 mm S.L.), 21°32'N : 91°29'E.

27. 1969.4.22.357-359 (3 : 49.0-51.0 mm S.L.), Gulf of Thailand.

28. 1969.4.22.360-366 (7 : 41.0-48.0 mm S.L.), Chantaburi, Thailand.

29. 1969.4.22.367 (1 : 44.5 mm S.L.), Chantaburi, Thailand.

30. 1969.4.22.368-369 (2 : 47.0-50.0 mm S.L.), Thailand.

31. 1969.4.22.370-384 (36 : 41.0-46.0 mm S.L.), Songkhla, Thailand.

32. 1969.4.22.385-395 (17 : 38.0-51.0 mm S.L.), Songkhla, Thailand.

33. 1969.4.22.396-445 (216 : 24.0-44.0 mm S.L.), Songkhla, Thailand.

34. 1969.4.22.914 (1 : 44.5 mm S.L.), Malabar; F. Day. Formerly

mixed among Dussumieria elopsoides, Ehirava fluviatilis and Dayella malabarica (originally BMNH. 1889.2.1.2048-2051).

35. BMNH 1969.4.22.1648-1658 (46 : 39.5-60.0 mm S.L.), Bombay.

36. 1969.5.30.1-9 (60 : 35.5-55.5 mm S.L.), Bombay. Mixed with a specimen of Escualosa thoracata.

37. 1969.5.30.1-18 (24 : 37.0-63.0 mm S.L.), Bombay.

38. 1969.5.30.34-45 (12 : 43.5-50.0 mm S.L.), Madras.

39. 1969.5.30.49-58 (35 : 33.0-45.0 mm S.L.), Kerala, India.

40. 1969.5.30.69 (1 : 55.0 mm S.L.), Kerala, India.

41. 1969.5.30.93-97 (5 : 35.5-44.5 mm S.L.), Digha beach, Bengal.

42. 1969.5.30.98 (1 : 50.5 mm S.L.), Songkhla, Thailand.

43. 1969.5.30.99 (1 : 38.0 mm S.L.), Songkhla, Thailand.

44. 1977.11.30.145-150 (7 : 45.0-49.0 mm S.L.), Chantaburi, Thailand.

45. 1977.11.30.151-157 (7 : 46.0-48.0 mm S.L.), Nakornsrithammaraj, Thailand.

46. 1977.11.30.158-161 (4 : 50.0-53.0 mm S.L.), Sriracha, Thailand.

47. 1977.11.30.162 (1 : 47.0 mm S.L.), Songkhla Lake, Thailand.

48. 1979.8.16.745 (1 : 46.5 mm S.L.), east of Tegal, Kramed, Indonesia; W. Soewardji. Being labelled as suitable for neotype of S. insularis by Mr I.A. Ronquillo.

49. 1979.8.16.746-803 (58 : 23.5-48.5 mm S.L.), Singapore.

Diagnosis:- A very common species of Stolephorus, characterized by having a concave posteroventral edge to the preoperculum (pl. 209 e 1); tip of depressed pelvics reaching to below origin of dorsal or about a quater of an eye diameter before it; posterior end of 1st suborbital bone distinctly produced (but much shorter in 3rd suborbital bone) (pl. 213a); prepelvic scutes usually 6 or 7, 2 branchiostegal rays on posterior ceratohyal (pl. 213b); teeth on anterior ceratohyal weakly developed (pl. 213b); gillrakers usually 16-20+22-28 (fig. 110); predorsal scute usually absent (but scuted specimens are not uncommon) and a double pigment line present on back from behind dorsal.

Remarks:- The occasional development of a predorsal spine or scute in this fish is very interesting from a phyletic point of view. For the time being it can be regarded as the most primitive of Indo-Pacific engraulid fishes to possess a predorsal scute and thus a possible intermediate form that links the previously mentioned species of Stolephorus, with the group S. dubiosus n. sp., S. baganensis and S. tri.

The presence of predorsal scute in a number of specimens and the abundance in most parts of the Indo-Pacific, strongly suggest S. tri and S. baganensis found in many publications were sometimes based on specimens of the present species, S. insularis. In fact, many lots of registered S. tri, S. baganensis and even S. batatiensis (= S. waitei) in the British Museum have been found to be misidentifications of the present fish.

On the basis of this study, my specimens of the present fish seem much nearer to what was described as S. insularis by Hardenberg (1933a, 1933b, 1934) than to his S. baganensis macrops (= S. baganensis). I judge this by the presence of a free dorsal spine, which becomes vestigial or absent in fullgrown specimens, and the position of the final ventral scute which is at some distance before the pelvics, in addition to the 20-26 gillrakers on the lower arch and the 4-7 ventral scutes diagnosed by Hardenberg (loc.cit.). As assumed by most authors, S. insularis bataviensis of Hardenberg (1933b) is a different species, and most likely is identical with S. waitei by this study. As stated earlier, Hardenberg's types have almost certainly disappeared and so one must assume that his subspecies baweanensis and oceanicus were indeed S. insularis as understood here.

Distribution:- Gulf of Oman to S. China Sea, Java Sea and China.

108. Stolephorus dubiosus n. sp.

(Plates 214a-f, 215a-e, 222e-f, 311b, 319h, 324i; Figures 30C, 111, 112;

Tables 12, 12.1)

Specimens examined (107 : 42.0-75.0 mm S.L.)

Types:

1. BMNH 1969.4.22.1826 (1 : 69.0 mm S.L.), Songkhla Lake, Thailand; I.A. Ronquillo. Holotype.

2. ANSP. 61760-61761 (2 : 50.0-59.0 mm S.L.), Paknam, Thailand; R.M. De Schauensee. Paratypes.

3. 60565-60577 (12 : 44.0-65.0 mm S.L.), Bangkok, Thailand; R.M. De Schauensee. Paratypes.

4. BMNH 1889.2.1.1840 (1 : 69.0 mm S.L.), Orissa; F. Day. Paratype.

5. 1969.4.22.1805-1809 (5 : 42.0-52.5 mm S.L.), Chilka Lake, Orissa; Babu Rao. Paratypes.

6. 1969.4.22.1823-1825 (3 : 60.0-70.0 mm S.L.), data as in 1. Paratypes.

7. 1977.11.30.71-76 (6 : 58.0-66.0 mm S.L.), Samutsakorn, Thailand; T. Tweesit. Paratypes.

Other specimens:

8. BMNH 1967.3.4.1-10 (10 : 42.0-53.0 mm S.L.), east coast of India; Babu Rao.

9. 1969.4.22.1084 (2 : 55.0-62.0 mm S.L.), Songkhla Lake, Thailand; T. Abe.

10. 1969.4.22.1803 (1 : 72.0 mm S.L.), Godavari estuary, Yanam, India; I.A. Ronquillo.

11. 1969.4.22.1810-1812 (3 : 50.0-65.0 mm S.L.), Songkhla Lake, Thailand; I.A. Ronquillo.

12. 1969.4.22.1813-1822 (28 : 49.5-65.0 mm S.L.), Songkhla Lake, Thailand; I.A. Ronquillo.

13. 1977.11.30.63 (1 : 64.5 mm S.L.), Nakornsrithammaraj, Thailand; T. Tweesit.

14. 1977.11.30.64 (1 : 75.0 mm S.L.), Surajthani, Thailand; T. Tweesit.

15. BMNH 1977.11.30.65-70 (6 : 49.0-68.0 mm S.L.), Songkhla, Thailand. T. Tweesit.

16. 1979.8.16.804 (1 : 67.0 mm S.L.), Songkhla, Thailand; I.A. Ronquillo.

17. 1979.8.24.107-130 (24 : 47.0-75.0 mm S.L.), Aluhaluh, Barito river, Borneo.

Diagnosis:- A new species of Stolephorus, which differs from most others in having a predorsal scute; a spine on the pelvic scute (pl. 319h); and the striations on the posterior parts of the scales forming a reticulated pattern (pl. 215d). It is closest to S. baganensis and S. tri, but is easily separated in having a higher count of gillrakers 19-24+25-31 (cf. 14-19+18-24) (fig. 111), and pyloric caeca only 7-12 (cf. 11-16) (fig. 112). The presence of a narrow but distinct patch of granular teeth on the palatine and pterygoids, a double pigment line on the back from dorsal to caudal and a pale darkish inner edge to the caudal lobes make it closer to S. baganensis.

Remarks:- When Hardenberg (1933b) divided his S. baganensis into two subspecies, he diagnosed S. baganensis baganensis as having 22-23 lower gillrakers and S. baganensis macrops as having only 19-20, but he ignored the range 20-29 which he had assigned to S. baganensis as a whole. Dutt & Babu Rao (1959), however, gave a mode of 23.28-23.60 gillrakers for their third new subspecies, Anchoviella baganensis bengalensis. On these counts and other specific characters I consider that the three subspecies are possibly identical but are not the present species. Interestingly, Dutt & Babu Rao (loc. cit.) gave the range of their count of gillrakers of A. baganensis as 22-28 which is similar to the count of Hardenberg (loc. cit.). Unfortunately, Dutt & Babu Rao (loc. cit.) used the name S. baganensis baganensis for their specimens with a high count of gillrakers (26.21). To eleminate the problem and as the fish shows some other distinctive characters I prefer to describe it as a new species.

The specific name is derived and given for its uncertainty in the past.

In the catches from Java Sea and Gulf of Thailand, this fish was usually found together with *S. baganensis* and *S. tri*.

Distribution:- Bay of Bengal, Java Sea and Gulf of Thailand.

109. *Stolephorus baganensis* Hardenberg, 1931

(Plates 216a-d, 217a-e, 222g; Figures 30D, 111, 112; Tables 12, 12.1)

Stolephorus baganensis Hardenberg, 1931, *Treubia*, **13** (1) : 107 (Rokan river mouth, name only).

Stolephorus baganensis baganensis Hardenberg, 1933, *Natuurk. Tijdschr. ned.-Indië*, **93** (2) : 260 (Indragiri river mouth, Sumatra).

Stolephorus baganensis macrops Hardenberg, *ibid*. : 260 (Indragiri river mouth, Sumatra).

Anchoviella baganensis bengalensis Dutt & Babu Rao, 1959, *Curr. Sci.*, **28** : 160 (Waltair, Kakinada).

Specimens examined (55 : 26.0-68.0 mm S.L.)

1. BMNH 1895.2.28.67-68 (2 : 51.0-67.0 mm S.L.), Sarawak.
2. 1967.11.13.526-533 (7 : 26.0-68.0 mm S.L.), Singapore; mixed with a specimen of *Stolephorus tri*, 67.0 mm S.L.
3. 1967.11.13.536-552 (17 : 31.0-46.0 mm S.L.), Alor Star.
4. 1967.11.13.553-555 (3 : 54.0-55.0 mm S.L.), Singapore.
5. 1969.4.22.1801 (1 : 50.0 mm S.L.), Malaya.
6. 1969.4.22.1802 (1 : 46.0 mm S.L.), Penang, Malaysia.
7. 1969.5.30.100 (1 : 35.0 mm S.L.), Surajthani, Thailand.
8. 1979.8.16.805-827 (23 : 43.0-62.0 mm S.L.), Singapore.

Diagnosis:- A species of *Stolephorus*, with a predorsal scute; a spine on the pelvic scute; striations on the posterior portion of the scales forming a reticulated pattern (pl. 217d); gillrakers 16-19+20-24 (fig. 111); a narrow but distinct patch of teeth on palatine and pterygoids; teeth on upper edge of anterior ceratohyal poorly developed or absent (pl. 217b);

a double pigment line on the back from dorsal to caudal and the inner edge of the caudal lobes pale darkish.

Remarks:- Like S. dubiosus and S. tri, predorsal scute and the spine on the pelvic scute are well developed even in the smallest specimens examined, the latter spine always larger than the former. The spine can be easily observed by pushing a finger against it to feel the sharp end. This technique was also found to be practical by George (1958).

Distribution:- Malay Peninsula, Gulf of Thailand and Sarawak.

110. Stolephorus tri (Bleeker, 1852)

(Plates 218a-e, 219a-e, 222h, 315d, 331c; Figures 30D, 111, 112; Tables 12, 12.1)

Engraulis tri Bleeker, 1852, Verh. batav. Genoot. Kunst. Wet., 24 : 40 (Batavia).

Specimens examined (29 : 66.0-95.0 mm S.L.)

Types:

1. RMNH 2222 (1 : 87.5 mm S.L.), Sampil, Batavia. Lectotype of E. tri.

Other specimens:

2. BMNH 1867.11.28.60 (1 : 83.0 mm S.L.), Batavia.
3. 1977.9.8.73-95 (23 : 66.0-80.0 mm S.L.), Java Sea.
4. 1977.11.30.163-166 (4 : 82.0-95.0 mm S.L.), Surajthani, Thailand.

Diagnosis:- A species of Stolephorus, with a predorsal scute; a spine on the pelvic scute; striations on the posterior portion of the scales forming a reticulated pattern (pl. 219d); gillrakers usually 15-17+19-22 (fig. 111); a large granular patch of teeth on the palatine and pterygoids; teeth on upper edge of anterior ceratohyal more or less developed (pl. 219b); posterior end of 1st and 3rd suborbital distinctly produced (pl. 219a); pyloric caeca about 15-16 (fig. 112); a prominent double pigment line along the midline of the back from occiput to caudal, a small dark spot at base of predorsal spine and with a prominent dark inner edge caudal.

Remarks:- Phyletically, S. dubiosus, S. baganensis and S. tri, seem to form the most specialized group of Stolephorus and I have no doubt that S. tri is the most advanced form among them. This is principally on the basis of its compressed and deeper body, long maxilla, the presence of a predorsal spine and spine on the pelvic scute; reticulated striae on scales; 1st and 3rd suborbital bones distinctly produced posteriorly; well developed patch of teeth on palatine and pterygoids; fewer pseudobranchial filaments; fewer gillrakerss; abbreviated form of stomach and intestine; attenuated gas bladder and finally its prominent colour markings on the body and fins. Conversely, in the absence of these characters, the most primitive form must therefore be S. purpureus. It is also possible now to regard members of Stolephorus as a good monophyletic group.

The record of the present fish from the Philippines by Roxas (1934) was probably a misidentification of S. waitei. This conclusion is mainly based on Roxas' drawing of a scale (pl. 2, fig. 14) which shows no reticulated striations; also 4-6 prepelvic scutes, 22 gillrakers and 13 branchiostegal rays, all of which fit well with my counts for S. waitei. The occurrence of it from India also needs to be confirmed. It is, however, abundant in near-shore water of Java Sea.

Distribution:- Java Sea and Gulf of Thailand.

111. Thryssa (Thrissina) baelama (Forsskål, 1775)
(Plates 223a-d, 224a-e, 315e, 320a, 325a, 331d; Figures 31A, 113, 118; Tables 13, 13.1, 13.2)

Clupea baelama Forsskål, 1775, Descript. Animal. : 72 (Djidda, Red Sea).
Clupea tuberculosa Lacepède, 1803, Hist. Nat. Poiss., 5 : 425, 460

(Mauritius, on Commerson MS.).

? Engraulis nesogallicus Bennett, 1831, Proc. zool. Soc. Lond., 1 : 162 (Mauritius).

Engraulis encrasicholoides Bleeker, 1851, Natuurk. Tijdschr. Ned.-Indië, 2 : 214 (Celebes, name only); Bleeker, 1852, ibid. ; 3 : 173 (Batavia, Surabaya, Kammel, Kupang).

Engraulis samam Montrouzier, 1857, Fauna Woodlark : 209 (Woodlark I. or Moiou).

Engraulis polynemoides Günther, 1868, Cat. Fishes Brit. Mus., 7 : 394 (Madagascar).

? Engraulis nasutus Castelnau, 1878, Proc. Linn. Soc. N.S.W., 3 : 51 (Norman river, Australia, not Anchoa nasuta Hildebrand & Carvalho, 1948).

Anchovia evermanni Jordan & Seale, 1905, Bull. Bur. Fish., 25 : 188, fig. 4 (Apia, Samoa).

? Engraulis macrops Kishinouye, 1911, J. Coll. agric. Tokyo, 2 : 385 (Habajma, Bonin Is.) (as micropus in fig. 3).

Specimens examined (304 : 20.0-108.0 mm S.L.)

Types:

1. RMNH 3536 (1 : 98.0 mm S.L.), E. Indies. Lectotype of E. encrasicholoides.
2. BMNH 1979.7.5.26 (1 : 95.0 mm S.L.), Madagascar. Holotype of E. polynemoides.

Other specimens:

3. BMNH 1867.3.7.543 (1 : 77.0 mm S.L.), Zanzibar.
4. 1867.11.28.50 (1 : 106.5 mm S.L.), E. Indies.
5. 1969.6.12.4-8 (5 : 69.0-74.0 mm S.L.), Cosscir.
6. 1870.6.7.11 (1 : 73.5 mm S.L.), Port Blair, Andaman Is.
7. 1870.8.31.127-128 (2 : 84.5-90.0 mm S.L.), Misol I.
8. 1871.7.20.78-79 (2 : 88.0-92.5 mm S.L.), Munado, Indonesia.
9. 1872.4.6.91 (1 : 88.5 mm S.L.), N. Celebes.
10. 1882.8.16.54-55 (2 : 75.0-77.5 mm S.L.), no data.

11. BMNH 1883.3.11.31 (3 : 65.5-78.0 mm S.L.), New Britain.

12. 1931.5.26.3-4 (2 : 79.0-84.0 mm S.L.), Mauritius.

13. 1933.3.11.23 (1 : 86.5 mm S.L.), Mindanao, Philippines.

14. 1941.4.18.3 (1 : 78.0 mm S.L.), Black river, Mauritius.

15. 1949.11.29.27 (1 : 88.0 mm S.L.), Cocos Keeling.

16. 1963.12.9.1-19 (19 : 72.5-105.0 mm S.L.), Jibuti, Mukalla.

17. 1963.12.9.20-21 (2 : 89.0-96.0 mm S.L.), Bandar Kassin, Somalia.

18. 1963.12.9.27-30 (4 : 61.0-71.0 mm S.L.), Port Sudan.

19. 1964.12.14.360 (1 : 81.0 mm S.L.), Chukwami ponds, Zanzibar.

20. 1964.12.14.361-381 (21 : 65.0-105.0 mm S.L.), Dar-es-Salaam.

21. 1966.1.17.143-146 (4 : 63.5-74.0 mm S.L.), Palau I.

22. 1966.11.16.979-982 (4 : 83.0-105.5 mm S.L.), Dar-es-Salaam.

23. 1966.11.16.983-984 (2 : 93.0-94.0 mm S.L.), Mombasa.

24. 1966.11.16.985-992 (8 : 91.0-94.0 mm S.L.), Mombasa.

25. 1966.11.16.993-1012 (20 : 75.0-108.0 mm S.L.), Mombasa.

26. 1966.11.20.21-24 (4 : 90.0-93.0 mm S.L.), Guam.

27. 1966.11.20.25-32 (8 : 24.0-37.0 mm S.L.), Guam.

28. 1967.11.20.107-156 (60 : 90.0-108.0 mm S.L.), Comolo I.

29. 1967.11.20.157-158 (2 : 29.0-30.0 mm S.L.), north of Pamanzi landing.

30. 1971.2.8.49-58 (10 : 65.0-79.9 mm S.L.), New Britain.

31. 1971.2.8.59-70 (14 : 22.0-33.5 mm S.L.), Bougainville.

32. 1971.2.8.71-76 (6 : 20.0-21.0 mm S.L.), New Ireland.

33. 1971.5.25.4-7 (4 : 103.0-106.5 mm S.L.), Galle, Ceylon.

34. 1971.8.25.112-114 (3 : 55.0-62.0 mm S.L.), Fiji.

35. 1974.5.25.148 (1 : 37.8 mm S.L.), Madang, New Guinea.

36. 1974.5.25.149 (1 : 73.5 mm S.L.), Madang, New Guinea.

37. 1978.8.17.9-10 (2 : 82.0-91.0 mm S.L.), Pomona. Queensland.

38. 1979.3.21.337 (4 : 42.0-57.5 mm S.L.), Amboina.

39. 1979.8.16.54-79 (26 : 30.0-38.0 mm S.L.), Berbera, Somalia.

40. MNHN 3721 (2 : 100.0-107.0 mm S.L.), Amboina.

41. NIOA uncat. (2 : 42.0-46.0 mm S.L.), Amboina.

42. RMNH 23365 (44 : 33.5-102.0 mm S.L.), E. Indies.

43. USNM uncat. (1 : 104.0 mm S.L.), Palawan, Philippines.

Diagnosis:- The single species of the subgenus Thryssa (Thrissina), characterized by having no prepectoral scute or only 1-2, followed by a gap (pl. 315e); ventral scutes 4-9+7-10 (tbl. 13.1); anal origin distinctly behind dorsal base and with only about 29-34 rays (tbl. 13); tip of depressed pelvics reaching well behind dorsal origin, mouth slightly inferior; posterior tip of maxilla extending slightly beyond anterior border of preoperculum; 1st and 2nd supramaxillae distinctly developed (pl. 223c); pseudobranch large, its base as long as eye diameter and with 16-29 (filaments (tbl. 13.2); gillrakers only 14-20+19-26 (fig. 113); pneumatic duct emerging from upper posterior tip of fundus of stomach (pl. 223b) and gas bladder open to the outside at anus.

Remarks:- This very wide ranging species of Thryssa was placed in Thrissina as a separate genus by Jordan & Seale (1925, 1926). It was kept generically distinct by Hardenberg (1933a), Herre (1934, 1940a), Roxas (1934), Whitehead (1965a, 1967a, 1968b, 1969b, 1973b), Losse (1966, 1968), Whitehead, Boeseman & Wheeler (1966), Whitehead & Talwar (1971) and Tiews, Ronquillo & Santos (1971). Fowler (1941), on the other hand, recognised it as only a subgenus of Thrissocles (= Thryssa). Thrissina was distinguished by its weak ventral scutes, which are almost hidden by the scales and are absent in front of the pectorals, and its few gillrakers. In the present work, in which many more characters are considered I conclude that the fish does not differ from Thryssa at a generic level; it is very closely related to T. (Scutengraulis) chefuensis. Since I separate T. (Thryssa) setirostris subgenerically from the remaining species of Thryssa (Scutengraulis), the present species is also best given subgeneric rank. It can be noted that there is parallel absence of prepectoral scutes in several species of Coilia, and that the prepelvic scutes are even absent in most specimens of Stolephorus purpureus, while prepectoral scutes may sometimes develop in specimens of T. (Thrissina) baelama (pl. 315e).

The name Engraulis samam has not been used since it was described and the type as well as the drawing are lost. Nevertheless, I found no difficulty in recognising it as the present species, partly on the basis of its range but also the pectoral fin tip, which is stated by Montrouzier (1857) to pass the pelvic origin; this has been found to be an ontogenetic character of young specimens of this fish. In the case of E. nasutus of Castelnau (1878), I hesitate to identify it with this fish; it is not T. (Scutengraulis) aesturia, but very close to it (fide Ogilby, 1911). For E. macrops of Kishinouye (1907), its original description lacks good characters and I followed Whitehead (1973b) in tentatively synonymizing it with the present species. The future collection of Kishinouye's species from its type locality may help to eliminate this problem and confirm the real identity of his E. macrops and E. koreanus (see Thryssa (Scutengraulis) chefuensis).

This fish is most likely an intermediate form between Stolephorus and the rest of Thryssa. The anterior few horizontal striae on scales, the pin-shaped cross-section of urohyal (pl. 224c) and the low scaly sheath at dorsal base are primitive characters that place it near to Stolephorus.

Distribution:- Indo-Pacific from east coast of Africa to Fiji.

112. Thryssa (Scutengraulis) chefuensis (Günther, 1874)

(Plates 225a-d, 226a-e; Figures 31B, 113, 118; Tables 13, 13.1, 13.2)

Engraulis chefuensis Günther, 1874, Ann. Mag. nat. Hist., (4) 13 : 158 (Chefoo, China).

Engraulis koreanus Kishinouye, 1907, J. Imp. Fish Bur. Tokyo, 14 (3) : 101, Pls. 20 (2), 21 (6) (Kinshu Peninsula, S. Korea).

Specimens examined (7 : 80.0-107.0 mm S.L.)

Types:

1. BMNH 1874.1.16.54 (6 : 80.0-107.0 mm S.L.), Chefoo; C. Ping.

Types of E. chefuensis.

Other specimens:

2. BMNH 1928.6.22.4 (1 : 95.0 mm S.L.), Amoy, China.

Diagnosis:- A Chinese species of Thryssa (Scutengraulis), with 29-34 rays in the anal fin (tbl. 13), its origin well behind tip of last dorsal ray; tip of depressed pelvics well behind origin of dorsal; mouth distinctly inferior (pl. 225a); posterior tip of maxilla not surpassing hind border of preoperculum; 1st and 2nd supramaxillae large and slender (pl. 225c); lateral scales 30-33 (tbl. 13); branchiostegal rays 10-11 (tbl. 13.2); pseudobranch moderately developed, its base about half eye diameter in length and with 10-16 filaments (tbl. 13.2); pyloric caeca about 13; pneumatic duct emerging from a short distance above posterior tip of fundus of stomach (pl. 225b); and gas bladder open to outside at anus (pl. 225b).

Remarks:- The types of E. koreanus Kishinouye (1907) are said to have been lost during the last war (Dr O. Okamura, pers. comm.). The original description and a fairly good figure of it fall largely within my data for the present fish. Although it also resembles T. (Thrissina) baelama, that species has fewer ventral scutes 4-9+7-10 (cf. 17+7 for E. koreanus), but 16-18+9-10 in T. (Scutengraulis) chefuensis. However, it could also be T. (S.) kammalensis.

Distribution:- N. China Sea.

113. Thryssa (Scutengraulis) rastrosa Roberts, 1978

(Plates 227a-d, 228a-e; Figures 31B, 113, 118; Tables 13, 13.1, 13.2)

Thryssa rastrosa Roberts, 1978, Smithson. Contr. Zool., No. 281 : 29, fig. 10b (Fly river, New Guinea).

Specimens examined (4 : 52.0-68.0 mm S.L.)

Types:

1. BMNH 1977.11.17.33-36 (4 : 52.0-68.0 mm S.L.), 450 kms up from

Toro Pass, Fly river, New Guinea; T. Roberts. Paratypes.

Diagnosis:- A riverine species of Thryssa (Scutengraulis), differing from all known species of Thryssa in having a much higher count of gillrakers, 39-44+55-61 (fig. 113), and in the absence of gillrakers on the posterior face of the 3rd epibranchial. It is, however, close to T. (S.) scratchleyi, T. (S.) aestuaria and T. (S.) kammalensis in its short maxilla, which terminates a short distance before the hind margin of the preoperculum, 1st and 2nd supramaxillae well developed (pl. 227c); gas bladder forming a blind end and with no connection with anus (pl. 227b); and the presence of a pseudobranch with about 12-14 filaments (tbl. 13.2). However, it differs from these three species in having the vertical striae on the scales mostly continuous but mostly not overlapping at the centre or forming a reticulated pattern; pneumatic duct emerging at a short distance above the posterior end of the fundus of the stomach (pl. 227b).

Remarks:- A slight development of the posterior frontal fontanelles is found in fishes of 52.0 mm S.L.

According to Roberts (1978), the fish grows to 116.2 mm S.L.

Distribution:- Upper and middle courses of the Fly river, New Guinea (Roberts, loc. cit.).

114. Thryssa (Scutengraulis) scratchleyi (Ramsay & Ogilby, 1886)
(Plates 229a-d, 230a-f; Figures 31B, 113, 118; Tables 13, 13.1, 13.2)

Engraulis scratchleyi Ramsay & Ogilby, 1886, Proc. Linn. Soc. N.S.W., (2) 1 : 18 (Strickland river, New Guinea).

Specimens examined (4 : 95.0-305.0 mm S.L.)

1. BMNH 1913.12.15.2 (1 :305.0 mm S.L.), Lorentz river, New Guinea.
2. 1977.11.17.37 (1 : 95.0 mm S.L.), Fly river, New Guinea.
3. 1979.11.16.1-2 (2 : 110.5-300.0 mm S.L.), Mitchell river, Queensland.

Diagnosis:- A second riverine species of Thryssa (Scutengraulis), with a short maxilla which extending only to the anterior border of the preoperculum; 1st and 2nd supramaxillae well developed (pl. 229c); anal rays about 38; entire pelvic fins noticably before origin of dorsal; vertical striae of scales slightly overlapping at centre (pl. 230d, e); lateral scales 43-44, predorsal scales 19-20; ventral scutes 19+12 (tbl. 13.1); gillrakers 15-18+18-20 (fig. 113); pseudobranchial filaments 12-13; gas bladder forming a blind end, without any connection to anus (pl. 229b); pneumatic duct long and emerging at a considerable distance before posterior end of fundus of stomach (pl. 229b); and pyloric caeca about 21.

Remarks:- This is one of the six species of clupeoid fishes that exclusively lives in freshwaters of Papua New Guinea. The other five species are Clupeoides papuensis, C. venulosus, Nematalosa papuensis, N. flyensis n. sp., and Thryssa (Scutengraulis) rastrosa (Clupeoides multispinus is now believed to be C. papuensis). Two specimens of this fish (BMNH. 1979.11.16.1-2) were sent by Mr M.R. MacKinnon, from Ten Mile Lagoon, Mitchell river drainage, Queensland, and these represent its first record outside Papua New Guinea and new record for Australia. According to Roberts (1978) this species can grow to a large size (371.0 mm S.L.).

I have not seen the type of this fish, but the available data make it easily separated from others. On the basis of seventeen specimens ranging from 94 to 371 mm S.L., Roberts (loc. cit.) produced more complete meristic data on its principal characters; his anal ray count was 38-42, ventral scutes 17-19+10-12, gillrakers 15-18+18-20, and free vertebral centra 43-46.

Distribution:- Strickland river, Lorentz river and Fly river of New Guinea and Mitchell river, Queensland, Australia.

115. Thryssa (Scutengraulis) aestuaria (Ogilby, 1911)

(Plates 231a-d, 232a-e; Figures 31C, 113, 118; Tables 13, 13.1, 13.2)

Anchovia aestuaria Ogilby, 1911, Proc. Roy. Soc. Queensland, 23 (1) : 4

Brisbane river, Australia).

Thryssa brevicauda Roberts, 1978, Smithson. Contr. Zool., No. 281 : 29, fig. 10c (Gulf of Papua, New Guinea).

Specimens examined (7 : 38.5-119.0 mm S.L.)

Types:

1. AMS I. 9497-9498 (2 : 96.0-119.0 mm S.L.), Brisbane river, Australia. Cotypes of A. aestuaria.
2. BMNH 1977.11.17.26-30 (5 : 38.5-50.5 mm S.L.), outer entrance of Toro Pass, opposite west end of Parama I., Guiavi Creek, Fly river, New Guinea. Paratypes of T. brevicauda.

Diagnosis:- A species of Thryssa (Scutengraulis), clearly allied to T. (S.) kammalensis in its reticulated striae on scales (pl. 232d) and the presence of a diffuse dark saddle blotch on the nape. Generally, it is characterized by having a short maxilla, which reaches only about to the hind border of the preoperculum, 1st and 2nd supramaxillae well developed (pl. 231c); mouth inferior; anal rays 33-36 (tbl. 13); tip of depressed pelvics reaching to below base of 6th-9th dorsal ray; lateral scales 34-39 (fig. 13); gill-rakers 22-25+27-29 (fig. 113); pseudobranch moderately developed, attenuated and with 14-22 filaments (tbl. 13.2); gas bladder forming a blind end posteriorly and without connection to the anus (pl. 231 b).

Remarks:- The saddle blotch on the nape of this fish is well developed in all thirty-one type specimens (30.3-56.5 mm S.L.), of T. brevicauda from the Fly river (fide Roberts, 1978), but it is not visible in two cotypes of A. aestuaria, which are much larger specimens and from Brisbane river, Australia.

This may due to changes with growth or to preservation over a long period. Apart from the colour difference, I cannot find any other characters to separate the two nominal species. Posterior frontal fontanelles are slightly developed in the smaller fish.

Distribution:- Gulf of Papua to Queensland, Australia.

116. Thryssa (Scutengraulis) kammalensis (Bleeker, 1849)

(Plates 233a-d, 234a-e, 325b; Figures 31C, 113, 118; Tables 13, 13.1, 13.2)

Engraulis kammalensis Bleeker, 1849, Verh. batav. Genoot. Kunst. Wet., 22 : 13 (Madura Straits near Kammal and Surabaya).

Engraulis rhinorhynchos Bleeker, 1852, Natuurk. Tijdschr. Ned.-Indië, 3 : 434 (Sampit, Batavia, Surabaya, Kammal; replacement name for Engraulis kammalensis Bleeker, 1849).

Specimens examined (54 : 45.0-83.0 mm S.L.)

Types:

1. RMNH 7067 (1 : 76.5 mm S.L.), Madura Straits near Kammel and Surabaya. Lectotype of E. kammalensis and also E. rhinorhynchos.

Other specimens:

2. BMNH 1867.11.28-56 (1 : 83.0 mm S.L.), Java.
3. 1868.1.28.9 (1 : 80.5 mm S.L.), Borneo.
4. 1966.11.20.9 (1 : 62.0 mm S.L.), Pakpoon, Thailand.
5. 1967.11.13.631-647 (17 : 65.0-77.5 mm S.L.), Singapore.
6. 1967.11.13.650-653 (4 : 57.0-73.0 mm S.L.), Singapore.
7. 1967.11.13.654 (1 : 57.0 mm S.L.), Singapore.
8. 1969.8.19.37-38 (2 : 45.0-46.0 mm S.L.), Songkhla, Thailand.
9. 1979.8.16.505-512 (9 : 60.0-72.0 mm S.L.), Singapore.
10. MNHN 1232 (1 : 73.0 mm S.L.), Celebes, Banka.
11. 24962 (16 : 47.0-76.5 mm S.L.), Madura Straits near Kammel and Surabaya.

Diagnosis:- A species of Thryssa (Scutengraulis), related to T.(S.) rastrosa, T. (S.) scratchleyi and T. (S.) aestuaria in its short maxilla, which reach only to the hind border of the interoperculum or scarcely beyond it in larger fish; 1st and 2nd supramaxillae well developed (pl. 233c); inferior mouth; and gas bladder forming a blind end and without connection with anus (pl. 223b).

It is however, closer to T. (S.) aestuaria in its reticulated striae on scales (pl. 234d) and the presence of a dark saddle blotch on the nape but chiefly distinguished from that species in its slender and longer posterior portion of the maxilla behind 2nd supramaxilla (pl. 233c); tip of depressed pelvics reaching only to below base of 1st-4th dorsal ray or nearly so; pseudobranch largely covered by its basal membrane; pneumatic duct very long and inserting to gas bladder at a point just above pelvic base (pl. 233b) and also its marine habit.

Remarks:- Posterior frontal fontanelles are slightly developed. Whitehead's (1973b) record of this fish from Godavari river, India was misidentification of T. (S.) kammalensoides n. sp. The records of this fish from S. New Guinea by Hardenberg (1941) and from Papua by Munro (1964) is problematic because T. (S.) aestuaria occurs in the same area. Chinese records of it (Fowler, 1931; Wang, 1933; Chen, 1961) were possibly based on T. (S.) chefuensis.

Distribution:- Gulf of Thailand, Java Sea and Celebes.

117. Thryssa (Scutengraulis) kammalensoides n. sp.
(Plate 235a-d; Figures 31D, 114, 118; Tables 13, 13.1, 13.2)

Specimens examined (2 : 108.0-112.0 mm S.L.)

Types:

1. BMNH 1965.7.12.248 (1 : 112.0 mm S.L.), Godavari estuary, India; S. Dutt. Holotype.

2. 1965.7.12.247 (1 : 108.0 mm S.L.), data as in 1. Paratype.

Diagnosis:- An Indian species of Thryssa (Scutengraulis), chiefly differing from other species in the combination of a slightly inferior mouth; maxilla short and reaching only to about hind border of interoperculum; 1st supramaxilla absent; anal rays 34-35; tip of pelvics terminating at about three-fourths to only one half of eye diameter before origin of dorsal; vertical striae on scales continuous at centre (pl. 235c); lateral scales 36-37 (tbl. 13); gillrakers 18+24-25 (fig. 114) and not clumped (pl. 235d); pseudobranch entirely hidden under skin; gas bladder open to outside at anus; pneumatic duct emerging from a fair distance before posterior end of fundus of stomach (pl. 235b); and with a diffuse dark saddle blotch on nape.

Remarks:- A member of the group with a nuchal blotch (viz. T. (S.) aestuaria, T. (S.) kammalensis and possibly also T. (S.) dussumieri) it is readily separated from them by its significantly higher count of gillrakers, which is, however, somewhat similar to that in T. (S.) polybranchialis n. sp. (gillrakers 18-21+25-27) (fig. 115). From that species it is distinguished by many important characters, e.g. counts of anal rays, lateral scales, transverse scales, nature of mouth and vertical striae of scales, and colouration.

Named for its external appearance which is very similar to that of T. (S.) kammalensis.

Distribution:- Godavari estuary, India.

118. Thryssa (Scutengraulis) vitrirostris (Gilchrist & Thompson, 1908)
(Plates 236a-d, 237a-f; Figures 31D, 114, 118, 119; Tables 13, 13.1, 13.2)

Engraulis vitritostris Gilchrist & Thompson, 1908, Ann. S. Afr. Mus., 6 : 201 (Durban, Natal).

Specimens examined (187 : 32.0-174.0 mm S.L.)

1. BMNH 1889.2.1.1771 (1 : 122.0 mm S.L.), Bombay.
2. 1889.2.1.1774-1775 (2 : 112.0-134.0 mm S.L.), Madras
3. 1919.9.12.4-5 (2 : 63.0-174.0 mm S.L.), Durban.
4. 1922.2.9.2 (1 : 131.0 mm S.L.), Delagoa Bay.
5. 1958.6.10.21 (1 : 78.0 mm S.L.), Ceylon.
6. 1964.12.14.352-359 (7 : 41.0-113.0 mm S.L.), Pungani Bay, Tanzania.
7. 1965.7.12.232-243 (12 : 127.0-140.0 mm S.L.), Waltair.

8. BMNH 1965.7.12.258-259 (2 : 109.0-132.0 mm S.L.), Waltair.

9. 1966.11.16.934-936 (3 : 83.0-104.0 mm S.L.), Malindi, Kenya.

10. 1966.11.16.937-950 (14 : 110.0-144.0 mm S.L.), Zanzibar.

11. 1966.11.16.951 (1 : 142.0 mm S.L.), Zanzibar.

12. 1966.11.16.952-954 (3 : 110.0-129.0 mm S.L.), Nosy Bay, Madagascar.

13. 1966.11.16.955-957 (3 : 122.0-150.0 mm S.L.), Nosy Bay, Madagascar.

14. 1966.11.16.969-978 (8 : 90.0-150.0 mm S.L.), Malindi, Kenya.

15. 1967.11.20.325-339 (15 : 106.0-135.0 mm S.L.), 23°16'N : 63°16' E.

16. 1967.11.20.340-347 (8 : 110.0-131.0 mm S.L.), 23°45'N : 67° 26'E.

17. 1967.11.20.348-350 (3 : 135.0-152.0 mm S.L.), 18°48'N : 72° 37'E.

18. 1967.11.20.351 (1 : 74.0 mm S.L.), 13°24'S : 48°42'E.

19. 1968.4.4.67 (1 : 141.0 mm S.L.), Progoos estuary.

20. 1968.4.4.68-69 (2 : 40.0-47.0 mm S.L.), Ruva estuary, Saadotis.

21. 1969.8.19.8 (1 : 46.5 mm S.L.), Bombay.

22. 1969.8.19.15 (1 : 32.0 mm S.L.), Waltair.

23. 1969.8.19.23-24 (17 : 35.0-46.0 mm S.L.), Waltair.

24. 1969.11.6.21 (1 : 135.0 mm S.L.), Porto Novo.

25. 1970.4.24.60-61 (2 : 118.0-125.0 mm S.L.), 23°16'N : 67°50'E.

26. 1970.10.21.60-61 (2 : 130.0-133.0 mm S.L.), Porto Novo.

27. 1970.10.22.33-36 (4 : 34.0-36.0 mm S.L.), Mozambique.

28. 1970.10.22.37-40 (4 : 59.0-114.0 mm S.L.), Mozambique.

29. 1970.10.22.49 (1 : 114.0 mm S.L.), Mozambique.

30. 1970.10.22.50-51 (2 : 90.0-102.0 mm S.L.), Durban.

31. 1970.10.22.52-63 (12 : 36.0-85.0 mm S.L.), Delagoa Bay.

32. 1970.10.22.64-75 (12 : 80.0-93.0 mm S.L.), Mozambique.

33. 1970.10.22.76-87 (12 : 105.0-120.0 mm S.L.), Colombo, Ceylon.

34. BMNH 1970.10.22.88 (1 : 37.5 mm S.L.), Mozambique.

35. 1974.9.23.11-14 (4 : 111.0-132.0 mm S.L.), Durban.

36. 1977.9.9.24-31 (8 : 111.0-134.0 mm S.L.), Pakistan.

37. 1979.8.15.11 (1 : 136.0 mm S.L.), Porto Novo.

38. UZMK C. 1-2 and 6-14 (11 : 66.0-130.0 mm S.L.), Omanbugten, Persiske Haubugt, Persian Gulf.

39. C. 5 (1 : 132.0 mm S.L.), Bushire Port, Persiske Haubugt, Persian Gulf.

Diagnosis:- An Indian Ocean species of Thryssa (Scutengraulis), with a slightly inferior mouth; posterior tip of maxilla reaching to pectoral base or nearly so in smaller fish; 1st supramaxilla greatly reduced in size (pl. 236c); anal rays 34-43 (tbl. 13), its origin below base of 9th to just behind base of last dorsal ray; tip of pectorals reaching to pelvic base or to anterior third of its length; entire pelvics distinctly before origin of dorsal; vertical striae of scales continuous or very slightly overlapping at centre (pl. 237d); lateral scales 40-44 (tbl. 13); gillrakers usually 14-17+20-23 (fig. 114); with clumped serrae in large adults (pl. 237e, f); pseudobranch entirely hidden under skin; gas bladder open to outside at anus, its pneumatic duct emerging from a short distance above posterior end of fundus of stomach (pl. 236b); and with a humeral dark blotch.

Remarks:- According to the British Museum specimens, this fish seems to be very common along the east coast of Africa and its islands, its anal ray count being slightly higher than that of Indian specimens. In very large adults the mouth is apparently terminal. The species has been frequently misidentified or mixed among specimens of T. (S.) mystax.

Distribution:- East coast of Africa, from Madagascar to east coasts of India.

119. Thryssa (Scutengraulis) adelae (Rutter, 1897)

(Plate 238a-d; Figures 31D, 116, 118, 119; Tables 13, 13.1, 13.2)

Trichosoma adelae Rutter, 1897, Proc. Acad. nat. Sci. Philad. : 65 (Swatow).

Specimens examined (10 : 72.0-111.0 mm S.L.)

Types:

1. SU 1565 (8 : 72.0-102.0 mm S.L.), Swatow, Kwangtung, China. Types of Trichosoma adelae.

Other specimens:

2. BMNH 1851.12.27.199 (1 : 88.0 mm S.L.), China.
3. 1860.7.20.34 (1 : 110.0 mm S.L.), Amoy, China.

Diagnosis:- A second Chinese species of Thryssa (Scutengraulis), characterized by having a subterminal and somewhat superior mouth; posterior tip of maxilla reaching to pectoral base or slightly beyond it in larger adults, 1st supramaxilla very small; anal rays 38-44, the fin originating below base of 7th-10th dorsal ray; tip of pectorals reaching to anterior third or front half of pelvics; pelvics entirely before origin of dorsal; vertical striae of scales slightly overlapping at centre (pl. 238c); lateral scales 43-45 (tbl. 13); gillrakers 13-16+20-22 (fig. 116) and without clumped serrae (pl. 238d); pseudobranch entirely hidden under skin; gas bladder open to outside at anus, its pneumatic duct emerging from a region just behind oesophagus (pl. 238b); and a humeral darkish blotch present.

Remarks:- This poorly known Thryssa has possibly been misidentified as T. (S.) mystax by authors. The only two non-typical specimens studied were registered as Engraulis mystacoides. The present species is however, readily distinguished from T. (S.) mystax by the significantly higher count of gillrakers 13-16+20-23 (cf. 9-12+13-17); pneumatic duct short and anterad instead of long and posterad. Fowler (1931) is one of the very few authors who recognised this species, but he gave the gillraker count as 20 or below, which likely indicates the smaller fish in his study, future work on Thryssa from China might show that the species is not uncommon in that area.

Distribution:- N. China Sea.

120. Thryssa (Scutengraulis) dussumieri (Valenciennes, 1848)

(Plates 239a-d, 240a-e, 311c; Figures 32A, 114, 118, 119; Tables 13, 13.1, 13.2)

Engraulis dussumieri Valenciennes, 1848, Hist. Nat. Poiss., 21 : 69 (no locality).

Engraulis auratus Day, 1865, Proc. zool. Soc. Lond. : 312 (Cochin, Malabar).

Specimens examined (379 : 24.5-111.0 mm S.L.)

Types:

1. BMNH 1966.11.30.1 (1 : 111.0 mm S.L.), 2°22'N : 71°47'E. Putative neotype of E. dussumieri.
2. 1889.2.1.1779 (1 : 92.0 mm S.L.), Malabar. Lectotype of E. auratus.

Other specimens:

3. BMNH 1858.4.21.13 (1 : 100.0 mm S.L.), Bombay.
4. 1867.5.30.13 (1 : 83.0 mm S.L.), Madras.
5. 1867.11.28.49 (1 : 111.0 mm S.L.), E. Indies.
6. 1868.6.9.11-12 (2 : 65.0-68.0 mm S.L.), Sarawak.
7. 1884.5.15.26 (1 : 53.0 mm S.L.), Taiwan.
8. 1889.2.1.1780 (1 : 55.5 mm S.L.), Canara.
9. 1965.7.12.245-246 (2 : 96.0-101.0 mm S.L.), Waltair.
10. 1965.10.20.60 (1 : 84.0 mm S.L.), Singapore.
11. 1965.10.20.78 (1 : 24.5 mm S.L.), Singapore.
12. 1967.11.13.617-630 (14 : 27.0-35.0 mm S.L.), Batu Muang, Penang.
13. 1967.11.13.648-649 (2 : 33.0-33.2 mm S.L.), Singapore.
14. 1967.11.13.658-660 (3 : 53.0-59.0 mm S.L.), Singapore.
15. 1967.11.13.661 (1 : 56.5 mm S.L.), Singapore.
16. 1967.11.13.662 (1 : 50.0 mm S.L.), Singapore.
17. 1967.11.13.663 (1 : 40.5 mm S.L.), Batu Muang, Penang.

18. BMNH 1967.11.13.664-671 (8 : 28.0-34.0 mm S.L.), Singapore.

19. 1967.11.13.672 (1 : 27.5 mm S.L.), Alor Star.

20. 1967.11.13.993-994 (2 : 59.0-63.0 mm S.L.), Singapore.

21. 1967.11.20.163-304 (142 : 78.0-98.0 mm S.L.), 20°27'N : 92°20'E.

22. 1967.11.20.305-316 (12 : 86.0-105.0 mm S.L.), 25°10'N : 65°50'E.

23. 1967.11.20.317-319 (3 : 57.0-95.0 mm S.L.), 15°04'N : 95°51'E.

24. 1967.11.20.320-324 (5 : 46.0-83.0 mm S.L.), 15°04'N : 95°51'E.

25. 1967.11.20.426-427 (2 : 24.5-25.0 mm S.L.), Singapore.

26. 1969.8.19.7 (1 : 37.0 mm S.L.), Waltair.

27. 1969.8.19.26-35 (106 : 24.0-30.5 mm S.L.), Lamna, Hong Kong.

28. 1969.8.19.36 (1 : 38.5 mm S.L.), Hong Kong.

29. 1970.10.12.29-32 (4 : 71.0-90.0 mm S.L.), Purendi I., Malaya.

30. 1973.6.4.72 (1 : 93.5 mm S.L.), Calcutta.

31. 1976.4.27.80-88 (11 : 39.0-46.0 mm S.L.), Hong Kong.

32. 1977.9.8.96-128 (33 : 70.0-94.0 mm S.L.), Java Sea.

33. 1977.9.9.18-25 (6 : 62.0-94.0 mm S.L.), Pakistan.

34. 1978.8.18.164-166 (3 : 88.0-98.0 mm S.L.), Bangladesh.

35. 1979.8.15.12 (1 : 91.0 mm S.L.), Porto Novo.

36. 1979.8.15.29-30 (2 : 86.0-93.9 mm S.L.), Phuket I., Thailand.

Diagnosis:- A widely distributed species of Thryssa (Scutengraulis), chiefly recognised by having a subinferior mouth with a long and slender maxilla which reaches to the pelvic base in the largest fish; 1st supramaxilla absent (pl. 239c); anal rays usually 34-38 (tbl. 13); its origin below base of last dorsal ray or just behind it; pectoral tips reaching to anterior half of pelvic length; tips of depressed pelvics below base of 3rd-8th dorsal ray; all vertical striae of scales uninterrupted at centre (pl. 240d);

lateral scales usually 35-40 (tbl. 13); ventral scutes 14-16+6-9 (tbl. 13.1) gillrakers usually 13-16+17-19 (fig. 114) and with prominent clumped serries (pl. 240e); pseudobranch largely hidden under skin, only extreme tips of longest filaments being exposed; gas bladder open to outside at anus and with pneumatic duct at just above posterior end of fundus of stomach (pl. 239b); humeral dark spot present and sometimes adjoining with the one on opposite side to form a saddle blotch; pyloric caeca dark.

Remarks:- The counts of gillrakers in specimens from the Arabian Sea are (at a given size) about 1-2 rakers higher than those of specimens from the rest of its range. The clumped serrae of the gillrakers are usually developed in specimens larger than 40 mm S.L.

In most keys of authors this fish has been placed next to Thryssa (Thryssa) setirostris because of their elongated maxillae and it might be misidentified with that species. However, that species is here separated by subgeneric level, primarily on account of its unique jaw elements (pl. 261c, d); its very short posterior extensions of the 1st and 3rd suborbital bones (pl. 262a) and its gillrakers count of only 5-6+10-12 (fig. 117), which is the lowest normal count of all members of the genus Thryssa and other Indo-Pacific clupeoids as well.

Distribution:- Pakistan to S.E. Asia and Taiwan.

121. Thryssa (Scutengraulis) mystax (Schneider, 1801).
(Plates 241a-e, 242a-f; Figures 32B, 114, 118, 119; Tables 13, 13.1, 13.2)

Clupea mystax Schneider, 1801, Syst. Ichth. Bloch. : 426, pl. 83 (Malabar).
? Thryssa subspinosa Swainson, 1839, Nat. Hist. Anim., 2 : 293 (on Poorawah of Russell, 1803, Fishes of Coromandel, 2 : 72, pl. 189).
? Thryssa poorawah Jerdon, 1851, Madras J. Lit. Sci., 17 : 145.
Engraulis mystacoides Bleeker, 1866, Verh. batav. Genoot. Kunst. Wet., 24 : 42 (Batavia, Surabaya, Samarang, Pasuruan, etc.).
Stolephorus (Thryssa) valenciennesi Bleeker, 1866, Ned. Tijdschr. Dierk., 3 :

306 (Singapore, Sumatra, Java, Borneo).

Engraulis hornelli Fowler, 1924, J. Bomb. nat. Hist. Soc., 30 (1) : 41 Calicut).

Specimens examined (114 : 32.0-155.0 mm S.L.)

Types:

1. RMNH 7069 (1 : 145.0 mm S.L.), E. Indies. Lectotype of E. mystacoides.
2. BMNH 1867.11.28.54 (1 : 139.0 mm S.L.), E. Indies Archipelago. One of the syntypes of E. mystacoides.
3. RMNH 24966 (12 : 67.0-135.0 mm S.L.), E. Indies. Syntypes of E. mystacoides.
4. 7071 (1 : 99.0 mm S.L.), E. Indies. Lectotype of S. (T.) valenciennesi.
5. BMNH 1867.11.28.53 (1 : 100.0 mm S.L.), Singapore. One of the syntypes of S. (T.) valenciennesi.
6. RMNH 24413 (8 : 50.2-84.0 mm S.L.), Singapore, Sumatra, Java, Borneo. Syntypes of S. (T.) valenciennesi.
7. ANSP 51465 (1 :103.5 mm S.L.), Calicut, India. Holotype of E. hornelli.
8. 51466 (1 : 70.5 mm S.L.), Calicut, India. Paratype of E. hornelli.

Other specimens:

9. BMNH 1889.2.1.1755 (1 : 150.0 mm S.L.), Calicut, India.
10. 1889.2.1.1762-1769 (19: 54.0-126.0 mm S.L.), Bombay.
11. 1965.9.7.21 (1 : 81.0 mm S.L.), Prachuab-kirikhan, Thailand.
12. 1966.2.28.34-37 (4 : 124.0-141.0 mm S.L.), Prachuab-kirikhan, Thailand.
13. 1966.2.28.38 (1 : 100.0 mm S.L.), Chantaburi, Gulf of Thailand.
14. 1966.3.8.47-53 (7 : 107.0-145.0 mm S.L.), Gulf of Thailand.
15. 1966.11.20.10 (1 : 89.0 mm S.L.), Chantaburi, Gulf of Thailand.

16. BMNH 1967.1.2.1-5 (5 : 142-151.0 mm S.L.), Nakornsrithammaraj, Thailand.

17. 1967.1.2.6-11 (6 : 140.0-151.0 mm S.L.), Nakornsrithammaraj, Thailand.

18. 1967.3.4.60 (1 : 149.0 mm S.L.), India.

19. 1967.3.4.61 (1 : 127.0 mm S.L.), India.

20. 1967.11.13.602 (1 : 66.5 mm S.L.), Siglap.

21. 1967.11.13.603-614 (12 : 39.0-52.0 mm S.L.), Siglap.

22. 1967.11.13.615-616 (2 : 47.0-50.0 mm S.L.), Singapore.

23. 1969.8.19.6 (1 : 115.0 mm S.L.), Madras.

24. 1969.8.19.10-14 (5 : 32.0-40.0 mm S.L.), Waltair.

25. 1969.8.19.16-22 (7 : 32.0-38.0 mm S.L.), Waltair.

26. 1969.8.19.39-41 (3 : 39.5-43.0 mm S.L.), Visakhapatnam, India.

27. 1970.10.21.52-59 (8 : 130.0-155.0 mm S.L.), Porto Novo.

28. 1977.9.8.134 (1 : 145.0 mm S.L.), Java Sea.

29. 1979.8.15.13 (1 : 137.0 mm S.L.), Porto Novo.

Diagnosis:- Another widespread species of Thryssa (Scutengraulis), with a subterminal mouth; maxilla extending to base of pectoral or nearly so, 1st supramaxilla very small (pl. 241c); anal rays usually 35-39 (tbl. 13) and commencing below base of 8th dorsal ray or just behind base of that fin; tip of pectorals reaching at most to anterior half of pelvics or only just before its base; pelvics entirely before dorsal origin; vertical striae on scales interrupted at centre (pl. 242e, f); ventral scutes 16-20+8-13 (tbl. 13.1); gillrakers usually 9-11+13-16 (fig. 114), serrae uneven in larger fish (pl. 242c, d); pseudobranch entirely hidden under skin; cross-section of urohyal abbreviated Y-shaped (pl. 242b); gas bladder open to outside at anus, with its pneumatic duct emerging from midpoint between oesophagus and hind end of fundus of stomach (pl. 241b); a large dark humeral spot present, pyloric caeca colourless.

Remarks:- Whitehead (1969a) made a re-examination of the holotype of Clupea mystax (ZMB. 3884, 134.7 mm S.L.) and I have followed his published data and notes. The only major difference is that the predorsal length in my specimens is always longer than the postdorsal length 51-55 (cf. 44-50) % S.L. but it is vice versa in the holotype. This is possibly due to different methods of measurement.

The maxilla in Russell's Poorawah (Russell, 1803 : 72, pl. 289), which projects to pectoral base, suggests that he had the present species.

The record of this fish from Amoy by Whitehead (1973b) was apparently a misidentification of T. (S.) adelae. McCulloch (1929) greatly extended the range of this species to Queensland, but I have no means to confirm this.

Distribution:- Entire coasts of India to S. China Sea and Java Sea.

122. Thryssa (Scutengraulis) polybranchialis n. sp.*
(Plates 243a-d, 244a-e; Figures 32C, 115, 118; Tables 13, 13.1, 13.2)

Specimens examined (10 : 47.0-170.0 mm S.L.)

Types:

1. BMNH 1889.2.1.1757 (1 : 170.0 mm S.L.), Bombay; F. Day. Holotype.
2. 1889.2.1.1758 (1 : 113.0 mm S.L.), data as in 1. Paratype.
3. 1889.2.1.1760 (2 : 136.0-140.0 mm S.L.), Canara, India; F. Day. Paratypes.
4. 1967.3.4.57 (1 : 121.0 mm S.L.), India; Babu Rao. Paratype.
5. 1979.8.15.25 (1 : 149.0 mm S.L.), Porto Novo; A. Sivakumar. Paratype.

Other specimens:

6. BMNH 1969.8.15.25 (1 : 47.0 mm S.L.), Waltair; I.A. Ronquillo.
7. 1979.8.15.26 (1 : 70.5 mm S.L.), Porto Novo; A. Sivakumar.
8. 1979.8.15.27-28 (2 : 72.0-78.0 mm S.L.), Porto Novo; A. Sivakumar.

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* Co-authored by Mr A. Sivakumar.

Diagnosis:- A new species of Thryssa (Scutengraulis) from India, readily recognised by having a combination the following characters. Mouth oblique and subterminal; maxilla 21.1-23.1 % S.L., its tip scarcely reaching beyond or only to hind border of interoperculum (pl. 243c); 1st supramaxilla greatly reduced in size (pl. 243c) or sometimes absent; predorsal slightly longer than postdorsal length 50-53 (cf. 48-51) % S.L.; anal rays 38-42 (tbl. 13), its origin below base of 8th dorsal ray or very slightly behind base of dorsal; tip of depressed pelvics about three-fourths of an eye diameter before origin of dorsal; vertical striae on scales discontinuous and with a slight gap at centre (pl. 244d); ventral scutes 15-17+9-10 (tbl. 13.1); gillrakers 18-21+25-27 (fig. 115), the serrae not clumped (pl. 244e); pseudobranch entirely hidden under skin; cross-section of urohyal pin-shaped (pl. 244c); gas bladder open to outside at anus, its pneumatic duct emerging from a region of some distance above hind end of fundus of stomach (pl. 243a); and a humeral dark spot present.

Remarks:- The British Museum specimens of this fish were registered as Engraulis malabarica and E. kammalensis, which indicates its resemblance in some ways to those fishes. It has also been misidentified as T. hamiltonii by some Indian workers. It is near to T. (S.) kammalensoides on the basis of its remarkably high count of gillrakers 18-21+25-27 (cf. 18+24-25).

Distribution:- West and east coasts of India.

123. Thryssa (Scutengraulis) gautamiensis Babu Rao, 1970

(Plates 245a-d, 246a-f; Figures 32C, 115, 118, 119; Tables 13, 13.1, 13.2)

Thryssa gautamiensis Babu Rao, 1970, Adv. Abstr. Contr. Fish.aquat. Sci. India, 4 (1) : 63 (Godavari river, name only); idem, 1971, Copeia, No. 3 : 479, fig. 1 (Godavari and Hooghly rivers, India).

Specimens examined (42 : 52.0-190.0 mm S.L.)

Types:

1. ZSI F. 4600/2 (1 : 107.0 mm S.L.), Godavari estuary. Holotype of *T. gautamiensis*.

Other specimens:

2. BMNH 1967.3.4.58 (1 : 112.0 mm S.L.), east coast of India.
3. 1969.2.10.21-30 (11 : 67.5-95.0 mm S.L.), Hooghly river, India.
4. 1970.10.21.44-47 (4 : 179.0-190.0 mm S.L.), Porto Novo.
5. 1973.6.4.73-84 (17 : 52.0-182.0 mm S.L.), Calcutta.
6. 1979.8.15.17-18 (2 : 100.0-111.0 mm S.L.), Porto Novo.
7. 1979.8.15.19-24 (6 : 81.0-190.0 mm S.L.), Porto Novo.

Diagnosis:- An Indian species of *Thryssa* (*Scutengraulis*), from the east coasts of India, with an oblique mouth; maxilla 21.0-25.0 % S.L. and extending slightly beyond hind border of interoperculum; its 1st sypramaxilla extremely small, teeth in jaws slightly enlarged, those on lower jaw larger (pl. 245c, d); predorsal somewhat longer than postdorsal length 51-55 (cf. 45-51) % S.L.; anal rays 36-40 (tbl. 13) and originating below base of 8th dorsal ray or just behind base of dorsal; tip of pectorals reaching to midpoint of depressed pelvics or slightly beyond; tip of depressed pelvics terminating at a short distance before origin of dorsal; vertical striae on scales interrupted and slightly overlapping at centre (pl. 246d, e); gillrakers 11-13+17-19 (fig. 115), the serrae not clumped (pl. 246f); pseudobranch completely covered by skin; cross-section of urohyal Y-shaped (pl. 246c); gas bladder open to outside at anus, its pneumatic duct emerging from a region slightly behind oesophagus (pl. 245b); and a pair of dark lines on back, from head to caudal.

Remarks:- Easily misidentified as *T.* (*S.*) *malabarica* but they are rather different, as indicated in the key. In the smallest studied specimen 52.0 mm S.L., its lower jaw teeth are still bigger than those of upper jaw and the pigment lines on the midline of the back are very well developed.

Distribution:- East coasts of India.

124. Thryssa (Scutengraulis) malabarica (Bloch, 1795)

(Plates 247a-d, 248a-e; Figures 32C, 115, 118; Tables 13, 13.1, 13.2)

Clupea malabarica Bloch, 1795, Naturg. ausländ. Fische, 9 : 115, pl. 432 (Tranquebar).

Thryssa cuvieri Swainson, 1839, Nat. Hist. Anim., 2 : 293 (on Poorwa of Russell, 1803, Fishes of Coromandel, 2 : 75, pl. 194).

Specimens examined (17 : 81.0-175.0 mm S.L.)

Types:

1. BMNH 1868.10.25.27 (1 : 164.0 mm S.L.), Madras. Putative neotype of C. malabarica.

Other specimens:

2. BMNH 1852.9.13.173 (1 : 168.0 mm S.L.), N.E. Arabian Sea.
3. 1889.2.1.1759 (1 : 135.0 mm S.L.), Malabar.
4. 1898.12.24.52 (1 : 81.0 mm S.L.), Kurrachee.
5. 1965.7.12.256-257 (2 : 138.0-151.0 mm S.L.), Waltair.
6. 1967.3.4.59 (1 : 122.0 mm S.L.), India.
7. 1967.11.20.159-160 (2 : 117.0-130.0 mm S.L.), 25°11'N : 66°20'E.
8. 1969.11.6.18-20 (3 : 147.0-175.0 mm S.L.), Porto Novo.
9. 1970.10.21.48-51 (4 : 148.0-156.0 mm S.L.), Porto Novo.
10. 1979.8.15.16 (1 : 120.0 mm S.L.), Porto Novo.

Diagnosis:- A deep bodied species of Thryssa (Scutengraulis), from Pakistan and India, its depth 33.5-37.4 % S.L., with a subterminal and distinctly oblique mouth; maxilla projecting slightly behind hind border of interoperculum and 20.9-22.6 % S.L.; 1st supramaxilla very small; teeth in jaws villiform (pl. 247c, d), predorsal slightly shorter than postdorsal length 49-50 (cf. 50-53) % S.L.; anal rays 37-41 (tbl. 13) and originating below base of last dorsal ray or just half an eye diameter behind it; tip of pectorals reaching to pelvic base or anterior half of that fin; tip of depressed pelvics about three-fourths of an eye diameter before origin of dorsal or to below predorsal scute; vertical striae on scales interrupted and slightly overlapping at centre (pl. 248d); gillrakers 14-16+17-19 (fig. 115) the serrae not clumped (pl. 248e); pseudobranch almost entirely concealed under skin, or tips of longest filaments slightly exposed; cross-section of urohyal Y-shaped (pl. 248c), gas bladder open to outside at anus and unique in having a short posterior median prolongation and its pneumatic duct emerging from just behind oesophagus (pl. 247b); most parts of head and fins dirty and with a distinct humeral spot.

Remarks:- The development of a short posterior extension of the gas bladder is very characteristic and has not been so far reported in any species of engraulid fishes. The pectorals are sometimes black (BMNH. 1979.8.15.16); this colour variation is also reported by Nair (1953). The occurrence of this fish in Sulawesi (N. Celebes) as quoted by Weber & DeBeaufort (1913) after A.B. Meyer (1985), is probably erroneous.

Distribution:- Pakistan to Waltair, India.

125. Thryssa (Scutengraulis) hamiltonii Gray, 1835
(Plates 249a-d, 250a-f; Figures 32D, 115, 118; Tables 13, 13.1, 13.2)

Thryssa hamiltonii Gray, 1835, Illustr. Ind. Zool., Hardwicke, 2 : pl. 92 (no locality).

Engraulis grayi Bleeker, 1851, Natuurk. Rijdschr. Ned.-Indië, 2 : 492 (Batavia, Rio).

Specimens examined (100 : 32.0-200.0 mm S.L.)

Types:

1. RMNH 7068 (1 : 160.0 mm S.L.), Batavia, Rio. Lectotype of E. grayi.
2. BMNH 1867.11.28.51 (1 : 142.0 mm S.L.), Batavia, Rio. Paralecto-

type of *E. grayi*.

Other specimens:

3. BMNH 1845.6.22.113 (1 : 158.0 mm S.L.), Sumatra.
4. 1851.12.27.197 (1 : 153.0 mm S.L.), China.
5. 1852.9.13.174 (1 : 158.0 mm S.L.), N.E. Arabian Sea.
6. 1852.11.4.9 (1 : 173.5 mm S.L.), Molucca.
7. 1860.3.19.445 (1 : 117.0 mm S.L.), Penang (left side dried skin).
8. 1889.2.1.1752-1754 (3 : 104.0-140.0 mm S.L.), Madras.
9. 1889.2.1.1756 (1 : 170.0 mm S.L.), Andaman Is.
10. 1889.2.1.1770 (1 : 70.0 mm S.L.), Bombay.
11. 1889.2.1.1772-1773 (2 : 147.0-160.0 mm S.L.), Madras.
12. 1895.2.28.69 (1 : 141.0 mm S.L.), Sarawak.
13. 1898.12.24.55-56 (2 : 102.0-151.0 mm S.L.), Kurrachee.
14. 1913.12.9.215-216 (2 : 98.5-99.0 mm S.L.), Minita river, New Guinea.
15. 1935.10.21.1 (1 : 86.5 mm S.L.), Palau Langawi, N.W. Malaya.
16. 1964.11.6.12 (1 : 183.0 mm S.L.), China.
17. 1964.11.6.13 (1 : 187.0 mm S.L.), China (left side dried skin).
18. 1965.9.7.16-20 (5 : 93.0-130.0 mm S.L.), Prachuab-kirikhan, Thailand.
19. 1965.10.20.61-63 (3 : 35.0-86.0 mm S.L.), Singapore.
20. 1966.2.28.33 (1 : 140.0 mm S.L.), Chantaburi, Thailand.
21. 1966.3.8.54-65 (12 : 105.0-156.0 mm S.L.), Gulf of Thailand.
22. 1966.11.20.8 (1 : 90.5 mm S.L.), Chantaburi, Thailand.
23. 1967.11.13.655 (1 : 69.0 mm S.L.), Siglap, Malay Peninsula.
24. 1967.11.13.656-657 (2 : 32.0-48.5 mm S.L.), Siglap, Malaya Peninsula.
25. 1969.11.6.24-25 (2 : 150.0-171.0 mm S.L.), Porto Novo.
26. 1971.5.25.3 (1 : 161.0 mm S.L.), Ceylon.
27. 1972.5.9.1-3 (3 : 102.0-110.0 mm S.L.), Bimura Gulf, Papua New Guinea.

28. BMNH 1972.5.9.4-5 (2 : 190.0-200.0 mm S.L.), Kerema Bay, Papua New Guinea.

29. 1972.5.9.6-8 (3 : 92.0-104.0 mm S.L.), Baimura Gulf, Papua New Guinea.

30. 1977.6.17.23 (1 : 167.0 mm S.L.), Porto Novo.

31. 1977.11.17.31-32 (2 : 41.5-42.0 mm S.L.), Panama I., Papua New Guinea.

32. 1978.8.18.167 (1 : 166.0 mm S.L.), Bangladesh.

33. 1978.9.8.129-130 (2 : 150.0-161.5 mm S.L.), Java Sea.

34. 1978.9.8.131-133 (3 : 152.0-173.0 mm S.L.), Java Sea.

35. 1979.8.15.1 (1 : 159.0 mm S.L.), Porto Novo.

36. 1979.8.15.2-4 (3 : 59.0-95.0 mm S.L.), Porto Novo.

37. 1979.8.15.5-9 (5 : 41.0-110.0 mm S.L.), Porto Novo.

38. RMNH 24963 (19 : 108.0-163.0 mm S.L.), Batavia, Rio.

39. USNM 6462 (1 : 134.0 mm S.L.), Bomin I.

40. 72521 (2 : 113.0-122.0 mm S.L.), Batavia, Java.

41. 217045 (1 : 119.0 mm S.L.), Fly river, Papua New Guinea.

42. uncat. (1 : 43.0 mm S.L.), west side of Daru Wharf, Gulf of Papua

Diagnosis:- A widely distributed species of *Thryssa* (*Scutengraulis*), with an oblique and subterminal mouth; maxilla only extending to hind border of interoperculum or not more than three-fourths of a pupil diameter beyond it; 1st supramaxilla very small or sometimes absent; teeth in jaws very small (pl. 249c, d); anal rays 35-41 (tbl. 13), its origin below base of 7th or last dorsal ray, but very rarely behind the latter; tip of pectorals reaching to anterior half or just before base of pelvics; pelvics very short, 6.4-8.3% S.L., their tips about one or three-fourths of an eye diameter before origin of dorsal; vertical striae of scales usually interrupted at centre (pl. 250d, e); gillrakerss only 7-10+11-15 (fig. 115), their serrae not clumped (pl. 250f); pseudobranch completely hidden under skin, cross-section of urchyal Y-shaped (pl. 250c), a dark spot on humeral region and pigment lines along midline of back present.

Remarks:- The pelvics are relatively shorter than in other members of this genus. The low gillraker count makes it near to T. (S.) mystax (9-12+13-17) and T. (S.) spinidens (9-11+13-15), but it is separated from them by other important characters.

The type of T. hamiltonii is not extant and no attempt has hitherto been made to establish a neotype for it. This is perhaps because of uncertainties surrounding its type locality. For the time being I follow most authors in recognising the species of Gray (1835) as the senior synonym of Bleeker's E. grayi.

Distribution:- Pakistan to S.E. Asia, China and Papua New Guinea.

126. Thryssa (Scutengraulis) whiteheadi n. sp.
(Plates 251a-d, 252a-e; Figures 33A, 116, 118, 119; Tables 13, 13.1, 13.2)

Specimens examined (22 : 59.0-143.0 mm S.L.)

Types:

1. BMNH 1920.3.3.192 (1 : 111.5 mm S.L.), Basra, Persian Gulf; C. Chrysty. Holotype.
2. 1920.3.3.183-191 (19 : 59.0-143.0 mm S.L.), data as in 1 Paratypes.
3. UZMK CN. 3-4 (2 : 99.0-160.0 mm S.L.), Bushire road, Persiske Haubugt; H. Blegvad. Paratypes.

Diagnosis:- A new species of Thryssa (Scutengraulis) from the Persian Gulf, with an oblique mouth; maxilla 19.2-21.3 % S.L. and slightly projecting beyond hind margin of interoperculum; 1st supramaxilla wanting; teeth in jaws distinctly enlarged, teeth on the lower jaw larger and uneven (pl. 251c, d); predorsal about equal to postdorsal length 49-52 (cf. 47-51) % S.L.; anal rays 42-46 (tbl. 13) and originating below base of 6th to last dorsal ray; tip of pectorals terminating just at pelvic base or first-third of depressed pelvics; pelvics entirely and distinctly before origin of dorsal; vertical striae on scales interrupted and overlapping at centre (pl. 252d); branchiostegal rays 11-12 (tbl. 13.2); gillrakers usually 13-15+18-20 (fig. 116), their serrae not clumped (pl. 252e); pseudobranch concealed under skin; cross-section of urohyal abbreviated Y-shaped (pl. 252c); gas bladder open to outside at anus, its pneumatic duct very short and emerging from just behind oesophagus (pl. 251b); humeral spot indistinct and no prominent markings on midline of back.

Remarks:- In its enlarged jaw teeth, this fish resembles *T.* (*S.*) *spinidens* and *T.* (*S.*) *dayi* n. sp. From the former species it differs in its higher count of gillrakers, 12-15+18-21 (cf. 9-11+13-15) (fig. 116) and its very short and anterad position of the pneumatic duct. From the latter species, it chiefly differs in having a shorter maxilla, 19.2-21.3 (cf. 23.0-26.9) % S.L., nonfilamentous pectoral and also a higher count of gillrakers, 12-15+18-21 (cf. 11-13+14-18). To this can be added its absence of a 1st supramaxilla and the allopatric distribution.

The second species of *Thryssa* that inhabits the Persian Gulf is *T.* (*S.*) *vitrirostris*.

This new species is named for Dr P.J.P. Whitehead, my doctorate supervisor and Head of the Fish Section, British Museum (Natural History), London, to whom I am greatly indebted for his willing supervision, generous encouragement and patient attending to my endless queries during the long course of my study in his beautiful museum and liberalized country, England.

Distribution:- Persian Gulf.

127. *Thryssa* (*Scutengraulis*) *purava* (Hamilton-Buchanan, 1822)
(Plates 253a-e, 254a-e, 331e; Figures 33A, 116, 118, 119; Tables 13, 13.1, 13.2)

Clupea purava Hamilton-Buchanan, 1822, *Fishes of the Ganges* : 238, 382
(Ganges estuaries).

Thryssa megastoma Swainson, 1839, Nat. Hist. Anim., 2 : 293 (on Pedda poorwah of Russell, 1803, Fishes of Coromandel, 2 : 73, pl. 190)

Engraulis annandalei Chaudhuri, 1916, Mem. Indian Mus., 5 (4) : 419, fig. 3 (Chilka Lake).

Engraulis kempi Chaudhuri, ibid. : 421, fig. 4 (Chilka Lake).

Engraulis rambhae Chaudhuri, ibid. : 423, fig. 5 (Chilka Lake).

Specimens examined (49 : 46.0-137.0 mm S.L.)

Types:

1. ZSI F. 8781/1 (1 : 137.0 mm S.L.), Nalbano I., Chilka Lake. Holotype of E. annandalei.
2. F. 8782/1 (1 : 67.0 mm S.L.), off Barkal, Chilka Lake. Holotype of E. kempi.
3. F. 8785/1 (1 : 64.0 mm S.L.), Patsahnipur, Chilka Lake. Cotype of E. kempi.
4. F. 8786/1 (1 : 60.0 mm S.L.), data as in 3.
5. F. 8787-8788/2 (2 : 58.0-61.0 mm S.L.), data as in 3.
6. F. 8790/1-8799/1 (10 : 46.0-56.0 mm S.L.), data as in 3.
7. F. 8783/1 (1 : 95.0 mm S.L.), Rambha Bay, Chilka Lake. Holotype of E. rambhae.
8. F. 8800/1 (1 : 102.0 mm S.L.), data as in 6. Cotype of E. rambhae.
9. F. 8801/1 (1 : 53.5 mm S.L.), off Nalbano, Chilka Lake. Cotype of E. rambhae.

Other specimens:

10. BMNH 1889.2.1.1792 (1 : 72.0 mm S.L.), Orissa.
11. 1889.2.1.1804-1809 (6 : 89.0-115.0 mm S.L.), Madras.
12. 1969.2.10.1-10 (10 : 66.0-93.5 mm S.L.), Hooghly estuary, India.
13. 1969.2.10.11-20 (10 : 61.0-85.0 mm S.L.), Hooghly river, India.

14. BMNH 1979.7.5.25 (1 : 103.0 mm S.L.), no data.

15. 1979.8.15.14-15 (2 : 136.0-142.0 mm S.L.), Porto Novo.

Diagnosis:- A species of Thryssa (Scutengraulis), from the east coast of India, with an oblique mouth; maxilla 19.6-23.1 % S.L., its tip projecting beyond hind border of interoperculum to about first-third or half of distance between it and base of pectoral; 1st supramaxilla very small (pl. 253d, e); teeth in lower jaw slightly larger than those in upper jaw (pl. 253d, e); predorsal about equal to postdorsal length 47-52 (cf. 48-54) % S.L.; anal rays 42-47 (tbl. 13) and originating below base of 15th to last dorsal ray, tip of pectorals reaching to pelvic base or first half of depressed pelvics; pelvics entirely and distinctly before origin of dorsal; vertical striae on scales more or less interrupted at centre (pl. 254d); branchiostegal rays usually 13 (tbl. 13.2); gillrakers usually 14-16+18-19 (fig. 116), serrae not clumped (pl. 254e); pseudobranch hidden under skin; cross-section of urohyal abbreviated Y-shaped (pl. 254c); gas bladder open to outside at anus, its pneumatic duct of moderate length and emerging from just behind oesophagus (pl. 253c); humeral spot indistinct and a very faint dark or dusky band along midline of back from head to caudal.

Remarks:- Hamilton-Buchanan's (1822) description of C. purava lacks most relevant data, but he gives the anal ray count for his fish as 46, the back arches, and the upper lip produced into a dagger-like process. He also indicated the absence of spots on its body and added that the fish was very common in the estuaries of the Ganges. He related his fish to Russell's Poorawah, Bloch's Clupea malabarica and C. setirostris of Bonnaterre (Tabl. Encycl. p. 186, pl. 76, fig. 316). The arched back could be caused during preservation, as has been found in many of my own specimens (types of E. rambhae, ZSI. F. 8783/1, 8800/1, 8801/1 and BMNH. 1969.2.10.1-10, 1969.2.10.11-20) (fig. 253b). From his account and on the basis of my material, only T. (S.) stenosoma n. sp. and T. (S.) spinidens could perhaps also qualify as purava, but my specimens suggest that these two species are much less common in the area. For the time being, therefore, I feel fairly confident in regarding my forty-nine specimens as the same fish as Hamilton-Buchanan's.

On the basis of the above diagnosis and other characters presented elsewhere in this work, E. annandalei, E. kempi and E. rambhae are found with some confidence to be identical to each other and junior synonyms of T. (S.) purava.

It is interesting to note here that the pectorals of a specimen from Porto Novo (BMNH. 1979.8.15.14-15), 142 mm S.L. are black; this rare variant has otherwise only been recorded in T. (S.) malabarica, but not in other congeners.

The distribution of T. (S.) purava as given by most authors does not agree with my material. Its occurrence outside the Bay of Bengal needs to be confirmed, but is most likely erroneous.

In the absence of strictly topotypical specimens, I cannot select a neotype for C. purava from the Hooghly estuary.

Distribution:- Entire east coast of India and Ganges estuaries.

128. Thryssa (Scutengraulis) stenosoma n. sp.

(Plates 255a-d, 256a-e; Figures 33A, 116, 118, 119; Tables 13, 13.1, 13.2)

Specimens examined (9 : 71.0-148.0 mm S.L.)

Types:

1. BMNH 1965.7.12.231 (1 : 128.0 mm S.L.), Godavari estuary, India; S. Dutt. Holotype.
2. 1965.7.12.226-230 (5 : 121.0-148.0 mm S.L.), data as in 1. Paratypes.
3. 1967.3.4.56 (1 : 148.0 mm S.L.), India; Babu Rao. Paratype.
4. 1978.8.18.162-163 (2 : 71.0-74.0 mm S.L.), Bangladesh. M.A. Quddus. Paratypes.

Diagnosis:- A new species of Thryssa (Scutengraulis) from the Godavari and Ganges estuaries, with slender body, its depth 23.4-26.3 % S.L., mouth subterminal; its maxilla 20.4-24.5 % S.L., projecting to pectoral base or just behind it; 1st supramaxilla present but very small; lower jaw teeth slightly larger than those in upper jaw (pl. 255c, d); predorsal about equal to postdorsal length or 49-52 (cf. 49-53) % S.L.; anal rays 43-48 (tbl. 13), its origin commencing below base of 9th to last dorsal ray; pectoral length 16.9-18.8 % S.L., its tip reaching to pelvic base or not beyond anterior third of depressed pelvic length, pelvics entirely before origin of dorsal; vertical striae on scales interrupted at centre (pl. 156d); gillrakers usually 13-15+17-19 (fig. 116), serrae large but not clumped (pl. 256e); pseudobranch entirely hidden under skin; cross-section of urohyal Y-shaped (pl. 256c); gas bladder open to outside at anus, its pneumatic duct emerging from a short distance behind oesophagus (pl. 255b); no humeral spot but a pair of pigment lines on midline of back from head to caudal.

Remarks:- The maxilla of this new species is slightly longer than the length of the head in moderate size or larger fish, but it is about equal or just shorter than head in specimens of 74 mm S.L. or smaller.

Apart from T. (S.) dayi n. sp., a species which differs chiefly in the presence of a short pectoral filament, deeper body, slightly longer maxilla and fewer gillrakers. The present fish is closely related to T. (S.) purava. From the latter species it can be distinguished by its slenderer body 23.4-26.3 (cf. 24.6-29.5) % S.L.; its maxilla reaching pectoral base (instead of only to first-third or half way between hind border of interoperculum and base of pectoral); and its head, 19.5-21.0 (cf. 21.2-24.7) % S.L.

Named for its slender body when compared with closely allied species.

Distribution:- Godavari and Ganges estuaries..

129. Thryssa (Scutengraulis) dayi n. sp.

(Plates 257a-d, 258a-e; Figures 33B, 116, 118, 119; Tables 13, 13.1, 13.2)

Specimens examined (12 : 66.0-215.0 mm S.L.)

Types:

1. BMNH 1889.2.1.1803 (1 : 208.0 mm S.L.), Bombay; F. Day. Holotype.
2. 1860.3.19.820 (1 : 145.0 mm S.L.), Sind; environs of Karachi. Paratype.
3. 1889.2.1.1802 (1 : 215.0 mm S.L.), Sind; F. Day. Paratype.
4. 1965.7.12.249-250 (2 : 128.0-145.0 mm S.L.), Bombay; S. Dutt. Paratypes.
5. 1965.7.12.251-255 (5 : 138.0-152.0 mm S.L.), Ernaculam, India; S. Dutt. Paratypes.

Other specimens:

6. BMNH 1889.2.1.1794 (1 : 66.0 mm S.L.), Bombay; F. Day.
7. 1969.8.19.9 (1 : 80.5 mm S.L.), Bombay; I.A. Ronquillo.

Diagnosis:- A new species of Thryssa (Scutengraulis) from Pakistan and the west coast of India, characterized by having an oblique mouth; maxilla produced into a long process and reaching pectoral base, 23-27 % S.L. (pl. 119) or slightly longer than head; 1st supramaxilla present but very small, teeth in jaws enlarged those in lower jaw larger (pl. 257c, d); anal rays 44-49 (tbl. 13) and originating below base of 6th to 9th dorsal ray; upper pectoral ray produced into a short filament; tip of depressed pelvics about an eye diameter before origin of dorsal; vertical striae on scales interrupted at centre (pl. 258d); gillrakers 10-13+14-18 (fig. 116), their serrae enlarged, but not clumped (pl. 258e); pseudobranch entirely hidden under skin; cross-section of urohyal Y-shaped (pl. 258c); gas bladder open to outside at anus, its pneumatic duct emerging from just behind oesophagus (pl. 257b); humeral spot indistinct a pair of double pigment lines along midline of back from head to caudal and upper pectoral rays usually dirty dark.

Remarks:- This is the only species of Thryssa which has short filamentous pectoral rays. It closely resembles T. (S.) purava and replaces that species on the west coasts of India. They differ, however, in a number of important characters as shown in the key and disgnoses of both species.

Named as a tribute to Francis Day, the greatest of the early ichthyologists to study Indian fishes. His Fishes of India and Fishes of Malabar, although written a century ago, were still of the greatest use to me in establishing and organizing the fish collection for the Marine Fisheries Laboratory in Bangkok in 1965.

Distribution:- Pakistan and west coast of India.

130. Thryssa (Scutengraulis) spinidens (Jordan & Seale, 1925)
(Plates 259a-d, 260a-e, 315f, 320b; Figures 33B, 116, 118, 119; Tables 13, 13.1, 13.2)

Xenengraulis spinidens Jordan & Seale, 1925, Copeia, No. 141 : 29 (India, Siam, Calcutta, Rangoon).

Specimens examined (9 : 59.5-162.0 mm S.L.)

Types:

1. MCZ 31541 (1 : 162.0 mm S.L.), Thailand; Salmin. Paratype of X. spinidens.

Other specimens:

2. BMNH 1872.4.17.66a (1 : 59.5 mm S.L.), N.E. Bengal Bay.
3. 1891.11.30.384-388 (5 : 112.0-129.5 mm S.L.), Sittang river, Burma.
4. MCZ 17967 (1 : 155.0 mm S.L.), Rangoon.
5. 18054 (1 : 162.0 mm S.L.), Calcutta.

Diagnosis:- An eastern Indian Ocean species of Thryssa (Scutengraulis), with an oblique mouth; maxilla projecting slightly beyond hind border of interoperculum about half of an eye diameter or half way to base of pectorals, its extreme length 19-22 % S.L., 1st supramaxilla present but very small or more usually absent; teeth in jaws distinctly enlarged, those on lower jaw larger (pl. 259c, d); predorsal longer than postdorsal length, 52-55 (cf. 46-50) % S.L., anal rays 44-48 (tbl. 13) and commencing below base of 6th to 12th dorsal rays; tip of pectorals reaching pelvic base or to anterior third of depressed pelvics; tip of pelvics terminating at about two and a half to one and a half eye diameters before origin of dorsal; vertical striae on scales distinctly interrupted at centre (pl. 260d); gillrakers only 9-11+13-15 (fig. 116), their serrae not clumped (pl. 260c); pseudobranch entirely hidden under skin; cross-section of urohyal Y-shaped (pl. 260c); gas bladder open to outside at anus, its pneumatic duct very long and emerging from just behind oesophagus (pl. 259b); humeral spot indistinct and without dark bands or lines on back.

Remarks:- The extreme length of the maxilla of this fish is always slightly shorter than the head length in specimens smaller than 150 mm S.L. (19.2-21.8, cf. 20.0-23.4 % S.L.) but vice versa in larger fish (19.2-20.4, cf. 18.8-19.1 % S.L.). The enlarged jaw teeth, although characteristic of the species, are also found in S. (S.) whiteheadi n. sp., S. (S.) dayi n. sp. and S. (S.) gautamiensis. Its small hidden spine on the anterodorsal portion of the operculum is in fact developed more or less in most species of this genus. I have therefore found no reason to place this fish in the separate genus Xenengraulis as did Jordan & Seale (1925).

The British Museum specimens were misidentified as Engraulis mystax or E. purava. These species are rather different, as indicated in the key and their diagnoses.

The recent record of this fish from the Gulf of Papua by Roberts (1978) turns out to be misidentification of T. (S.) hamiltonii.

Distribution:- Bay of Bengal, from Calcutta, Burma to Thailand.

131. Thryssa (Thryssa) setirostris (Broussonet, 1782)
(Plates 261a-d, 262a-e, 331f; Figures 33C, 117, 118, 119; Tables 13, 13.1, 13.2)

Clupea setirostris Broussonet, 1782, Ichth. : text and pl. 2, no pagination (Pacific near Tanna Is., Society group).

Clupea mystacina Schneider, 1801, Syst. Ichth. Bloch. : 428 (Tanna Is., On Forster MS. name; in synonymy of Clupea setirostris); Lichtenstein, 1844, Descript. Anim. Forst. : 295 (Tanna Is., on Forster MS.).

Clupea seticornis Rees, 1807, New Cyclopedia, 8 (2), pt. 16 : no pagination, under Clupea.

Thryssa macrognathos Bleeker, 1849, Verh. batav. Genoot. Kunst. Wet., 22 : 14 (Madura near Bangcallang, Kammal, Surabaya).

Specimens examined (73 : 31.0-147.5 mm S.L.)

1. BMNH 1852.9.13.172 (1 : 90.5 mm S.L.), N.E. Arabian Sea.
2. 1867.11.28.58 (1 : 127.5 mm S.L.), E. Indies. Bearing a label indicating it to be suitable as a neotype of T. macrognathos by Whitehead, Boeseman & Wheeler (1966).
3. 1919.4.1.2. (1 : 100.5 mm S.L.), Durban.
4. 1928.6.22.5 (1 : 87.0 mm S.L.), Amoy, China.
5. 1963.12.9.60-80 (21 : 68.0-123.0 mm S.L.), Mukalla, Jibuti, Gulf of Aden.
6. 1963.12.9.81-89 (18 : 31.0-53.0 mm S.L.), Berbera, Gulf of Aden.
7. 1964.12.14.345 (1 : 89.0 mm S.L.), Ruvu estuary.
8. 1964.12.14.346-351 (6 : 80.0-104.0 mm S.L.), Pangani Bay, Tanzania.
9. 1965.7.12.244 (1 : 129.0 mm S.L.), Waltair.
10. 1966.11.16.958-965 (8 : 119.0-133.0 mm S.L.), Formosa Bay, Kenya.
11. 1966.11.16.966-968 (3 : 120.5-135.0 mm S.L.), Malindi, Kenya.
12. 1966.11.20.11 (1 : 92.5 mm S.L.), Chantaburi, Thailand.
13. 1967.11.13.598 (1 : 103.0 mm S.L.), Siglap.
14. 1967.11.13.599 (1 : 40.0 mm S.L.), Krangi.
15. 1967.11.13.600-601 (2 : 39.5-40.0 mm S.L.), Siglap.
16. 1967.11.20.161 (1 : 116.5 mm S.L.), 23°16'N : 23°12'E.
17. 1967.11.20.162 (1 : 118.0 mm S.L.), 21°00'N : 91°59'E.

18. BMNH 1969.11.6.22-23 (2 : 113.0-147.5 mm S.L.), Porto Novo.

19. 1978.8.18.168 (1 : 130.5 mm S.L.), Bangladesh.

20. 1979.8.15.10 (1 : 122.0 mm S.L.), Porto Novo.

Diagnosis:- The single species of the subgenus *Thryssa* (*Thryssa*), strikingly different from *T.* (*Thrissina*) and *T.* (*Scutengraulis*) in having a bluntly rounded snout; maxilla exceedingly long, 43-61 % S.L. and reaching base of pelvics in very young fish (31 mm S.L.) or to origin of anal in large adult fish; 1st supramaxilla present and about one-fourth of the size of 2nd supramaxilla; lower jaw with a high coronoid process, a somewhat similar bony process also developed on maxilla just under posterior portion of 2nd supramaxilla; teeth in jaws villiform (pl. 261c, d); predorsal slightly longer than postdorsal distance, 50-53 (cf. 46-50) % S.L.; anal rays 32-39 and originating below base of 10th to just behind last dorsal ray; tip of pectorals reaching to just before pelvic base or to first third of its length; tip of depressed pelvics below base of 3rd to 4th dorsal ray; vertical striae of scales continuous or overlapping at centre (pl. 262d); gillrakers only 5-6+10-12 (fig. 117), their serrae small and not clumped (pl. 262e); pseudobranch entirely hidden under skin; branchiostegal rays only 10-11 and greatly increasing in size posteriorly (pl. 262b); 1st and 3rd suborbital bones with very short posterior extensions (pl. 262a); cross-section of urohyal pin-shaped (pl. 262c); gas bladder open to outside at anus, with its pneumatic duct emerging from just above hind end of fundus of stomach (pl. 261b); humeral spot indistinct.

Remarks:- The coronoid process of this fish, which was first observed and used to diagnose the species by Whitehead (1968b, 1973b), is unique and led to a search for other specialized characters. Although Whitehead (*loc. cit.*) did not place the fish in a distinct subgenus, he nevertheless clearly separated it from the rest of *Thryssa* in the key. In addition to the jaw specialization and other characters indicated in the above diagnosis, the overall shape of head is also unique, implying further osteological differences

In comparison with T. (Thrissina) baelama, a species formerly recognised as a separate genus merely on the basis of the absence of prepectoral scutes, the present species is far more worthy of separation at subgeneric or even generic level.

This widely recorded species has also been reported from the Philippines by Fowler (1941) and from New Guinea by Hardenberg (1941) and Munro (1964). I have no hesitation in accepting Marshall's (1964) description and his perfect colour drawing of this fish from Queensland. Its type locality is the Pacific near Tanna Is. (Society group), but I have seen no specimen from this area and no designation can be made of a neotype. My interpretation of Broussonet's species is based entirely on previous authors, but the extremely long maxilla is apparently unique to this species.

Distribution:- East coast of Africa to S.E. Asia, China and Tanna Is.

132. Papuengraulis micropinna Munro, 1964

(Plates 263a-d, 264a-e, 315h, 325d, 332b; Figures 33D, 121; Table 14)

Papuengraulis micropinna Munro, 1964, Papua and New Guinea agric. J. 16 (4) : 150, fig. 2 (Port Romilly, Gulf of Papua).

Specimens examined (4 : 106.0-118.0 mm S.L.)

Types:

1. CSIRO C. 3517-3518 (2 : 116.0-117.0 mm S.L.), off Port Romilly, Gulf of Papua. Paratypes.

Other specimens:

2. RMNH uncat. coll. 304; U.W. 106 (2 : 106.0-108.5 mm S.L.), off North New Guinea.

Diagnosis:- The single species of the genus Papuengraulis, unique in its many rather specialized characters; body greatly compressed its depth 28.4-29.4 % S.L.; mouth greatly upturned, tip of lower jaw distinctly prominent; maxilla short and projecting only to front border of preoperculum, its posterior end reaching slightly beyond 2nd supramaxilla, 1st supramaxilla and premaxillae large; teeth in jaws villiform (pl. 263c, d); dorsal greatly reduced in size, its rays only 5-6, preceded by a small scute; anal rays 54-56 (tbl. 15); pectoral rays 13-14, its first ray strongly ossified, the tip of the fin surpassing base of pelvics, its extreme length 23.1-24.1 % S.L.; scales with many radii (pl. 264d), as in Setipinna and Coilia; only 5-6 spike-like prepectoral scutes; gillrakers 15-16+25-27 (fig. 121), their serrae very small and not clumped (pl. 264e); branchiostegal rays 10-11 and slender (pl. 264b); pseudobranch present, with 14-16 filaments; cross-section of urohyal distinctly Y-shaped (pl. 264c); gas bladder well developed and open to outside at anus, its pneumatic duct very short and emerging from just behind oesophagus (pl. 263b); pyloric caeca about 13, humeral spot present.

Remarks:- Phyletically, P. micropinna is highly specialized in its compressed body; carinate belly; reduction of dorsal; ossification of uppermost pectoral ray and large size of that fin; high number of anal rays; upturned mouth and well developed premaxillae and the Y-shaped cross-section of the urohyal. Nevertheless, it retains many primitive characters, e.g. short maxilla, large 1st supramaxilla, villiform teeth in jaws; slender branchiostegal rays; exposed pseudobranchial filaments; radial striae on scales; spike-like prepectoral scutes; well developed gas bladder which opens to the outside at anus and the anterad position of the pneumatic duct.

The combination of so many primitive with so many specialized characters makes it difficult to assess the real affinities of this fish. It seems to mark an end-point in certain trends found in the genus Thryssa, most particularly in its highly compressed body, large pectorals, small dorsal fin but long anal. A similar end-point is seen in the clupeids Odontognathus of the New World and Raconda of the Indo-Pacific. On the other hand, the apparent retention of so many primitive characters seems to suggest long isolation from the rest of the Thryssa-Lycothrissa-Setipinna-Heterothrissa group.

Distribution:- Papua New Guinea.

133. Lycothrissa crocodilus (Bleeker, 1850)

(Plates 265a-d, 266a-e, 315g, 320c, 325c, 332a; Figures 33D, 120; Table 15)

Engraulis crocodilus Bleeker, 1850, Natuurk. Tijdschr. Ned.-Indië, 1 : 15 (Bandjermassing).

Specimens examined (20 : 58.0-228.0 mm S.L.)

Types:

1. RMNH 7015 (1 : 147.0 mm S.L.), Bandjermassing. Holotype of E. crocodilus.

Other specimens:

2. ANSP 61496-61501, 60552-60564 (15 : 58.0-191.0 mm S.L.), Bangkok; mixed with three specimens of Setipinna melanochir, 44.0-46.0 mm S.L.
3. BMNH 1867.11.28.48 (1 : 129.0 mm S.L.), Borneo.
4. KUMF 2843 (1 : 228.0 mm S.L.), Nontaburi, Thailand.
5. MNHN 3726 (1 : 187.0 mm S.L.), Sumatra.
6. NIFI uncat. (1 : 135.0 mm S.L.), Bueng-borapet (lake), Nakornsawan, Thailand.

Diagnosis:- The single species of Lycothrissa, slender body, depth 19.0-23.4 % S.L.; maxilla bluntly pointed posteriorly its hind end slightly projecting beyond 2nd supramaxilla; 1st supramaxilla absent; some teeth in jaws greatly enlarged and canine-like, but interspersed by a number of small teeth (pl. 265c, d); dorsal originating above base of 7th to 11th anal rays and much nearer to caudal than tip of snout (58-62 cf. 40-42 % S.L.); anal rays 47-51; pectorals with uppermost ray moderately ossified, its tip reaching just beyond pelvic base or almost to tip of that fin; pelvics very small (5.2-7.3 % S.L.), with 7 or rarely 6 rays, and distinctly placed before origin of dorsal or anal; scales with a few interrupted vertical striae or radii (pl. 266d); ventral scutes 7-9+8-11 and never developed before lower pectoral base, gillrakers 6-7+8-10, their serrae enlarged but not clumped (pl. 266e);

inner face of 3rd epibranchial without rakers; branchiostegal rays 12-15 and very similar to Setipinna in shape, pseudobranch very small, with 2-5 filaments or entirely hidden under skin, posterior portion of urohyal transformed into a rod-shaped process, its cross-section pin-shaped (pl. 266c); 1st suborbital bone very slender and short, while 3rd suborbital greatly expanded (pl. 266a); pyloric caeca about 13; gas bladder greatly reduced and forming a thread-like tube, its pneumatic duct emerging from a short distance above hind end of fundus of stomach (pl. 265b); no humeral spot, digestive tract colourless.

Remarks:- This species resembles in many characters Setipinna and Heterothrissa and perhaps they stemmed from a common ancestor. It's thicker and slender body and fewer anal rays imply that it is more primitive than these two, however.

Apart from the localities of the specimens listed, Weber & DeBeaufort (1913) reported it from Borneo (Bandjermassing, Pontianak, Sinkawang, middle course of the Kapuas river); Sumatra (Banjuasin, Palembang, Djambi) and Chevey (1932) and Chevey & Poulain (1940) found it at Tonle Sap, Cambodia. It's ability to ascend into the freshwaters or the lower courses of rivers within tidal influence is also supported by the findings of Hardenberg (1936) from the Kapuas river, Borneo and by Smith (1945) from the Chao Phraya river, Thailand. Interestingly, one of my specimens, 135 mm S.L. (NIFI. uncat.) was collected from Lake Bueng-borapet of that same river in Thailand, about 210 km from the sea. Because of its unique body shape and fins, I do not doubt the previous records of its distribution.

Distribution:- Marine and freshwaters of S. China Sea and Java Sea regions.

134.1 Setipinna tenuifilis tenuifilis Valenciennes, 1848

(Plates 267a-d, 268a-e, 332c; Figures 34A, 122, 123; Tables 16, 16.1, 16.2)

Engraulis tenuifilis Valenciennes, 1848, Hist. nat. Poiss., 21 : 62 (Rangoon).

Setipinna godavari Babu Rao, 1961, Proc. 1st. all-India Congr. Zool., 1959 : 367 (Godavari estuary).

Specimens examined (55 : 55.0-133.0 mm S.L.)

Types:

1. MNHN 3731 (2 : 105.0-106.0 mm S.L.), Irrawady river, Rangoon. Syntypes of E. tenuifilis.

Other specimens:

2. BMNH 1868.6.9.11.12 (2 : 73.0-75.0 mm S.L.), Sarawak.
3. 1889.2.1.1790-1791 (2 : 72.0-113.0 mm S.L.), Orissa.
4. 1889.2.1.1800 (2 : 55.0-57.5 mm S.L.), Andaman Is.
5. 1889.2.1.1810 (1 : 100.0 mm S.L.), Calcutta.
6. 1967.11.20.376-404 (32 : 65.0-133.0 mm S.L.), 15°20'N : 96°24'E.
7. 1967.11.20.405-406 (2 : 80.0-85.0 mm S.L.), 15°20'N : 96°24'E.
8. 1973.6.4.1-6 (6 : 99.0-118.0 mm S.L.), Calcutta.
9. 1979.8.16.844 (2 : 68.0-68.5 mm S.L.), India.
10. 1979.8.24.131-132 (2 : 95.0-114.0 mm S.L.), Takisung, Kalimantan.
11. 1979.8.24.143 (1 : 100.0 mm S.L.), Bandjermassing, Kalimantan.
12. 1979.8.24.169 (1 : 91.0 mm S.L.), Aluhaluh, Barito river, Borneo.

Diagnosis:- The nominate form of Setipinna tenuifilis, differs from S. tenuifilis gilberti as indicated in the diagnosis of that fish. Anal origin about three-fourths or one eye diameter before origin of dorsal. Pyloric caeca 26-36, colourless; oesophagus and stomach jet dark, intestine dusky.

Remarks:- It is now clear that the syntypes of E. tenuifilis are a good species and not S. taty, as believed by Whitehead (1967a). Their gillraker count of 11+14, with slightly clumped serrae; ventral scutes 19+7; pectoral filament reaching base of 15th-16th anal ray and the absence of scales (scale pockets) on the dorsal are all distinctive characters which distinguish them from S. taty. The original description of S. godavari also agrees perfectly with the present species, instead of with S. papuensis as thought by Whitehead (1973b). The differences between these two species are shown under S. papuensis.

The serrae of the gillrakers are usually indistinctly clumped, but they are occasionally distinctly clumped (BMNH. 1979.8.24.143).

Distribution:- Bay of Bengal to Sarawak.

134.2 Setipinna tenuifilis gilberti Jordan & Starks, 1905
(Plate 269a-c; Figures 34A, 122, 123; Tables 16, 16.1, 16.2)

Setipinna gilberti Jordan & Starks, 1905, Proc. U.S. natn. Mus., 28 : 194, fig. 1 (Chemulpo, Korea).

? Setipinna lighti (Herre) Wu, 1929, Contr. biol. Lab. Sci. Soc., China, 4 : 26, fig. 20 (Amoy).

Specimens examined (2 : 125.0-131.0 mm S.L.)

Types:

1. USNM 37766 (1 : 125.0 mm S.L.), Korea. Holotype of S. gilberti.

Other specimens:

2. BMNH 1928.6.22.3 (1 : 131.0 mm S.L.), Amoy, China.

Diagnosis:- A Chinese subspecies of Setipinna tenuifilis, chiefly differing from S. tenuifilis tenuifilis in having a somewhat shallower body, 27.2-30.0 (cf. 28.3-32.6)% S.L. (fig. 123); back evenly and smoothly convex instead of forming a broadly acute angle at dorsal origin (pl. 267a); anal origin below origin of dorsal; pectoral rays 13 (cf. usually 12) (tbl. 16.1), its filament reaching to 9th (cf. 11th-21st) anal ray (tbl. 16.2); ventral scutes 19-20+8 (cf. 17-21+7) (tbl. 16.1, 16.2); gillrakers 12+16-17 (cf. 10-11+13-14) (fig. 122), their serrae indistinctly clumped (pl. 267c).

Remarks:- Re-examining the holotypes and other specimens of S. gilberti and

and S. tenuifilis, I find a slight but distinct difference which justifies recognition of a Chinese subspecies.

Chang, Chu-lin et alii (1955, in Chinese) and Lindberg & Legeza (1967) provide good illustrations of their S. gilberti from Huang Po Hai and Yellow Sea (respectively) and these show the characteristic short pectoral filament which reaches to anal origin or just before it.

For the time being I tentatively refer S. lighti of Wu (1929) from Amoy to the present fish. Its original description, although imperfect, cannot be related to other species of Setipinna, and its distribution conforms with this subspecies. The description of the same species by Wang (1933) from Tsingtau also fits very well with my data.

Distribution:- N. China Sea.

135 Setipinna papuensis Munro, 1964

(Plate 270a-f; Figures 34B, 122, 123; Tables 16, 16.1, 16.2)

Setipinna papuensis Munro, 1964, Papua and New Guinea agric. J., 16 (4) : 150, fig. 1 (Port Romilly, Gulf of Papua).

Specimens examined (4 : 80.5-110.0 mm S.L.)

1. WAM P. 16267-16270 (4 : 80.5-110.0 mm S.L.), Medusa Bank, Cambridge Gulf, W. Australia.

Diagnosis:- A species of Setipinna from Papua New Guinea, very closely related to S. tenuifilis but differing in having a distinctly hump dorsal profile; depth 33.2-34.6 (cf. 27.2-32.4) % S.L. (fig. 123); dorsal originating above base of 6th-8th anal ray, its height 21.0-23.4 (cf. 16.5-20.7) % S.L. (fig. 123); tip of main pectorals reaching to anal origin or nearly so instead of only to anterior half of depressed pelvics, its filament also longer and reaching base of 27th-41th (cf. 9th-21st) anal ray (tbl. 16.2); pelvic length 9.0-9.7 (cf. 5.6-7.7) % S.L. (fig. 123) or reaching to anus instead of some distance before it in that species; most serrae of gillrakers smaller, only few enlarged (pl. 270f); tip of dorsal, distal half of pectorals and pyloric caeca blackish (cf. without dark markings).

Remarks:- In the degree of convexity of the dorsal profile, the body depth and the length of the pectoral filament, S. tenuifilis gilberti, S. tenuifilis tenuifilis and S. papuensis show a gradiation from lesser to greater. The position of the anal origin in relation to that of dorsal has also tended to move a little more forward in the latter species. Although Whitehead (1968b) thought this fish was a probable synonym of S. godavari (= S. tenuifilis tenuifilis), he correctly kept them separated and more recently (Whitehead, 1973b) considered them the same species. I prefer to treat them as different species, with allopatric distributions. From S. taty, it significantly differs in many decisive characters, as shown in the key.

Distribution:- Gulf of Papua and Cambridge Gulf, W. Australia.

136. Setipinna melanochir (Bleeker, 1849)
(Plates 271a-d, 272a-e; Figures 34B, 122; Tables 16, 16.1, 16.2)

Engraulis melanochir Bleeker, 1849, Verh. batav. Genoot. Kunst. Wet., 22 : 13 (Kammal, Surabaya).

Specimens examined (24 : 44.0-218.0 mm S.L.)

Types:

1. RMNH 7079 (1 : 182.0 mm S.L.), Kammal, Surabaya. Putative neotype of E. melanochir.

Other specimens:

2. ANSP 61496-61501, 60552-60564 (3 : 44.0-46.0 mm S.L.), Bangkok; mixed among fifteen specimens of Lycothrissa crocodilus, 58.0-191.0 mm S.L.)
3. BMNH 1855.9.19.1172 (1 : 123.0 mm S.L.), locality unknown.
4. 1867.11.28.52 (1 : 218.0 mm S.L.), E. Indies.
5. 1966.3.8.72 (1 : 154.0 mm S.L.), Gulf of Thailand.

6. BMNH 1979.8.24.5-7 (3 : 87.0-203.0 mm S.L.), Aluhaluh, Barito river, Borneo.
7. NIFI uncat. (3 : 100.0-144.0 mm S.L.), Puangklong-nongmor, Ayudhya, Thailand.
8. MNHN 3756 (1 : 153.0 mm S.L.), Sumatra.
9. RMNH 24967 (10 :96.0-214.0 mm S.L.),E.Indies;mixed with a specimen 101.0 mm S.L. of S. taty, now removed to RMNH 27710.

Diagnosis:- A quite distinctive species of Setipinna, with a very short (or without) pectoral filament, which never reaches the origin of the anal; gillrakers only 7-10+9-12 (fig. 122); main pectoral usually blackish, its filament usually whitish or the whole fin sometimes without melanophores. Other minor differentiating characters are shown in the key.

Remarks:- This species has from time to time been reported as ascending the lower courses of rivers and even coming into absolute freshwater (Weber & DeBeaufort, 1913; Hardenberg, 1931 and Smith, 1945). In Thailand Smith (loc. cit.) recorded it from Chao Phraya river at Loburi, which is about 150 km from the sea. I have also been told by a Thai fisheries officer that small and large individuals were collected in Lake Bueng-borapet further north of Loburi and about 210 km from the Gulf of Thailand.

Three of my specimens, 100-144 mm S.L. (NIFI. uncat.), are certainly freshwater representatives from Thailand since they were collected at Puangklong-nongmor, Ayudhya, about 90 km from the sea. They clearly have no indication of a pectoral filament.

Distribution:- Marine and freshwaters of S. China Sea and Java Sea regions.

137. Setipinna taty (Valenciennes, 1848)
(Plates 273a-d, 274a-e, 311d, 316a, 320d, 325e, 332d; Figures 34C, 122; Tables 16, 16.1, 16.2)

Engraulis taty Valenciennes, 1848, Hist. nat. Poiss., 21 : 60 (Pondicherry).

Engraulis telaroides Bleeker, 1849, Verh. batav. Genoot. Kunst. Wet., 22 : 13 (Madura near Sampang, Kammal, Surabaya).

Specimens examined (375 : 22.0-136.0 mm S.L.)

Types:

1. MNHN 3730 (2 : 126.5-136.0 mm S.L.), Pondicherry. The largest fish was selected as lectotype of E. taty, the smaller being the paralectotype.
2. RMNH 7080 (1 : 86.5 mm S.L.), E. Indies. Putative neotype of E. telaroides.

Other specimens:

3. BMNH 1858.8.15.143 (3 : 97.0-115.0 mm S.L.), India.
4. 1860.3.19.449 (1 : 114.0 mm S.L.), Malaya (left side dried skin).
5. 1860.3.19.691 (1 : 88.0 mm S.L.), India House coll. (dried specimen).
6. 1967.11.28.59 (1 : 106.0 mm S.L.), E. Indies.
7. 1889.2.1.1793 (1 : 58.0 mm S.L.), Madras.
8. 1889.2.1.1795-1799 (5 : 46.5-60.0 mm S.L.), Andaman Is.
9. 1889.2.1.1801 (1 : 63.0 mm S.L.), Andaman Is.
10. 1965.9.8.22-24 (3 : 95.0-116.0 mm S.L.), Prachuab-kirikhan, Thailand.
11. 1965.10.20.64 (1 : 97.0 mm S.L.), Singapore.
12. 1965.10.20.65-67 (3 : 28.5-65.0 mm S.L.), Singapore.
13. 1965.10.20.68-77 (10 : 35.5-49.0 mm S.L.), Singapore.
14. 1966.3.8.66-71 (6 : 111.0-135.0 mm S.L.), Gulf of Thailand.
15. 1967.11.13.673-692 (20 : 68.0-108.0 mm S.L.), Singapore.
16. 1967.11.13.693-775 (83 : 46.0-76.5 mm S.L.), Singapore.
17. 1967.11.13.776-821 (51 : 31.0-57.0 mm S.L.), Singapore.
18. 1967.11.13.822-915 (93 : 21.0-73.0 mm S.L.), Penang.
19. 1967.11.13.916-926 (11 : 22.0-53.0 mm S.L.), Penang.

20. BMNH 1967.11.13.927-936 (10 : 28.0-48.0 mm S.L.), Penang.

21. 1967.11.13.937-946 (10 : 25.0-40.5 mm S.L.), Penang.

22. 1967.11.13.947-948 (2 : 45.0-46.0 mm S.L.), Singapore.

23. 1967.11.13.949 (1 : 41.0 mm S.L.), Singapore.

24. 1967.11.20.357-375 (24 : 91.0-122.0 mm S.L.), 15°20'N : 96°24'E.

25. 1977.6.17.22 (1 : 58.0 mm S.L.), Porto Novo, India.

26. 1977.9.8.44-50 (7 : 113.0-119.0 mm S.L.), Java Sea.

27. 1977.9.8.51-53 (3 : 110.0-115.0 mm S.L.), Java Sea.

28. 1979.7.5.28-29 (2 : 50.0-51.0 mm S.L.), Calcutta.

29. 1979.8.21.1-5 (5: 42.0-113.0 mm S.L.), Singapore.

30. MNHN 3729 (1 : 111.0 mm S.L.), Pondicherry.

31. RMNH 24964 (11 : 84.5-126.0 mm S.L.), E. Indies.

32. 27710 (1 : 101.0 mm S.L.), E. Indies.

Diagnosis:- This is the most common and widely distributed species of *Setipinna*. It is unmistakably recognisable by the presence of scales on the dorsal and anal fins; predorsal scute is rather strongly ossified than other known Indo-Pacific engraulids; anal originating below base of 1st-6th dorsal ray; gillrakers usually 13-17+18-20 (fig. 122) with distinct clumped serrae (pl. 274e); many polygonal reticulations at middle of scales (pl. 274d).

Remarks:- The presence of scales on the dorsal and anal fins in this fish is an unusual character and it is not known in any other clupeoid fish of the Indo-Pacific (nor probably in the New World either). For the time being the explanation is debatable. These scales are mostly or partly shed, but their scale pockets are still easily observed.

The similarity in caudal fin shape of *S. taty*, *S. wheeleri* n. sp., *S. phasa* and *S. brevifilis* is worth noting; it may reflect relationships or may merely indicate a particular mode of life.

The first record of *S. taty* from Papua New Guinea was by Hardenberg (1941), but his count of total ventral scutes as 27, with 6-7 of them being post-ventral, perfectly agrees with my count and distribution of S. papuensis and certainly not with S. taty.

Distribution:- Bay of Bengal, S. China Sea and Java Sea.

138. Setipinna wheeleri n. sp.

(Plate 275a-c; Figures 34D, 122, 124; Tables 16, 16.1, 16.2)

Specimens examined (3 : 116.5-185.0 mm S.L.)

Types:

1. BMNH 1891.11.30.390 (1 : 116.5 mm S.L.), Sittang river, Burma; E.W. Oates. Holotype.

2. 1889.2.1.1788-1789 (2 : 119.5-185.0 mm S.L.), Rangoon; F. Day. Paratypes.

Diagnosis:- A new species of the subgroup of Setipinna that includes S. phasa and S. brevifilis; it is known from the rivers of Burma. It is similar to those two species (as indicated in the key), but significantly differs from them in having a very long pectoral filament, which extends to the base of the 45th-51st dorsal ray (tbl. 16.2); tip of main pectoral reaching to origin of anal (instead of to posterior half of depressed pelvics); gillrakers 16-18+21-22 (cf. 14-16+17-19) (fig. 122) and serrae distinctly clumped (pl. 275c) even in small fish; pectorals always pale in colour.

Remarks:- In this study, several forms hitherto considered to be mere geographical variations or polymorphs have been shown to be distinct at species level. In the case of Burmese fishes, Gudusia variegata, Gonialosa whiteheadi n. sp. and G. modesta are clearly confined to the freshwaters of this area and are distinctly different from their congeners from Indian waters. I therefore believed that S. wheeleri n. sp. is also separable from S. phasa and S. brevifilis. The previous Burmese records of S. telara, S. phasa or S. brevifilis were therefore presumably misidentifications of S. wheeleri n. sp.

More specimens of this fish (and other endemic Burmese freshwater clupeoid fishes) are needed.

Named in honour of Mr A.C. Wheeler of the British Museum (Natural History), London, for his kind help in many ways during my study and preparation of the manuscript of the present work in the Fish Section of his Museum. I also learned a lot from him.

Distribution:- Sittang river and Rangoon, Burma.

139. Setipinna phasa (Hamilton-Buchanan, 1822)
(Plates 276a-d, 277a-f, 325f; Figures 34D, 122, 124; Tables 16, 16.1, 16.2)

Clupea phasa Hamilton-Buchanan, 1822, Fishes of the Ganges : 240, 382 (brackish rivers of Bengal).

Clupea telara Hamilton-Buchanan, ibid. : 241, 382, pl. 2 (72) (high up the Ganges).

Setipinna truncata Swainson, 1839, Nat. Hist. Anim., 2 : 292 (on Clupea telara Hamilton-Buchanan, 1822).

Setipinna megalura Swainson, ibid. : 292 (on Clupea phasa Hamilton-Buchanan, 1822).

Specimens examined (10 : 62.0-209.0 mm S.L.)

1. BMNH 1867.2.14.29 (1 : 187.0 mm S.L.), Chacar, India.
2. 1867.11.28.63 (1 : 133.0 mm S.L.), Bengal.
3. 1889.2.1.1781-1784 (4 : 62.0-203.0 mm S.L.), Orissa.
4. 1889.2.1.1785 (1 : 209.0 mm S.L.), Calcutta.
5. 1973.6.4.7-9 (3 : 218.0-241.0 mm S.L.), Calcutta.

Diagnosis:- An Indian species of Setipinna, overlapping in many characters with S. brevifilis, e.g. anal rays 69-82 (tbl. 16); lateral scales 54-57; predorsal scales 24-29 (tbl. 16.1); ventral scutes 5+6-7 (tbl. 16.1, 16.2). It chiefly differs from that fish and from S. wheeleri in having the head length 15.6-18.1 % S.L. (fig. 124); pectoral filament reaching to base of

15th-39th anal ray (tbl. 16.2); gillrakers usually 15-16+18-19 (fig. 122), and pectorals with melanophores in specimens larger than 136 mm S.L.

Remarks:- My counts of anal rays in ten specimens of this fish (69-82) agree with the original count of C. phasa (75-78), but Hamilton-Buchanan (1822) described its caudal lobes as "sharp". Possibly he included S. taty, which is common in brackish waters of Bengal, in his description of C. phasa, since mixed catches of these two species were reported by Jones & Menon (1951). According to Day (1889) this species can grow to a large size (16 inches in length), maximum record of Alahabad specimens by Jhingran (1963) was 324 mm T.L.

There are no extant types of C. phasa (? brackish water locality) and C. telara (? freshwater locality), but there is a holotype of E. brevifilis (? freshwater locality). I have presumed for the moment that the two Hamilton-Buchanan species are the same and different from E. brevifilis of Valenciennes. The selection of neotypes for C. phasa and C. telara must be postponed until this problem is resolved and with better specimens from the mentioned localities.

Distribution:- Orissa, Calcutta and Chacar of the Bay of Bengal.

140. Setipinna brevifilis (Valenciennes, 1848)
(Plates 278a-d, 279a-f; Figures 34C, 122, 124; Tables 16, 16.1, 16.2)

Engraulis brevifilis Valenciennes, 1848, Hist. nat. Poiss., 21 : 54 (Bengal).

Specimens examined (8 : 102.0-260.0 mm S.L.)

Types:

1. MNHN 3719 (1 : 260.0 mm S.L.), Bengal. Holotype of E. brevifilis.

Other specimens:

2. BMNH 1889.2.1.1786-1787 (2 : 102.0-121.0 mm S.L.), Calcutta.

3. 1889.2.1.4857 (1 : 160.0 mm S.L.), Delhi.

4. 1934.10.17.22-25 (4 : 202.0-220.0 mm S.L.), Allahabad.

Diagnosis:- A species of Setipinna, closely related to S. phasa of India and S. wheeleri n. sp. of Burma as shown in the key. From S. phasa, which is likely sympatric in the distribution, this fish mainly differs in having a longer head 18.0-19.7 (cf. 15.6-18.1) % S.L. (fig. 124); pectoral filament shorter and reaching only to base of 1st-15th anal ray (tbl. 16.2); gill-rakers usually 14-15+17 (cf. 15-16+18-19) (fig. 122); and no dark markings on the pectoral at all ages (instead of brackish pectorals in specimens larger than 136 mm S.L.).

Remarks:- Whitehead (1967a) believed the holotype of E. brevifilis to be S. phasa of Hamilton-Buchanan, as also assumed by most previous authors. The freshwater record of S. brevifilis, based on Allahabad and Delhi specimens, suggests a sympatric distribution with C. telara. However, the adults of that species were originally described with black pectorals, which are always pale in the present species. In addition to this they are also distinctively different in the length of the pectoral filament. Therefore I consider C. telara (= S. phasa) as different from S. brevifilis.

Distribution:- Calcutta, Allahabad and Delhi, India.

141. Heterothrissa breviceps (Cantor, 1850)
(Plates 280a-d, 281a-e, 316b; Figures 34D, 122; Tables 16, 16.1, 16.2)

Engraulis breviceps Cantor, 1850, J. Asiatic Soc. Bengal, 18 (2) : 1288 (Penang).

Engraulis pfeifferi Bleeker, 1852, Natuurk. Tijdschr. Ned.-Indië, 3 : 433 (Kapuas river, Pontianak, Borneo).

Specimens examined (6 : 195.0-240.0 mm S.L.)

Types:

1. BMNH 1860.3.19.448 (1 : 200.0 mm S.L.), Penang, (left side dried skin). Holotype of E. breviceps.
2. RMNH 7077 (1 : 195.0 mm S.L.), Kapuas river, Pontianak, Borneo. Holotype of E. pfeifferi.

Other specimens:

3. BMNH 1867.11.28.55 (1 : 240.0 mm S.L.), Borneo.

4. 1894.1.19.81 (1 : 210.0 mm S.L.), Sarawak.

5. 1979.8.16.513-514 (2 : 201.0-223.0 mm S.L.), Selangor, Malaya.

Diagnosis:- The single species of Heterothrissa, genus closely related to Setipinna (as indicated in the key). Unique in having a very shallow head; distance from tip of snout to posterior end of occipital process only 8.1-8.8 cf. 9.7-15.7 % S.L. in Setipinna; greatly upturned mouth; both jaws very slender (pl. 280c, d); tip of lower jaw prominent; 2nd supramaxilla elongate and almost half length of maxilla; posterior extension of 1st and 3rd sub-orbital bones distinctively produced (pl. 281a); dorsal rays 17-18 (cf. 13-16 in Setipinna) (tbl. 16.1) and originating above base of 11th-15th anal ray; branchiostegal rays 20 (cf. 12-16 in Setipinna) (tbl. 16.1) and greatly reduced in size posteriorly (pl. 281b); gillrakers only 7-8+11-12 (fig. 122) and without clumped serrae except some enlarged ones (pl. 281e).

Remarks:- I regard Cantor's E. breviceps, hitherto treated as a species of Setipinna, as a member of a distinct genus, for the name Heterothrissa of Günther (1868) is available. The name Stethochaetus of Gronovius (1754), which was accepted by Jordan & Seale (1926), Hardenberg (1933a) and Fowler (1941) for this fish, has been shown to apply to an anabantid fish by Fraser-Brunner (1952) and Wheeler (1958).

Apart from the localities of my studied specimens, Day (1878, 1889) and Nair (1953) described it from India; Lloyd (1907) recorded it from Burma and Fowler (1941) extended its range to China.

Distribution:- Penang to S. China Sea.

Subfamily Coiliinae

142. Coilia ramcarati (Hamilton-Buchanan, 1822)

(Plates 282a-d, 283a-e, 311e, 332e; Figures 35A, 125,126; Tables 17, 17.1, 17.2)

Mystus ramcarati Hamilton-Buchanan, 1822, Fishes of the Ganges : 233, 382 (Ganges estuaries).

Engraulis (Coilia) hamiltonii Gray, 1835, Illustr. Ind. Zool., Hardwicke, 1 : pl. 85 (3) (Bengal rivers).

Coilia quadragesimalis Valenciennes, 1848, Hist. nat. Poiss., 21 : 83 (Ganges).

Coilia cantoris Bleeker, 1853, Verh. batav. Genoot. Kunst. Wet., 25 : 148, pl. 6 (2) (Calcutta).

Specimens examined (6 : 88.0-162.0 mm S.L.)

Types:

1. BMNH 1858.8.19.104 (1 : 136.0 mm S.L.), Ganges. Neotype of M. ramcarati.
2. MNHN 3734 (1 : 135.0 mm S.L.), Ganges delta. Holotype of C. quadragesimalis.
3. BMNH 1867.11.28.266 (1 : 88.0 mm S.L.), Calcutta. Holotype of C. cantoris.

Other specimens:

4. BMNH 1848.8.22.74 (1 : 106.0 mm S.L.), India.
5. 1860.3.19.8110 (1 : 162.0 mm S.L.), Calcutta.
6. 1889.2.1.1845 (1 : 92.0 mm S.L.), Calcutta.

Diagnosis:- A species of Coilia with a short maxilla from the Bay of Bengal, immediately distinguished from the other twelve Coilia species in having total pelvic rays 9-10 (cf. 7 or rarely 6) (tbl. 17); and its pneumatic duct emerging from a short distance above hind end of fundus of stomach (282b), instead of from just behind oesophagus.

Remarks:- I have not studied Engraulis (Coilia) hamiltonii of Gray and followed Whitehead (1968b), who positively placed that fish with C. ramcarati on the basis of very reliable evidence.

Distribution:- Ganges estuaries, India.

143. Coilia borneensis Bleeker, 1851

(Plates 286a, d, f, 316d; Figures 35A, 125; Tables 17, 17.1, 17.2)

Coilia borneensis Bleeker, 1851, Natuurk. Tijdschr. Ned.-Indië., 2 : 58 (Bandjermassing, name only); Bleeker, 1852, ibid. ; 3 : 437 (Bandjermassing, Pamangkat).

Specimens examined (37 : 73.0-124.0 mm S.L.)

Types:

1. BMNH 1867.11.28.78 (1 : 104.0 mm S.L.), Bandjermassing, Pamangkat. Putative neotype of C. borneensis.

Other specimen:

2. BMNH 1979.8.24.10-38 (29 : 87.0-124.0 mm S.L.), Aluhaluh, Barito river, Borneo.

3. RMNH 7075 (7 : 73.0-111.0 mm S.L.), Bandjermassing; mixed with a specimen 88.5 mm S.L. of C. coomansi, now removed to RMNH. 27711.

Diagnosis:- A species of Coilia from Borneo, chiefly differing from other species in having the following combination of features : short maxilla, never produced beyond hind border of interoperculum; 13 or rarely 14 pectoral filaments and 5-7 pectoral rays (pl. 17); anterior striae of scales not forming a web-like structure (pl. 286d); only 1-2 scales at base of isthmus (pl. 316d) or absent; ventral scutes 4-5+7-8 or total 11-13 (tbl. 17.1, 17.2); gillrakers 21-23+32 (fig. 125).

Remarks:- A specimen labelled C. borneensis from Rangoon in the Indian Museum, Calcutta (ZSI. 2511) is in fact C. reynaldi. I am inclined to think that the Indian or Bay of Bengal records of the present species (e.g.

Varghese, 1961) were misidentifications of C. reynaldi. Although these two species are very similar and until recently recognised as a single species by Whitehead (1969b), I prefer to separate them by the several characters shown in the key. In their study of the larval stages of Coilia spp. from the Hooghly river, Jones & Menon (1952) correctly identified their specimens (27.6-103.5 mm T.L.) with 7-12 pectoral filaments as C. reynaldi. They added that the fish is the most common species of Coilia in that region and in the tidal stretches of the adjacent rivers and creeks of the Gangetic delta.

Dr P.J.P. Whitehead's large collection from Aluhaluh, Barito river, Borneo (BMNH. 1979.8.24.10-38) arrived to late for my usual anatomical study of this fish.

Distribution:- Borneo, Java Sea.

144. Coilia reynaldi Valenciennes, 1848

(Plates 284a-d, 285a-e; Figures 35C, 125, 126; Tables 17, 17.1, 17.2)

Coilia reynaldi Valenciennes, 1848, Hist. Nat. Poiss., 21 : 81 (Rangoon).

Coilia korua Dutt & Seshagiri Rao, 1972, J. Bombay nat. Hist. Soc., 69 (1) : 136 (Gollapalem, Andhra).

Coilia whiteheadi Babu Rao, 1973, J. Bengal nat. Hist. Soc.: (? unpublished, Hooghly estuary; Babu Rao, MS. name cited in the synonymy of Coilia korua by Whitehead, 1973, J. mar. biol. Ass. India, 14 (1) : 242 fig. 66).

Specimens examined (15 : 59.0-116.0 mm S.L.)

Types:

1. MNHN 3733 (2 : 70.0-82.0 mm S.L.), Rangoon. Two out of the four syntypical specimens of C. reynaldi.
2. BMNH 1974.9.29.1-5 (5 : 99.0-114.0 mm S.L.), Hooghly estuary, India. Paratypes of C. whiteheadi.

Other specimens:

3. BMNH 1867.11.28.77 (1 : 100.0 mm S.L.), E. Indies.

4. BMNH 1977.6.17.7-12 (6 : 59.0-116.0 mm S.L.), Porto Novo.

5. ZSI F. 2511 (1 : 78.0 mm S.L.), Rangoon.

Diagnosis:- A species of Coilia from the Bay of Bengal, more closely allied to C. borneensis than to C. coomansi or other species, chiefly in having a short maxilla which never reaching beyond hind border of interoperculum; nonfilamentous pectoral rays 6-7 and nearly reaching base of pelvics; pelvic rays 7; ventral scutes 6-9+7-11, total 13-19 (tbl. 17.1, 17.2). It can be separated from C. borneensis by having slightly fewer pectoral filaments, 10-13 (cf. 13-14) (tbl. 17); slightly more gillrakers 20-27+28-36 (cf. 21-23+32) (fig. 125); anterior striae of scales forming a web-like structure (pl. 285d) instead of the normal somewhat parallel striae; basal half of isthmus scaled, instead of entirely naked or with few scales at base.

Remarks:- The differences separating this species from C. borneensis are fairly small, and it is possible that, when more specimens from intermediate areas are available, C. borneensis may be regarded merely as an eastern form or subspecies of C. reynaldi. However, studies of C. reynaldi have always been made on smaller fish than for C. borneensis, yet they have had higher counts of ventral scutes and gillrakers and a more complicated striation on the scales, as well as more scales at the base of the isthmus. I am therefore inclined to believe that they are different fishes.

Cantor's (1850) specimens of his E. reynaldi, which were described as C. quadrifilis by Günther (1868), are in fact C. dussumieri and they have 6 filaments in the pectorals, not 4 as stated by these two authors.

To my knowledge the original description of C. whiteheadi of Babu Rao has not so far been published but its type specimens exist. I have no hesitation to follow Whitehead (1973b) in its identity; this name may prove to be invalid and should be suppressed as a nomen nudum.

Distribution:- Bay of Bengal.

145. Coilia commansi Hardenberg, 1934

(Plates 286b, c, e; Figures 35D, 125; Tables 17, 17.1, 17.2)

? Coilia polyfilis Volz, 1903, Zool. Anz., 26 : 559 (Banjuasin, Palembang, Sumatra).

Coilia coomansi Hardenberg, 1934, Treubia, 14 (3) : 294 (lower course of Kapuas river, W. Borneo).

Specimens examined (2 : 88.5-123.0 mm S.L.)

1. RMNH 27711 (1 : 88.5 mm S.L.), Bandjermassing. Removed from Bleeker's seven specimens, 73.0-111.0 mm S.L., of C. borneensis, RMNH. 7075.
2. ZMBI uncat. (1 : 123.0 mm S.L.), Djungkat, Kapuas basin, Borneo; T. Roberts.

Diagnosis:- A species of Coilia with a short maxilla from Borneo near to C. reynaldi of the Bay of Bengal and C. borneensis of Borneo in the characters shown in the key. From those two species it is easily separated in having more prepectoral scutes or in total more scutes 11-12+9-11, total 21-23 (cf. 4-9+7-11, total 11-19) (tbl. 17.1, 17.2). It has also decisively fewer pectoral filaments than C. borneensis, 10-11 (cf. 13-14) (tbl. 17).

Remarks:- This is one of the least known species of Coilia. It is likely that all records of it since the appearance of the original description by Hardenberg (1934) were only compilations or misidentifications. Thus, my specimens may be the first studied since then. The specimen from the exact type locality and the specimen found among Bleeker's material are extremely interesting because they agree in all major features with the original description of C. coomansi.

Should the necessity ever arise, the specimen, ZMBI. uncat. from Djungkat, Kapuas basin, Borneo would be available for neotype selection.

Prior to Hardenberg's discovery of this fish, it may have been the basis for the description of C. polyfilis by Volz (1903). His salient characters were : pectoral filaments 11, maxilla extending just to hind border of gill cover, lower gillrakers about 28 and type locality Banjuasin, Palembang, Sumatra. Although the above details also fit C. reynaldi, that species has been known only from the Bay of Bengal. Thus, I tentatively consider C. polyfilis to be this fish, but for the time being prefer not to use it as senior synonym until the type can be located and re-examined or a suitable number of specimens of Coilia from its type locality have been satisfactorily studied.

Distribution:- West and south coasts of Borneo.

146. Coilia rebentischii Bleeker, 1859

(Plates 287a-d, 288a-e, 320e; Figures 35B, 125, 126; Tables 17, 17.1, 17.2)

Coilia rebentischii Bleeker, 1859, Act. Soc. Sci. Indo-Néerl. 5 : 5 (Singkawang, Borneo).

Coilia rutherfurdi Fowler, 1939, Notul. Nat., No. 8:1, fig. 1 (Saigon).

Specimens examined (7 : 83.0-152.0 mm S.L.)

Types:

1. BMNH 1867.11.28.74 (1 : 143.0 mm S.L.), Borneo. Holotype of C. renbentischii.

Other specimens:

2. BMNH 1898.11.2.3. (1 : 152.0 mm S.L.), Borneo.

3. 1905.11.14.1-6 (5 : 83.0-151.0 mm S.L.), Kuching, Borneo.

Diagnosis:- A species of Coilia, woth a short maxilla from the S. China Sea, easily differentiated from other Coilia in having 16-19 pectoral filaments (tbl. 17) and with 0-1+10-12 ventral scutes (tbl. 17.1, 17.2). It is similar only to C. ramcarati in having the posteriormost branchiostegal ray slender like the preceding ones (pl. 288b).

Remarks:- Although Fowler (1939) noticed that his C. rutherfurdi was very similar to C. rebentischii, he ignored the possibility of variation in anal ray and pectoral filament counts and used only these characters to separate his new species. The counts of anal rays and pectoral filaments from seven Borneo specimens are iii 90-93 and 16-19 respectively (cf. ii 66 and 17 in the holotype of C. rutherfurdi, fide Fowler, loc. cit.). His count of pelvic rays was i 7 instead of the usual i 6 in most species of Coilia, except i 8-9 for C. ramcarati. Such a number has not so far been recorded and it may proved to be erroneous. I have been unable to re-examine the two type specimens (ANSP. 68460-68461) of C. rutherdurdi, but they are likely to be identical to C. rebentischii.

Distribution:- West coast of Borneo and S. Vietnam.

147. Coilia neglecta Whitehead, 1968

(Plates 289a-d, 290a-e, 325g; Figures 35A, 125, 126; Tables 17, 17.1, 17.2)

Coilia neglecta Whitehead, 1968. J. mar. biol. Ass. India, 9 (1) : 33, fig. 4 (Arabian Sea, N.W. of Bombay, also off Indus, Ganges, Irawaddy deltas).

Specimens examined (189 : 48.0-169.0 mm S.L.)

Types:

1. BMNH 1967.11.70.560-569 (10 : 142.0-169.0 mm S.L.), N.E. Arabian Sea. Paratypes of C. neglecta.

Other specimens:

2. BMNH 1967.11.13.950-973 (23 : 108.0-140.0 mm S.L.), Singapore.
3. 1967.11.13.974-992 (19 : 48.0-95.0 mm S.L.), Singapore.
4. 1967.11.20.407-424 (18 : 110.0-138.0 mm S.L.), Bay of Bengal.
5. 1967.11.20.425-428 (4 : 89.0-112.0 mm S.L.), Bay of Bengal.
6. 1967.11.20.429-436 (8 : 84.0-121.0 mm S.L.), Bay of Bengal.
7. 1967.11.20.437-461 (25 : 93.0-155.0 mm S.L.), Arabian Sea.
8. 1967.11.20.462-559 (78 : 105.0-160.0 mm S.L.), Arabian Sea.
9. 1968.12.31.1 (1 : 128.0 mm S.L.), Singapore.

10. BMNH 1970.10.22.14 (1 : 95.0 mm S.L.), Penang.

11. 1979.8.24.8-9 (2 : 112.0-114.0 mm S.L.), Aluhaluh, Barito river, Borneo.

Diagnosis:- A species of *Coilia*, with a short maxilla, very closely related to *C. dussumieri* in having 6 pectoral filaments; the lower portion of the pectorals with 9-11 rays (tbl. 17) and greatly produced, the tips reaching much beyond the base of the pelvics and much longer than those fins; scales continued onto the entire length of isthmus; no prepectoral scutes, ventral scutes 5-7+7-9 or total 12-15 (tbl. 17.1, 17.2); gillrakers only 15-19+22-27 (pl. 125); digestive tract except intestine jet black (pl. 289 b). It is, however, distinguished from *C. dussumieri* solely by the absence of pearly spots along flanks and on the isthmus.

Remarks:- Dutt & Seshagiri Rao (1974) believed that fading and disappearance of the pearly spots of *C. dussumieri* usually occurs when the fish is preserved in formalin (see also Haneda, 1961). They considered *C. neglecta* as a mere preservational artifact of *C. dussumieri*.

Fortunately, I have recently gone through a large collection of clupeoid fishes collected by Dr Whitehead from the Java Sea in June 1978. Among them were two specimens (BMNH. 1979.8.24.8-9) of *C. neglecta*, from the Barito river, Borneo and six specimens (BMNH. 1979.8.24.133-138) of *C. dussumieri* from Takisung, Kalimantan. The two forms were identically preserved in formalin. I conclude that the absence of such spots in *C. neglecta* is the natural condition of that fish. However, their complete similarity in all other respects is very curious and needs some explanation (unless some more characters are found to distinguish the two forms). Interestingly, unpublished data on the anatomy of the light organs (as termed by Haneda, *loc. cit.*) of *C. dussumieri*, by Dr Whitehead provides evidence of their specialized structure. For the time being I keep the two forms separate and this is supported by the finding of both sexes in each species.

A study of the larval development of specimens identified as *C. dussumieri* was made by Jones & Menon (1952). This work was, however, limited to individuals not longer than 20 mm S.L., without pearly spots and there have been no records of the minimum size at which the pearly spots are developed. It is possible that these specimens were C. neglecta or some other species.

Further study will be very interesting and may provide some answers to the status of C. dussumieri and C. neglecta.

Distribution:- N.E. Arabian Sea, Bay of Bengal to Java Sea.

148. Coilia dussumieri Valenciennes, 1848

(Plates 291a-d, 292a-e, 316c, 332f; Figures 35B, 125, 126; Tables 17, 17.1, 17.2)

Coilia dussumieri Valenciennes, 1848, Hist. nat. Poiss., 21 : 81, pl. 610 (Bombay).

Leptonurus chrysostigma Bleeker, 1849, Verh. batav. Genoot. Kunst. Wet., 22 : 14 (Madura, near Kammal and Surabaya).

Coilia quadrifilis Günther, 1868, Cat. Fishes Brit. Mus., 7 : 403 (Penang, Malay Peninsula, Singapore).

Demicoilia margaritifera Jordan & Seale, 1926, Bull. Mus. comp. Zool. Harvard, 67 (11) : 363 (Colombo, Ceylon).

Specimens examined (44 : 65.0-164.0 mm S.L.)

Types:

1. MNHN 3749 (4 : 113.0-156.0 mm S.L.), Bombay. The largest fish was selected as lectotype of C. dussumieri; the remainder presumably paralectotypes.

2. RMNH 7073 (1 : 120.0 mm S.L.), Madura near Kammal and Surabaya. Lectotype of L. chrysostigma.

3. BMNH 1979.7.5.30-31 (2 : 150.0-155.0 mm S.L.), Penang, Malay Peninsula, Singapore (left side, once dried skins, now in alcohol). Syntypes of C. quadrifilis.

Other specimens:

4. BMNH 1867.11.28.75 (1 : 130.0 mm S.L.), E. Indies.

5. 1889.2.1.1846-1851 (6 : 140.0-154.0 mm S.L.), Bombay.

6. 1889.2.1.1853-1855 (2 : 130.0-137.0 mm S.L.), Orissa.

7. 1889.2.1.1856-1857 (2 : 110.0-111.0 mm S.L.), Orissa.

8. 1905.11.14.5-6 (2 : 80.0-104.0 mm S.L.), no data.

9. 1969.8.19.1-3 (3 : 65.0-83.0 mm S.L.), Bombay.

10. 1969.8.19.4 (1 : 83.0 mm S.L.), Songkhla Lake, Thailand.

11. 1969.8.19.5 (1 : 126.0 mm S.L.), Bombay.

12. 1973.6.4.85-86 (2 : 100.0-133.0 mm S.L.), Calcutta.

13. 1979.8.24.133-138 (6 : 104.0-127.0 mm S.L.), Takisung, Kalimantan.

14. MNHN 3718 (3 : 142.5-164.0 mm S.L.), Mahé, Malabar.

15. RMNH 24970 (8 : 92.0-140.0 mm S.L.), Madura near Kammal, and Surabaya.

Diagnosis:- This unmistakable species of *Coilia* is characterized by the presence of pearly spots along the lower half of the flanks and on the isthmus (pl. 316c). It is very similar to *C. neglecta* in every other character. From other short maxilla species this fish is further distinguished by having the combination of 6 pectoral filaments, nonfilamentous pectorals enlarged and consisting of 8-11 rays (tbl. 17), the longest rays reaching beyond the base of the pelvics and much longer than the pelvic fin; isthmus entirely scaled; no prepectoral scutes, ventral scutes usually 5-6+7-9, or total 12-15 (tbl. 17.1, 17.2); gillrakers 17-20+23-26 (fig. 125); and digestive tract (except for intestine) jet black (pl. 291b).

Remarks:- The two syntypes of *C. quadrifilis* of Günther (1868) have been found in an old jar. They were previously unregistered (now BMNH. 1979.7.5.30-31) and without locality or collector data except the name "*Coilia quadrifilis*" on the outside of the jar, with the date "Aug. 1883". There is also a pencilled note, but it is very faded and impossible to read. They are left side skins, in very bad condition and once dried, but put into alcohol a very long time ago, possibly by Günther. In the original description of C. quadrifilis, the fish was based on two dried skins collected by Dr T. Cantor and identified by him as C. reynaldi. The fishes were 7 inches long. They were characterized by having 10 branchiostegal rays, 16 dorsal rays, 107-116 anal rays, 4 filaments and 11 rays in the pectoral and golden rounded spots along the flanks. The two specimens are now only slightly shorter than 7 inches, but the spots are almost impossible to observe. A pencil note on a piece of paper inside the jar bears the name "Coilia dussumieri" indicating the correct identification of the fish. They have 6 pectoral filaments instead of 4, and the isthmus is entirely scaled. I have no doubt, however, that they were the specimens of C. reynaldi of Cantor (1850) and thus the basis of Günther's C. quadrifilis. The miscount of the pectoral filaments by both authors possibly happened because they were not aware of the over-lapping of the filaments. This condition I have frequently found in many specimens of Coilia. This incorrect count has been represented as the lowest range of the present species in most subsequent papers, as for example in work of Weber & DeBeaufort (1913) and Whitehead (1973b). Among my forty-four studied specimens there is only one instance of a fish with only 5 pectoral filaments* (RMNH. 7073) and none has 4. I have not seen the type of D. margaritifera (MCZ. 31533) from Colombo, Ceylon, but the presence of pearl coloured spots undoubtedly makes it C. dussumieri.

Curiously, although this species is widely distributed, it is similar to all other Coilia species in having no records from the Philippines or from other eastern islands beyond the Java Sea. Specimens of Coilia are also absent from all collections from the Persian Gulf, Red Sea and the entire coast of Africa. The Mahé record of this species by Valenciennes (1848) followed by Smith & Smith (1968), was believed to be doubtful by Whitehead

* Day (1889) reported the variation of 5-6 for the pectoral filaments of Coilia reynaldi from the Hooghly at Calcutta.

(1973b) as there are no Seychelles specimens in Paris. Hardenberg (1936) extended its known ranges to the Kapuas river, Borneo.

Distribution:- West and east coasts of India to Java Sea and Gulf of Thailand.

149. Coilia rendahli Jordan & Seale, 1926

(Plates 293a-d; Figures 35B, 125, 126; Tables 17, 17.1, 17.2)

Coilia rendahli Jordan & Seale, 1926, Bull. Mus. comp. Zool. Harvard, 67 (11) : 362 (Shanghai, China).

Specimens examined (3 : 205.0-270.0 mm S.L.)

Types:

1. MCZ 18052 (1 : 225.0 mm S.L.), China. Holotype of C. rendahli.

Other specimens:

2. BMNH 1926.10.14.1 (1 : 205.0 mm S.L.), Nanking, China.

3. 1927.3.26.2 (1 : 270.0 mm S.L.), Nanking, China.

Diagnosis:- A species of Coilia from China, nearest to C. neglecta and C. dussumieri in having a short maxilla and a long nonfilamentous portion to the pectoral, the distal tip of which reaches beyond the origin of the pelvics. From them, it strongly differs in having a much higher count of ventral scutes, 18-20+34-36 (cf. 4-7+7-9) (tbl. 17.1) and the anterior striation on the scales represented only by very few longitudinal striae (pl. 293c) (instead of many more and forming a web-like pattern) isthmus naked and intestinal tract colourless (instead of blackish).

Remarks:- C. rendahli can be grouped with the seven preceding species solely by its short maxilla. I feel, however, that its place is with the long-maxilla species. This is mainly on the basis of its very high count of ventral scutes, the length of the nonfilamentous portion of the pectorals, the pattern of striation on the scales and the common centre of distribution of those species in the North and South China Seas.

Distribution:- N. China Sea.

150. Coilia grayii Richardson, 1845

(Plates 294a-d, 295a-e; Figures 35B, 125, 126; Tables 17, 17.1, 17.2)

Coilia grayii Richardson, 1845, Ichth. Voy. Sulphur : 99, pl. 54 (1-2) (China Sea).

Specimens examined (9 : 77.0-250.0 mm S.L.)

Types:

1. BMNH 1855.9.19.1581 (1 : 250.0 mm S.L.), China Sea. Holotype of C. grayii.

Other specimens:

2. BMNH 1851.12.27.193-195 (3 : 77.0-140.0 mm S.L.), China Sea.
3. 1855.9.19.1157 (2 : 103.0-177.0 mm S.L.), China Sea.
4. 1933.3.11.839 (1 : 210.0 mm S.L.), Canton, China.
5. 1964.11.6.2. (1 : 236.0 mm S.L.), China.
6. 1971.5.21.1 (1 : 145.0 mm S.L.), Kerala, India. Formerly registered as C. mystus, ZSI. F. 6169/2.

Diagnosis:- A species of Coilia, with the distal portion of the maxilla reaching well beyond the hind border of the interoperculum (pl. 294c). It is, however, easily separated from all other known species in having 7 pectoral filaments (tbl. 17). Pyloric caeca about 18-19 (fig. 126).

Remarks:- This fish has so far been recorded only from China and Hong Kong (Jordan & Seale, 1926), but its range is now extended to India by the finding of a specimen (BMNH. 1971.5.21.1) from Kerala, collected by Mr A. Daniel. This fish has 7 pectoral filaments on both sides and 15+22 ventral scutes. In all other characters also it perfectly agrees with my Chinese specimens of C. grayii. This specimen was presented by Dr P.K. Talwar and was probably one of the four fishes which he recorded as C. mystus in his work in 1971.

The status of C. grayii with regard to C. mystus is still problematic (see also C. mystus). It is possible that they are synonyms in view of the count of 7 pectoral filaments in the supposed type of Clupea mystus in Uppsala, which was given by Lönnberg (1896; see also discussion by Whitehead, 1966a, 1967a). However, in some subsequent notes on this historic specimen (151.6 mm S.L.), made by Dr P.J.P. Whitehead, the Uppsala fish is stated to have only 6 pectoral filaments; also 12 rays below them, dorsal iii 10, anal iii 82, pelvic i 6, branchiostegal rays 10, lower gillrakers 29, ventral scutes 15+26 and with elongated maxilla (29.7 mm). These characters are all consistent with my fifty-five specimens, which I place under the name C. mystus. However, at present I prefer to keep the name C. grayii for the present species until a Lagerström specimen (labelled Clupea encrasicolus Mus. Lin.) has been re-examined (see below). If the 7 pectoral filament count is confirmed, C. mystus must be used as the name of the present species and Mystus clupeoides should take priority for the other fish. Whitehead (1973b), however, included C. grayii and also other three nominal species in the list of synonyms of C. mystus.

Distribution:- China to Kerala, India.

151. Coilia lindmani Bleeker, 1858
(Plates 296a-d, 297a-e, 316e, 325i, 333b; Figures 35C, 125, 126; Tables 17, 17.1, 17.2)

Coilia lindmani Bleeker, 1858, Act. Soc. Sci. Indo-Néerl., 3 : 48 (Palembang).
Coilia macrognathus aequidentata Chabanaud, 1924, Bull. Mus. Hist. nat. Paris, 30 : 59 (Saigon).

Specimens examined (25 : 67.0-198.0 mm S.L.)

Types:

1. BMNH 1867.11.28.76 (1 : 150.0 mm S.L.), Palembang. Holotype of C. lindmani.

2. MNHN 203-205 (3 : 175.0-187.0 mm S.L.), Saigon. Syntypes of

C. macrognathus aequidentata.

Other specimens:

3. BMNH 1855.9.19.1163-1165 (4 : 67.0-105.0 mm S.L.), locality unknown.

4. 1898.4.2.246-250 (5 : 117.0-198.0 mm S.L.), Menam river (= Chao Phraya river), Thailand.

5. 1966.2.28.39-40 (2 : 167.0-172.0 mm S.L.), Bangpakong river, Thailand.

6. 1966.2.28.41-42 (2 : 154.0-159.0 mm S.L.), Bangkok.

7. 1966.2.28.43-45 (3 : 108.0-130.0 mm S.L.), Bangpakong river, Thailand.

8. 1966.2.28.46-49 (4 : 91.0-117.0 mm S.L.), Thailand.

9. 1966.11.20.12 (1 : 130.0 mm S.L.), Bangpakong river, Thailand.

Diagnosis:- A species of Coilia with an elongate maxilla (pl. 296c), with 6 pectoral filaments and a few pairs of scales at the base of isthmus (pl. 316e). It is close to C. macrognathos in having a very long nonfilamentous portion of the pectorals, the distal tip reaching more or less to the tip of the depressed pelvics. The fish is, however, quite different from that species in having a higher count of gillrakers 18-25+29-34 (cf. 15-16+22-24) (fig. 125); fewer ventral scutes 13-15+20-25 or total 34-40 (cf. 14-16+31-39 or total 47-54) (tbls. 17.1, 17.2); and with uniform small teeth in jaws (pl. 296c, d).

Remarks:- Re-examination of three syntypes of C. macrognathus aequidentata from Saigon shows that they possess a combination of characters that belongs to C. lindmani and not to C. macrognathos. Because of the several differences between C. lindmani and C. macrognathos I have preferred to keep them separate, as originally proposed by Bleeker (1852, 1858).

Distribution:- Gulf of Thailand, Saigon and Java Sea.

152. Coilia macrognathos Bleeker, 1852

(Plates 298a-d, 299a-e, 325h, 333a; Figures 35D, 125, 126; Tables 17, 17.1, 17.2)

Coilia macrognathos Bleeker, 1852, Natuurk. Tijdschr. Ned.-Indië, 3 : 436 (Pamangkat).

Specimens examined (5 : 132.0-211.0 mm S.L.)

Types:

1. RMNH 7074 (1 : 185.0 mm S.L.), Pamangkat. Lectotype of C. macrognathos.

Other specimens:

2. BMNH 1867.11.28.73 (1 : 198.0 mm S.L.), Borneo.
3. 1895.2.28.71 (1 : 211.0 mm S.L.), Sarawak.
4. 1979.8.16.3-4 (2 : 132.0-140.0 mm S.L.), Phuket I., Thailand.

Diagnosis:- A species of Coilia, nearest to C. lindmani but distinguished from it as shown in the key and diagnosis of that species. It also differs in having villiform teeth in the jaws, which are interspersed by slightly but distinctly enlarged teeth (pl. 298c, d) and also a dusky black oesophagus and stomach (pl. 298b), instead of being nonpigmented.

Remarks:- Whitehead, Boeseman & Wheeler (1966) added that C. lindmani and C. macrognathos differ also in the shape of the anterior (1st) supramaxilla, but I have not found this so.

Distribution:- Phuket I., Andaman Sea to Borneo and Sarawak.

153. Coilia mystus (Linnaeus, 1758)

(Plates 300a-d, 301a-e, 333c; Figures 35C, 125, 126; Tables 17, 17.1, 17.2)

[Mystus ensiformis Linnaeus, 1754, Chinensia lagerströmiana - Dissertatio : 26, fig. 12] (China, on Laglerström material).

[Clupea mystus Osbeck, 1757, Dagbok Ostind. Resa : 256] (Canton area).

Clupea mystus Linnaeus, 1758, Syst. Nat., 10th ed., 1 : 319 (on Osbeck and Lagerström description).

Mystus clupeoides Lacepède, 1803, Hist. Nat. Poiss., 5 : 466 (sea of the Indies).

Choetomus playfairii McClelland, 1844, Calcutta J. nat. Hist., 4 : 405, pl. 24 (3) (China, on Playfair material).

Osteoglossum prionostoma Basilewsky, 1855, Nov. Mém. Soc. nat. Moscow, 10 : 244 (Gulf of Tschiliensi, China).

Specimens examined (55 : 66.0-191.0 mm S.L.)

1. BMNH 1847.5.10.5 (1 : 150.0 mm S.L.), China. Whitehead (1966a) claimed that it is the basis of the figure of Choetomus playfairii in the "Voyage of the Sulphur"., but it is not a type.
2. 1851.12.27.196 (1 : 175.0 mm S.L.), no data.
3. 1855.9.19.1759-1762 (4 : 111.0-126.0 mm S.L.), locality unknown.
4. 1855.12.26.477 (1 : 189.0 mm S.L.), locality unknwon.
5. 1860.7.20.35-36 (2 : 175.0-191.0 mm S.L.), Amoy, China.
6. 1923.2.26.11 (43 : 66.0-164.0 mm S.L.), Port Arthur, China.
7. 1924.10.9.2. (1 : 160.0 mm S.L.), Wenchow, China.
8. 1979.8.16.1-2 (2 : 112.0-124.0 mm S.L.), Phuket I., Thailand.

Diagnosis:- A species of Coilia, with the maxilla greatly produced beyond the hind border of the interoperculum (pl. 300c); pectoral filaments 6; pelvic rays i 6. It is near to C. nasus, but differs from it in having only 10-14 predorsal scales, instead of 17-24 (tbl. 17); branchiostegal rays 10 (cf. usually 11-12) (tbl. 17); scales with many anterior longitudinal striae (pl. 301d), instead of only very few ones; and with only about 9-12 pyloric caeca, instead of 15-18 (fig. 126).

Remarks:- I have studied some unpublished notes by Dr P.J.P. Whitehead on the supposed type of Clupea mystus in Uppsala University (UUL. 108, 151.6 mm S.L.) and found it agrees very well with the present specimens (see also remarks under C. grayii). A problem arises because another Linnaean specimen (123.5 mm S.L., once dried out and very fragile) is in the Stockholm collection collected by Lagerström. It is possibly one of the syntypes of C. mystus. Dr Whitehead's notes show that this fish has 7 pectoral filaments on both sides, ventral scutes 15+23 and with lower gillrakers 29. The posterior portion of the right maxilla of this specimen was broken off at a point just behind the 2nd supramaxilla. Apart from the damaged maxilla, in my opinion this specimen should be C. grayii of the present study. Lönnberg (1896) recorded 7 (cf. 6 in Whitehead's notes) pectoral filaments for the Uppsala specimen of C. mystus, but I am inclined to believe that his count might be erroneous. A decision is therefore needed as to which specimen should be selected as the real type of Clupea mystus. This is not easy because Linneaus (1758) did not mention pectoral filaments (see below), and the figure of Mystus ensiformis also allows no possibility to do so. This can only be resolved when the specimens are again closely examined, but since I have no opportunity to do this, I prefer to retain the names C. mystus and C. grayii for the two species recognised here.

The following is the original description of Clupea mystus (Syst. Nat., 1758 : 319) :

"Clupea. Corpus maxillarum superiorum mystacibus serratis.

Membr. branch. radius VIII : Branchiae interne setaceae.

Corpus : Abdominis carina serrata. Pinnae ventrales saepe novem radiatae

Mystus. 8. C. corpore ensiform, pinna ani caudae coadunata.

D. 12, p. 18, V. 6, A. 84, C. 11.

Osbeck. intin. 256, Clupea.

Mystus. B. 10, D. 13, P. 17, V. 7, A. 86, C. 13.

Chin Lagerstr. 31 t.l.f.

12 Mystus corpore ensiformi. D. 12, p. 17, V. 6,
A. 84, C. 11.

Habitat in Mari Indico.

Pinna ani excurrit in pinnam caudae integram; forte

genera sub diverso comprebendi posset?"

Until the type specimens of O. prinostoma are located and reexamined, I have no other choice than provisionally to place this name with the present C. mystus, solely on the basis of its 10 branchiostegal rays and its type locality, Gulf of Tschiliensi.

The record of this species from Kerala, India by Talwar (1971) was in fact a misidentification of C. grayii.

Distribution: N. China Sea and Phuket I., Thailand.

154. Coilia nasus Schlegel, 1846

(Plates 302a-d, 303a-e; Figures 35D, 125, 126; Tables 17, 17.1, 17.2)

Coilia nasus Schlegel, 1846, Fauna Japonica, pts 10-14 : 243, pl. 109 (4) (seas of Japan).

Coilia ectenes Jordan & Seale, 1905, Proc U.S. natn. Mus., 29 : 517 fig. 1 (Shanghai).

Coilia brachygnathus Kreyenberg & Pappenheim, 1908, Sber. Ges. naturf. Freunde Berl.: 96 (Tungting, Hankow).

Specimens examined (88 : 11.0-350.0 mm S.L.)

Types:

1. RMNH 3367 (2 : 250.0-255.0 mm S.L.), seas of Japan. The largest fish was selected as lectotype of C. nasus, the smaller being paralectotype.
2. USNM 52077 (1 : 89.0 mm S.L.), Shanghai, China. Holotype of C. ectenes.

Other specimens:

3. BMNH 1844.2.16.66 (1 : 172.0 mm S.L.), Adara, Japan.
4. 1845.11.10. ? (2 : 112.0-127.0 mm S.L.), China
5. 1854.2.10.48 (1 : 201.0 mm S.L.), N. Ningpo, China.
6. 1873.7.30.109-113 (5 : 94.0-258.0 mm S.L.), Shanghai, China.

7. BMNH 1889.6.8.74-77 (3 : 287.0-350.0 mm S.L.), Kiu Kiang, China.

8. 1891.1.31.31 (1 : 59.0 mm S.L.), Shanghai, China.

9. 1898.2.28.18 (1 : 240.0 mm S.L.), Liao-ho, China.

10. 1923.3.5.1 (1 : 314.0 mm S.L.), Seoul, Korea.

11. 1926.10.14.2 (1: 225:0 mm S.L.), Nanking, China.

12. 1936.10.19.3-7 (6 : 112.0-166.0 mm S.L.), Tatung, China.

13. 1968.5.23.1-2 (2 : 301.0-308.0 mm S.L.), Chikugo river, Kyushu, Japan.

14. 1971.2.8.167-170 (4 : 37.0-47.0 mm S.L.), Japan.

15. 1971.2.8.171-182 (30 : 11.0-24.0 mm S.L.), Japan.

16. 1971.2.8.183-185 (3 : 51.0-75.0 mm S.L.), Japan.

17. 1971.2.8.186-190 (5 : 145.0-297.0 mm S.L.), Japan.

18. 1979.8.16.5-23 (19 : 241.0-285.0 mm S.L.), Tara, Saga, Japan.

Diagnosis:- A species of *Coilia* with a long maxilla, very closely related to *C. mystus* but differing from it as indicated in the key and diagnosis of that species.

Remarks:- I find that the two syntypes of *C. nasus* and the holotype of *C. ectenes* are identical. The count of ventral scutes (total 43-61; tbl. 17.2) is a good character for the present species. I have not seen the type of *C. brachygnathus*, but I have very little hesitation in synonymizing this species of Kreyenberg & Pappenheim (1908) with the present species. They recorded its ventral scutes as about 58, a number well outside the range (41-50) of *C. mystus*. This is well supported by its 101 anal rays, about 20 lower gillrakers and its type locality (not possible for species other than *C. mystus*).

Recently Tanaka (1978) and Tanaka & Matsutani (1979) concluded that there are no localities in Japan where *Coilia* is known except Ariake Sound. Tanaka (*loc. cit.*) added that *C. nasus* was the only species occurring there and proposed that the types must have been collected from that area. Re-examination of the British Museum specimens of *Coilia* confirms his view that *C. nasus* is the only species found in Japan (Adara, Chikugo river and Tara, Saga), but it has also been frequently captured from China and Korea, where it is more abundant.

According to the specimens examined, this fish grows to 314.0 mm S.L. and probably is the largest species of all *Coilia*. It has also the highest count of ventral scutes of all known clupeoid fishes of the Indo-Pacific. Nichols (1943) reported finding *C. nasus* and *C. brachygnathus* from the seas and freshwaters of China, while Okada (1960) confirmed its regular ascent up the rivers that flow into Ariake Sound in Japan.

Distribution:- N. China Sea and Kyushu, Japan.

Analysis of characters and phyletic relationships

Much more information is needed before any discussion of the evolution and relationships of the clupeoid fishes can be seriously attempted. This is especially true of functional or adaptive interpretations, since some puzzling species suggest that there have been a number of independent developments. A proposed scheme of relationships of Indo-Pacific clupeoid fishes is shown in figures 1-12 and is based primarily on analysis of the characters described below.

1. General body form

Body form in the Indo-Pacific clupeoid fishes shows complete variation from cylindrical to distinctively compressed shapes. This occurs in both the Clupeidae and Engraulidae and their gradations are generally represented by small and large species from different habitats.

The cylindrical shape or very slightly compressed body in the family Clupeidae is examplified by Etrumeus, Dussumieria, Ehirava, Dayella, Clupeoides papuensis, Corica, Clupeichthys, Spratelloides, Sardinella (Sardinella), Amblygaster, Herklotsichthys quadrimaculatus, H. lossei and H. punctatus; and for the family Engraulidae this is found in Engraulis, Stolephorus purpureus, S. buccaneeri, S. heterolobus, S. devisi, S. oligobranchus and S. indicus. The moderately compressed body shape of the clupeid fishes is represented by Clupeoides borneensis, C. venulosus, most species of Sardinella (Clupeonia), Herklotsichthys spilura, H. dispilonotus, Escualosa, Hilsa, Tenualosa, Konosirus, Nematalosa japonica, Pellona, and most species of Ilisha; in the engraulid fishes, this is seen in Stolephorus dubiosus, S. baganensis, S. tri, Thryssa and Lycothrissa. The more compressed members of the former family are for example Sardinella brachysoma, Herklotsichthys gotoi, Gudusia, Clupanodon, most species of Nematalosa, Gonialosa, Anodontostoma, Ilisha macrogaster, Opisthopterus and Raconda; similarly in the Engraulidae this form is found in Papuengraulis, and species of Setipinna and Heterothrissa. Remarkably different from the above forms is the tapering body shape of Coilia, all species of this genus having a uniformly little compressed body, greatly tapering to an unequally forked caudal, (except when regeneration of the caudal occurred, this has been well described by Menon, 1950; and Jones & Menon, 1952). However, except for Coilia, clear separation between forms is difficult because of perfect intermediates. Interestingly, within many genera there is a gradation in the degree of compression of the body. This is particularly pronounced in genera which have large numbers of species, e.g. Sardinella, Herklotsichthys, Nematalosa, Ilisha, Stolephorus and Thryssa.

Trends of progressive invasion by members of most genera into nearshore waters from open waters have generally been accompanied by a corresponding loss of the subcylindrical body shape, except in those species that have retained a small size, e.g. the pellonuline species, and Spratelloides and Stolephorus. This change is also accompanied by the forward movement of the pelvic fins, superiority of the mouth, a tendency toward the loss of the pelvic fins or the dorsal fin, an increase in size and length of the anal fin, enlargement of the pectoral fins, and development of balancing pectoral rays or filaments. Regarding the proportions of head there are trends of distortion in many dimensions in specialized species of clupeoid fishes, e.g. Escualosa, Opisthopterus, Raconda, Setipinna, Heterothrissa and Coilia. Thus, the opercular series in many genera may fail to cover the posterior part of the isthmus, possibly resulting from independent development of the upturned mouth or an excessive increase of body depth and of opercular bones.

Initial analysis of the morphometric data, which cover some 30 items (see under heading Material and method) has shown that few of them provide good separating characters between related species. Thus, a thorough analysis of those characters is not presented in this work.

Body measurements (especially body depth) in many species of clupeoid fish can show considerable variation, possibly according to age, length, sex, season and habitat. They are usually not very useful in solving problems of subspecific or geographic variation. Comparison of proportions by means of statistical analysis is valid only when an isometric pattern of relative growth exists between the character and standard length and when the measurement is normally distributed. The simplest and most reliable approach to the problem is to plot the raw data graphically and make a visual assessment. This practice, although as laborious as the counts, was used here in the analysis of data. In this study some species were found to exhibit a great range of body depth, e.g. Clupeoides borneensis, Sardinella (Clupeonia) sindensis, S. (S.) gibbosa, S. (S.) fimbriata, S. (S.) albella, Herklotsichthys quadrimaculatus, Hilsa kelee and Ilisha melastoma. Having now provided a better analysis of the species, it should be possible for field workers to attempt to correlate these variations in body depth with endogenous and exogenous factors, an attempt that frequently failed in the past because depth itself was used (erroneously) to distinguish and separate species.

2. Jaws

A. Upper jaw

In species of Indo-Pacific Clupeidae and Engraulidae, each side of the upper jaw generally consists of one premaxilla, one maxilla and two supramaxillae. However, the 1st supramaxilla is always absent in Etrumeus, Pellonulinae, Dorosomatinae (but present in Dorosoma of the New World), Lycothrissa, Setipinna and Heterothrissa. In some species of the subgenus Thryssa (Scutengraulis) the 1st supramaxilla is greatly reduced in size and may disappear intraspecifically, or it is always absent in other species. Supplementary to the four (three) jaw bones is the toothed hypomaxilla, found solely in Pellona and the New World Harengula. The occurrence of this extraordinary bone is well described by Berry (1964b). On the evolution of this bone, Berry felt that "It probably arose as a permanent splitting off of a portion of the maxillary or premaxillary; it is less probable that its origin was the spontaneous development of a new site of ossification". I agree with this (see below).

In clupeid fishes, the premaxilla always form the tip of the snout. They usually curve proximally to meet their counterpart in the midline. They form a notch in the Alosinae. This notch was noticed and first used for separating shads from other clupeoid fishes by Huxley (1881) and later by Regan (1917a). The upper edge of this bone fits closely into a groove on the ventrolateral surface of the maxilla. According to Kirhhoff (1958), the protrusile ability of the premaxillae in these fishes is imperfect. It is to some extent automatically rotated, not protruded, when the mouth is opened (Gosline, 1961).

The maxilla of clupeoid fishes is the largest bone in the upper jaw. Whatever the shape of the mouth, it always forms the posterior end of the upper jaw; its tip may be bluntly rounded and dilated or produced into a very long and slender process. It is a rule that the degree of prolongation of the maxilla, e.g. in Thryssa, Coilia and also Setipinna, is always more or less correlated with the development of an ascending process on its dorsal surface just under the distal end of the 2nd supramaxilla. In Thryssa (Thryssa) setirostris this process is very high and matches the coronoid process on the lower jaw. In Coilia also the absence or presence of a coronoid process is directly related to a short or long maxilla. The maxilla has two condyles anteriorly which articulate with the palatine. A great prolongation of the maxilla was interpreted by Valenciennes (1848) as an artificial character (see Whitehead, 1967a). Although bearing teeth throughout its length, which indicates carnivorous habits, a long maxilla probably serves a hydrostatic function.

Unlike higher teleosts, in which the premaxilla almost or completely borders the lower edge of the upper jaw, in clupeoid fishes the maxilla itself generally occupies the major portion, while the premaxilla is confined to the anterior portion. Ridewood (1904) cited Woodward (1898) and stated that "The evidence of palaeontology goes to show that the most primitive form of mouth is that bounded above by a small premaxilla and a comparatively long maxilla."

However, in this study the advanced condition is found in Konosirus, Nematalosa, Gonialosa and Anodontostoma. Among the 154 species of Indo-Pacific clupeoid fishes there are trends of enlargement of the premaxilla. The gradation of increasing size and length of this bone is usually exhibited among related genera rather than within genera or species groups. In Etrumeus and Dussumieria of the Dussumieriinae, the premaxillae are comparatively small and more or less rectangular in shape. In the Pellonulinae, Spratelloidinae, Clupeinae, Pristigasterinae, Engraulinae (except for Papuengraulis) and Coiliinae the premaxillae are slightly longer than in the Dussumieriinae. In the Alosinae and Dorosomatinae the premaxillae range from as short as in the above groups (e.g. Hilsa, Tenualosa ilisha and Clupanodon) to moderate length in the rest of the Alosinae and very long in other dorosomatid fishes.

In the Spratelloidinae, Clupeinae, Pristigasterinae and most members of Pellonulinae there is a distinct gap between the posterior end of the premaxilla and the maxilla. This gap is perfectly filled by the hypomaxilla in Pellona (also Harengula of the New World). However, in Ilisha sirishai this gap is partially occupied by an outgrowth or bony lamina from the main maxilla (pl. 159 C). This peculiar feature may to some extent fulfill Berry's (1964b) hypothesis of the origin of the hypomaxilla. This seems likely since Pellona and Ilisha sirishai are closely related fishes, as possibly also Harengula of the Clupeinae.

The supramaxillae are small, usually comprising two bones attached to each other, the 1st or anterior partially lying above the anteroventral margin of the 2nd or posterior one, which is always larger. With respect to the position of the 1st supramaxilla (if it is present), its anterior end always surpasses that of the 2nd in all members of Clupeidae and in Engraulis, Stolephorus, Thryssa (Scutengraulis) chefuensis, T. (S.) scratchleyi and Papuengraulis; it is relatively smaller and situated more or less behind the anterior tip of the 2nd supramaxilla in the rest of the Engraulidae. The form of the posterior supramaxilla has repeatedly been used as a generic character in clupeoid fishes. It is a small and slender bone in Etrumeus and the Dorosomatinae, but is an enlarged bone in Escualosa, Herklotsichthys and the Pristigasterinae. On the other hand it becomes a large crescentic bone and imperfectly attached to the posterior upper corner of the maxilla in Lycothrissa, Setipinna and Heterothrissa. It seems that in general, when the premaxillae increase in size, the 1st supramaxilla tends to be reduced, or even to be completely lost in many genera and species. The gradual process of elimination of this bone is clearly seen in the species of Thryssa.

Two maxillarae are found in many lower teleost fishes, for example the Mesozoic pholidophorids, leptolepids, ichthyodectids and oligopleurids. It is therefore likely that the presence of these bones in living clupeoid fishes is generally a conservative character, the loss of the 1st bone being a specialized step. It may be that the two bones originally served as a reinforcement to the maxilla and when maxilla or premaxilla become stronger, the need of an accessory bone was unnecessary.

In clupeoid fishes, the evolution of the maxilla seems to have given rise to two major trends. The first was toward a reduction in the size of the maxilla. This has occurred in some Alosinae and in members of the related Dorosomatinae. Independently, this is also found in Clupeoides venulosus of the Pellonulinae. The second trend was toward the prolongation of the maxilla, which is seen in various genera and species of both families. For the Clupeidae, it is found in Clupeichthys and Raconda of the Indo-Pacific and also in Chirocentrodon and Odontoganthus of the New World. In the Engraulidae, it is more common and seems to show independent evolutionary trends in Stolephorus, Thryssa, Setipinna and Coilia. No matter in which lineage the maxilla becomes developed, it always becomes stronger and its associated 1st supramaxilla usually tends to diminish in size or disappear. The retention of the normal form of the 1st supramaxilla in Coilia is perhaps related to the peculiar mode of life of these fishes or may be merely a conservative character of this offshoot of the engraulid fishes. The latter conclusion is supported by the primitive (anterad) position of the pneumatic duct to stomach, its inferior mouth and the high count of branchiostegal rays, all characters which contrast with the highly specialized body form.

B. Lower jaw

The clupeoid lower jaw or mandible consists of a dentary, anguloarticular (articular of authors), retroarticular (angular of authors) and Meckel's cartilage. The gross shape of the mandible of the Indo-Pacific Clupeidae is more or less triangular; it may be robust, by having short lower edge, or slender. It is distinctly elongate and forms an abbreviated Y- or V-shape in the Engraulidae.

The dentary, which is the largest bone of the mandibular series, has upper and lower processes posteriorly. It is generally a flat bone in the Clupeidae, but has a socket at the meeting point of the two processes in the Engraulidae. It is the most anterior and ventral part of the mandible. Its shape varies greatly among these fishes. The upper process is more or less modified into a free ascending (coronoid) process in the Engraulidae, and is especially developed in <u>Thryssa</u> (<u>Thryssa</u>) <u>setirostris</u>, but much smaller in other species of the genus. Anteriorly, it meets its counterpart of the opposite side at a slightly flexible symphysis.

The anguloarticular is a smaller bone. In the Clupeidae, it is greatly expanded anteriorly, with upper and lower pointed ends which alternately overlap with those of the dentary. Conversely, in the Engraulidae, it is a wedge-sheped bone narrowly pointed anteriorly and rigidly lodged in the socket within the dentary. The anterodorsally directed ascending process, which is characteristic of this bone in the latter family, is also strongly pronounced (even more than the coronoid process). Between these two processes is a deep gap. Posteriorly, this bone tape and becomes massive and well ossified; on its dorsal surface is a deep transverse depression which offers an articulatory fossa for the ventral condyle of quadrate.

The retroarticular is rudimentary and lies against the posteroventral angle of the anguloarticular (it is absent in the Engraulidae). The suture between these two bones is not distinct. To its lower end is always attached an anteroperculo-mandibular (tenacious) ligament, which connects to the interoperculum.

A rod-shaped Meckel's cartilage is present along the inner face of the anguloarticular and continues onto the dentary until it reaches a bony open pocket a short distance behind the anterior end of that bone. Ridewood (1904) believed that "It thus serves to bind all the elements of the mandible securely together."

3. Dentition

The presence, absence and configuration of the teeth in the jaws and on the vomer, palatines, pterygoids, glossohyal (tongue) and gill arches (pharyngeal) are certainly related to the mode of feeding of clupeoid fishes. Taxonomically, they have been used, but only to a limited extent, at specific, generic, subfamilial or familial levels. In recent years, many works, especially by Nelson (1967a, 1969, 1970a), have emphasized the phyletic aspects of teeth on the gill arches of clupeoid fishes and related groups, and they have guided various hypotheses on evolutionary relationships.

In this work the teeth, especially those in the jaws, have been studied and figured along with the jaw elements. In certain cases the teeth on the palatines and pterygoids have also been studied, chiefly in the search for further taxonomic characters; only to a lesser degree were they used for the study of relationships. Morphologically, the jaw of clupeoid fishes does not directly bear teeth. External to each jaw is a flat surface whose base is a layer of tough connective tissue. On these surfaces are borne sets of teeth. Ridewood (1904) diagnosed the jaw teeth of the clupeoid fishes as not lodged in sockets but anchylosed to the edge of the jaws and flanked by a slight ledge on the external side. In contradiction, Boulenger (1904) separated the Chirocentridae from the Clupeidae by the presence of teeth in sockets, but this is not the case. Morphologically, jaw teeth are villiform in most species of the clupeoid fishes. In some species of *Thryssa* (*Scutengraulis*) and *Coilia macrognathos* they are randomly enlarged, but they are canine-like in only very few species, e.g. *Lycothrissa* and some species of the Pellonulinae.

Although the Alosinae and Dorosomatinae have been repeatedly characterized as lacking teeth in the jaws and in the mouth I have found that a row of microscopic teeth is present on the premaxilla of Konosirus punctatus (pl. 120 C) of the latter subfamily. The finding of teeth in this fish supports the separation of this genus from the monotypic Clupanodon thrissa as proposed by Herre & Myers (1931) and accepted by Whitehead (1962b, 1970b). The latter worker regarded Konosirus as a probable annectant form between Clupanodon and Nematalosa and I agree with him, especially also on the basis of its jaw elements (pl. 120 C), the configuration of predorsal bones, and the cross-section of the urohyal (pl. 121 C).

The prominent patch of teeth on the palatine and pterygoids is a good character for separation of many closely related fishes. For example, the presence of these teeth serves to differentiate Amblygaster from Sardinella. They are also very well developed in Escualosa, some species of Herklotsichthys, all species of the Pristigasterinae and most generalized and specialized forms of the Engraulidae. In my opinion, if the degree of carnivorous habits of congeneric fishes cannot otherwise be demonstrated, e.g. by stomach contents, the conformation of this group of teeth can help more or less to solve the problem. Apart from the above mentioned species and also members of Clupeichthys of the Pellonulinae, the rest of the Indo-Pacific clupeoids have less developed or no pterygoid teeth.

The teeth and toothplates on the gill arches were not specifically studied, having been well described by Nelson (1967a, 1969, 1970a), whose results have been taken into account in attempting to construct a phylogeny here. However, it was noted for the first time that teeth occur on the upper edge of the anterior ceratohyal and upper hypohyal in certain members of Stolephorus (see under heading Hyoid arch in this section).

4. Eyes

All members of the Indo-Pacific clupeoid fishes have the eyes on the lateral sides of the skull, oval in shape and placed nearer to the dorsal profile of head. The centre is more or less in the anterior part of the head in both families. Generally, the eyes in the Clupeidae are covered by anterior and posterior flaps of transparent skin (adipose eyelids), immovable and with a vertical slit between them (noted by Huxley, 1881). The upper and lower corners of the posterior flap slip under the anterior one. Exceptionally, the vertical slit is much smaller and occupies only the upper half of the eyes in both species of Dussumieria. Conversely, the eyes are entirely covered by the skin in Etrumeus of the Dussumieriinae and in all species of the Engraulidae.

The size of the eyes varies considerably. They are relatively smaller and much nearer to the snout in the Engraulidae, especially in species of Coilia, than in the Clupeidae. In the latter family the eyes are near to the midpoint of head and are largest in some species of Herklotsichthys, Pellona and Ilisha. It is likely that members of both families which are plankton feeders or microphagous species usually have relatively larger eyes than the carnivorous species. Like most other fishes, there is good evidence that the smaller individuals of the same species generally have proportionally larger eyes than larger specimens (figs. 29, 54, 57, 74).

In comparing the two families, one can say that the Engraulidae are generally more nearshore fishes than the Clupeidae. They may have retained this habit from an early date in their evolution. This is solely judging from the anterior position of the eyes, complete adipose skin over the eyes and the reduction in their size for living in intertidal areas.

5. Fins

A. Dorsal fin

Although the use of the position, shape, counts, etc. of the dorsal fin as taxonomic characters is very limited when compared with others fins, they provide a useful separating feature in particular cases. In the Indo-Pacific Clupeidae as a whole, the range of the dorsal fin formula is ii-v 9-18, but it is exceptionally as low as ii-iii 3-4 in the extremely degenerated fin of Papuengraulis micropinna, or it is externally and internally absent in Raconda russeliana. It is ii-iii 9-15 in the Engraulidae. One of the most distinctive generic characters of the dorsal is the presence of a filament in the genera Clupanodon, Konosirus and Nematalosa (and in Opisthonema of the New World; also in Megalops and Tarpon). This is a modification of the last dorsal finray, which is produced into a very long filament in larger fish. It is presumably for hydrostatic purposes.

It is interesting that only the dorsal fin has a groove at its base. This is deep in Etrumeus and Dussumieria, providing a perfect recess for the depressed fin. I have also found that there is a possible transformation of the last unbranched dorsal ray into a branched ray. The process consists simply in a splitting of the tip of the unbranched ray. This causes some difficulties in counting the rays when it is in an intermediate stage. Similarly, this has happened also in the anal fin. The count of unbranched dorsal rays was found most useful when an attempt was made to separate Stolephorus heterolobus from S. devisi, since the former species has only ii while the latter has iii unbranched rays (tbl. 12).

Preceding the dorsal fin a small spine is usually developed in most species of the Engraulidae, except for species of Engraulis and most Stolephorus. Of the latter genus the spine is sometimes present in S. insularis, but always present in S. dubiosus, S. baganensis and S. tri. Initial study of the ontogenetic growth of the spine in S. insularis has been made and it is likely that it is modified from a median predorsal scale of that area. During early stages of its development the spine is scale-like and easily shed when disturbed by a needle point, but it is firmly attached to the anterior pterygophore in larger fish.

There are two main profiles of the posterior edge of the dorsal fin, the concave edge, which is the characteristic of the Clupeinae, Alosinae, Dorosomatinae and many species of Stolephorus of the Engraulinae; and the convex edge, which is found in most species of the Pristigasterinae, the rest of the Engraulinae and Coiliinae. However, there also exist intermediate forms with more or less straight edges, which is usually found in the Dussumieriinae, most species of the Pellonulinae, some species of the Pristigasterinae, Engraulis and some species of Stolephorus.

B. Anal fin

Like the dorsal fin, it is preceded by ii-v unbranched rays and is followed by 7-90 branched rays in the Clupeidae and 12-114 rays in the Engraulidae. Its anterior rays are longest and form an abbreviated falcate shape in most species, except only Setipinna taty and Coilia where they are obtusely rounded. As shown above, the number of finrays greatly varies in both families. Despite the great overlap in numbers between species or genera, with the support of other character(s) they provide one of the most important taxonomic characters in the study of the Indo-Pacific clupeoid fishes. On the basis of the distribution of the ray counts and the probable relationships between recent clupeoids, the number of anal rays in the earliest forms must have been small. If so, the increase in ray number apparently occurred independently in all major lineages of the clupeoids. This is most likely an adaptive feature (as is the increase in the body depth) toward more slow moving or more inshore or shallow water life styles.

Apart from Coilia (whose number of anal rays is often altered when the slender tail is damaged and regenerates a new pseudocaudal, fide Menon, 1950 and Jones & Menon, 1952), the genus Thryssa provides the most variable number of anal ray counts, from iii-v 24-32 in T. (Thrissina) baelama of the open waters, to iii 41-46 in T. (Scutengraulis) dayi of nearshore waters.

Among Indo-Pacific species of clupeoid fishes, Sardinella and Amblygaster have two enlarged posterior anal rays. This is more prominent in most species Sardinella, but to some extent occurs in S. (Clupeonia) marquesensis-melanura-atricauda. Slightly enlarged posterior rays also occur in several slender forms of Herklotsichthys, e.g. H. quadrimaculatus, H. lossei and also H. spilura. These species may represent annectant forms between Sardinella and Herklotsichthys. Independently, in Konosirus punctatus the last anal ray is produced into a short filament. Apart from the above, Corica and Clupeichthys (also Spratellomorpha of Madagascar and Mombasa) of the Pellonulinae also show enlargement of last two anal rays but are more specialized in that they form a pair of separate rays, like a distinct finlet.

C. Caudal fin

The number of caudal rays is a good taxonomic character at ordinal or familial level, but it usually of little value at generic and specific level. According to Gosline (1961) the principal caudal rays in most fishes consist of 15 (in higher teleosts) to 17 (in lower teleosts) branched rays. On the basis of this study, all species of Indo-Pacific clupeoids have 9 branched rays on the upper lobe and 8 branched rays on the lower lobe. The upper and lower edges of this set of rays are preceded by a series of unbranched rays, the last of which is the longest and strongest one and forms the outer edge of each caudal lobe. Matthews (1887) and many subsequent authors, including Jones & Menon (1952), Berry & Robins (1967) and Roberts (1972), recorded the count of principal caudal rays of their clupeid fishes as 19. This number presumably combined the two unbranched rays.

In most species, (except Coilia), there are two middle caudal rays which were said by Matthews (loc.cit.) to "... differ curiously in the form of their basal support, in so far as, instead of being short, sharp-pointed, rod-shaped bones, they take the form of much more elongated, thin, flat laminae..." (pl. 334 c).

Only members of Spratelloides show a generic difference in the rays, the 6th and 12th principal caudal rays (pl. 334 a) being characterized by having a strut-like bony appendage on their inner surfaces before the ordinary branches begin their course. Moreover, these two peculiar rays are relatively thinner than the neighbouring ones. This reduction in size of the rays is also found in the allied Dussumieria. As well as these unusual features, the preceding (procurrent unbranched) rays of Clupeoides borneensis, C. hypselosoma and species of Corica are more or less modified into spine-like rays (pl. 17b).

Unlike the majority of clupeoid species, the upper caudal lobe of Setipinna brevifilis, S. phasa, S. wheeleri and usually also S. taty form an obliquely truncate edge at its upper tip. It is unequally forked in Coilia, with the lower part confluent with the posterior anal rays.

D. Pectoral fin

In this study the count of pectoral fin rays has been made for all species of Indo-Pacific clupeoid fishes. Not always is the count on both sides the same, but the difference is usually only one or two and very rarely three rays. Although they do not greatly vary among species or genera they have been found to represent a fairly good taxonomic character in terms of their morphology (length, prolongation of 1st ray, modification into series of filaments, degree of ossification of the first ray and position of insertion).

The range of pectoral fin formula in the Clupeidae is i 9-18; and i 8-18 in the Engraulinae, but with 5-19 filaments and 5-14 rays in the Coiliinae.

The presence of a prolonged 1st pectoral ray in Setipinna and Heterothrissa and the series of free pectoral filaments in Coilia is perhaps an adaptive feature for hydrostatic purposes in nearshore or shallow waters. They are correlated with a long anal fin base, compressed or elongate body form and may be a substitute for the loss of a normal gas bladder in Setipinna and Heterothrissa. A parallel development of a prolonged pectoral ray is now known also in Thryssa (Scutengraulis) dayi (fig. 257a) of India and Anchoa filigera (Fowler, 1915; fig. 2) of the New World.

Between Etrumeus and Dussumieria, the lower insertion of this fin, at a point very near to the ventral surface, in Etrumeus is recognised as an indication of a more primitive form than the latter genus. In the Pristigasterinae similar differences may also have phyletic importance.

E. Pelvic fin

Although there is generally a constant number of rays at generic level, the number varies between species of Clupeichthys and Coilia of the Indo-Pacific region. The formula for clupeoid fishes is i 6 to i 9; but the usual count for the Clupeidae is i 7, and for the Engraulidae is i 6. Exceptionally, the fin is absent entirely in Opisthopterus and Raconda. Like the dorsal fin, it has a tendency to reduce in size within related genera and species. Phyletically, it shows an advancing position, from slightly behind the dorsal fin base in the more primitive Etrumeus teres to very far before the dorsal fin base in Lycothrissa, Setipinna and Heterothrissa.

6. Scales

Major attention has been focused here on the scales, which seem to be of great taxonomic and phylogenetic significance. An extensive study was made on the specific configuration of scales from above the anal origin, just on the horizontal myoseptum (pl. 1 a) of almost all species and the development and arrangement of scales from particular regions, e.g. the pectoral axillary scales, interpelvic scales, scales on isthmus, predorsal and postdorsal scales, alar scales and dorsal and anal scaly sheathes. Certain modifications of the squamation are evidently phylogenetically and functionally interrelated; I feel that understanding the nature and interrelations of the changes that have occurred in various groups of clupeoids will provide better phylogenetic insights.

Like most other groups of fishes, the number of scales in the lateral series, transverse series, circumpeduncular series and predorsal series have been repeatedly used in descriptions of clupeoid fishes. Although the results were sometimes treated as impractical for many reasons, they have been satisfactorily used in this work as at least a part of the combination of diagnostic characters for each species. All species of clupeoid fishes lack any kind of scales on the head, but Herre (1936) unfortunately illustrated his new Corica perakensis with several scales on its gill cover. There are no scales also on major part of the dorsal and anal fins except solely in Setipinna taty.

Historically, Russell (1803) and Hamilton-Buchanan (1822) were among the earliest workers who characterized several clupeoids by the presence or absence of the pectoral axillary scales. Cantor (1850) was probably the first who diagnosed some of these fishes as having vertical grooves or striations on the scales. In modern clupeoid taxonomy the morphology of the scales has been used in a number of works, of which only few are: Cockerell (1910, 1912), Weber & DeBeaufort (1913), Peabody (1928), Deraniyagala (1929), Chabanaud (1933), Hardenberg (1934), Roxas (1934), Fowler (1941), Bertin (1943), Lagler (1947), Das (1959), Monod (1961), Chan (1965), Whitehead (1965b, 1967a, 1969a, 1970, 1973a, 1973b), Whitehead, Boeseman & Wheeler (1966), Berry & Whitehead (1968), Talwar & Whitehead (1971) and Szymczyk (1978).

It has been shown that the morphology of the scales is related to their distribution on the body (Taylor, 1916; Wallin, 1957; Chan, loc.cit.; Szymczyk, loc.cit.). Differences are also due to ontogenetic growth (pers. observ.). To avoid the more extreme adaptations of scales to the lesser (front portion of body) and the more (hind portion of body) movable parts of the fish, as well as the asymmetrical ones, I have used scales from the intermediate area above the anal fin origin. The striations (grooves) on the scales are more highly developed in the tail region than on the body before the anal origin. However, the anal fin and the caudal musculature above it play an important role in the normal swimming of the fish and this must be reflected more or less in the modification of the scales of this region. The grooves were considered as "hinges" in the scales by Taylor (loc.cit.), permiting the scales to adapt to the differing flexibility of the different part of the body in accordance with the movements of the fishes.

Lagler (loc.cit.) tried to standardize the terminology of the markings on the scales from the pioneer work of Taylor (loc.cit.) and this was recently accepted by Szymczyk (loc.cit.). However, the term "striae" is used here instead of "radii or grooves" as applied by those investigators. Although the markings seem to evolve from primitive radii, they are usually transverse in direction in clupeid fishes (pl. 1 b) and more or less form a reticulated network in engraulid fishes (pl. 1 c). Nevertheless, radiating striae are not uncommon and are found intermingled with reticulated striae in many genera of anchovies, e.g. *Papuengraulis*, *Setipinna*, *Heterothrissa* and *Coilia*. This finding, and others discussed under the heading *Hyoid arch*, suggests that the Engraulidae are conservative in retaining certain primitive characters, although they are simultaneously specialized in many other characters.

Lagler (*loc.cit.*) also said: "That the essentially concentric pattern of ridges is primitive is suggested by the wide occurrence of this type of circuli in fishes, including such primitive ones as those classed in the Hiodontidae...and the Salmonidae and related families." This may be applicable to the Indo-Pacific *Ehirava fluviatilis*, *Clupeichthys perakensis*, *Gudusia chapra*, *Konosirus punctatus* and *Raconda russeliana*. However, on the basis of more significant characters, in the last three species it must be regarded as a case of convergence. Such was also considered by Lagler (*loc.cit.*) in his evolutionary analysis of the scales of the freshwater fishes of the Great Lakes of North America.

On this basis of the primitiveness of concentric radii, it is possible that those clupeoid fishes which possess some remnants of radii or anterior longitudinal striae, like *Etrumeus*, *Dussumieria*, *Dayella*, *Clupeoides*, *Corica* and many engraulids, are among the lowest forms in their groups. This character was similarly observed in the primitive *Amia* by Lagler (*loc.cit.*). On the other hand, the simple discontinuous transverse striated pattern on the scales of *Clupeichthys*, *Spratelloides gracilis*, *S. lewis*, some species of *Sardinella*, *Amblygaster*, *Gudusia*, *Nematalosa*, *Gonialosa*, *Pellona dayi*, most species of *Ilisha* and *Opisthopterus* might be an intermediated or generalized stage in the course of evolution. There is also a further step in this process, being the formation of overlapping and continuous transverse striae on the scales. This condition occurs in *Spratelloides delicatulus*, *S. robustus* some species of *Sardinella*, *Herklotsichthys*, *Escualosa*, *Anodontostoma* and *Thryssa*. The reticulated pattern exhibited in some species of *Stolephorus*, *Thryssa*, *Papuengraulis*, *Setipinna*, *Heterothrissa* and *Coilia* is here treated as a derived character, modified from the generalized or primitive pattern of the same groups. The perforation and fimbriation on the scales of many *Sardinella* spp. and in *Hilsa kelee* is likely a very specialized character.

The results of this study show that scale types and characters have variously undergone divergent, parallel, and convergent evolution, as concluded by Lagler (*loc.cit.*). There are intermediate forms in every lineage. However, it is possible to derive one type of scale from another in sequence (fig. 13).

In clupeoid fishes the differentiation of the scales reflects not only their phylogeny but more or less also their ecology. The fishes with relatively large, thin or decideous scales like *Etrumeus*, *Dussumieria*, pellonulines, *Spratelloides*, *Sardinella*, *Herklotsichthys*, *Engraulis* and most species of *Stolephorus* inhabit niches comparatively free from turbid waters or bottom floors. Those with a thicker texture of scales, e.g. *Escualosa*, most species of the Alosinae, Dorosomatinae and Pristigasterinae, *Stolephorus dubiosus*, *S. baganensis*, *S. tri*, some species of *Thryssa*, *Lycothrissa*, *Heterothrissa* and *Coilia* are well adapted to life in tidal areas. In the latter environments instead of having greater ossification on scales some fishes developed smaller but greatly overlapping scales on the body, is found in *Gudusia*, *Gonialosa* and *Raconda*.

Apart from the above difference in the scales along the flanks there are still a number of other specializations in squamation. Those that have been observed during this study are: (a) perforations and fimbriations that occur in some *Sardinella* (*Clupeonia*) and *Hilsa kelee*; (b) toothed scales in *Spratelloides robustus*, *Herklotsichthys quadrimaculatus*, *Gudusia variegata*, *Nematalosa nasus*, *N. japonicus*, *N. vlaminghi*, *N. papuensis*, *N. flyensis* and all species of *Anodontostoma*; (c) irregular size and arrangement of scales along the flanks in *Gudusia*, *Nematalosa papuensis*, *N. flyensis* and *Gonialosa manmina*. There are also some modified scales on particular parts of the body that are of taxonomic value.

A. Pectoral axillary scale

A pectoral axillary scale or process is always present in the Engraulidae. Generally it is a thin and slender process easily shed and is not always present in preserved specimens. In Papuengraulis, Lycothrissa, Setipinna, Heterothrissa, Coilia and some species of Thryssa the pectoral axillary scale becomes thicker through ossification and laterally curves outward over the uppermost pectoral ray. Possibly it serves as a roof to protect the delicate inner corner of the pectoral from particles found in tidal waters where they live. It is represented by an elongate scale in the Spratelloidinae and Pristigasterinae, but as a series of asymmetrical scales or absent in the Clupeinae. It varies generically or specifically from a very short or slender scale to a series of pointed scales, asymmetrical scales or entirely absent in the Dussumieriinae, Pellonulinae, Alosinae and Dorosomatinae. In some cases the rudiment or absence of this scale is not easily determined; this is examplified by some species of Nematalosa and Anodontostoma. It is probable that a single slender pectoral scale is primitive and that specialization is the reduction of such. However, this suggestion is only tentative because its full correlation with the mode of life of the fish is still unknown. Apart from protecting the perhaps delicate hinge of the pectoral, it may also have a hydrostatic function in reducing turbulence.

B. Interpelvic scales

The interpelvic scales are analogous to the pectoral axillary scale. They must help at least to reduce turbulence between the water and the fin rays. Their arrangement can be easily characterized into two types, (a) median and (b) paired. The median pattern consists of a group of scales that completely cover the ventral surface of the belly between the bases of the left and right pelvic fins, forming a median pointed end posteriorly by the last median scale. This is found in the Dussumieriinae, Ehirava, Engraulis and all species of Stolephorus. The second or paired pattern consists of two symmetrical groups of elongated scales that lie under the ventral surface of the basal half of each pelvic fin, being entirely separated from the opposite side by the corresponding abdominal scutes. This is characteristic of the rest of the Indo-Pacific clupeoid fishes. It is more likely that the median interpelvic scaled type is a primitive feature and the paired interpelvic scaled type is a derived one. In the connection to these fins an elongated scale is present at their upper corners, exceptionally it consists of 2-3 pointed scales in Etrumeus, Dussumieria and some species of Nematalosa.

C. Alar scales

Regarding the alar scales in Indo-Pacific clupeoid fishes, only a small number of species have them. These scales occur in Spratelloides, Sardinella (Sardinella), Amblygaster and Engraulis. They are, however, also developed in some species of Sardinella (Clupeonia), Herklotsichthys and Stolephorus. There is also intraspecific variation in the conformation of the scales in some deeper bodied species of Sardinella (Clupeonia), Herklotsichthys, Hilsa kelee and the subcylindrical species of Stolephorus. Superficially, the alar scales of Spratelloides consist of a pair of very enlarged single scales, whereas in other species they consist of two or three pairs or groups of small and elongate scales (pl. 334). Initial study of the attachment of them revealed a particular principal caudal ray(s) for each alar scale and this is different in two types of the scales. For example, in Spratelloides, the lower and upper alar scales are firmly attached to the 4th-5th and 14th-13th principal caudal branched rays, respectively; whereas in Stolephorus, the three pairs of scales are arranged as follows: the outer pair attach to the 5th and 13th rays, the middle pair attach to the 6th and 12th rays, and the inner pair attach to the 7th and 11th rays (pl. 334 a, d).

As noted by most authors, alar scales are usually developed in the cylindrical-shaped fishes and indicate the degree of swiftness or pelagic habit of them. The absence of these scales in Etrumeus and Dussumieria is therefore curious. Whitehead (1963a) suggested that it might be possible that the alar scales are restricted to genera that evolved subsequently.

More detailed information about alar scales is given in the remarks on Hilsa kelee in this work.

D. Basal scaly sheath of dorsal and anal fins

Except for Etrumeus, basal scaly sheaths are simultaneously developed on dorsal and anal fins in all forms of the Clupeidae and Engraulidae. Uniformly, this is a single row of modified scales that grow on connective tissue on both sides of the fin bases and provide a support to the fins as well as a furrow for reception of the depressed fins. Only in members of the Alosinae does the scaly sheath on the dorsal fin usually fail to develop at the bases of its posterior rays. Such incomplete series of scales varies slightly among species and is of minor taxonomic value (pl. 117 a-h). In compensation for the absence of scaly sheaths in Etrumeus, a distinctive groove is formed at the fin bases instead for the same purpose. Remarkably, Setipinna taty is the only known Indo-Pacific clupeoid fish that has scales on the entire dorsal and anal fins. Since no other pertinent characters have been found to merit a separate genus or subgenus, I prefer to retain it in Setipinna.

E. Scales on isthmus

The scales on the isthmus vary more or less in their shape and arrangement (pls. 312-316). In genera and species with ventral scutes reaching onto the isthmus, the scales on both sides of the scutes are symmetrical. On the other hand, they are slightly different and show generic or specific differences in fishes without a scuted isthmus (see under the headings Scutes, Isthmus and cleithral lobe of this section).

7. Scutes

The ventral scutes of clupeoid fishes have been used in almost all systematic studies to separate species, genera and other groupings. Recently they have been treated as an important phylogenetic clue (Chapamn, 1948; Whitehead, 1963a; Poll, Whitehead & Hopson, 1965; Greenwood, 1968; and Roberts, 1972). Apart from this group of fishes, scutes are found in the Notopteridae, in species of the deep-sea genus Hoplostethus (syn. Leiogaster) of the family Trachichthyidae and in Atherinella panamensis of the family Atherinidae.

The presence or absence of ventral scutes and their evolution are found to be closely related to the degree of roundness or sharpness of the belly of members of both Clupeidae and Engraulidae. Generally, the ventral scutes are less developed or not at all developed (except the W-shaped pelvic scute) in species which have a rounded abdominal surface. In Etrumeus and Dussumieria, which are related to each other, the former so far believed to be the most primitive of living clupeoid fishes (Gregory & Conrad, 1936, Whitehead, loc. cit.), the scute is represented only by an unkeeled bony plate-like scute immediately before the pelvic fins and greatly extending its arms laterally outside the pelvic base (Whitehead, loc.cit.; pl. 317 a). This character is also seen in Spratelloides (Chapman, 1948). The earliest ventral scutes are formed in ontogeny anterior to the pelvic base. They are few and plate-like elements and independently develop toward the isthmus. At this stage they possess lateral arms, but the arms tend to be poorly developed or absent in scutes at the front or in younger fishes. However, such early forms of scutes are sometimes found articulating with the tips of the ribs on both sides, except the very anterior ones which are free, e.g. Stolephorus purpureus, S. buccaneeri. Another type of ventral scute is found in most clupeoid fishes which have a generally compressed body. Such scutes are usually characterized by having well-developed ascending lateral arms and a sharp median keel with a posterior pointed end. They usually occupy the entire length of the abdominal profile, with the exception of Thryssa (Thrissina) baelama, Lycothrissa crocodilus and some species of Coilia, which have no scutes before the pectorals. However, in very rare cases there are 1-2 small scutes remotedly developed just behind the base of the isthmus (pl. 315 e), e.g. T. (T.) baelama. In the very characteristic species Papuengraulis micropinna, the scutes are spike-like and similar to Stolephorus, and there are also no postpelvic scutes. This is probably due to conservativism in scute development as well as, e.g. bluntly short posterior tip of maxilla, large 2nd supramaxilla, villiform jaw teeth (pl. 263 c, d), gas bladder open to the outside at anus and pneumatic duct emerging from just behind oesophagus (pl. 263 b) as contrasted with the considerable specialization in other features.

In connection with the early evolution of scutes, Chapman (1948) suggested that they are modified from ventral myorhabdoi. He saw the presence of ventral scutes as a primitive character in clupeoid fishes and this was accepted by Roberts (1972). Whitehead (1963a) pointed out that they may have evolved from the pelvic splint bones described by Gosline (1961), or simply have developed from the median series of abdominal scales, as in Denticeps, but there is also evidence to suggest that the evolution of the clupeoid scutes was in some manner linked to the evolution of the pelvic scute. Greenwood (1968) rejected the idea by Whitehead (loc.cit.) that the pelvic splint was the origin of the pelvic scutes, largely on the grounds that the pelvic scute is morphologically so similar to the other abdominal scutes.

In my opinion the ventral scutes are an adaptive feature that progressively developed to serve as protection for the softer abdomen when the sharpness of the belly increased during evolution. Ontogenetically, the scutes are incomplete and (rarely) fewer in very young fish, but they become fully developed when the fish gains the appearance and mode of life of the adult. Perhaps phylogenetically, the plate-like scutes, the precursors of the full series are the few prepelvic scutes occurring in Ehirava fluviatilis, Dayella malabarica, Clupeichthys perakensis, Stolephorus purpureus, S. buccaneeri and Thryssa (Thrissina) baelama. I am inclined to believe that the ventral scutes originated from the middle series of abdominal scales, as can be deduced from the arrangement of these scales along the abdomen. Basically, in species which have scutes throughout the entire length of the abdominal keel, scale rows next to the scutes usually do not overlap with those of the opposite side but form a pair with their partners (pls. 312-316). On the other hand, the median scales behind the base of the isthmus in cylindrical or subcylindrical-shaped clupeoid fishes are variously arranged, being (a) irregular or more usually paired and overlapping in the midline, (b) paired but not overlapping, or (c) forming a median row. The first type, which is presumably the most primitive of all, is found in Etrumeus (pl. 312 a), Spratelloides (pl. 312 c), Ehirava (pl. 314 f), Clupeoides (pl. 314 g), Engraulis (pl. 315 a), Stolephorus (pl. 315 b,c,d) and some species of Coilia (pl. 316 c,d). The second type is found in species of Clupeichthys (pl. 314 i,j); this pattern is evidently similar to the arrangement of predorsal scales of Clupanodon and Konosirus. Finally, there are species which have a median series of scales behind the isthmus. Among the primitive forms this is found in Dussumieria (pl. 312 b) and Corica (pl. 314 h), but it is also developed in Thryssa (Thrissina) (pl. 315 e) and Lycothrissa (pl. 315 g). From this transition in the arrangement of the abdominal scales could have come the development of scute-like scales just before the pelvic base in primitive forms of certain clupeoids. It seems possible, therefore, that ventral scutes became modified from median abdominal scales. If this assumption is true, then the ancestor of living clupeoid fishes should be a member of the round herring group and without ventral scutes.

8. Isthmus and cleithral lobe

The morphology of the isthmus and its functional association with the branchiostegal rays and membranes was initially studied by Whitehead (1963a, 1965a, 1965b, 1973b). He drew attention to a peculiar expanded area on the anterior portion of the cleithrum which he called the "cleithral flap" or later "cleithral lobe" for the Dussumieriinae, Spratelloidinae, Alosinae, Sardinella and also Harengula of the New World. Among the Indo-Pacific clupeoid fishes the cleithral lobe of Spratelloides, Sardinella, Amblygaster, Herklotsichthys and Hilsa is rather prominent. Whitehead (1965b) noticed a groove at the front of this lobe and differentiated its degree of development for species of Indo-Pacific Alosinae. He added that this is very shallow or absent in species in which the lobe does not project much into the gill cavity.

In general, the isthmus is formed by a robust (Clupeidae) or elongate (Engraulidae) sternohyoideus muscle, tapering forward to its attachment to the urohyal. However, in Etrumeus, Dussumieria, Spratelloides, Engraulis, Stolephorus purpureus, S. buccaneeri, S. heterolobus, S. devisi and S. oligobranchus the muscle is variously undeveloped in its anterior portion over the urohyal bone. The isthmus of Clupeidae is very short and strongly tapers anteriorly whereas it abruptly decreases in width but thereafter evenly tapers forward in the Engraulidae. The branchiostegal rays can vary in shape greatly in the former family, but only slightly in the latter. It is likely that during the evolution of the fishes the cleithral lobe become developed in species in which the interoperculum and other associated bones failed to cover the base of the isthmus or seal the gill cavity. To achieve this, the posterior branchiostegal rays and membranes must greatly enlarge. This is not found in the Engraulidae, possibly because they already have a very elongate mandible and opercular series, but a narrow isthmus.

The base or scaled part of the isthmus which lies between the cleithral lobes is extremely long in Etrumeus (pl. 312 a), while it is of intermediate length in Dussumieria (pl. 312 b) and even shorter in Spratelloides (pl. 312 c) and other Clupeidae. In the latter group the lobes are often poorly developed or even absent. The isthmus of Spratelloides is uniquely different from other clupeoid fishes in having two different sections of the scaleless part. The impression is of a sudden termination of the sternohyoideus muscle, and it really follows the shape of the urohyal bone (pls. 36 c, 38 c, 40 c, 41 e). Although the Pellonulinae are near to the Dussumieriinae in many respects, as discussed elsewhere in this study and noted by Whitehead (1962a, 1963a) their profiles of isthmus (pl. 314 f-j) are very much like those generalized forms of the Clupeidae.

Apart from the various shapes of the isthmus and the related organs or parts of organs, which provide useful systematic characters, the arrangements of scales and scutes in this area are also important (see under headings Scales, and Scutes).

9. Frontoparietal striation

In four subfamilies of the clupeoid fishes, viz. Clupeinae, Alosinae, Dorosomatinae and Pristigasterinae, the frontoparietal region of the head is variously exposed and bears longitudinal striae on both sides of the skull. These bony wedge-shaped ridges, parietal sculture or frontoparietal ridges as named by Whitehead (1962b, 1964a, 1965b), are not at all developed in the rest of the Clupeidae or Engraulidae, this part of the head being smooth and evenly covered by skin. According to Whitehead (1964a) it is possible that Bleeker (1849) and Cantor (1850) were the earliest workers independently to notice the presence of such a feature in Sardinella and Kowala (= Escualosa) respectively. Its use in modern systematics of Indo-Pacific clupeids first appeared in the works of Weber & DeBeaufort (1913) and Regan (1917b), followed by Fowler (1934, 1941), Whitehead (loc.cit., 1967a), Whitehead, Boeseman & Wheeler (1966) and particularly Berry & Whitehead (1968).

In this study, extensive counts were made on the number of striae for each species with such ridges. Although the number apparently increases during ontogeny, it is almost constant after the fish has passed the juvenile stage. Unfortunately, the results can only be approximate since, as described by Berry & Whitehead (loc.cit.) there is not enough uniformity in the patterns of ridges. This character is not treated as an important interspecific feature and I have not demonstrated the changes during ontogeny.

Among Indo-Pacific clupeids the frontoparietal ridges and also the posterior transverse bony ridges described by Whitehead (1962b), are most distinctly developed in Amblygaster, Escualosa, Hilsa and most species of Sardinella. They are moderate in Herklotsichthys, Gudusia and Nematalosa; but only slightly formed in Tenualosa, Gonialosa and Anodontostoma. In the Pristigasterinae, they are seen as a very few but well ossified elongate bony ridges on the top of the head, with several much smaller ones scattered on the posterior part; posterior transverse bony ridges are apparently not developed in this subfamily (pl. 183). The ill-defined pattern of striation in the latter group indicates either an independent line of development or perhaps a trend to the secondary loss of this character. This is also seen in some members of the subfamilies Clupeinae and Alosinae. Interestingly, in Sardinella (Clupeonia) the configuration of the striae in S. (C.) marquesensis, S. (C.) melanura and S. (C.) atricauda is very similar to that of all species of Herklotsichthys. When reinforced by many other important shared characters, e.g. median predorsal scales, shape of 2nd supramaxilla, the form of last two anal rays, and the low count of gillrakers, etc., it may be that Sardinella and Herklotsichthys are bridged by these species of Sardinella. Similarly, members of the Alosinae can also be linked with Sardinella by the genus Hilsa (striations present).

The importance of the frontoparietal ridges in the mode of life of clupeoid fishes is not yet known; they must surely have a functional nature. However, they are of great use in helping to assess relationships of some groups of Clupeidae, as recognised by Whitehead (1964a, 1965b). Morphologically, it is also found that when they are present that part of the head is always flattened.

10. Gillrakers

The use of gillrakers as a taxonomic character began when Troschel (1849) had divided them into two parts, viz. the upper and lower, and examined their number, thickness and length. He initially concluded that the families of teleosts cannot be separated by using the structure and arrangement of the gillrakers as a clue, but for generic classification they are useful. Morphological and physiological studies of gillrakers in Clupeidae was first made by Zander (1906) and they have ever since been used widely in the taxonomy of these fishes.

Gillrakers serve many functions: they gather food particles, protect the gill filaments, supplement the valve-like action of the gill filaments in separating buccal and opercular chambers, and taste food particles before they enter the oesophagus. As in most other groups of fishes, gillrakers in clupeoid fishes vary in number, form, size and arrangement.

More emphasis has been placed here on the count of gillrakers and their shapes (for every species whenever possible) than has ever been done before. Although my original counts were separately taken from the four portions of the 1st gill arch, as proposed by Berry & Barrett (1963), viz. on medio-pharygobranchial (absent in extreme carnivorous feeders), epibranchial, ceratobranchial and hypobranchial, they are collectively presented as the upper gillrakers and lower gillrakers. This is due to the limits of space and time. Generally, the counts of gillrakers on both arms provide similar taxonomic results, but for particular (very) few cases only the count of the upper arm shows a good distinctive character between allied species; it is vice versa in many other cases. With the exception of Clupanodon thrissa, Konosirus punctatus and Nematalosa flyensis n.sp., the lower gillraker counts are always higher than the count from the upper arm. Interestingly, these three species are among the most specialized microphagous feeders, having an extremely high count of gillrakers.

Although gillraker counts have a fair reputation in clupeoid taxonomy, there is evidence that they have been reluctantly used by some workers. This is because of the overlap in numbers between species and the increase in numbers with growth (Andreu, 1955). I have found that, although the numbers of gillrakers in many related species groups completely overlaps, at least when they are juveniles, they show a considerable degree of accuracy for separation when they are in the form of scatter diagrams in relation to standard length. The main difficulty is when species exhibit a great geographic variation or there are population differences. In most species of carnivorous feeders the gillraker counts are usually small and they are constant after the fishes attain a certain length. This is well examplified by Etrumeus teres, E. whiteheadi (fig. 36) and Thryssa (Thryssa) setirostris (fig. 117). On the other hand, a continuous increase in numbers commonly occurs during the growth of plankton or microphagous feeders, e.g. Nematalosa flyensis (figs. 97. 98).

It is noteworthy that the gillrakers on the mediopharyngobranchial can also be used as a clue to the taxonomy of clupeid fishes and with a reliability not less than the counts from other regions. But this is limited to species which have great numbers of gillrakers, e.g. Alosinae, Dorosomatinae and also Sardinella. Similarly, counts from other gill arches seem to provide an equal result but are less practical (although initially used here for Corica laciniata and C. soborna, see fig. 47). In many cases gillrakers occur on the posterior face of the epibranchials. It is perhaps a rule that there are no rakers on the posterior face of the 1st epibranchial in Indo-Pacific clupeoid fishes, and this is applicable also to the 2nd arch, except solely for species of Escualosa and Pellona, which have several tubercle-like gillrakers. Of the other two epibranchials, they are always provided with numbers of rakers, especially in plankton feeders, but very rudimentary in carnivorous species. However, there are no gillrakers on the posterior face of the 3rd epibranchial in Ehirava fluviatilis and Thryssa (Scutengraulis) rastrosa.

Unlike the Engraulidae, the gillrakers on the 1st gill arch of the Alosinae and Dorosomatinae are of two types, the normal slender and the broader ones; however, there exist many intermediate forms. Close examination has revealed that the broader forms are fewer in number and randomly interspersed among the slender ones. They apparently gradually increase in number on the hinder gill arches. Except for the difference in their widths and textures, they have the same length as the neighbouring slender ones. The development of such broader gillrakers has been found on the hinder arches of most species of Sardinella. This is presumably an adaptation for the increasing of their ability to gather minute food particles in microphagous feeders.

Apart from the above characters, the length of longest gillrakers on ceratobranchial, the mucosal buds, asperities and the natures of serrations on the gillrakers of these fishes also serve as important indications for taxonomy, relationships and modes of life. From this study I conclude that congeneric species of the Indo-Pacific clupeoid fishes most likely have more or less the same form of gillrakers. Upon this basis, and supported by many other characters, I therefore recognise the separation of Sardinella (Sardinella) from S. (Clupeonia) as did Whitehead (1973b), but treat Amblygaster as a distinct genus. Another character is the presence of curled gillrakers on the inner gill arches of Hilsa and Sardinella (Sardinella). Whitehead (1965b, and also pers. comm.) regarded it as a distinctive feature for separating Hilsa from Tenualosa and of use in Sardinella. I have found it useful especially for the former genus, but only to some extent in the latter (see also under Sardinella (Sardinella) lemuru).

11. Gill filaments

The use of gill filaments as a systematic character is very limited for clupeoid fishes. In general, measurements are made on the 1st gill arch indirectly by comparing the length of the longest gillraker on ceratobranchial with its corresponding gill filament. The result is only applicable for a very few closely related species, is usually indecisive and is hardly used above specific level. This is chiefly because it is highly variable among individuals and does not correspond with ontogenetic changes. Credit should be given to Herre & Myers (1931) and Whitehead (1962b, 1965b), who found a distinctive difference between the length of the outer and inner hemibranches when comparing neighbouring filaments in some members of the subfamilies Alosinae and Dorosomatinae. Besides Hilsa kelee, Tenualosa ilisha, Clupanodon thrissa and Konosirus punctatus, I have found this to occur also in Tenualosa reevesii, Gudusia chapra, G. variegata, Nematalosa flyensis and Anodontostoma thailandiae. Interestingly, this feature is for some species highly developed in large individuals and only indistinctly displayed in small specimens.

Disparity in the length of gill filaments between inner and outer hemibranches only decisively occurs among the Alosinae and Dorosomatinae and it may provide further evidence for combining both subfamilies. This was initially done by Regan (1917a) and recently by Monod (1961). It now seems likely that the presence (Alosinae) or absence (Dorosomatinae) of a small median notch at the tip of the upper jaw is an artificial character separating the two groups of fishes. Since it is only slightly developed in Clupanodon and Konosirus of the Dorosomatinae; also, a 1st supramaxilla is present in Dorosoma of the same subfamily. Furthermore, there are perfect intermediate forms showing a gradual development of the gizzard stomach in the Alosinae. It is therefore possible that tribal level is more suitable for the classification of these two related groups. However, this must be postponed until all living and fossil forms have been thoroughly revised on the basis of specimens from all parts of the world, supported by other morphological data.

12. Pseudobranch

The filaments of the pseudobranchial organ have provided one of the rather few numerical characters that change in number ontogenetically. New filaments are usually formed with increasing body length, and the rudimentary filaments of this comb-like organ are difficult to distinguish, while the total counts do not always correlate closely with the size of the fish. Nevertheless, they are of use in the taxonomy and diagnoses of many species or genera. Whitehead (1965b) regarded them as one of the important characters in the Indo-Pacific Alosinae and found it reliable.

Apart from overall shape, which ranges from a large attenuated organ to several short filaments emerging from a pocket or totally hidden under the skin. The presence or degree of development of a basal ridge and basal membrane has been of use for recognising certain species or even genera by authors. Regarding the basal ridge of the organ, it is a probably true that it is only formed in those species which have a great number of filaments, e.g. Alosinae and Dorosomatinae. The anatomy of it may show hyper-development of the vascular system that supplies the filaments.

In this study, the frequencies of total counts of filaments (if present) for each species are tabulated for gross comparison between species, rather than to show ranges ontogenetic variation. Interestingly, all species of the Clupeidae have a well developed pseudobranch. They are most highly developed in the Alosinae (tbl. 8.1) and Dorosomatinae (tbl. 9.2), but much less so in the Pellonulinae (tbl. 3.1). In the Engraulidae the filaments are concealed under the skin in Lycothrissa, Setipinna and Heterothrissa. They are, however, relatively very well developed in Engraulis, but only slightly less developed in Stolephorus, Papuengraulis and Coilia. Curiously, within Thryssa, the pseudobranch is variously exposed or else buried under a thin membrane or skin. It is well exposed and with many filaments in T. (Thrissina) baelama, less developed in T. (Scutengraulis) chefuensis, T. (S.) rastrosa, T. (S.) aestuaria, T. (S.) scratchleyi and almost entirely concealed by skin in T. (S.) kammalensis (tbl. 13.4); in the rest of the genus it is completely hidden under the skin or with only the extreme tips of the longest filaments exposed.

Regarding the basal membrane of this organ, although it can be used to differentiate some species of Ilisha as proposed by Seshagiri Rao (1974), I have found it is indecisive and preferred not to treat in this study.

Directly or indirectly the degree of development of the pseudobranch is probably correlated in some way to feeding habits. Certainly, within related groups of fishes the species which have the highest count of gillrakers always have a greater number of pseudobranchial filaments. Conversely, they are much fewer or none in carnivorous species. For this reason, Lycothrissa is placed nearer to Setipinna than to Papuengraulis, and this supposed relationship is reinforced strongly by the similar thread-like gas bladder.

13. Oesophagus

The oesophagus or front portion of the digestive tract or alimentary canal, is usually a muscular tube extending from the pharynx to the stomach. In Setipinna and Heterothrissa, in which the body cavity is relatively short through anterad migration of the anal fin base, the oesophagus still retains its normal length and therefore is proportionally longer than in other clupeoid fishes. The pneumatic duct does not join this part of the tract but emerges from just behind it or variously farther back. External demarcation between the oesophagus and the cardiac stomach is not observable since it is without constriction or other mark.

In this study an initial examination has been made of the inner surface of the oesophagus of some selected species of most genera. The surface of the lining seems to form four major patterns.

Firstly, those with longitudinal mucosal folds (pls. 304 a; 305 a); this is the most common type. It is a character of the Dussumieriinae, Pellonulinae, Spratelloidinae, Escualosa, Tenualosa toli, Gudusia, Konosirus punctatus, Nematalosa erebi and N. nasus. This form of oesophagus is capable of taking a considerable size of food and can more or less expand in shape. In the above mentioned species of Alosinae and Dorosomatinae the posterior part of such plicated folds usually has small mucosal buds. They might represent broken mucosal folds in that region.

Secondly, there are those with mucosal buds (pls. 304 b, c; 305 b). This is typical of all species of the Clupeidae (except for Escualosa and some Alosinae. The buds may be polygonal in shape, close to each other and of about equal size in each species, or may vary in size and be more or less separated in others. Equally important is their arrangement. They are longitudinally arranged in Amblygaster and Herklotsichthys (pl. 304 c), but oblique in Sardinella (pl. 304 b). On the other hand they are randomly arranged in Hilsa kelee, Tenualosa macrura, Clupanodon thrissa and Nematalosa papuensis. These mucosal buds were named "proventricular glands" by Day (1882) when he examined the digestive organs of Clupea pilchardus.

Thirdly, there is the mucosal papillae type (pl. 305 c), which is found in Gonialosa and Anodontostoma. The papillae are horn shaped, point backward and vary in size greatly. The large ones are, however, much fewer in numbers and occupy only the front part of the oesophagus. Intermediate sizes occur, but are only few in number.

Fourthly, there is the smooth type. It is common in the Pristigasterinae and Engraulidae, the oseophagus of these fishes thin and more or less swollen. There is evidence that in certain circumstances species of the first type could sometimes be classified as this type or vice versa, e.g. Escualosa and Thryssa (Thrissina). This is most likely due to the degree of constriction or expansion of the organ before or after feeding of these carnivorous fishes.

In general, and except for the fourth type, the main area of mucosal ridges or appendages is usually preceded or followed by more or less developed longitudinal folds. It is probable that the mucosal buds of many clupeid fishes were derived by breaking up the longitudinal folds. From this point of view, the ancestral clupeoids were presumably carnivorous.

14. Stomach, intestine and pyloric caeca

The correlation between the digestive tract of the fish, its food and feeding habit are reflected in the position and form of the mouth shape and disposition of teeth, gillrakers, oesophagus, stomach, pyloric caeca, intestine and relative length of it. Nevertheless there is some evidence that differences in intestinal coiling occur in related fishes which have similar food habits (Okamura, 1970). However, the relative inaccessibility of such internal characters has limited their use in assessing taxonomic relationships and in identifying clupeoid fishes in the past. From the late nineteenth century, a number of workers have contributed knowledge on the intestinal coiling in teleosts, but few have actually dealt with the coiling types of intestine for the purpose of phylogenetic interpretation. Jacobshagen (1911, 1913) was an outstanding author who first entered into the details of the digestive tract of fishes and tried to analyse the relation between the types of coiling and the feeding habits of some hundred species found in European waters. Another extensive work was that of Suyehiro (1942), who studied the digestive system as well as feeding habits of some 150 Japanese fishes, but without positive results on phylogeny. Among others were Svetovidov (1932, 1934), Ochiai (1966), Harder (1957, 1958, 1960), Kafuku (1958), Monod (1961), Nelson (1970a), Okamura (loc. cit.) and Nelson & Rothman (1973). Prior to these investigators, Hyrtl (1855, 1869) had described the anatomy of the pyloric caeca in *Heterotis* and some clupeoid fishes; while Day (1889) mentioned the number of pyloric caeca in some fishes, but his account was in no way comprehensive.

There are fundamental differences at subfamilial level down to specific level in the external features of the digestive tract of Indo-Pacific clupeoid fishes. These are (a) size and shape of the stomach (b) coiling or configuration of the flexure of the intestine, (c) length of the intestine, (d) number and arrangement of pyloric caeca, and (e) colouration. Apart from these characters, the anterior part of the tract (oesophagus) and the position of the insertion of the pneumatic duct on the stomach, also provide good taxonomic features. For convenience, however, they are separately described in this section. The actual length of the intestine of each species not given, however, since it is accessible from the drawings made from adult specimens of almost all species. Ontogenetically, a slight change in the digestive tract would be expected, but according to this study most seem to reach the adult pattern at a young stage, except for Engraulis (pl. 184b-e).

The stomach of clupeoid fishes is roughly Y-shape in most genera and V - or U - shape in most species of Stolephorus, Coilia and some Thryssa, but it is a characteristic gizzard-like organ in the Dorosomatinae and more or less varies from a muscular sac to a gizzard-like organ in the Alosinae. As in other fishes, the stomach can be subdivided into three parts, the cardiac stomach, fundus of stomach and pyloric stomach (pl. 2a). The intestine when emerging from the pylorus always extends backward along the right side of the stomach and then comes the coiling or first flexure (Harder, 1960). Usually, the gut opens to the outside just before the origin of the anal fin, except in most species of Stolephorus where it is distinctly advanced. The pyloric caeca or appendages are finger-like blind sacs, emerging from the anterior part of the intestine. In most subfamilies of the Clupeidae they occupy some length of the front part of the intestine, with the anterior ones longest, but they are restricted to the duodenum in the Pellonulinae and Engraulidae. In this study, I have counted the pyloric caeca and described the coiling of the intestine. Generally the number of caeca is almost unchanged with growth. The lowest count is found in species of the Pellonulinae, which have only 1-6 very large pyloric caeca (fig. 51). An enormous number of appendages is found in the Dorosomatinae and some species of the Alosinae. It is noteworthy that there are no pyloric caeca in the Chirocentridae. On the basis of five families of fishes (including the Clupeidae) from the temperate zone, Svetovidov (1934) concluded that "the fishes living on larger organisms have a higher number of pyloric caeca than those feeding on smaller ones". However, this is the reverse in most forms of tropical clupeoid fishes within this study, and it is easily demonstrated between congeneric species or related genera by means of the number of gillrakers, However, among carnivorous subfamilies, this is apparently contradicted, since there are many pyloric caeca in some species of Pristigasterinae. According to the characteristic coiling of the clupeoid intestine, it is now possible to suggest sequences of relationship (fig. 16). In the interpretation of these characters and with reinforcement by other relevant features (described elsewhere in this work) it is likely that the ancestors of the present clupeoids were carnivorous feeders with straight or short intestines and a low number of pyloric caeca.

Dussumieria, which is the nearest relative to Etrumeus, is similar to such an ancestor, particularly in the elongated fundus of the stomach and straight intestine (pls. 9c, 11b). Its pyloric caeca are finger-like and not great in number. These features are also found in the Spratelloidinae, Pellonulinae, Amblygaster, some species of Herklotsichthys (like H. lossei, H. spilura, H. punctatus and H. dispilonotus), most species of Ilisha, and all species of the Engraulidae; however, the length of the fundus of the stomach may gradually have shortened in the latter group of fishes. Superficially, Engraulis is the only one of these fishes which has a twisted intestine at a short distance before the anus (pl. 184b-e). By analogy, this form of the tract could be classified with the next type of intestinal tract. In this, instead of forming a flexure near the stomach, it is developed near the anus. It is possible that the short intestines in Amblygaster and the above species of Herklotsichthys are secondary development.

The next type of digestive tract is that of Sardinella (Clupeonia), Herklotsichthys quadrimaculatus, H. koningsbergeri, H. castelnaui, H. gotoi, Escualosa, Tenualosa toli, T. macrura, Pellona, Opisthopterus and Raconda. They are characterized by a longer intestine that forms a more or less Z-shaped flexure on the right side of the stomach. The stomach of these fishes has either a long or short fundibulum, this being a species character (as in the last group). The pyloric caeca tend to be more numerous than in the first type.

A more specialized form of intestinal tract is found in Sardinella (Sardinella) and probably also in Hilsa kelee. The intestine of these fishes is still longer than in the preceding forms. The anterior flexure is transformed into a double loop at the front of the stomach in the former, but is a very long single loop in the latter species. Their pyloric caeca are extremely numerous.

In the Dorosomatinae the fully developed gizzard-like stomach has been used as a major character of the group, supplemented by the very numerous and short pyloric caeca and the complexity of the coiling of the extremely long intestine. Harder (1958, 1960) and later Nelson & Rothman (1973) further diagnosed this group of fishes by the presence of a peculiar course of the intestine which they termed the "third primary flexure". They stated that it is absent, so far as known from all other clupeoids, but in fact, it also occurs in Tenuslosa reevesii, T. ilisha, T. thibaudeaui and Gudusia chapra (pls. 108b, 110b, 112b, 114b); due to a shortage of specimens of G. variegata, the presence of the third primary flexure is merely suspected. In the other species of Alosinae, although they possess no such flexure, the stomach is also more or less muscular and with trends toward the forming of a gizzard-like stomach. Correspondingly, their pyloric caeca are shortened and greatly increase in number. It is therefore likely that these are convergent characters which developed with the increasing number of gillrakers and adoption of a microphagous diet. They might stem from fishes with the previous type of gut, which is a different lineage of carnivorous feeders, e.g. Amblygaster, Herklotsichthys, Escualosa and especially the Pristigasterinae. Superficially, the primitive Etrumeus is the only clupeoid genus outside the subfamilies Dorosomatinae and Alosinae, so far as known to have the typical short dorosomatid pyloric caeca, but it retains an elongate stomach and short intestine. These contradictory features are possibly due to a sudden change in feeding habit, probably from large to much smaller organisms rather than being a primitive characters. This may explain the curious abrupt increase in the number of its gillrakers during growth (fig. 36). There is so far no apparent intermediate form between it and the Alosinae or Dorosomatinae.

As mentioned above, generally the intestine opens to the outside just before the origin of the anal fin, but in some species of Stolephorus (except for S. purpureus, S. buccaneeri, S. heterolobus, S. devisi, S. oligobranchus and S. indicus), the intestine is shortened and the anus is shifted forward well before the urogenital opening (which remains in its usual place). This peculiarity is presumably a step toward the shortening of the body cavity and the forward migration of the anal fin base found in both generalized or specialized genera of the same family. Interestingly, the unusual position of the anus in the six excepted species of Stolephorus coincides with the characteristic short maxilla of this species-group and also their cylindrical or subcylindrical body form. For this reason, I regard S. indicus as nearer to them than to the rest of the species of Stolephorus.

Regarding dark pigmentation of the digestive tract and peritoneum, this is not uncommon and can be used sometimes for generic or specific distinctions. This is separately discussed in the colouration section.

15. Gas bladder and pneumatic duct

It is generally conceded that the gas bladder evolved from an evagination of the embryonic fore gut in true fishes. This organ, which is always present in the Clupeidae and Engraulidae, is widely variable in shape and size and is recognised as a basis for many generic and also specific groupings. The present study has concentrated particularly on its morphology in all possible species. Weber (1820) was possibly the first to call attention to the study of the clupeoid gas bladder. Many subsequent investigators have since produced useful results. Among them were Bennette (1879), Retzius (1881), Ridewood (1892), Stark (1911), Tracy (1920), Nayak & Bal (1955), Srivastava (1955, 1956), Harder (1957, 1958, 1960), Bal, Nayak & Varde (1958), Monod (1961), Dehadrai (1962) and Nelson (1970a).

Generally, the gas bladder is a single chambered structure. It is a silvery or whiteish capsule, lying above the alimentary canal and either loosely attached or bound dorsally by tough ligments that run between opposite parapophyses. The shape of the gas bladder undergoes various changes in accordance with its air-content, quantity of food in the stomach and relative size of the gonads. In the clupeoid fishes it is the open type or physostomous, being provided with a short or long pneumatic duct which connects it with the stomach at some point on the dorsal surface of the cardiac stomach, or at the posterior end of the fundus of the stomach. Anteriorly it extends and becomes surrounded by cartilage (Ridewood, loc. cit.) before dividing into a pair of canals that pass forward one on each side to the back of the exoccipital, where they enter and fill bullae in the pterotics (absent in some clupeoids, e.g. Sprattus) and in the prootic. Various functions have been attributed to the gas bladder, the first and most widely accepted one being hydrostatic. It is also said to help in respiration, hearing and sound production (Nayak & Bal, loc. cit.). An occasional fat-storing function was added by Jones & Marshall (1953).

A decisive taxonomic differences in this organ among clupeoid fishes is the presence or absence of a connection at its posterior end to the outside. This character is usually a generic feature; it varies infragenerically only in Thryssa (Scutengraulis) and Tenualosa. Among the Indo-Pacific clupeoids a connection to the outside occurs in species of the Dussumieriinae, Clupeinae (except Escualosa), Hilsa, Tenualosa toli, T. reevesii, T. thibaudeaui, Dorosomatinae, Pristigasterinae and most species of Thryssa (except those mentioned below for the unconnected type). On the other hand it forms a blind end posteriorly and without opening to the outside in species of the Pellonulinae, Spratelloidinae, Escualosa, Tenualosa macrura, T. ilisha, Gudusia, Engraulis, Stolephorus, Thryssa (Scutengraulis) rastrosa , T. (S.) aestuaria, T. (S.) scratchleyi, T. (S.) kammalensis, Papuengraulis, Lycothrissa, Setipinna, Heterothrissa and Coiliinae.

Equally important is the extraordinary development of posterior coelomic extensions of the gas bladder in a number of clupeoid fishes, they provide a good taxonomic character. These fishes are Clupanodon, Konosirus, Pristigasterinae (except Pellona) and Thryssa (Scutengraulis) malabarica. Significantly, all of them belong to the group which has the gas bladder open to the outside at the anus. The form of the extension falls into three types as defined by Poll (1969, see Whitehead, 1973a). First, a posterior extension formed by a bud shape or median prolongation; it lies within the body cavity of the fish. This type is found in Ilisha sirishai (pl. 118b), I. novacula (pl. 120b) and Thryssa (Scutengraulis)malabarica (pl. 247b). Second, an extension of the gas bladder which has only one elongate prolongation that penetrates into the muscle on the right side of anal pterygophoses. This type is found in Ilisha megaloptera (pl. 163b), I. elongata (pl. 165b), I. filigera (pl. 167b), I. macrogaster and I. pristigastroides (pl. 170b). It is what Poll (loc. cit.) called a single but asymmetrical prolongation. Third the most specialized type, formed by equal development of the right and left extensions of the gas bladder and named by Poll (loc. cit.) bifid prolongation. It is characteristic of Ilisha kampeni (pl. 171b), I. striatula (pl. 173b), I. melastōma (pl. 175b), Opisthopterus valenciennesi (pl. 177c), O. tardoore (pl. 179b) and Raconda russeliana (pl. 181b).

The length of the prolongation of the gas bladder increases with growth of the fish. Its length in relation to the bases of the anal rays shows some specific value in certain species of the pristigasterinid fishes (figs 86, 88).

Another superficial development in connection with the gas bladder is the formation of a free tunica interna (pl. 159b) in Ilisha sirishai. It is a muscular sack-like appendage which lies free within inside the outer bladder wall (tunica externa). Study of this curious feature was by Dehadrai (1960), but unfortunately under the misused name I. indica. The function of this is not known and awaits an explanation. However, I can find no compelling arguement for removing this fish to a separate genus or subgenus.

The absence of any gas bladder prolongation in Pellona, alone of the Pristigasterinae, suggests that in this character at least, it is the generalized form. Since the small bud lying within the body cavity is found in one anchovy, two dorosomatines and two pristigasterines, this seems to be a convergent starting point for the single post-coelomic extension on the right side (Pristigasterinae only). The most specialized condition is presumably the bifid type since it occurs, inter alia, in the otherwise highly specialized Opisthopterus and Raconda, as well as in three species of Ilisha (all Pristigasterinae).

Among the Indo-Pacific clupeoid fishes the first stage of reduction of the gas bladder is found in members of the Pellonulinae and Stolephorus.

This seems to have occurred through successive steps in the transformation of the anterior half of the bladder into a slender or thread-like tube. In most such species there is a constriction between the two parts. The height of such evolution is seen in Lycothrissa, Setipinna and Heterothrissa. In these three genera the gas bladder is very thin throughout its entire length. However, thin as it is, the pneumatic duct still persists and connects with the stomach throughout the fish's life. As stated above, Stolephorus and the generic group or tribe which contains Lycothrissa, Setipinna and Heterothrissa are very close in this character. However, they distinctly differ in many other major features, e.g. jaw elements anal ray counts, form of digestive tract and pneumatic duct, nature of pectorals, scales,scutes, pseudobranch, etc. On the other hand Stolephorus is nearer to Thryssa in the above characters. The occurrence of such a similar form of the gas bladder must therefore be a parallel development, possibly in connection with their mode of life and not a direct phyletic link. This is also borne out by the fact that the inshore Pellonulinae are not related to the Engraulidae, although they have more or less the same development of the gas bladder.

Apart from the above, the fact that the pneumatic duct inserts to the stomach is also important in the systematics of the clupeoid fishes. Ridewood (1892) indicated that it is "slightly more anterior in the young than in the adult". Recently, Harder (1958, 1960) and Nelson (1970a) concluded that the anterior position of the duct doubtless is primitive relation to its posterior position.

In the family Clupeidae, and within the Dussumieriinae, the relatively primitive position of the pneumatic duct is retained in Dussumieria (pls. 9c, 11b). While its allied Etrumeus has an extreme posterior position of the duct. In the latter, the duct opens into the gut at the posterior end of a well-formed stomatic diverticulum (pl. 5d, 7e). I believe that this is a possible step simultaneously taken with a sudden change of feeding habit (as mentioned above) of this fish. This posterior shift of the duct has been followed also by other present day clupeids, namely, Pellonulinae, Spratelloidinae, Clupeinae, Alosinae and Dorosomatinae. Whatever the shape of stomach, the duct of these fishes always emerges from the posteriormost end of the cardiac stomach. On the basis of the more primitive position of the pneumatic duct in the Pristigasterinae, they might be seen as an independent offshoot from an early member of the ancestral stock of the other main groups of clupeoids (Nelson, loc. cit.). However, there exists evidence of convergent characters (jaw elements, scales) in the clupeoid fishes; and some members of the Pristigasterinae resemble Herklotsichthys, Harengula and Escualosa in certain characters, e.g. circumorbital bones, jaw elements and pterygoid teeth. I therefore prefer to treat them as a subfamily of the Clupeidae instead of giving them superfamilial level as done by Nelson (loc. cit.).

Unlike the Clupeidae, the position of the pneumatic duct on the stomach of the Engraulidae varies considerably between genera and species. In the

Engraulinae, the primitive anterior position is found in Engraulis, Stolephorus and Papuengraulis. In species of Thryssa, it is variously located at any point between the oesophageal-cardiac boundary and just above the posterior end of the fundus of the stomach. In Lycothrissa it is some distance before the posterior end of the stomach, while in all species of Setipinna and Heterothrissa the duct is immediately above the posterior end of the stomach. Among Coilia it is usually inserted to the stomach at the primitive position; exceptionally, it is a short distance above the tip of the stomach in C. ramcarati.

Ridewood (1892) noted that "The ductus pneumaticus is relatively longer in the adult herring than in the young". I have found that the length of this organ is also intraspecifically variable, especially in species which have a long fundibulum of the stomach, where the duct emerges from or near its posterior end. When the fundus is greatly shrunk and the stomach is empty, or extended when it is full, the pneumatic duct must swing fore and aft accordingly. Such movement of the stomach therefore requires changes in the length of the duct. However, there are many species that have a long duct which forms a V- or U-shaped turn, e.g. Clupeoides papuensis, C. venulosus, many species of Thryssa and Coilia ramcarati.

One may perhaps conclude that the different feeding habits of clupeoid fishes, as reflected in the form of the digestive tract, has had no direct effect on the general posterior shift in the position of the duct. As shown by Harder (1960) and later Nelson (1970a), this is therefore rather a good indication of phyletic relationships. To this study a possible phyletic trends of the stomach and the pneumatic duct have been proposed in Figure 15.

Regarding the insertion of the duct onto the gas bladder this also shows a general posterior migration, as pronounced as the former or more so. With the exception of species of the Clupeinae, it is usually situated relatively behind the end attached to the stomach. Very occasionally, it is situated well to the front and thus provides a good taxonomic character for some species, e.g. Thryssa (Thrissina) baelama (pl. 223b), T. (Scutengraulis) dussumieri (pl. 239b) and all the species of Coilia, especially C. ramcarati (pl. 282b).

16. Hyoid arch

The hyoid arch and associated branchiostegal rays provide useful taxonomic characters for certain generic or specific groups, either in their morphology or their counts. In particular, slender and numerous branchiostegal rays are usually considered a feature of lower forms.

The use of the term "epihyal" has been dropped in most works nowadays, since the true epihyal is homologous with the hyomandibular, whereas the bone incorrectly named "epihyal" represents the posterior ossified element of the ceratohyal. I am in agreement with Goodrich (1930) on this and have adopted his term "posterior ceratohyal" for what was known as epihyal, and "anterior ceratohyal" instead ceratohyal (pl. 4a). Nelson (1969, 1970a) and Whitehead (1973a) on the other hand, used posterohyal and anterohyal for these two bones.

Both ceratohyals are greatly compressed. Their surfaces are smooth, with a longitudinal groove for afferent hyoidean artery along the middle of the lateral faces. In most members of the Alosinae and Dorosomatinae the bones, especially the posterior ceratohyal, have a spongy surface. They are firmly joined to each other by a suture on inner face, the posterior one always being shorter than the anterior. With the exception of Tenualosa reevesii (pl. 109b) and Clupanodon thrissa (pl. 119b), the connection is by means of small and weak interdigitating processes. As in most other teleosts, the hyoid arch begins with two small paired bones, the upper and lower hypohyals, which connect to the glossohyal and anterior end of the urohyal; it ends with a rod-shaped or hour-glass shaped interhyal (pl. 3a). The latter is suspended from a fossa between the symplectic, hyomandibular and preoperculum.

In some cases the heads of the branchiostegal rays are merely bound to the lower edge of the ceratohyals or sometimes lower hypohyal (e.g. Engraulis japonicus, Stolephorus purpureus, S. buccaneeri, S. heterolobus and S. devisi), but the posterior ones on the posterior ceratohyal, are attached to the inner surface of the arch and partially cover the anterior ones; the anterior rays may insert into small notches or holes on the lower edge of the anterior ceratohyal.

In clupeoid fishes the anterior part of the branchiostegal membranes on each side are joined by means of a connection with the protractor hyoideus muscle (m. geniohyoideus). In the Clupeidae the right membrane is always overlapped by the left anteriorly. This is vice versa in Amia calva, as figured by Regan (1904), but being the same in Osteoglossidae, Pantodontidae and Notopteridae (Greenwood, 1971*).

In the Engraulidae the membranes from each side are joined anteriorly as a thin membrane and without overlap. Such a connection is essentially similar to that of the Chondrostean Rhabdolepis macropterus which was studied by Traquair (1877) and figured by Regan (loc. cit.), as also all the macruroid fishes in the study of Okamura (1970) and Mormyridae (Greenwood, loc. cit.).

The number of branchiostegal rays in the clupeoid fishes range between 4-20 (5-20 given for the Clupeoidei by McAllister, 1968). It often varies inter- and intraspecifically. However, it is constant in many genera of the Clupeidae, especially when the number is low (4, 5 or 6). During growth of the fish the new rays are formed anterior to the youngest one. This probably confirms that the number of rays on the posterior ceratohyal is constant in a fish after metamorphosis. There are always fewer rays on the posterior ceratohyal than on the anterior ceratohyal. Whether they are few

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* Bull. Br. Mus. nat. Hist. (Zool.), 22 (1) : 1-55.

or many in the number, the size always gradually increases posteriorly; except the reverse in Heterothrissa breviceps (pl. 281b). In the Engraulidae, only two rays are normal on the posterior ceratohyal, except in the species group of Stolephorus which includes S. indicus, S. commersonii, S. brachycephalus, S. waitei and S. chinensis, where there are three rays on this bone. The highest count of branchiostegal rays on this bone is five, six or rarely seven in Dussumieria, but four in Etrumeus, three in Spratelloides and two in most other Clupeidae. Only one ray on the posterior element is usual in species of Nematalosa and this seems to be a very specialized character*. In many cases a branchiostegal ray is freely attached to the space between the two bones and is a specific character for some species. Regarding the numbers, of rays, they agree largely the observations of Nelson (1970a). The only major difference concern his figure of 3+17 rays for Setipinna breviceps (= Heterothrissa breviceps), since the large posteriormost bone on the posterior ceratohyal of his study is actually the interoperculum and not the third ray. A similarity between the posterior branchiostegal rays and the interoperculum is not uncommon in species of the Engraulidae.

The enlargement of the posterior branchiostegal rays in most species of clupeoid fishes is probably a means of supplementing the sealing function and pumping action of the opercular apparatus. Thus the last ray in many clupeid fishes is greatly produced and correspondingly curved upward about the lower edge of the interoperculum. Moreover, it is very similar in shape to the interoperculum and probably serves the same function as that bone. In fishes with the branchiostegal rays few in number, flexibly thin and greatly expanded, this is related to a diet of weak prey; in contrast, the slender or short and greater number of rays seems to be correlated with a diet of struggling prey. The latter type of rays are found in species

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* This occurs also in Denticeps (fide Greenwood, 1968).

of the Dussumieriinae, Pellonulinae, Spratelloidinae and most of the Engraulidae.

It is also noteworthy that among the Indo-Pacific clupeoid fishes, Stolephorus commersonii, S. chinensis, S. tysoni, S. insularis, S. dubiosus, S. baganensis and S. tri have small teeth developed on the upper edge of the anterior ceratohyal. Such teeth also occur on the upper surface of the dorsal hypohyal in S. commersonii and S. tysoni. This unusual dentition may be specific, or it may occur sometimes in other species of Stolephorus; more specimens of various sizes should be examined. Whitehead (1973a) reported and figured similar teeth for Pterengraulis atherinoides from the Guyanas.

Phyletically, according to McAllister (1968) and also Nelson (1970a), the greatest total number of branchiostegal rays indicates most primitive condition in clupeoid fishes. Thus, the relatively high count of rays in the Engraulidae, coupled with their generalized I-shaped urohyal and anterad position of the pneumatic duct in most species of this family, seems to point to their being a more conservative lineage than the Clupeidae. In addition, the radiating striae of the scales in many species of the Engraulidae could be also considered a primitive feature rather than an adaptive one. Nevertheless, the Engraulidae have been by far the most successful in adapting to an inshore life and show very many specializations.

17. Urohyal

The urohyal, a small unpaired bone, connects the hyoid arches and the isthmus. Its anterior end tapers and forms a neck, the head of which diverges as two small processes in most species. It is firmly attached to the posterior inner surface of ventral hypohyal and its lateral surface serves for insertion of the sternohyoideus muscle.

In cross-section, this bone differs somewhat between certain subfamilies and genera, but is usually similar within genera. No ontogenetic variation has been found after the larval stage in any species. Apart from the cross-section, study has also made of the lateral and ventral aspects in almost all species and they have been figured for comparison.

The cross-section is a very useful criterion in the taxonomy of these fishes since affinities between groups tend to form a clear morphocline (fig. 14). For practical purposes, I have classified them into I-shaped, pin-shaped, T- or crucifix shaped, X-shaped and normal or inverted Y-shaped. However, there exist all kinds of intermediate shapes. Although the cross-section of this bone is I-shaped in many genera or species of both Clupeidae and Engraulidae, there are remarkable and decisive differences in many other both generalized and specialized species. Certain parallel developments are shown by the possession of the inverted pin-shape, T-shape and Y-shape in the Clupeidae, and normal pin-shape, T-shape and Y-shape in the Engraulidae. This is clearly a case of convergence. It seems likely that the fleshy or bony urohyal plate found in some species of Stolephorus is an independent development and has no connection with the evolution of a T-shaped or Y-shaped urohyal. Phyletically, the simple I-shaped cross-section of this bone is presumed to be primitive.

Regarding the lateral expansion of the urohyal, this is possibly a functionalized character which helps increase space for attachment of the sternohyoideus muscle. Interestingly, in Herklotsichthys the urohyal is deep and looks like that of Escualosa (pl. 101e); a similar shape of this bone is otherwise only found in species of the Pristigasterinae; it is extremely enlarged in Opisthopterus and Raconda.

In Setipinna tenuifilis, S. papuensis, S. melanochir and S. taty, the posterior half of this bone is greatly reduced in size and becomes a long slender rod-shaped process, while in S. wheeleri, S. phasa and S. brevifilis it is the normal blade-shape in lateral view. On this basis

Lycothrissa crocodilis and *Heterothrissa breviceps* are closely linked to the former *Setipinna* species group, as is also shown by their similarity in having a thread-like gas bladder.

Kusaka (1974) illustrated 713 forms of the urohyal of most genera of fishes from Japan. Included in his work were 29 species of clupeoid fishes. Unfortunately no attempt was made to explore their interrelationships, but he concluded (on dust cover page) that it "presents a new factor to support the present taxonomy of fishes".

18. Circumorbital bones

Circumorbital bones or at least the suborbital part of the series are highly variable in number and shape (Ridewood, 1904; Nelson, 1969) between individuals and also asymmetrical in one individual. Matthews (1887) was among the earlier workers who studied these bones in herring. In the Clupeidae and Engraulidae of the Indo-Pacific, they generally consist of eight or very rarely seven small and smooth bones which almost completely surround the eye: supraorbital, antorbital (preorbital) and six (or very rarely five) thin and delicate laminate bones (suborbital 1 or lachrymal, suborbitals 2-5 and dermosphenotic).

According to Gregory (1933) and Gosline (1961, 1965) the supraorbital is present in primitive teleosts, but is lost in advanced teleosts. In Indo-Pacific clupeoids it is always present. Smith & Bailey (1962) believed that within the Clupeiformes there is trend toward reduction. The supraorbital and antorbital bones do not support any cephalic sensory canal, but form the dorsal and anterior protection for the soft parts of the eyes. In the Clupeidae the supraorbital is a more or less straight, thick but narrow bone and usually bears one to several bony ridges posteriorly. It is, however, very thin, curved and relatively broader in the Engraulidae. In the latter family, the antorbital is very peculiar in shape. Instead of being a thin flat bone like in the Clupeidae, it is somewhat twisted like a scroll and bears one short and one slender process on its lower edge.

Smith & Bailey (loc. cit.) suggested that the lachrymal (not ant- or preorbital, but suborbital 1 in the present work) of the Clupeiformes is specialized to protect the anterior end of the maxilla. This seems likely, not only because it overlaps the maxilla, but because at familial level the decisive difference in the length of the jaw (or the maxilla) is accompanied by a correspondingly short suborbital 1 in the Clupeidae but extremely long suborbital 1 in the Engraulidae. However, the lachrymal (i.e. suborbital 1) as well as the supraorbital and antorbital were thought to participate in a system for pumping water in and out of the olfactory capsule in lower teleosts by Gosline (1961).

The suborbital bones (or infraorbitals as prefered by Gosline, 1965; and Nelson, 1969) form a large flat surface on the side of the head. They bear an open tube near their upper (inner) edge to support the infraorbital sensory canal. In the Clupeidae, it is suborbital 3, but in the Engraulidae suborbital 1, which is the largest bone of the series. While the dermosphenotic (pl. 4a) is the smallest. Characteristically, suborbitals 1 and 3 of the Clupeidae are well separated from each other; but in the Engraulidae, suborbital 1 is extremely produced posteriorly, and is met and overlapped by the similarly enlarged suborbital 3. Interestingly, the relative intermediate size of this bone is found in Chirocentrus dorab (fide Nelson, loc. cit.,fig. 3A).

According to Smith & Bailey (loc. cit.) the dermosphenotic is the only bone that contacts the sphenotic of neurocranium and does not border the eye (Gosline, 1965). Exceptionally, it is totally absent in Spratelloides. Suborbitals 1-5 and the dermosphenotic meet and more or less overlap consecutively, but suborbital 2 always slips over the top of the posterior end of suborbital 1 and the anterior end of suborbital 3. Fusion between these bones was not found and none of them has a subocular shelf (sensu stricto, Smith & Bailey, loc. cit.).

The use of these bones as a systematic character limited. In this work their morphology in most species is merely illustrated in drawings, since initial study of their form has shown that they tend to support rather than challenge the taxonomic conclusions reached on the basis of other character. For example, the finding of exceedingly long suborbitals 1 and 3 (pl. 281a) in Heterothrissa breviceps helps to support the separation of this fish from all other Setipinna; it can be differentiated by a number of other characters, as shown in the key.

The antorbital of Dussumieria is relatively a very small bone when compared with its supposed allied genus Etrumeus. In spite of this difference, suborbital 3 of these two genera, and also of Spratelloides, is unexpectedly similar and in its narrow shape resembles only that in the Pellonulinae (except for Corica). It is therefore likely that it provides further evidence of the relationships between them as proposed by Whitehead (1962a, 1963b). Whitehead (1962b, 1969a) used the shape of suborbital 3 (misnamed 2nd suborbital in his works) to differentiate some species of Nematalosa from others. This was followed by Nelson & Rothman (1973). Study of this bone in most species of Indo-Pacific clupeoids shows that it has a tendency to enlarge or expand greatly in carnivorous species, grading from Corica of the Pellonulinae, some Herklotsichthys and Escualosa of the Clupeinae, to all species of the Pristigasterinae and Engraulidae. I feel that this enlargement may serve to reinforce the other suspensorial bones in fishes that take struggling prey, as also must suborbital 1.

During this study the associated nasal bone was occasionally included and drawn. It is usually a very small thin bone, more or less flat in the Clupeidae but usually a twisted hollow tube in the Engraulidae. Although it was illustrated, no particular interpretation is given in this work.

19. Predorsal bones

The most comprehensive work on the predorsal bones was that of Smith &

Bailey (1961). Prior to their work this subject had been discussed to some extent by Bridge (1896), Eaton (1945) and Lindrey (1955). No comparable work has been so far done on the bones in the clupeoid fishes, except by Nelson (1970b) on Clupanodon thrissa.

Smith & Bailey (loc. cit.) accepted the works of those previous authors and considered that the predorsal bones are rayless pterygophores, being "vestigial supports of a previous elongate fin rather than as supraneurals". They also believed that the primitive number of predorsal bones of spiny-rayed fishes was one, but that a reduced number of bones may result also from anterior extension of the dorsal fin, the predorsal bones previously present having been forced out.

In the present study the predorsal bones have been examined from at least one representative species of each genus. This included the first pterygophore of the dorsal fin (except Raconda) and its associated 1st unbranched dorsal fin ray. They have been taken from cleared and stained specimens, with the exception of Papuengraulis which were obtained by radiograph.

The number of predorsal bones in Indo-Pacific clupeoid fishes varies from one bone in Coilia macrognathos (pl. 325h) to thirty bones in Raconda russeliana (pl. 323f). Within a single species the number of bones varies only slightly and the difference is not more than three bones, but greater differences might be expected if more specimens and species were studied. However, the total is almost constant in species which have fewer bones. By contrast, there is no predorsal bone in Chirocentrus.

The shape of the predorsal bones of the Clupeidae differs between genera rather than species. They are needle-like in Etrumeus (pl. 321a), Dussumieria (pl. 321b) and Corica soborna (pl. 324d); rod-shaped in Ehirava (pl. 323g), Spratelloides (pl. 321c), Pellona and Ilisha (pl. 323c, d); pin-shaped or T-shaped in Clupeoides (pl. 324a, b), Corica laciniata (pl. 324c), Clupeichthys aesarnensis (pl. 324e), Sardinella (Clupeonia), Amblygaster and Herklotsichthys (pl. 321e-h); and more or less cone-shaped in the rest.

Interestingly, these bones are always needle- or rod-shaped in all genera of the Engraulidae (pls. 324g-i, 325a-i).

On the basis of their shapes and numbers it is presumed that the progenitors of the living clupeoid fishes had simple slender-shaped predorsal bones and only few in number. If this is correct, then the genus Coilia might have evolved from a very early ancestral stock of engraulid fishes. On the other hand the cone-shaped predorsal bones should be a derived character. A further specialization seems to have occurred through trends of fusion of some predorsal bones. This occurs in Clupeoides papuensis (pl. 324b), Escualosa (pl. 322a), Clupanodon (pl. 322f) and Anodontostoma thailandiae (pl. 323b), and possibly many others. However, in the Engraulidae no such fusion has been found.

Interestingly there are a number of species, especially engraulid fishes and some pellonulines, which have a gap between the posteriormost predorsal bone and the first dorsal pterygophore. It is likely that this gap developed through a backward movement of the dorsal fin during the evolution.

Morphologically, there is also an increase size of the bones from anterior to posterior, especially in most deep bodied species like the Dorosomatinae, Alosinae and many species of Clupeinae. Evolutionary speaking, the presence of a gap between them and the dorsal pterygophores in many species of Engraulidae, suggests that the dorsal fin of the clupeoid fishes has tended to move backwards instead of forwards, as believed by Smith & Bailey (loc. cit.) for the percoid fishes.

Regarding the arrangement of the bones, in the Pristigasterinae they are vertical in Pellona, distinctly oblique in the opposite direction to the dorsal pterygophores in Opisthopterus and Raconda, and very slightly oblique in Ilisha (pl. 323c-f). On the contrary, they are apparently oblique and more or less parallel to the dorsal pterygophores in all the rest of the studied clupeoid fishes. On this character alone the pristigasterines can be separated from the other clupeoids. This provides an indication that they are an independent lineage, probably at least as old as the youngest of the other main groups, as pointed out by Nelson (loc. cit.), who worked on the basis of the condition of their pneumatic duct. Moreover, the gradual inclination of this series of bones coincides perfectly with gradual changes shown by other characters, e.g. body compression, number of anal rays, reduction and backward movement of dorsal fin, number of predorsal bones and the transformation of the gas bladder.

Superficially in Clupanodon thrissa there exists a median dorsal ridge or keel, which was recognised as dorsal scutes by Nelson (1970b), between the occiput and origin of the dorsal. Together with its ordinary ventral scutes the fish has been sometimes called a "double-armoured herring". Although Nelson counted 20-25 scutes, his count of predorsal bones was only 7-9. In this study it is shown that the "dorsal scutes" are merely the exposed tips of the predorsal bones; the discrepancy in the counts is normal, being due to the irregular exposure of the bones above the skin. This phenomenon is constant, but does not occur in its probably nearest relative Konosirus punctatus.

20. Caudal skeleton

The caudal skeletons of clupeoid fishes have been treated in some evolutionary detail by Regan (1910a, 1910b), Whitehouse (1910), Hollister (1936), Gosline (1960, 1961), Monod (1967) and Greenwood (1968). However, the similarities in major details has always lead to the same conclusion, that caudal anatomy is unimportant for clupeoid taxonomy at generic or specific levels, but is useful at ordinal or familial levels.

In this study (pls. 327-334), an attempt has been made to study the caudal components of all genera and many additional species of Indo-Pacific Clupeidae and Engraulidae. The primary results is that there are no decisive differences between the two families, except for the apparently oblique arrangement of the posterior ends of the parhypural, hypurals 1, 2 or sometimes also 3, and the occasional fusion of hypurals 1 and 2 in species of Coilia.

Osteologically (pl. 4c), the caudal skeletons of these fishes (adult) always consist of :

a. 9 upper + 8 lower principal (branched) caudal rays.

b. 0 to 3 epurals.

c. 2 independent paired uroneurals 2 to 3 (as well as uroneural 1, which is the largest and connects with the ural centra by ankylosis, Regan, 1910b).

d. 6 independent hypurals (except some species of Coilia, in which there exists a degree of fusion between hypurals 1 and 2); hypurals 1 and 3 largest (except Spratelloides 1 and 4 largest*; and Coilia, 1 and 3 or 4 largest). Hypural 1 is always separated from ural centrum 1 by a distinct gap and it bears seven principal branched caudal rays; hypural 2 with one ray; hypural 3 with one to four rays; hypural 4 with three to six rays; hypural 5 and 6 with one ray each. Specifically, the variation in the numbers of principal caudal rays on hypurals 3 and 4 is related directly to the size of these two bones. For example, there is six rayson hypural 4 of Spratelloides but three rays on the same bone in Stolephorus (pl. 334a, d).

e. Parhypural (= haemal spine of preural centrum 1) barely separated from preural centrum 1 and provided with a more or less distinct parhypural process (hypurapophysis in Roberts, 1972) on its anterior upper surface.

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*This occurs also in Jenkinsia lamprotaenia of the same subfamily from the New World (fide Hollister, 1936, text-figure 44).

f. Preural centrum 1, ural centrum 1 and 2, and uroneural 1 fused and forming a single solid bony element (urostyle of authors); they were observed and figured as separate elements by Regan (1910b) and Hollister (1936) for young clupeoids.

It is now clear that the number of epurals is one of the most interesting characters of the caudal skeletons of clupeoid fishes. The comparative data given below were taken from one to four specimens of most species whenever possible. Interestingly, no ontogenetic variation in number was found. Due to the limited scope of this study and the existence of intraspecific variation in many species, and also the small number of specimens, the following data are merely given for genera, subgenera or some important species.

a. 1 epural : Etrumeus, Corica, Spratelloides*.

b. none - 1-2 epurals : Coilia.

c. 2 epurals : Dussumieria (partly fused), but normally separated in Ehirava, Dayella, Clupeoides, Clupeichthys, Sardinella (Sardinella), Gudusia, Clupanodon, Engraulis, Stolephorus and Lycothrissa.

d. 2-3 epurals : Sardinella (Clupeonia) (usually 3), Tenualosa, Nematalosa (usually 3), Anodontostoma (usually 3), Thryssa (Thrissina), T. (Scutengraulis) adelae, T. (S.) purava, T. (S.) dayi and Setipinna.

e. 3 epurals : Amblygaster, Herklotsichthys, Escualosa, Hilsa, Konosirus, Gonialosa, Pellona, Ilisha, Opisthopterus, Raconda, most species of Thryssa (Scutengraulis), T. (Thryssa) and Papuengraulis.

Phyletically, the above data suggest that there is a positive trend of increase in the number of epural bones from the supposed more primitive

*This number is also found in Jenkinsia lamprotaenia of the New World (fide Hollister, 1936, text-figure 44).

species or genera toward the more advanced. However, it must be remembered that each of these groups may comprise several evolutionary lineages. I certainly believe that from this clue, future study at specific level will produce more concrete evidence of the phyletic relationships of the present clupeoid fishes and their allied groups.

In general, the epurals are elongate, plate-like bones. They may be straight or curved and lie obliquely next to each other and are usually equal in length and width. Among the studied fishes, the sibling species Coilia neglecta and C. dussumieri are the only species in which the bones are represented by tiny round elements (pl. 332f) or have disappeared. This is presumably a degeneration rather than an early stage of formation. Functionally or adaptively, a similar phenomenon occurs also in some species of macruroid fishes (Okamura, 1970), which have about the same profile of slender caudal. The low number of epural bones in this genus supports the hypothesis that Coilia is a primitive form rather than a member of an advanced group.

In the species of Sardinella (Sardinella), the upper half of the anterior epural always splits* into twin bodies (pl. 326e). This is possibly a step in the evolution of a new (third) epural. The first stage is perhaps seen in S. (Clupeonia) brachysoma, whose anterior epural bears a small incision on its upper end (pl. 326f). In addition to the above, in Dussumieria the anterior epural is much smaller than the posterior one. The two epurals in this genus are still fused with each other throughout their length (pl. 326b) and require some force in order to separate them. It is likely that this is the last step in the formation of a new epural (if this hypothesis is acceptable).

Judging from the shape of the individual bones of the caudal skeleton, some taxonomic value lies in the shapes of various parts. The most useful

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*This occurs also in Anchoviella choerostoma of the New World (fide Hollister, 1936, text-fig. 46).

may be the parhypural process, especially in Spratelloides (pl. 326c, d)* ; the shape of the bony lamina or plate on preural 1 (its neural arch); the hypurals, especially the relative sizes of hypurals 3 and 4; and the epurals.

Another reliable character is the presence or absence of a midcaudal gap (pl. 4c), which lies between the posterior part of hypurals 2 and 3. This feature was noted and studied to some extent by Monod (1967) in many different groups of fishes. In Etrumeus, which has so far been treated as a very primitive clupeid (Gregory & Conrad, 1936; Chapman, 1948; Whitehead, 1963a; Nelson, 1967a), the gap is wide and deep (pl. 326a) and generally similar to that in Elops (fide Regan, 1910a) and Pterothrissus gissu by Gosline (1961). The gap is shallower but still very distinctive in Dussumieria of the same subfamily Dussumieriinae (pl. 326b) and in all other members of the Clupeidae except the Pristigasterinae. Of the Engraulidae, only species of Engraulis and Stolephorus retain the wide gap (pl. 331a-c); it has completely disappeared in other genera. However, it still slightly exists in Coilia. In Thryssa (Thrissina) baelama, which was suggested as a probable transitional form between Stolephorus and Thryssa by Whitehead (1965a, 1973b) there is no such gap and it is here placed as a subgenus of Thryssa.

On the basis of this character, all clupeids and engraulids can be separated into two main groups. Disregarding the adaptive or functional aspects of the presence or absence of this gap, it is likely that its absence is the more specialized condition. If this is true, then the suggestion of Harder (1958, 1960), Bertmar, Kapocr & Miller (1969) and Nelson (1970a) can be accepted that the pristigasterine fishes are an independent lineage of the clupeoid fishes that arose from a very old

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* This occurs also in Jenkinsia lamprotaenia of the New World (fide Hollister, loc. cit., text-figure 44).

common ancestral stock. They have radiated in many characters (as shown elsewhere in this work) but still retain the primitive anterad position of the pneumatic duct and rod-shaped predorsal bones. Again, the presence of this small gap in Coilia (pls. 332e, f; 333a-c) further supports the contention that this genus is a primitive one within the Engraulidae. Ontogenetically, according to many text-figures of Hollister (loc. cit.) this gap is deeper in younger fish other than larval stages.

It should also be mentioned that in the species which have a gap between hypurals 2 and 3 there are no principal caudal rays at this point. They have moved upward to articulate with the remaining posterior margin of hypural 3, or the rest of its rays sharing the limited space with those on hypural 4. There is no change of number of rays on hypurals 5 and 6 (see above).

21. Colouration

Attention has also been given to colouration where known from the studied material; chiefly to find further means of identification. In most cases the colours in preserved specimens are due to melanophores and silvery reflections from guanine layers.

In museum specimens, the colour on the back remains darker than on the lower part, which is usually silvery or at least lighter. Except for some species or individuals of Dussumieria, Sardinella, Amblygaster, Herklotsichthys, Nematalosa and Thryssa (Scutengraulis), the line of demarcation between the two zones is usually not pronounced. Instead of this line, in many species of both families there exists a more or less developed lateral band along the flanks, either silvery or dusky. There is evidence that in the same species the band may be silvery or dusky, depending on the state of preservation and size of the fish. A lateral band occurs in probably all species of the Pellonulinae as well as Escualosa, Engraulis and Stolephorus.

However, young individuals of many species also have a broad silvery lateral band. There are also a number of species that display several narrow more or less dark lines along the series of scales near the back, e.g. some species of Sardinella, Nematalosa, Anodontostoma and Clupanodon. Apart from this, in Amblygaster sirm, some species of Herklotsichthys, most species of the Alosinae, Konosirus and Nematalosa chanpole, there are prominent series of dark blotches or spots along the flanks. Coilia dussumieri is the only species of clupeoids that has several series of pearly spots along the lower part of the flanks. They were identified as light organs by Haneda (1961) and the anatomy of the organ has been studied and drawn by Whitehead (unpublished). Light organs are otherwise unknown in clupeoid fishes.

The other common but important marking that provides a good character for many species of both Clupeidae and Engraulidae is the humeral spot or blotch. It may be formed by a dense aggregation of dark pigment (e.g. Alosinae and Dorosomatinae) or by a group of dark venules (e.g. Thryssa), but a great number of species have no such spot or only a very obscure or small one. There are still many other patterns of dark pigmentations on the head, body and fins of these fishes. These include, for example, the dark spot at the base of front dorsal rays in some species of Sardinella (Clupeonia); the prominent spots on the back near the base of the dorsal in some species of Herklotsichthys; the pigment line along the midline of the back in many species; dark dots on the tip of the jaws, on the frontal fontanelles, on various parts of the fins, under the surface of the gill cover and on various parts of the inside of the mouth.

Besides external markings, dark pigments or silvery layers are also found in the internal organs and the body wall. The presence of a long gut and a black peritoneum in herbivorous or microphagus fishes would appear to be correlated in some functional way, possibly to prevent further photosynthesis in phytoplankton (Whitehead, pers. comm.). In Indo-Pacific clupeoid fishes the colouration of the digestive tract, including its pyloric caeca and also the peritoneum, is to some extent a useful taxonomic character since it varies in presence or absence, shade and extent among the genera and species.

On the whole, however, external colouration has not proved very useful in preserved material except for the more striking examples, e.g. the spots along the flanks of Amblygaster sirm, or the small spots on the back of Herklotsichthys punctatus (which at last made sense of Rüppell's species name and enabled me to separate the species from H. quadrimaculata). In life, the colours make a useful guide to field identification, but too many misidentifications exist in the literature for this to be fully exploited at present. Morphologically, it is known that in the fresh materials, apart from the brilliant silvery, the only bright colours that exhibit in these fishes are blue, green (on body), sometimes yellow and rarely orange or reddish (usually on fins).

Distribution

The Clupeidae and Engraulidae comprise rather generalized fishes (except for the rat-tailed Coilia) found in virtually all seas and in many freshwaters. Their ancestry is by no means clear and it is debatable whether fossil genera such as Etrumeus, Clupea and Sardinella are truly the same as their recent representatives. It is not within the scope of this work to probe the ancestry of the clupeoids, nor to search for their nearest living relative. However, a consideration of their present distribution may throw some light on their probable centres of origin.

The main area studied here, the Southeast Asian waters, lies in the middle of the largest archipelago in the world, with the depth of the sea less than 200 m (Ekman, 1953), thus providing all the conditions for a huge assemblage of colourful and highly diverse fishes. Geologically, the islands are only recently separated from each other or from the continents, by the submerging of the low land which having been variously connected in the past (Pleiocene and Pleistocene, together of about 11,000, 000 years) to form the Sunda land. This area has often been regarded as an evolutionary and distributional centre of fishes for the entire Indo-Pacific region or farther (Jordan, 1901; Herre, 1936, 1940; Hora, 1937, 1949, 1952; DeBeaufort, 1951; Randall, 1955; Fowler, 1956; Gosline & Brock, 1960; Briggs, 1967a, 1967b, 1968, 1969, 1974; Whitehead, 1967a; Smith, 1971; Menon, 1978). In comparison with the clupeoid faunas from other parts of the world (Svetovidov, 1963, U.S.S.R.; Hildebrand, 1964, the western North Atlantic; Cervigón, 1966, Venezuela; Whitehead, 1973a, Guianas) the greatest diversity of living clupeoid species is found in the Indo-Pacific region (Bleeker, 1872, Indonesia; Day, 1878, India; Nair, 1953, India; Whitehead, 1965a, Red Sea; 1966a, Hong Kong; 1969b, Malaya; 1973b, India). In the area studied, and according to this work, there are at least 154 species of 32 genera (excluding Sardinops, Sprattus, Clupea, Potamalosa, Hyperlophus, Sauvagella, Spratellomorpha and Gilchristella, which are confined to the borders of the area) and 9 subfamilies (within 2 families, viz. Clupeidae and Engraulidae). In comparison, Nelson (1976) gave 292 species in 72 genera of 4 families, viz. Denticipitidae, Chirocentridae, Clupeidae and Engraulidae for the whole world (evidently an underestimate, however, considering the number of new species and some additional genera recognised here; almost certainly the number of New World taxa will be increased when fully studied).

According to McCosker (1977) "Two major geological events have directly affected the distribution of tropical marine organisms. These were the Miocene (?) closure of the Tethyan Seaway through the convergence of the European and African continental plates (Phillips & Forsyth, 1972), isolating the Mediterranean and Atlantic from the Indo-Pacific, and the late Pliocene to Pleistocene closure (Whitmore & Stewart, 1965) of the Middle

American Seaway, separating the New World oceans (Rosenblatt, 1963)". Prior to Rosenblatt (loc. cit.), Mayr (1946) and Simpson (1950), also emphasised the role of such land barriers.

Of the 40 clupeoid genera that inhabit Indo-Pacific waters, six genera (Etrumeus, Clupea, Sardinella, Pellona, Ilisha and Engraulis) have representative (s) in other seas (s), but Etrumeus teres alone has a world-wide distribution. The similarity among populations of this species is striking and was described in a some detail by Whitehead (1963a). If a Southeast Asian parental centre is accepted, then the occurrence of Etrumeus and other representatives of the Indo-Pacific clupeoid subfamilies (except the endemic Coiliinae) in the New World is significant, since there also exist some isolated sibling species, e.g. Sardinella (Sardinella) aurita/lemuru, Pellona harroweri/ditchela (fide Whitehead, 1973a) and Engraulis encrasicolus/japonicus. They prove that their dispersal was effected before the land barriers were formed, and that the ancestral stocks were well separated after that time. Except for the man-made Suez passage, which now allows interchange of the faunas (fide Ben-Tuvia, 1953, 1976; Whitehead, 1965a), it is fairly clear that no crossings have been made since the gaps closed and this is sufficient to indicate the rate of evolution of the clupeoid fishes, in both the New World and the Indo-Pacific region. The absence of many widely distributed Indo-Pacific genera, e.g. Dussumieria, Spratelloides, Amblygaster, Herklotsichthys, Hilsa, Stolephorus and Thryssa, from the tropical Atlantic perhaps suggests a post-Tethyan origin or ancient Southeast Asian endemism of them, rather than the lack in the Atlantic of suitable habitats.

The origin of genera with species distributed across major barriers might be deduced from an analysis of the species involved, on the basis that regions with the greatest number of autochthonous species may be regarded as centres of distribution. Caution however, must be applied in any assumptions concerning the present distribution of clupeoid genera because many recent collections have yielded new species of other groups, some of which represented new genera or even new families, and it is likely that many clupeoids remain uncollected or described.

Within the Indo-Pacific region, 48 species of all 9 subfamilies of clupeoids are found to inhabit both the east and west sides of the Malay Peninsular barrier. More than a dozen of these are very dominent species. Added to the above number, there are 64 species restricted to the east side of the Peninsular, and 42 species that occur in the Indian Ocean alone. In arriving at these totals, stray specimens of Sardinella (Sardinella) lemuru, Clupanodon thrissa and Coilia mystus, which were collected from Phuket island in the Andaman Sea, were not treated as east-west species but included in the species count from the east. However, these numbers may have to be slightly altered when more collections are examined and the eight genera which were not studied in this work are included.

Generically speaking, 6 genera, e.g. Clupeoides, Clupeichthys, Clupanodon, Konosirus, Papuengraulis and Lycothrissa (making 11 when one includes Sardinops, Sprattus, Clupea, Potamalosa and Hyperlophus) are recorded for the western Pacific area. On the other hand, only 4 genera, e.g. Ehirava, Dayella, Gudusia and Gonialosa (making 7 when one includes Sauvagella, Spratellomorpha and Gilchristella) are endemic to the Indian Ocean and its rivers; while 22 genera are common to both sides.

This strongly suggests that the Southeast Asian area has been a better place for evolutionary radiation and dispersal of the clupeoids than the Indian Ocean and its rivers. This must partly be explained by the existence of landbridges in the east, largely consisting of the Indonesian and Philippine archipelagoes, Papua New Guinea, Solomon Islands, Australia to Samoa and other south Pacific islands of Micronesia and Polynesia. In the Eastern Indian Ocean, however, some divergence of these fishes has occurred in the upper part of the Bay of Bengal. Within this area the Andaman-Nicobar Islands and Mergui archipelago, in addition to the extremely large estuaries (e.g. Ganges and Irrawady) of the mainland, offered an opportunity for evolution, but the Western Indian Ocean was somewhat isolated by major oceanic waters and the Indian Peninsular barrier. Thus, the clupeoid species of this subregion are much fewer along the east coast of Africa. Losse (1968) reported only 21 clupeoid species (including Spratellomorpha bianalis) from the coastal waters of Tanzania and Kenya, while Whitehead (1965a) recorded 26 species from the Red Sea, Gulf of Aden, Gulf of Oman and Persian Gulf.

In the whole Indo-Pacific region, there are about 51 species that are widely distributed, with ranges of not less than 3,000 km. A further about 55 species occur in particular parts of coastal waters or rivers from the Hawaiian Islands to the east coast of the Africa. About 19 species among them are estuarine or anadromous forms, namely : Ehirava fluviatilis, Dayella malabarica, Clupeoides borneensis, Corica laciniata, C. soborna, Tenualosa toli, T. macrura, T. reevesii, T. isisha, Ilisha novacula, ? I. kampeni (see remarks under diagnosis of species), Lycothrissa crocodilus, Setipinna melanochir, S. taty, Coilia borneensis, C. reynaldi, C. coomansi, C. macrognathus and C. nasus. Surprisingly, as many as 22 species are found to live in freshwaters only. Nelson's (1976) record of 25 species for the freshwater Clupeiformes of the world is therefore an underestimate. The most important centres for these endemic freshwater forms are three tropical high rainfall drainage areas :

a. Rivers of Bay of Bengal : Gudusia chapra, G. variegata, Gonialosa whiteheadi, G. manmina, G. modesta, Setipinna wheeleri, S. phasa and S. brevifilis.

b. Rivers and lakes of the South China Sea : Clupeoides hypselosoma, Clupeichthys bleeker, C. aesarnensis, C. goniognathus, C. perakensis, Sardinella (Clupeonia) tawilis and Tenualosa thibaudeaui.

c. Rivers of Papua New Guinea and Australia : *Clupeoides papuensis*, *C. venulosus*, *Nematalosa erebi*, *N. papuensis*, *N. flyensis*, *Thryssa (Scutengraulis) rastrosa* and *T. (S.) scratchleyi*.

Judging from these numbers, the highest degree of endemism is exhibited on the east side of the Malay Peninsular. This seems to agree well with the trends of their original distribution mentioned above. Among them and according to Mookerjee & Mookerjee (1950), Jones & Menon (1950, 1951) and Jhingran (1963), a mild catadromous habit is apparently characteristic of *Setipinna phasa*. Among the strictly fluviatile clupeoids, *Clupeichthys goniognathus* is peculiar in inhabiting both continental and island rivers of Southeast Asia. It probably used the Pleistocene land bridge to disperse, but its populations now disconnected by 1,000 to 1,500 km saltwater barrier.

So far as the known distribution of *Coilia* is concerned, its species are recorded only from nearshore waters of the main land from northeast of the Arabian Sea to Korea and the southern islands of Japan. They are especially abundant at many river mouths. The record of *C. dussumieri* from Mahé, Seychelles by Valenciennes (1848), later followed by Smith & Smith (1963), is almost certainly unreliable (*fide* Whitehead, 1973b). No single species has been listed for the Philippines by Roxas & Martin (1937) and Herre (1953) and it is not found eastward beyond the Wallace's Line either.

In conclusion, it can be said that the clupeoid fishes bear out the general contention that the Indo-Australian Archipelago has provided the richest evolutionary centre for marine fishes and that there has been a gradual dispersal from that area toward the periphery of the Indo-Pacific. It seems likely that those taxa common to the New World and the Indo-Pacific were widely distributed before the emergence of land barriers; their usually greater speciation in the Indo-Pacific is possibly evidence of their origin there, but may also reflect the greater ecological diversity of that area.

The diversity of freshwater forms rivals or exceeds that found in Europe, South America and West Africa, but is curiously little in peninsula India (where cyprinid and siluroid competition is no less than in West Africa).

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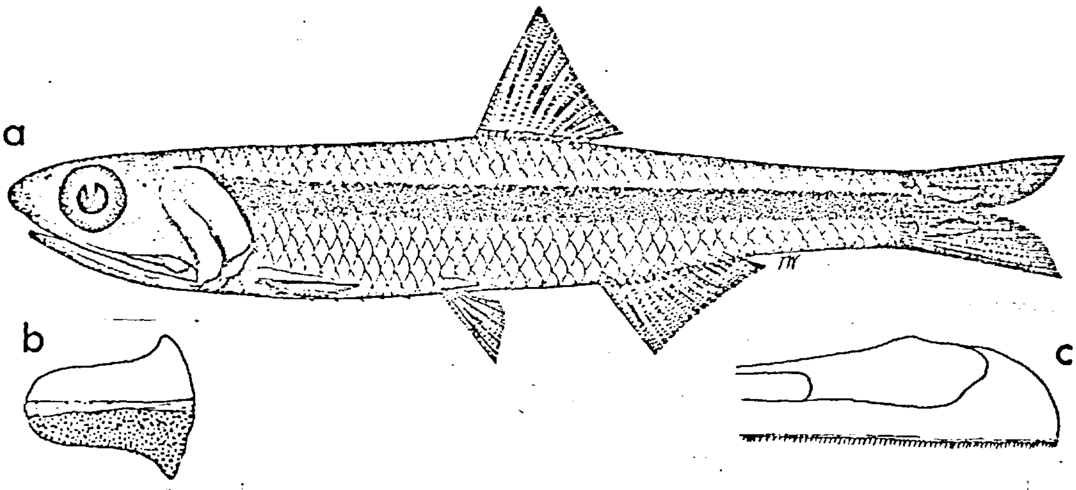
Appendix

Stolephorus oligobranchus n. sp. *



Stolephorus oligobranchus n.sp., a. holotype, BMNH. 1979.12.5.3, 57.0 mm S.L.; b. posterior frontal fontanelles and c. posterior half of its upper jaw.

Stolephorus Species B. Whitehead, 1965b, J. Mar. biol. Ass. India., 9 (1) : 16 (Philippines and Taiwan) (based on I.A. Ronquillo).

Specimens examined (3 : 53.1-62.0 mm S.L.)

Types:

1. BMNH 1979.12.5.3 (1 : 57.0 mm S.L.), Rosario, Cavite, Manila Bay, Philippines; I.A. Ronquillo. Holotype.

2. 1979.12.5.4-5 (2 : 53.1-62.0 mm S.L.), same data as in 1. Paratypes.

Diagnosis:- A Philippine species of Stolephorus, resembling S. heterolobus and S. devisi in the presence of a bony urohyal plate. It is, however, much closer to the latter species in having iii unbranched dorsal and anal rays. Tip of maxilla reaching only to anterior border of preoperculum, the part behind the posterior end of the 2nd supramaxilla distinctly broader than

*Co-authored by Dr P.J.P. Whitehead.

long (fig. c), no enlarged teeth in jaws. Tips of depressed pelvics terminating below base of 7th dorsal ray (cf. usually 2nd-5th in S. devisi). Gillraker count 13-14+17-18 being the lowest count at any given size when compared with all other known species of the same genus (14-27+18-35). Two branchiostegal rays on the posterior ceratohyal. Snout and tip of lower jaw densely dotted with dark, its stomach darkish, pyloric caeca and intestine without melanophores.

Remarks:- Due to the late arrival of these specimens (poor condition), their data have not been included in the graphs and tables and no attempt has been made to study its osteology. The followings are the counts of the holotype, with figures from the paratypes in parenthesis (counts of the scales are referred to the scale pockets) :

D iii 11 (11-13), A iii 15 (15), P i 13 (11-13), V i 6, Br. St. 12 (12), g.r. 13+17 (14+17-18), Lt.l. scales 41 (40-41), Tr. scales 9, Pred. scales 19 (19), Circump. scales 12, scutes 5 (5), pseud. fil. 16 (18).

Although Whitehead (1968b, based on I.A. Ronquillo), Ronquillo (1970) and Tiews, Ronquillo & Santos (1971) related this fish with S. purpureus, I have found it is nearer to S. devisi instead. They gave the lower gillraker count of the fish as 16-18 and with 4-7 ventral scutes, my counts of the three original Ronquillo specimens are, however, 17-18 and 5 respectively. According to Ronquillo (loc. cit.), his Taiwan record was possibly drawn from Fowler's (1941) S. zollingeri from that area. As we are uncertain about the Taiwan distribution, we feel it better to restrict its range to the Philippines.

Among species of Stolephorus this fish is rare; it "was obtained only in Manila Bay after 20 months (341 st sample") (fide Tiews, Ronquillo & Santos, loc. cit.). More specimens are badly needed for museums.

It is our great pleasure to acknowledge Mr I.A. Ronquillo of the Bureau of

Fisheries and Aquatic Resources in Manilla, who handed over the present valuable specimens and gave us permission to name and describe it.

The new specific name oligobranchus refers to the remarkably low count of gillrakers.

Distribution:- Rosario, Cavite in Manila Bay, Philippines.

SYSTEMATICS OF CLUPEOID FISHES OF THE INDO-PACIFIC REGION

by

THOSAPORN WONGRATANA

A THESIS

SUBMITTED FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

IN THE FACULTY OF SCIENCE

UNIVERSITY OF LONDON

DEPARTMENT OF ZOOLOGY AND APPLIED ENTOMOLOGY

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY

SOUTH KENSINGTON, LONDON SW7 2AZ

January, 1980

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Figures 36-126.	Relations of the number of gillrakers, pyloric caeca and some other characters to the standard length
Tables 2-17.	Frequency distributions for certain meristic characters in Indo-Pacific species of clupeoid fishes

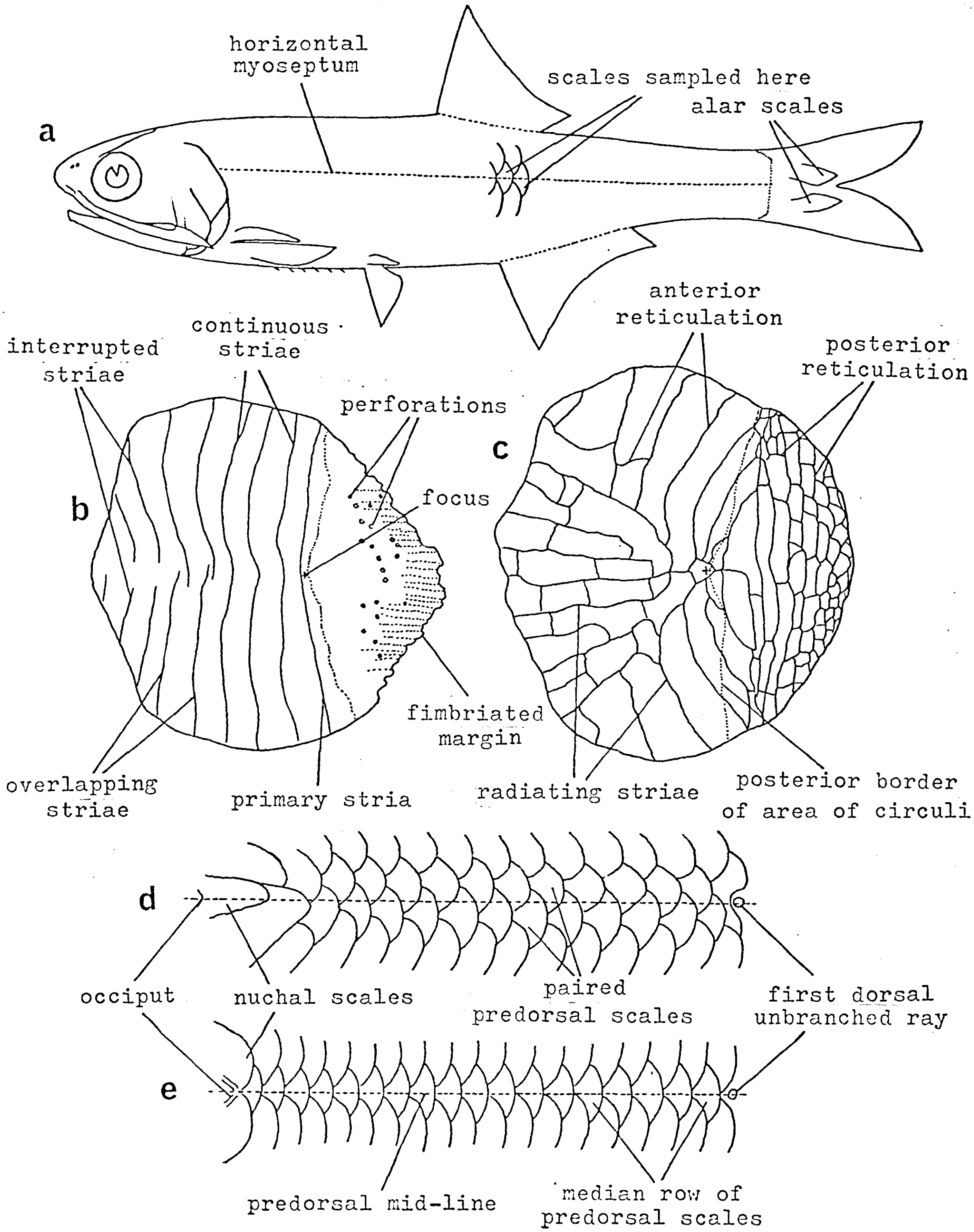


Plate 1. Diagrammatic illustrations indicate terminology of some selected characters of : a, adult; b, c, scales; d, e, predorsal scales.

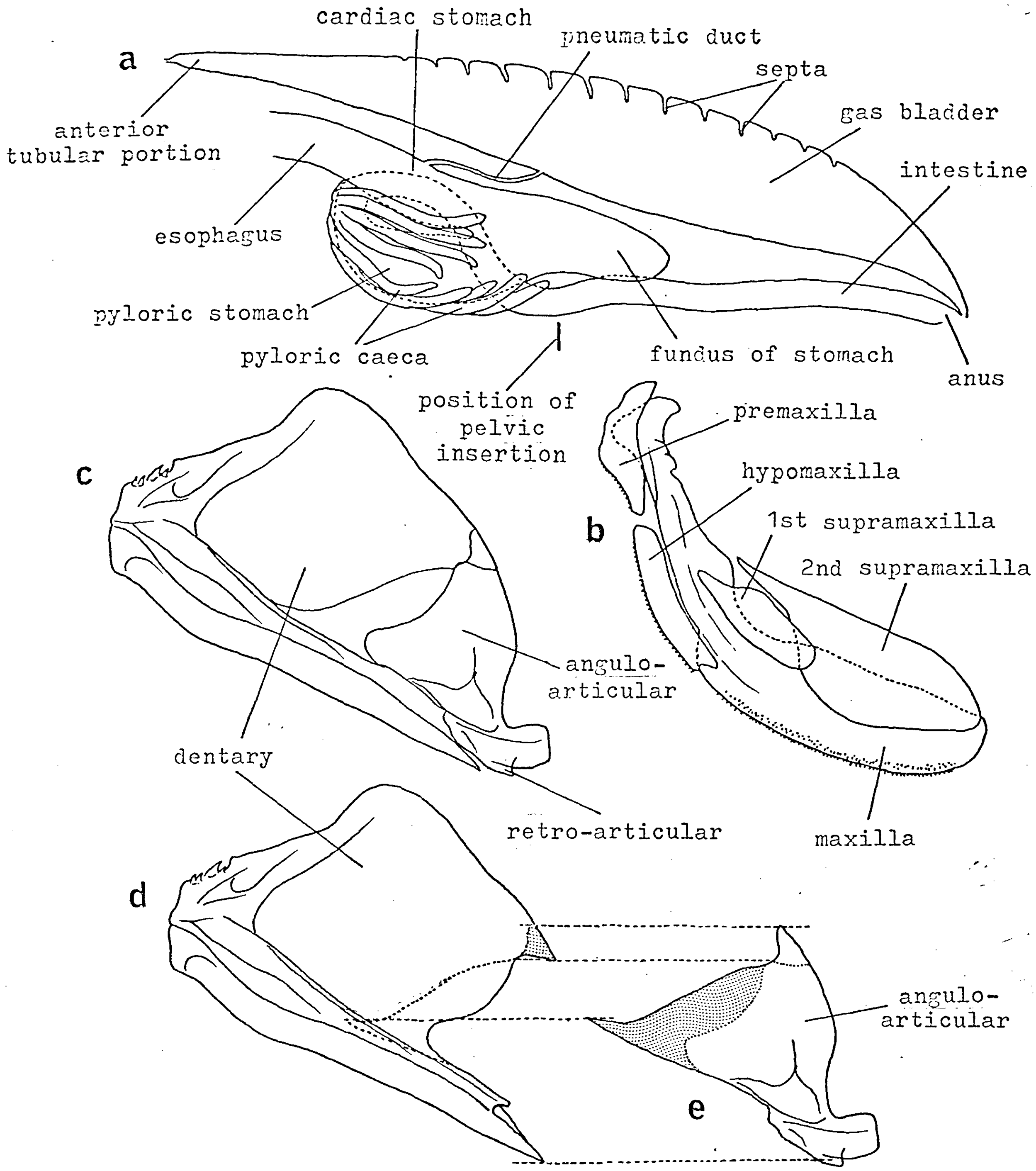


Plate 2. Diagrammatic illustrations indicate terminology of some selected characters (cont'd) of : a, gas bladder; b, c, upper and lower jaws; d, e, disarticulated lower jaw, stippled area indicates region covered by corresponding part of associated bone.

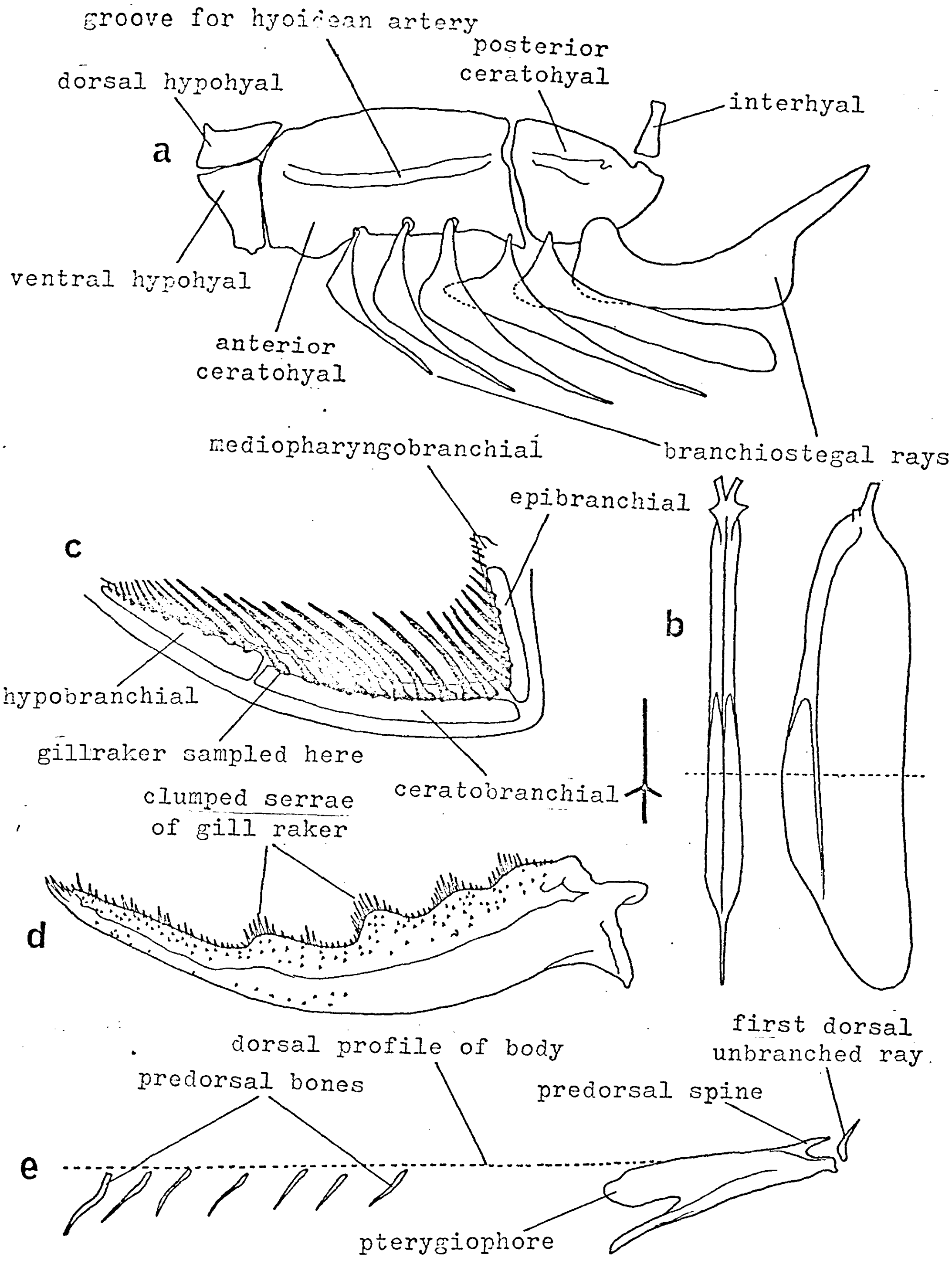


Plate 3. Diagrammatic illustrations indicate terminology of some selected characters (cont'd) of : a, hyoid (hyobranchial) arch, mesial view of right side; b, urohyal, from right to left, lateral view, ventral view and cross-section; c, first gill arch, left side; d, gillraker; e, predorsal bones and first pterygiophore.

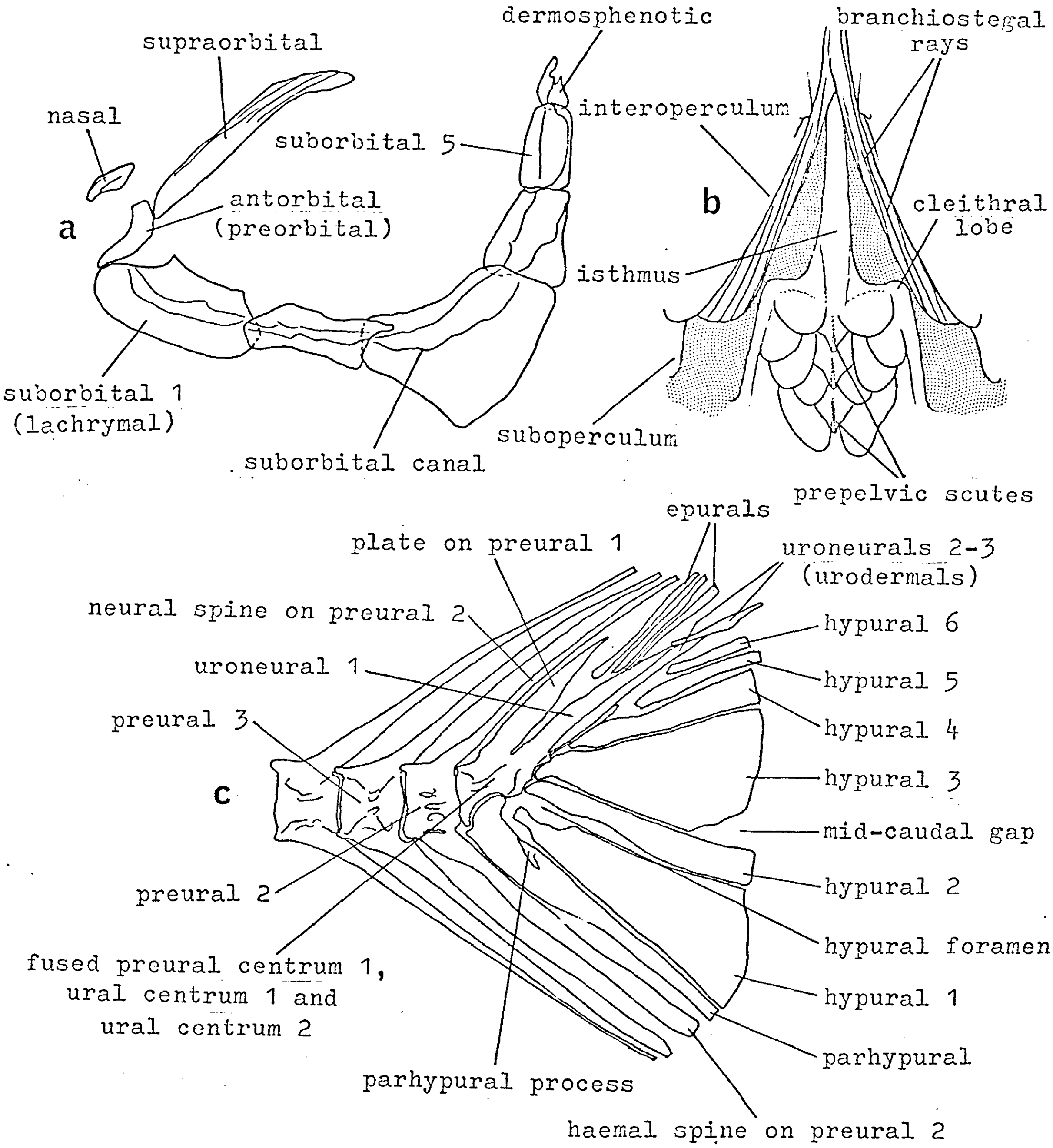


Plate 4. Diagrammatic illustrations indicate terminology of some selected characters (cont'd) of : a, circumorbital bones; b, isthmus and related elements; c, caudal skeleton.

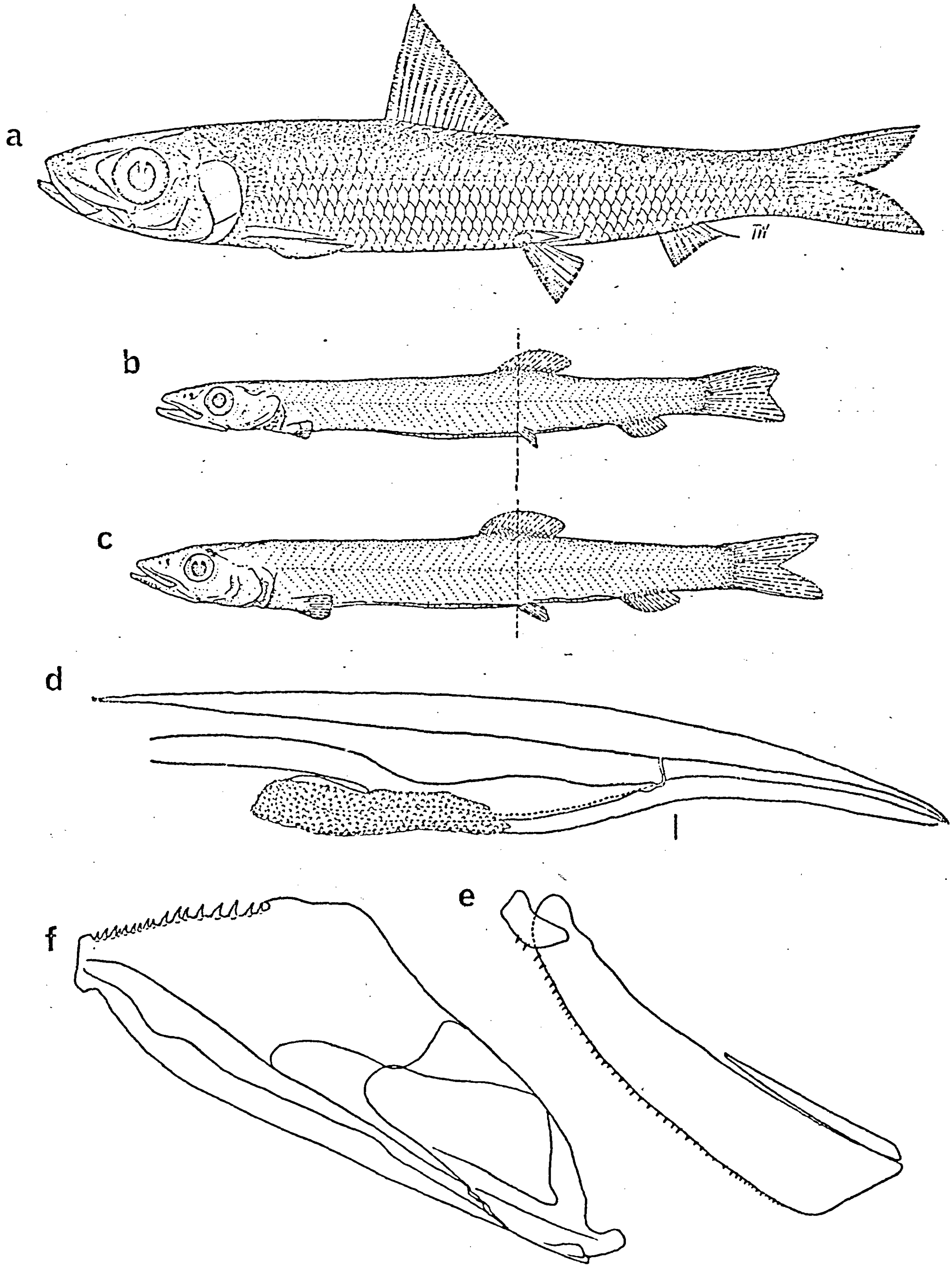


Plate 5. Etrumeus teres:- a, adult; b, c, juveniles; d, gas bladder and digestive tract; e, f, upper and lower jaws (a, d, e, f from BMNH. 1965.7.5.76-79, 64.0 mm S.L. for a and 59.0 mm S.L. for d, e, f; b, c from BMNH. 1976.4.27.109-142, 26.8 and 29.5 mm S.L. respectively).

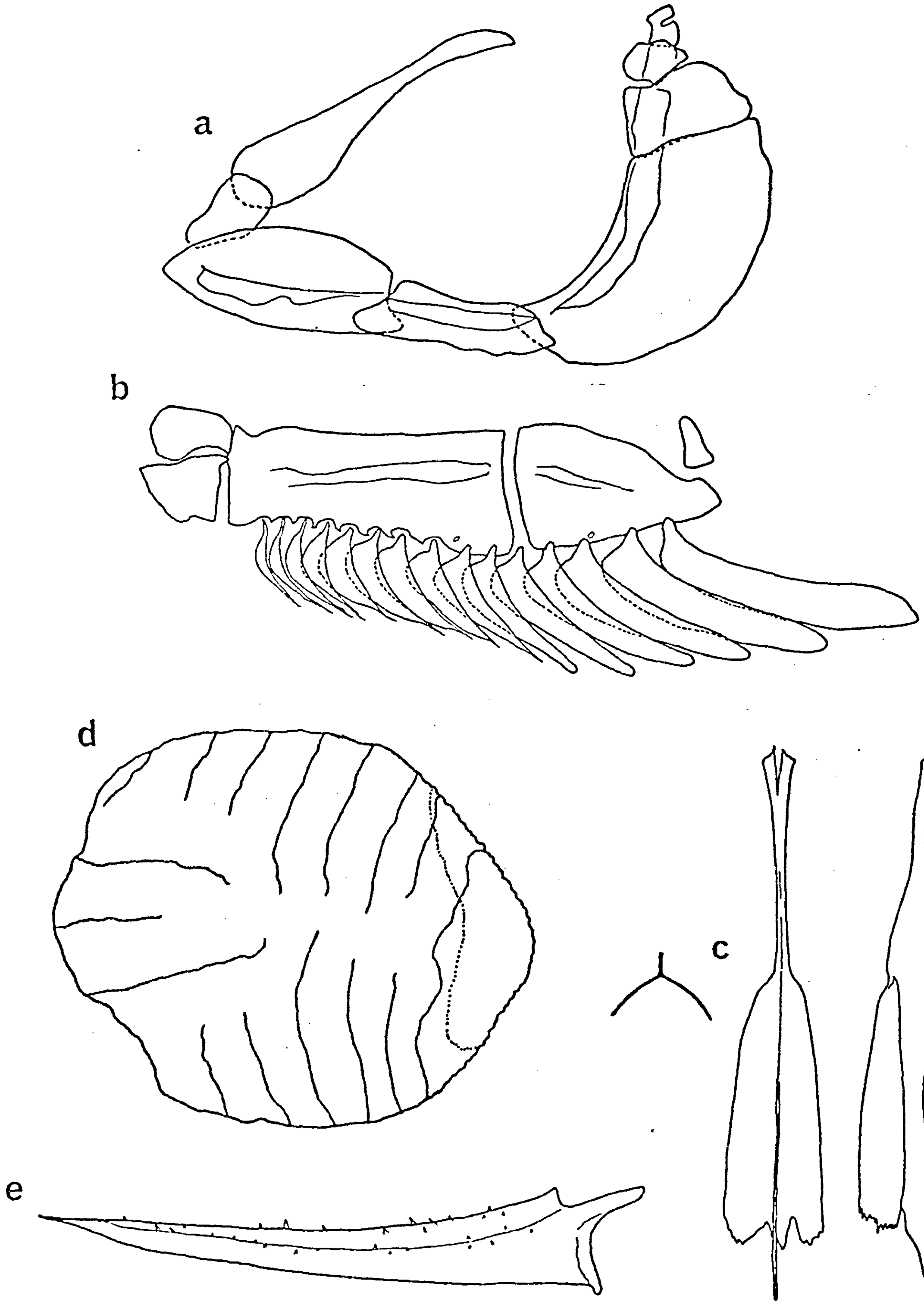


Plate 6. Etrumeus teres:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1965.7.5.76-79, 59.0 mm S.L.; d from BMNH. 1907.12.23.91, 141.0 mm S.L.).

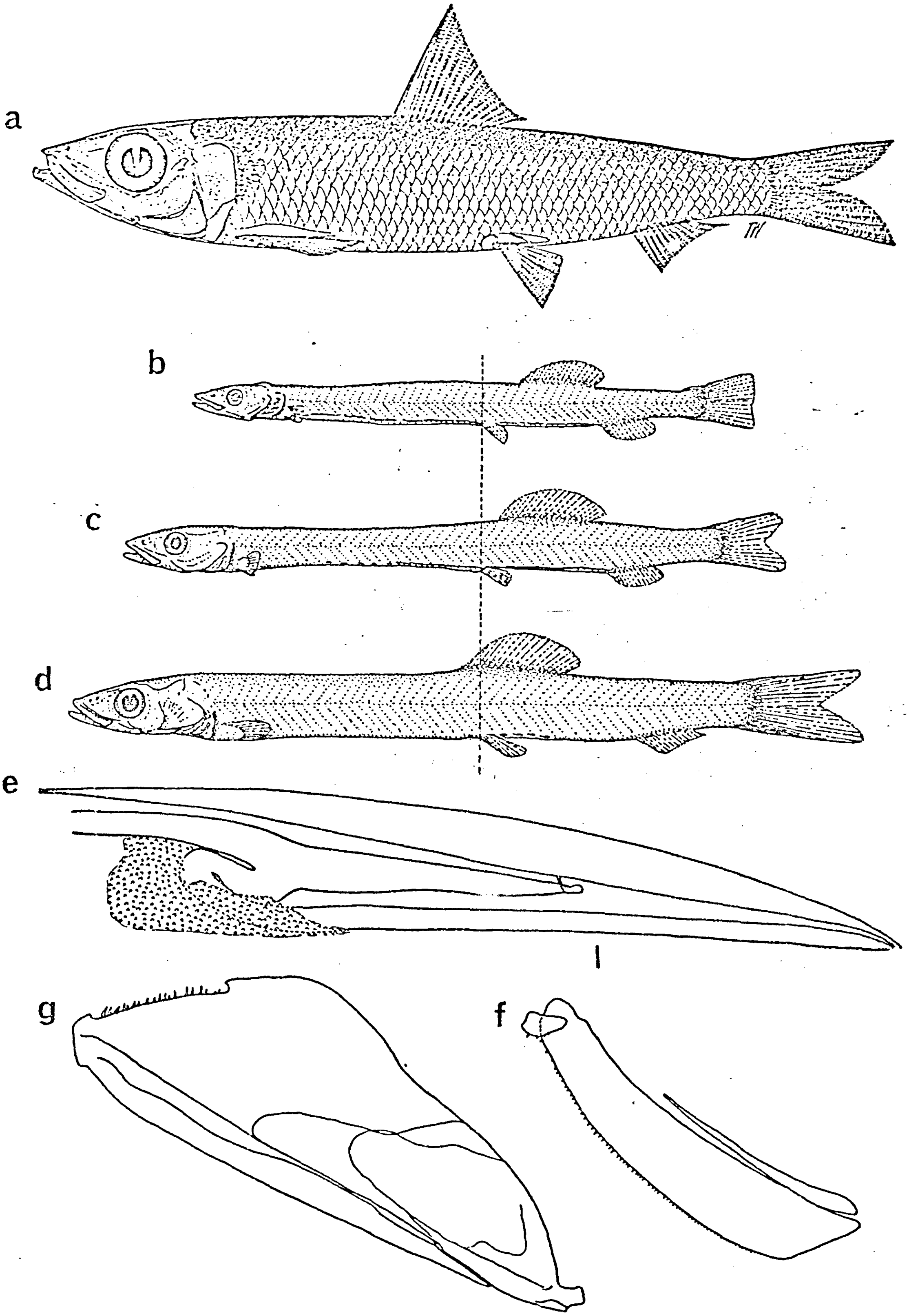


Plate 7. Etrumeus whiteheadi: - a, adult; b, c, d, juveniles; e, gas bladder and digestive tract; f, g, upper and lower jaws (a from BMNH. 1890.6.27.24, 166.0 mm S.L., holotype; b, c, d from BMNH. 1965.4.5.5-18, 25.0, 28.6 and 34.7 mm S.L. respectively; e, f, g from BMNH. 1965.4.5.1-4, 58.0 mm S.L.).

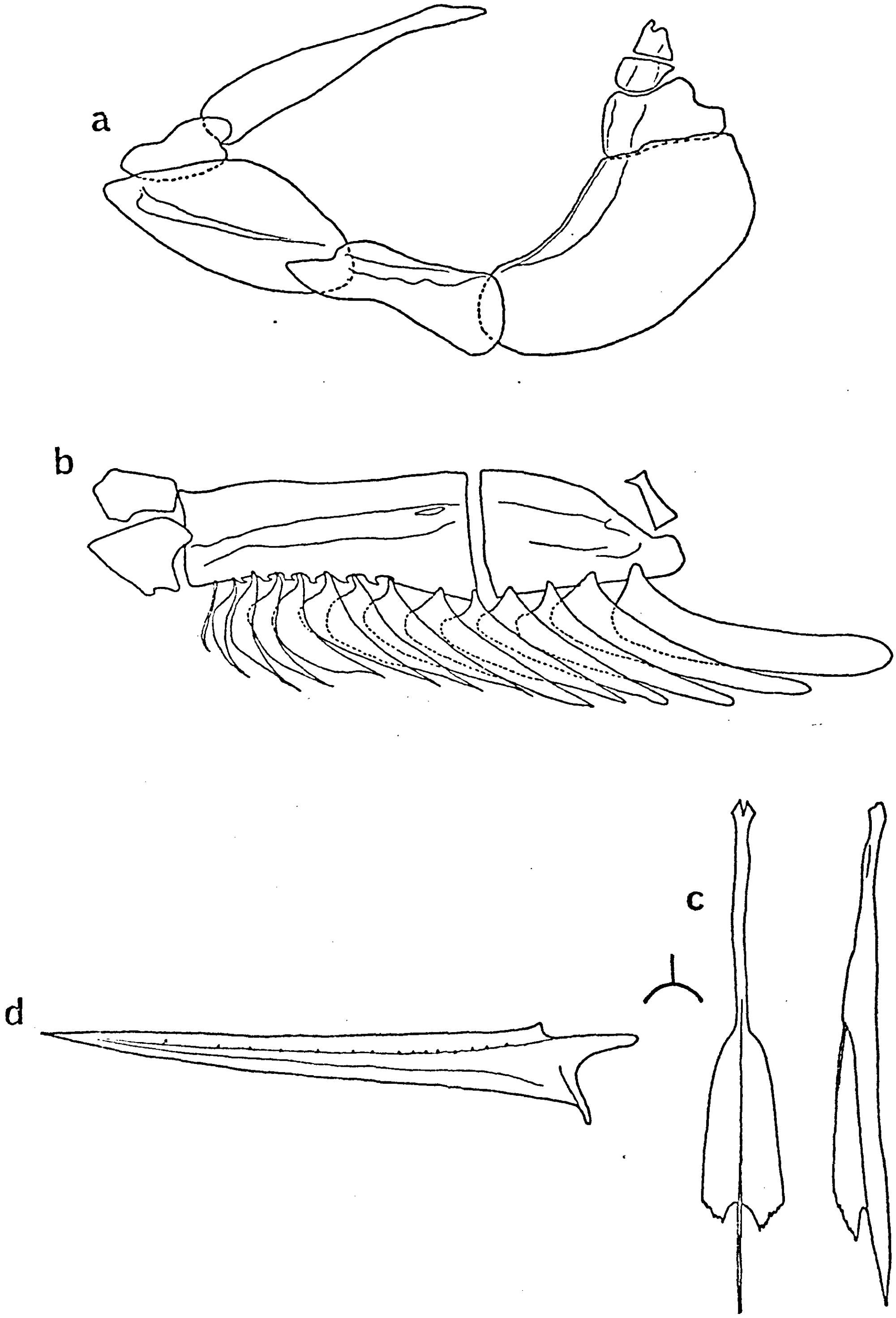


Plate 8. <u>Etrumeus whiteheadi</u>:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, gillraker (all from BMNH. 1965.4.5.1-4, 58.0 mm S.L.).

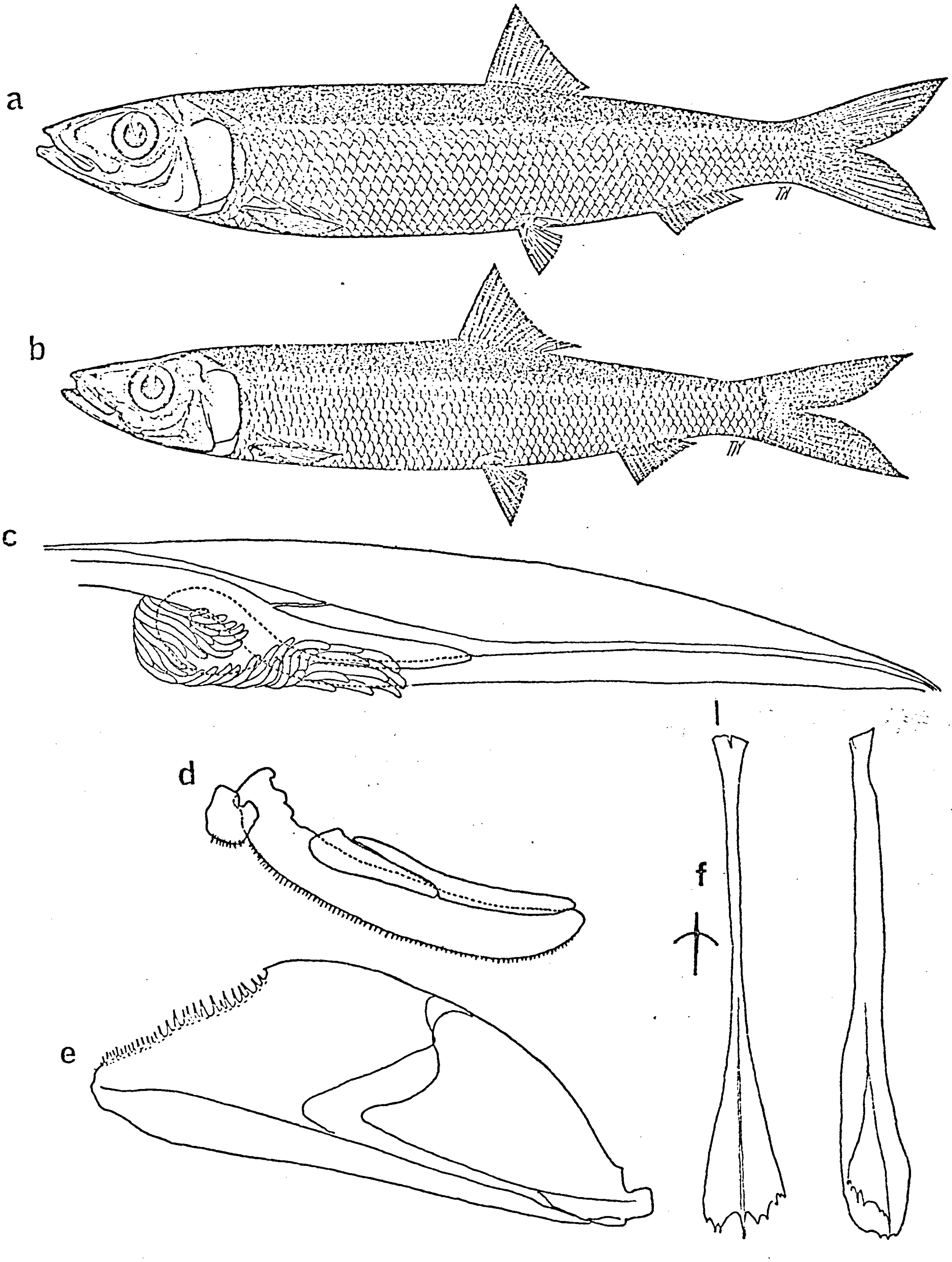


Plate 9. Dussumieria elopsoides:- a, d, adult (deep and slender body forms respectively); c, gas bladder and digestive tract; d, e, upper and lower jaws, f, urohyal (a from BMNH. 1867.11.28.21, 135.0 mm S.L., neotype of D. hasseltii; b from BMNH. 1965.7.5.73, 143.0 mm S.L.; c from BMNH. 1966. 2.28.8, 91.5 mm S.L.; d, e, f from BMNH. 1979.7.5.21-23, 90.0 mm S.L.).

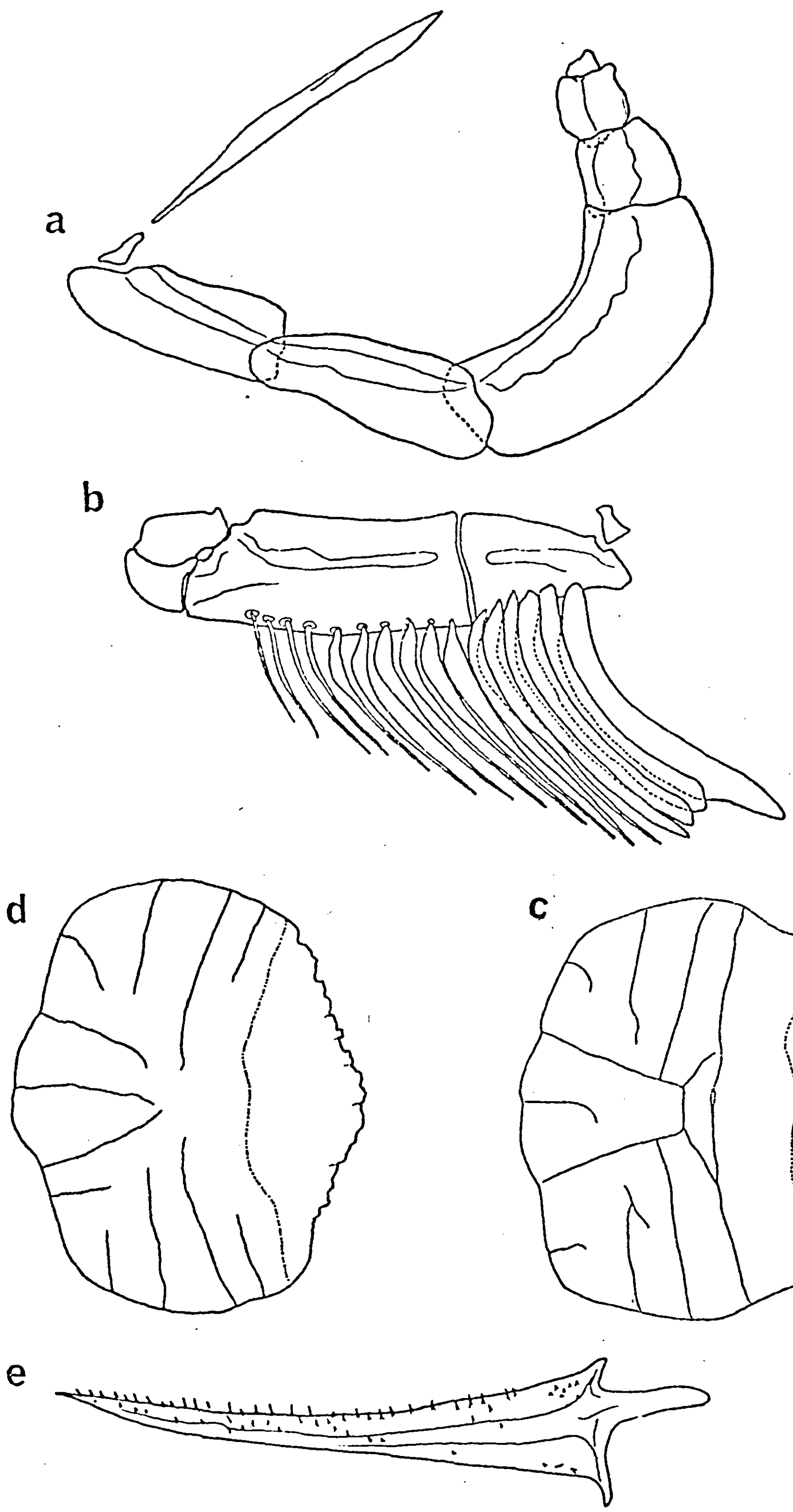


Plate 10. Dussumieria elopsoides:- a, circumorbital bones; b, hyoid arch; c, d, scales; e, gillraker (a, b, c, e from BMNH. 1979.7.5.21-23, 90.0 mm S.L.; d from BMNH. 1962.3.26.211-216, 150.0 mm S.L.).

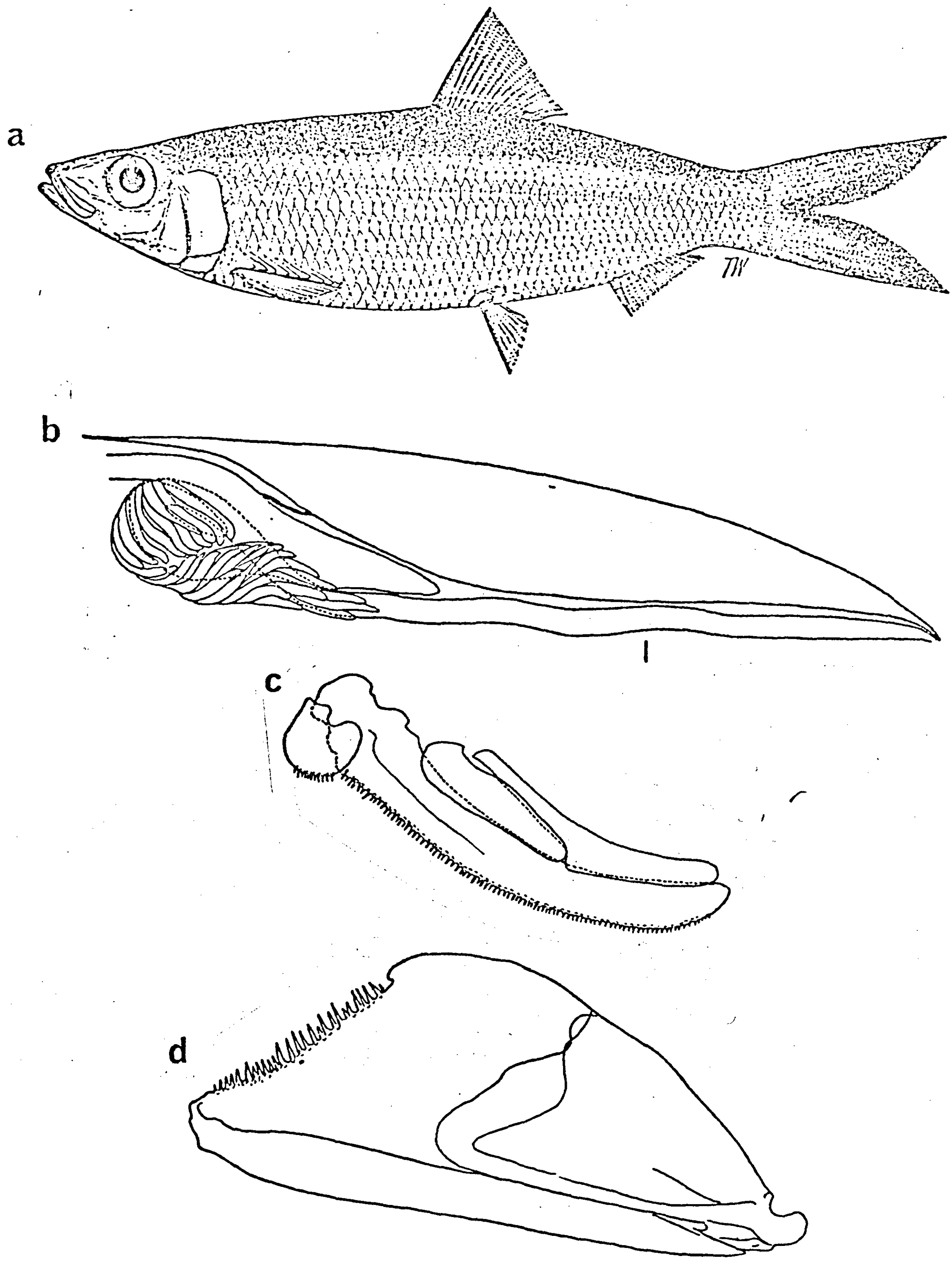


Plate 11. Dussumieria acuta:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1935.4.12.3-12, 110.0 mm S.L. for a and 114.0 mm S.L. for b, c, d.).

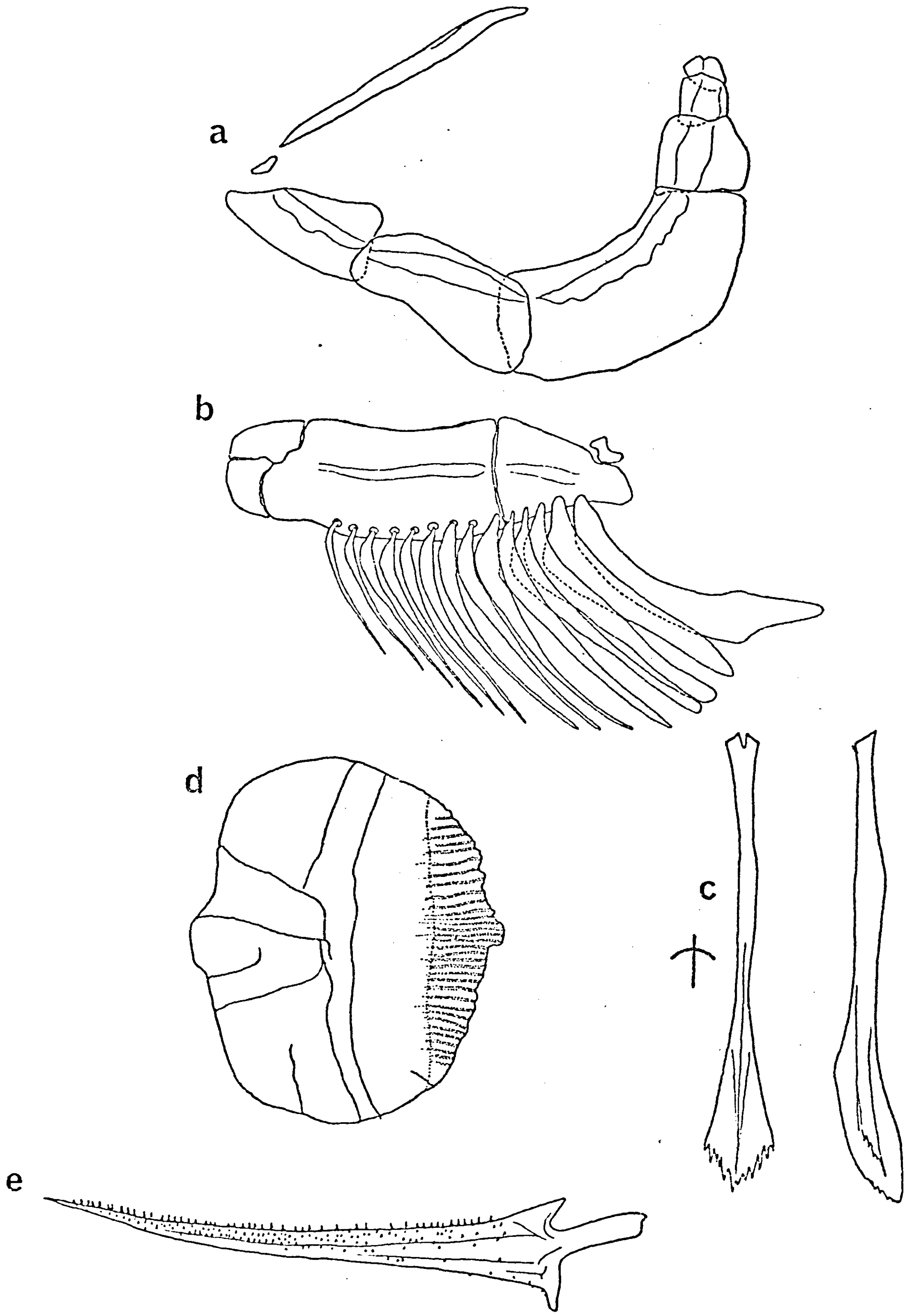


Plate 12. Dussumieria acuta:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1935.4.12.3-12, 114.0 mm S.L.; d from BMNH. 1920.7.13.4-5, 117.0 mm S.L.).

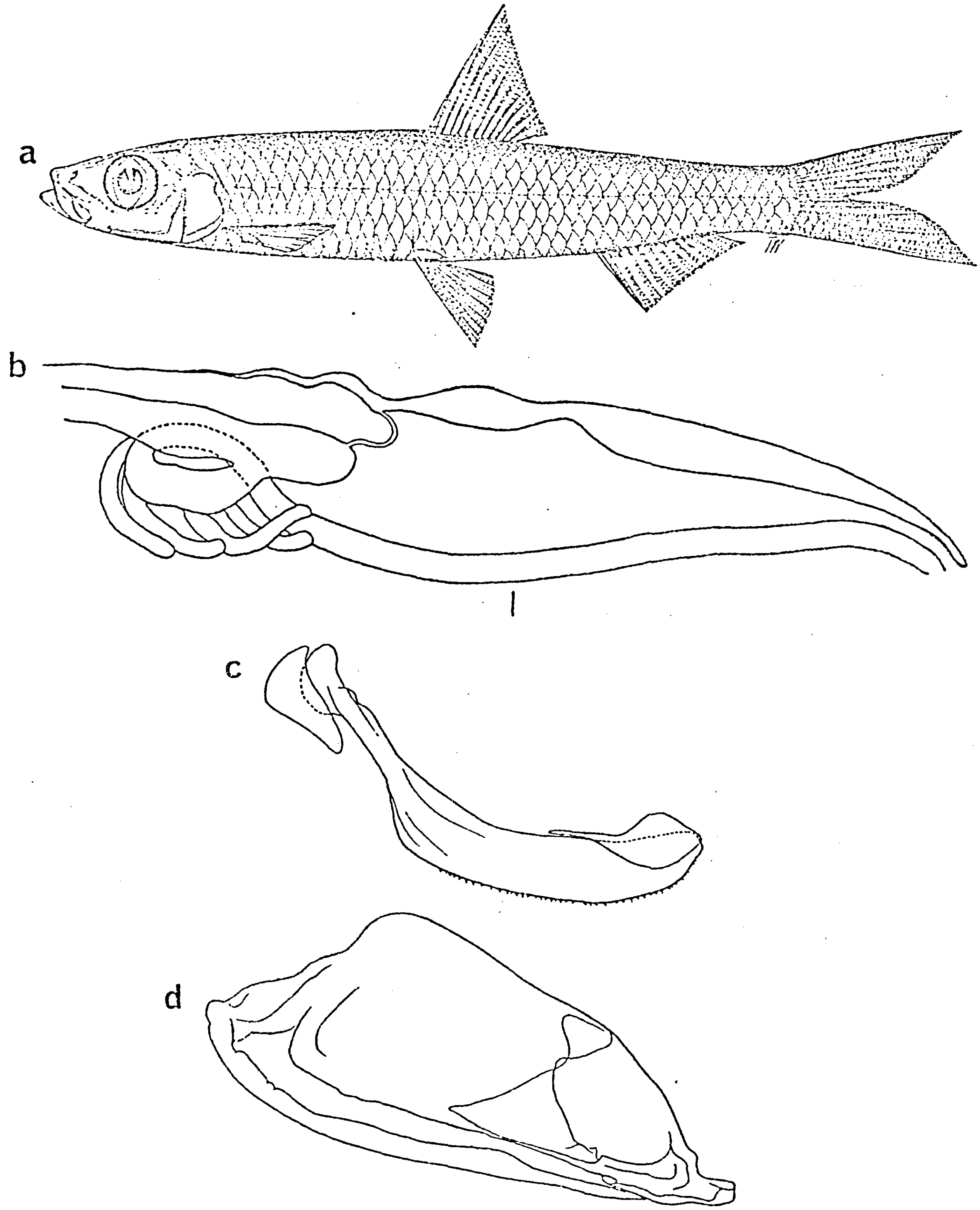


Plate 13. Ehirava fluviatilis:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1929.7.1.1, 48.0 mm S.L.; holotype of Ehirava fluviatilis; b from BMNH. 1929.7.1.2-9, 39.0 mm S.L., paratype; others from BMNH. 1889.2.1.2051, 48.0 mm S.L.).

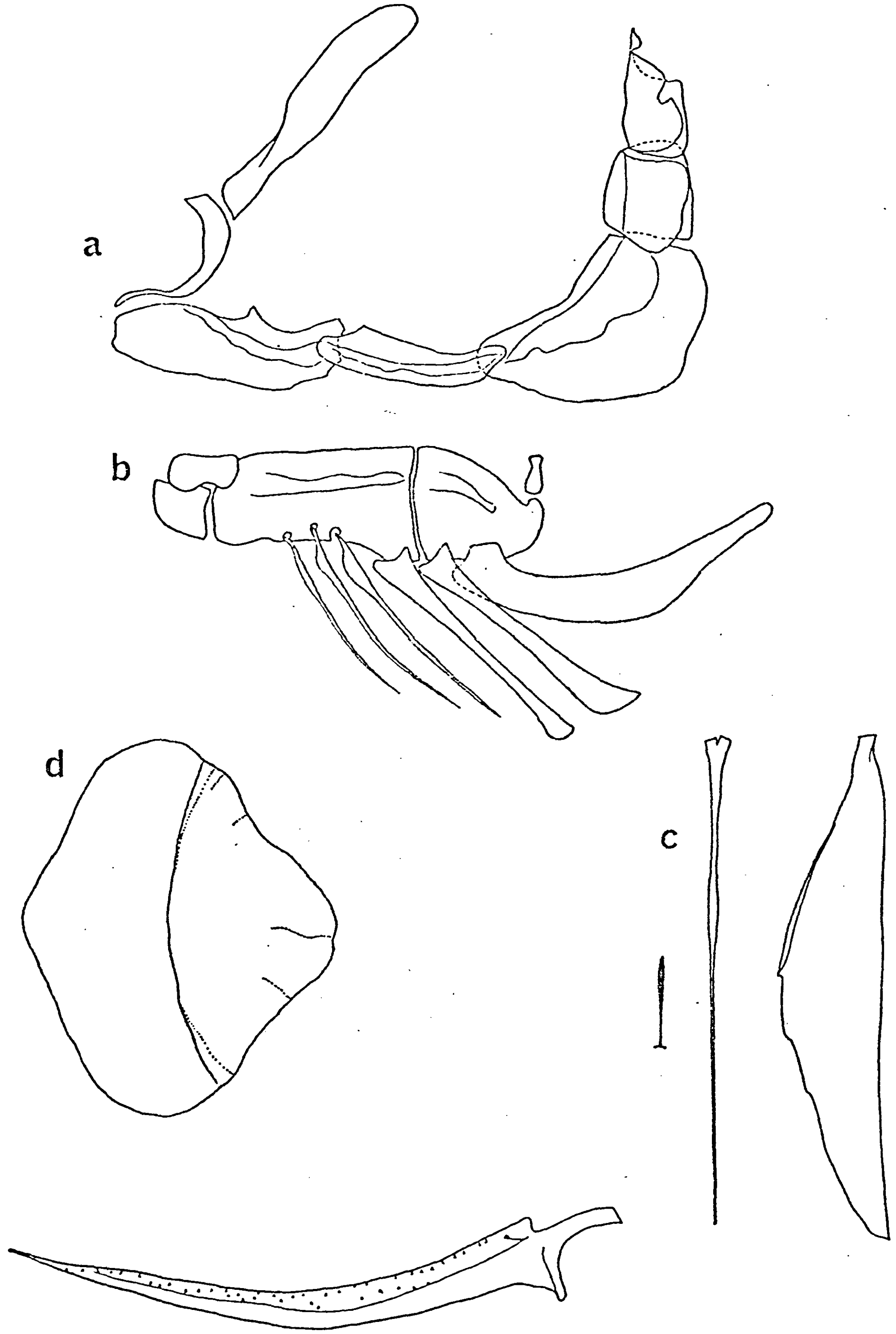


Plate 14. Ehirava fluviatilis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1889.2.1.2051, 48.0 mm S.L.; d from BMNH. 1929.7.1.2-9, 47.0 mm S.L., paratype).

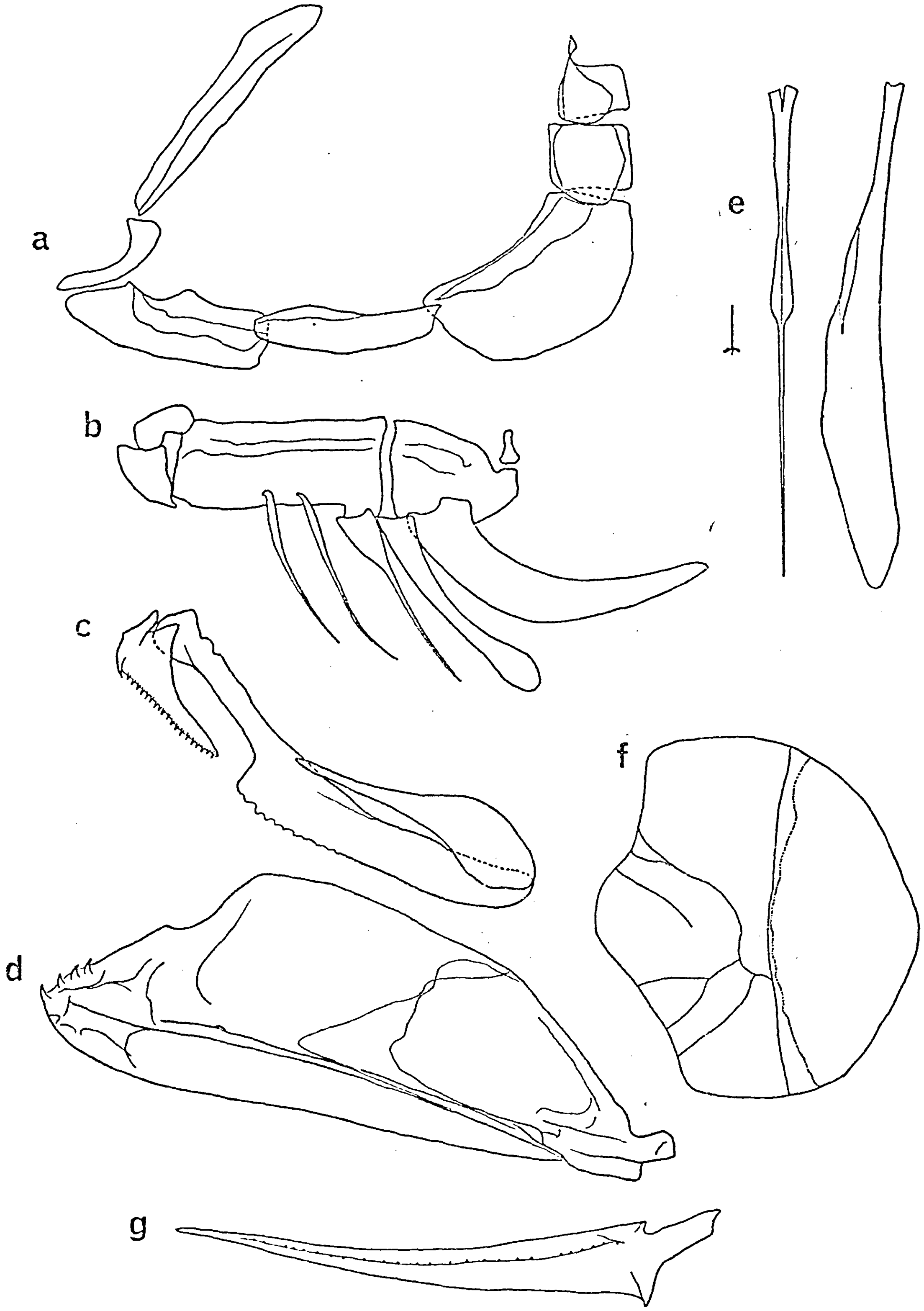


Plate 15. Dayella malabarica:- a, circumorbital bones; b, hyoid arch; c, d, upper and lower jaws; e, urohyal; f, scales; g, gillraker (all from BMNH. 1889.2.1.2048, 46.9 mm S.L., paralectotype).

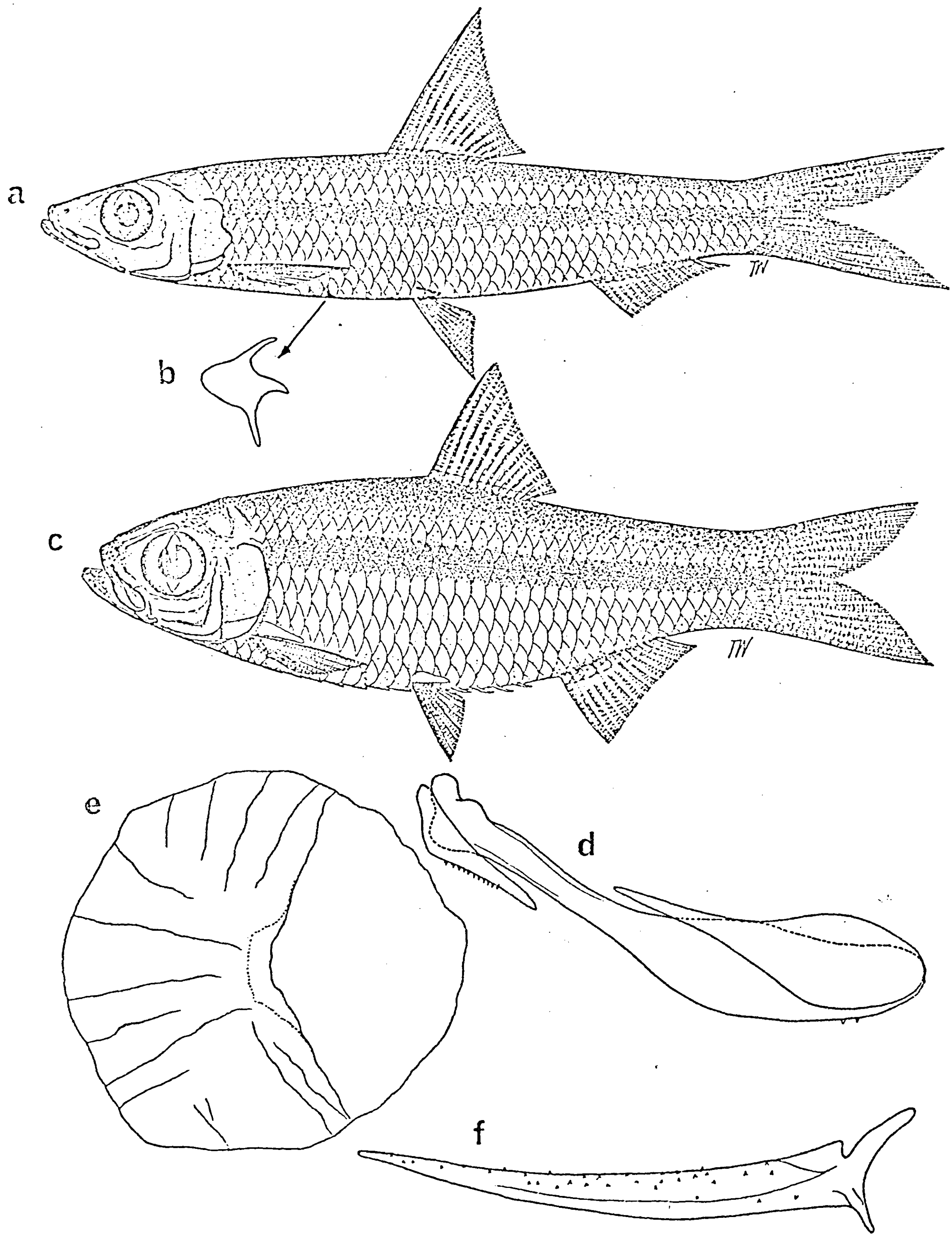


Plate 16. Dayella malabarica:- a, adult; b, enlargement of solely prepelvic scute (a, b, from BMNH. 1889.2.1.2048, 46.9 mm S.L., paralectotype of Spratelloides malabaricus).

Clupeoides hypselosoma:- c, adult; d, upper jaw, in situ; e, scale; f, gillraker (all from BMNH. 1867.11.28.35, 42.0 mm S.L., holotype of Clupeoides hypselosoma).

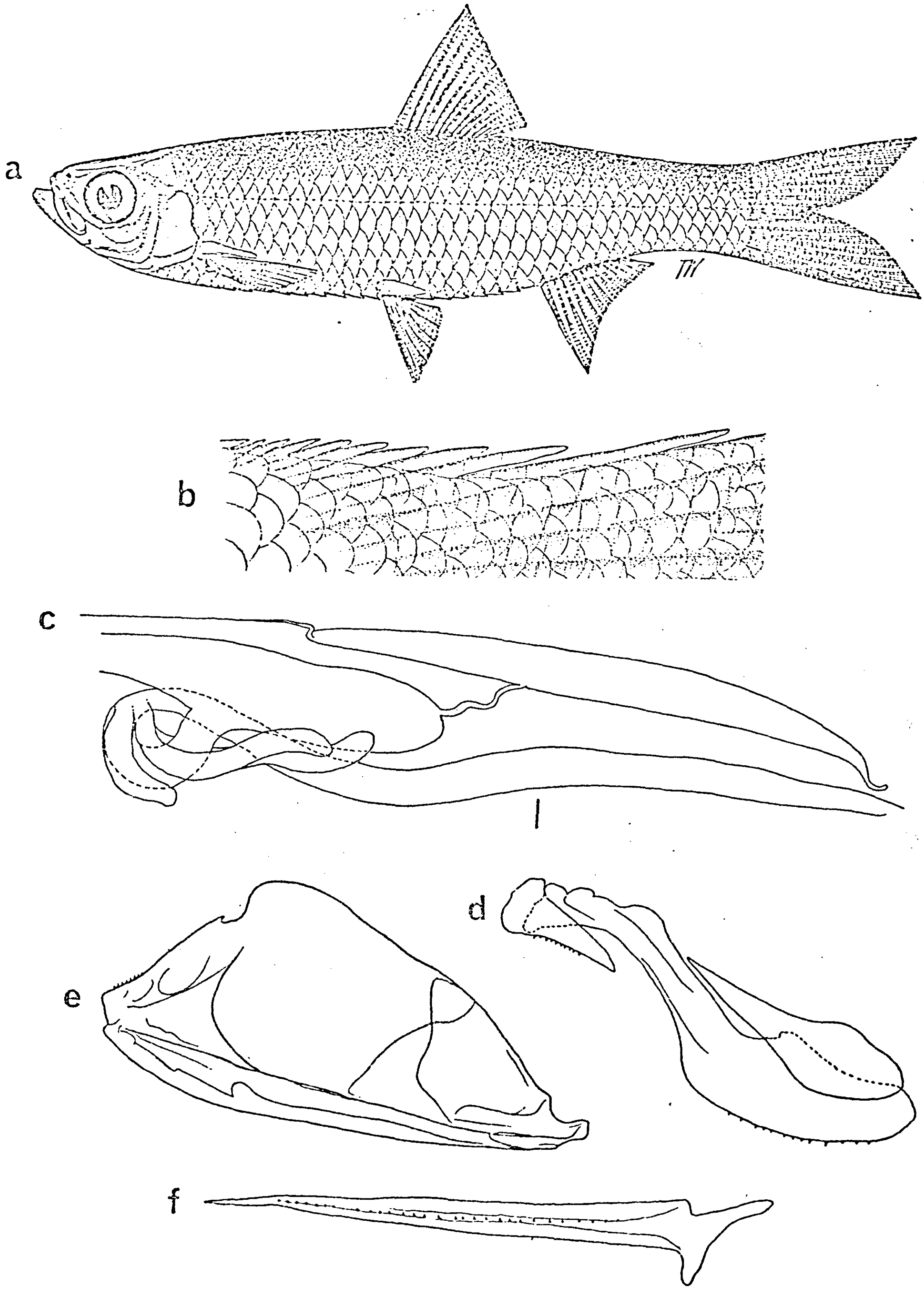


Plate 17. Clupeoides borneensis:- a, adult; b, upper procurrent caudal rays, showing their free tips; c, gas bladder and digestive tract; d, e, upper and lower jaws; f, gillraker (a, b, c, d, e from BMNH. 1979.7.5.7, 44.7 mm S.L.; f from BMNH. 1979.8.17.4-5, 48.0 mm S.L.).

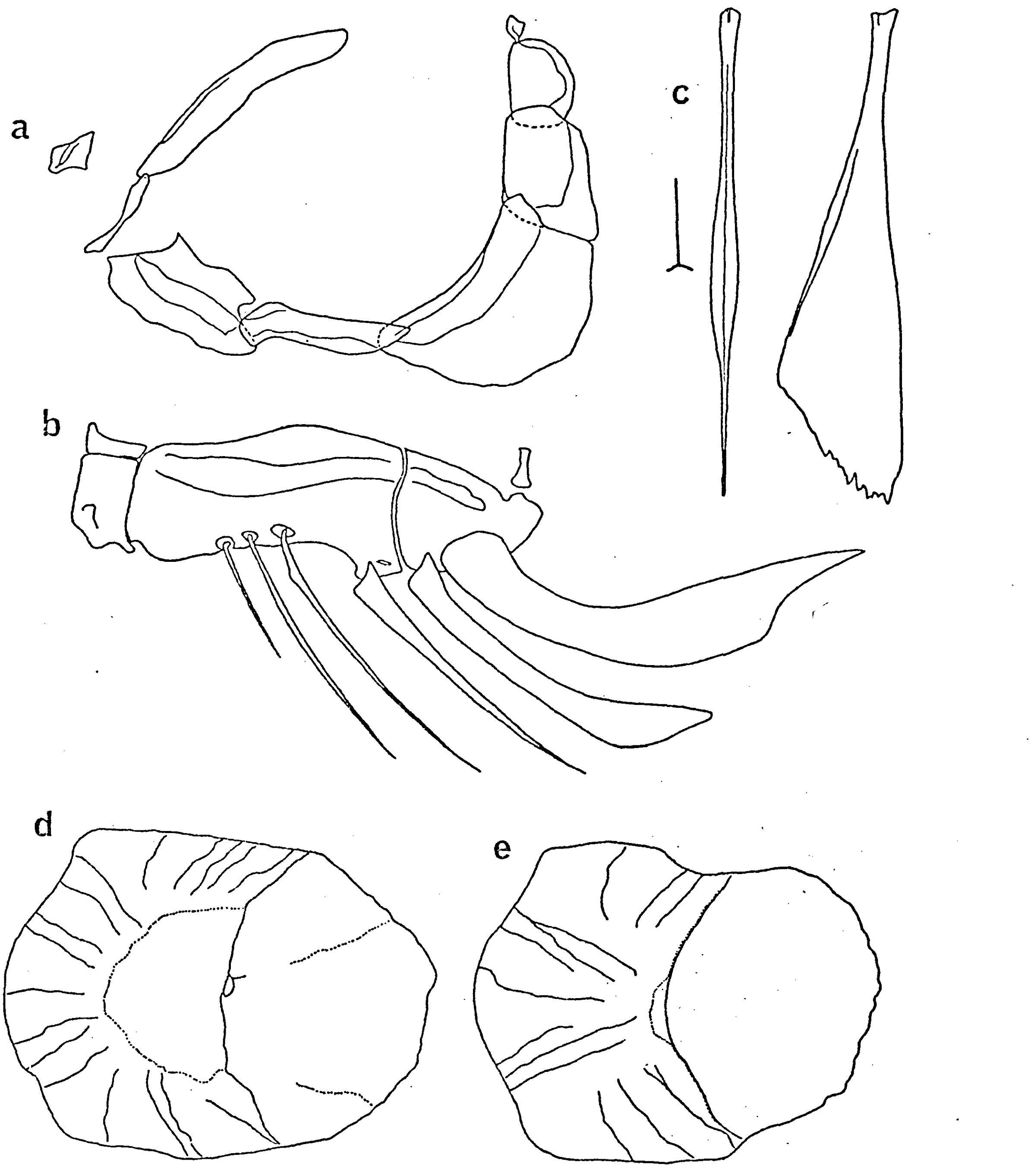


Plate 18. Clupeoides borneensis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, scales (a, b, c, e from BMNH. 1979.7.5.7, 44.7 mm S.L.; d from ANSP. 60508, 50.0 mm S.L., holotype of Clupeoides exilis).

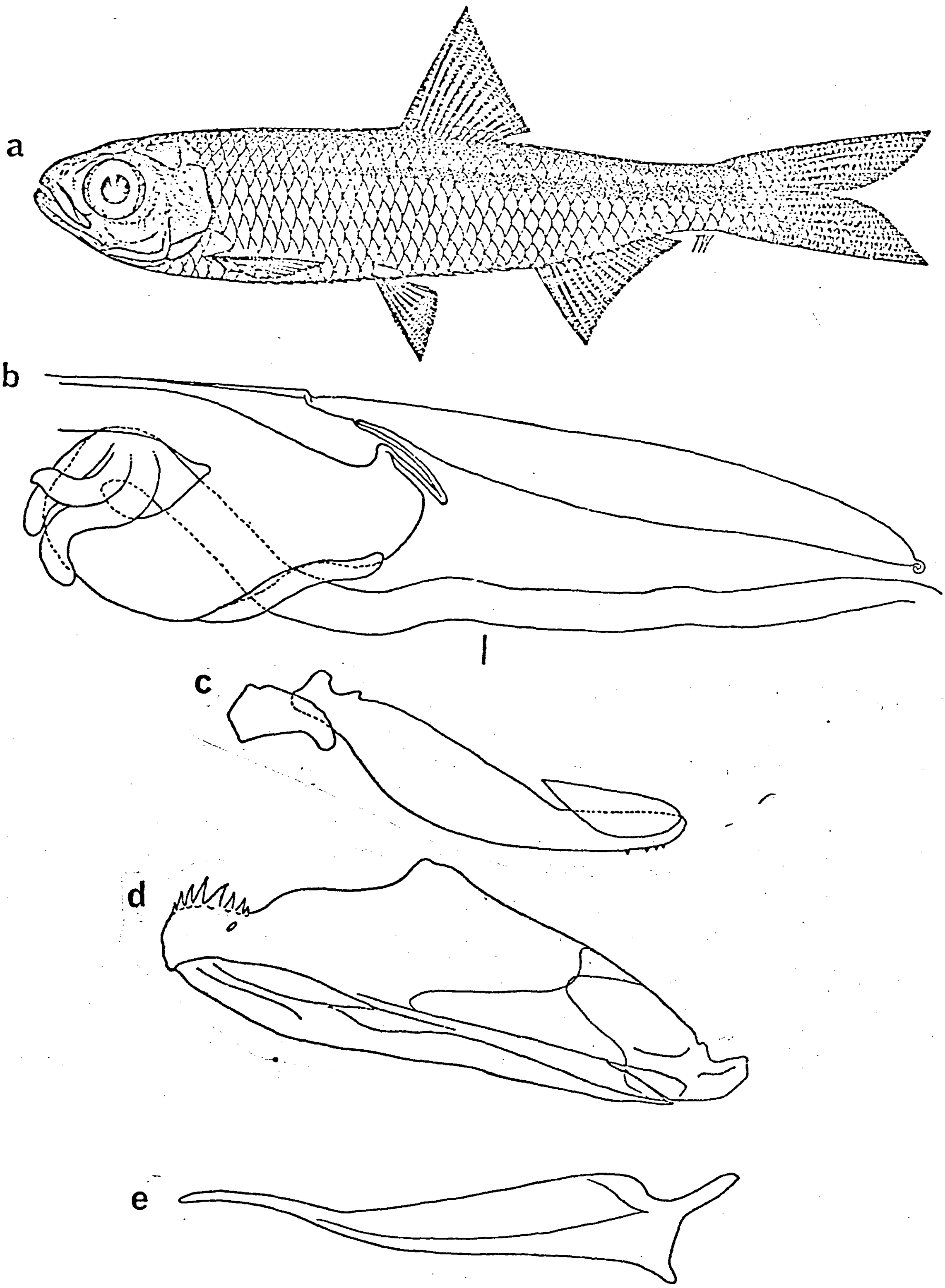


Plate 19. Clupeoides papuensis:- a, adults; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, gillraker (all from BMNH. 1977.11.17. 1-19, 43.5 mm S.L. for a and 42.0 mm S.L. for others).

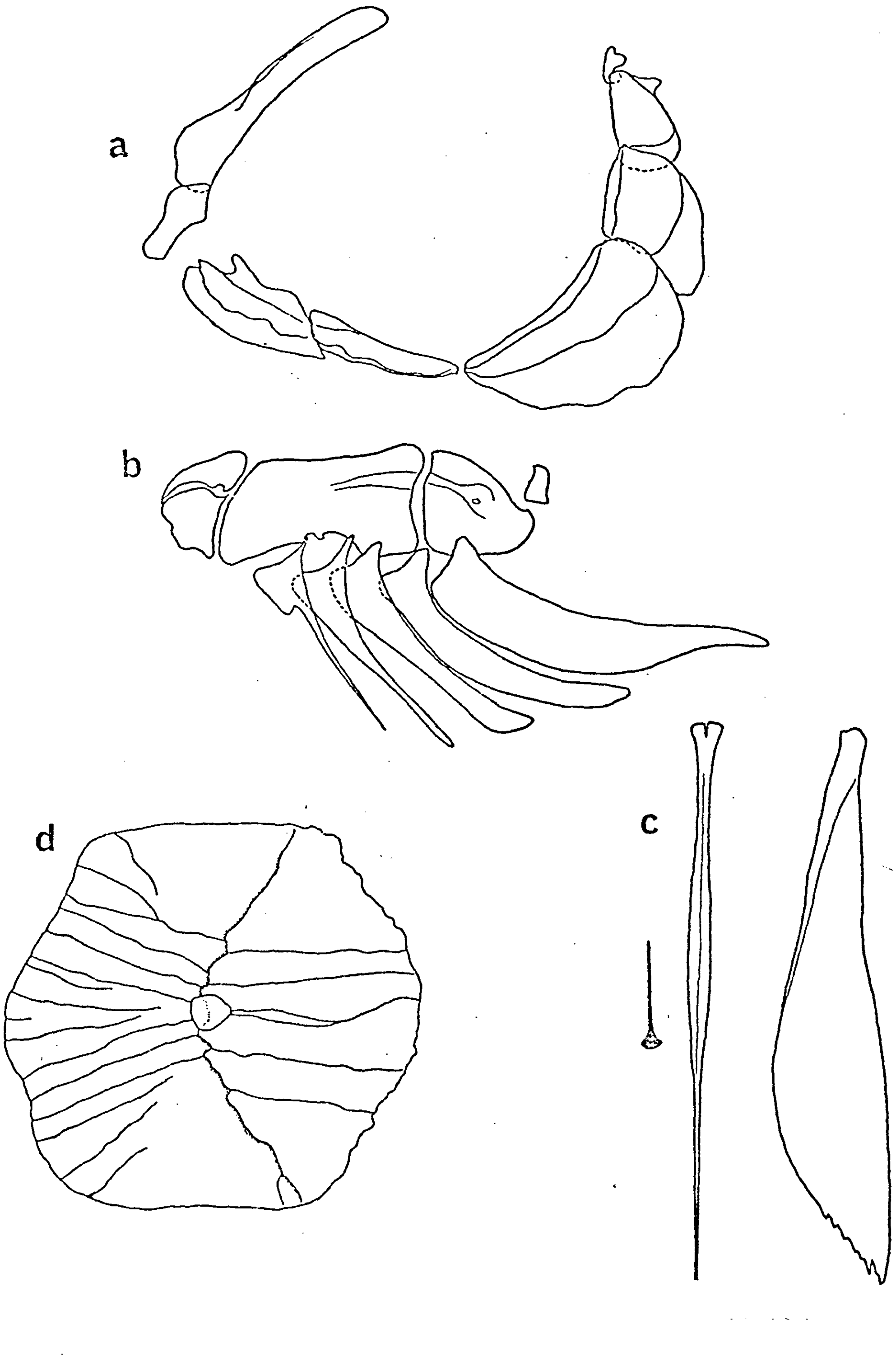


Plate 20. Clupeoides papuensis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale (a, b, c from BMNH. 1977.11.17.1-19, 42.0 mm S.L.; d from AMS. B. 9955, 77.0 mm S.L., holotype of Clupeoides papuensis).

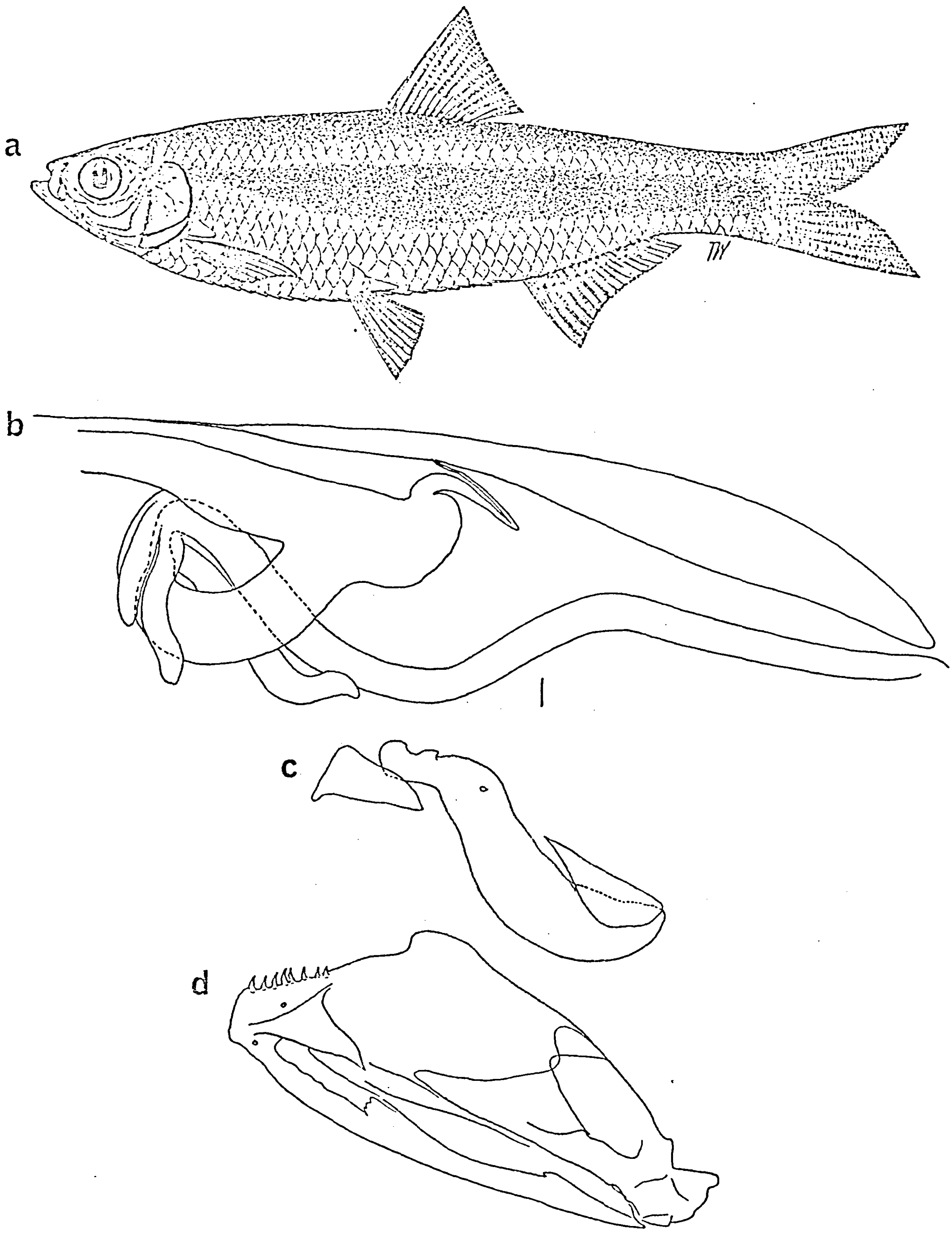


Plate 21. Clupeoides venulosus:- a, adult; b, gas bladder and digestive tract; c, upper and lower jaws (a from BMNH. 1913.12.15.1, 30, 86.0 mm S.L.; others from BMNH. 1977.11.17.20-21, 71.0 mm S.L.).

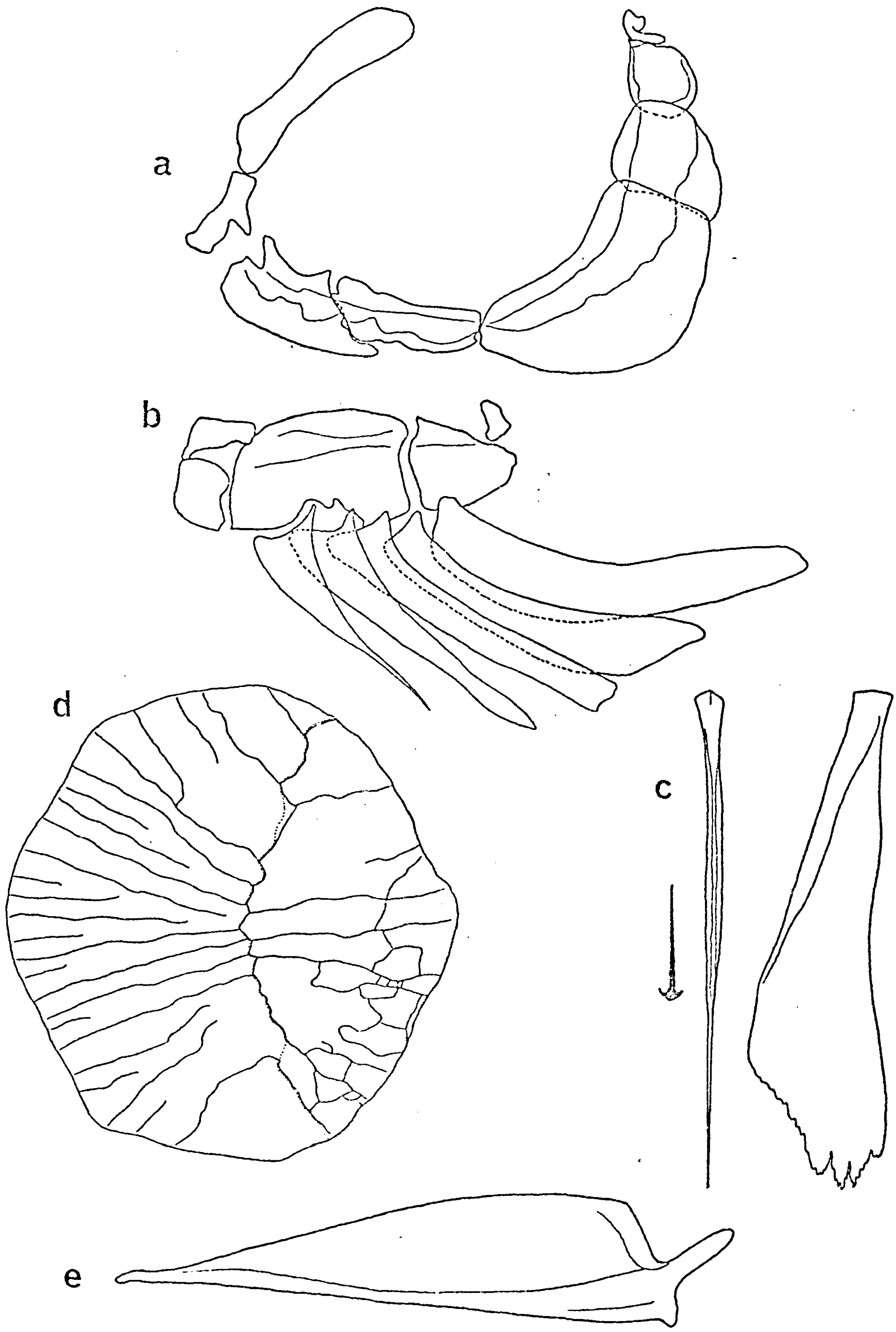


Plate 22. *Clupeoides venulosus*:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1977.11.17.20-21, 71.0 mm S.L.).

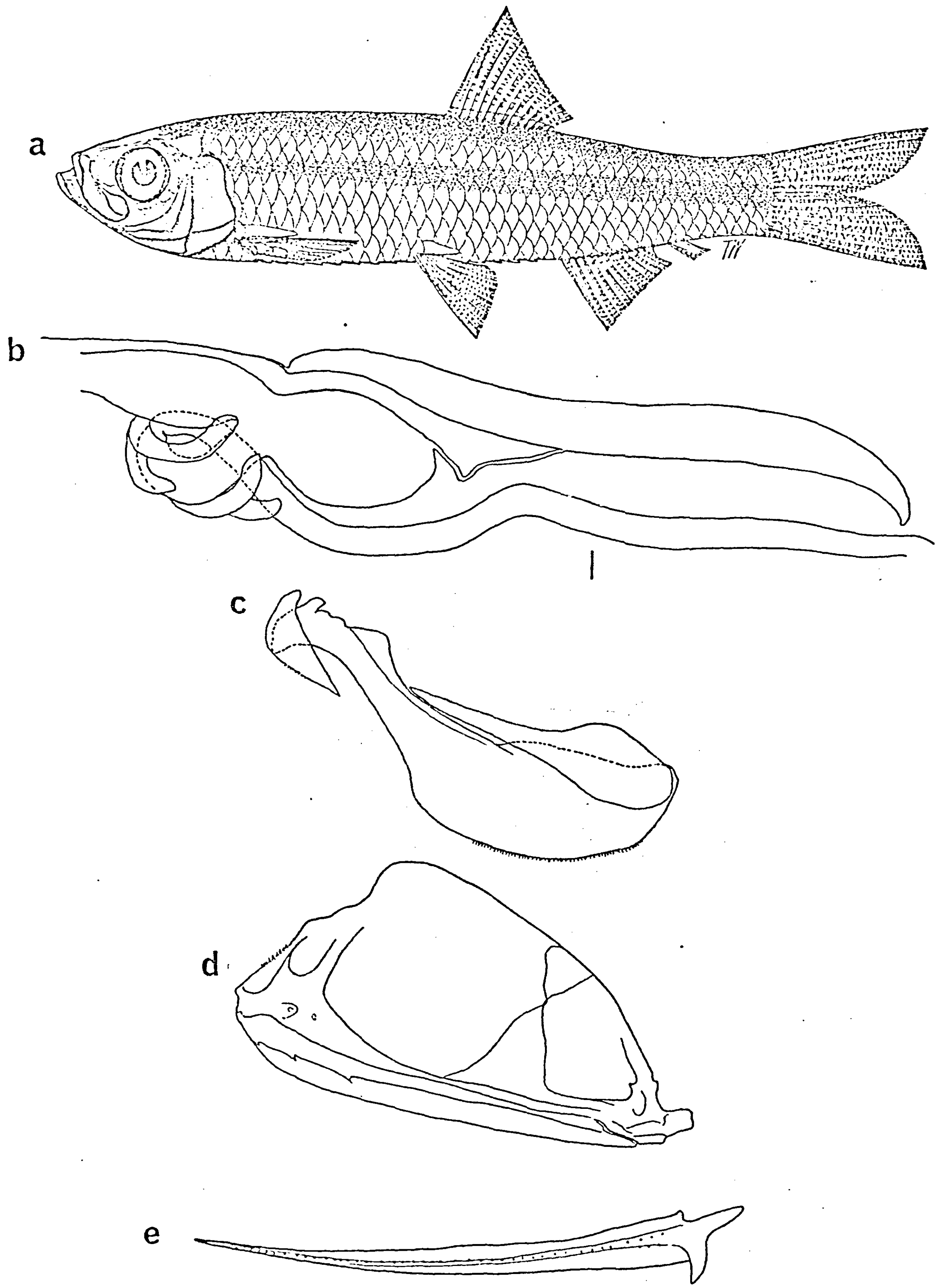


Plate 23. *Corica laciniata*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, gillraker (all from BMNH. 1979.8.16.850, 39.0 mm S.L.).

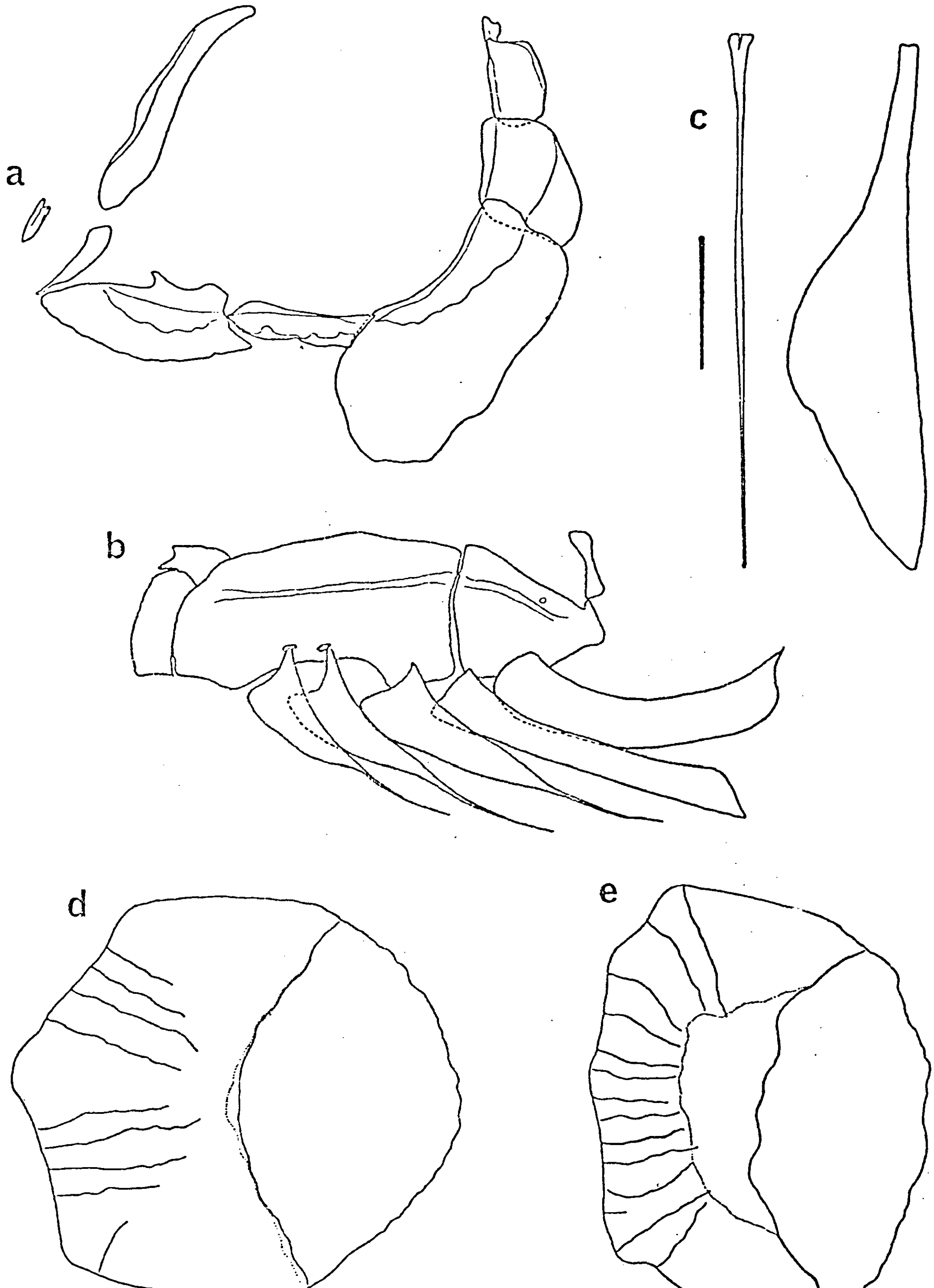


Plate 24. *Corica laciniata*:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, scales (a, b, c from BMNH. 1979.8.16.850, 39.0 mm S.L.; d from ANSP. 61416-61457 and 60519-60551, 40.5 mm S.L., paratype of *Corica laciniata*; e from ANSP. 61415, 50.0 mm S.L., holotype of *Corica laciniata*).

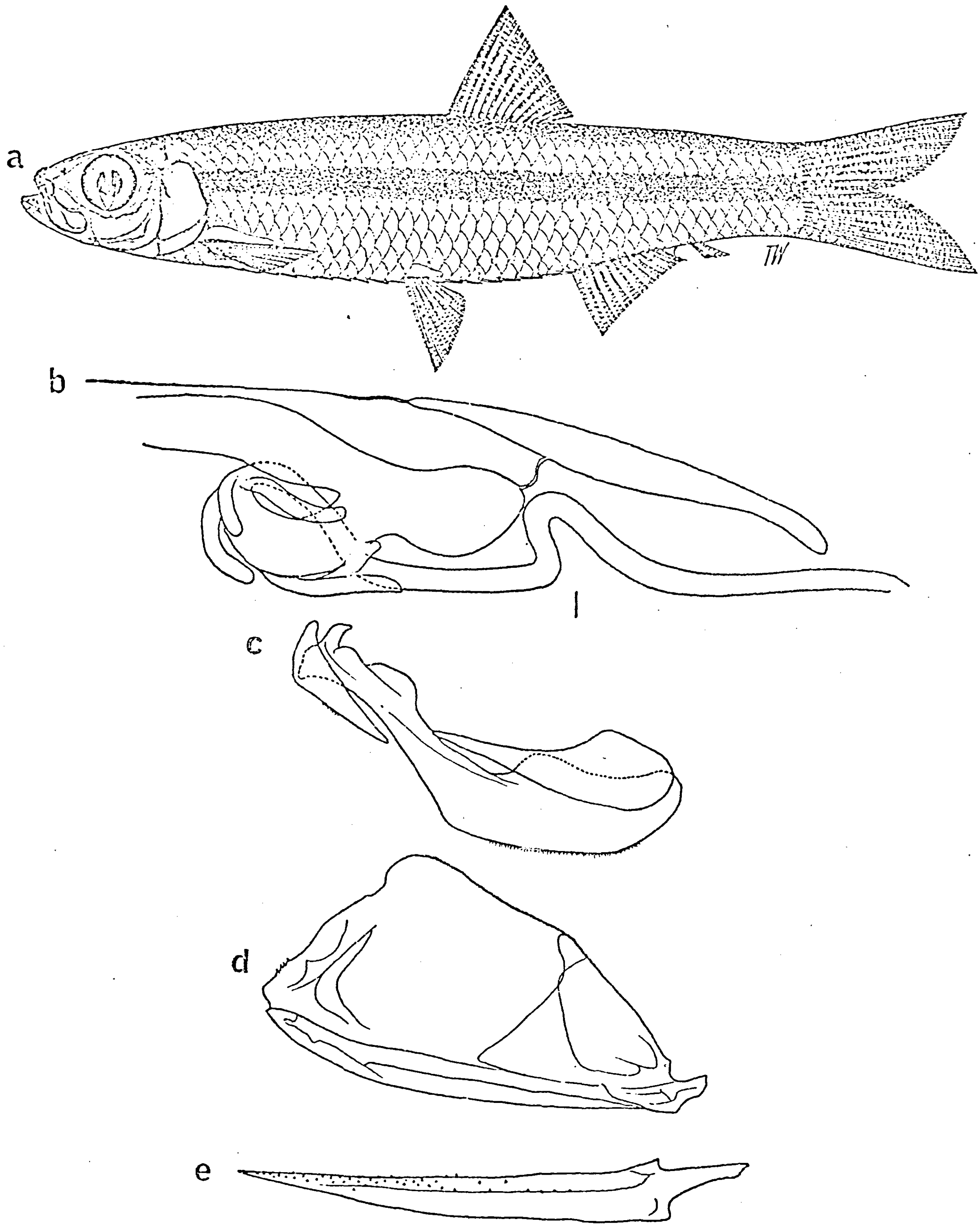


Plate 25. *Corica soborna*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, gillraker (all from BMNH. 1889.2.1.4219-4222, 41.0 mm S.L. for a and 34.0 mm S.L. for others).

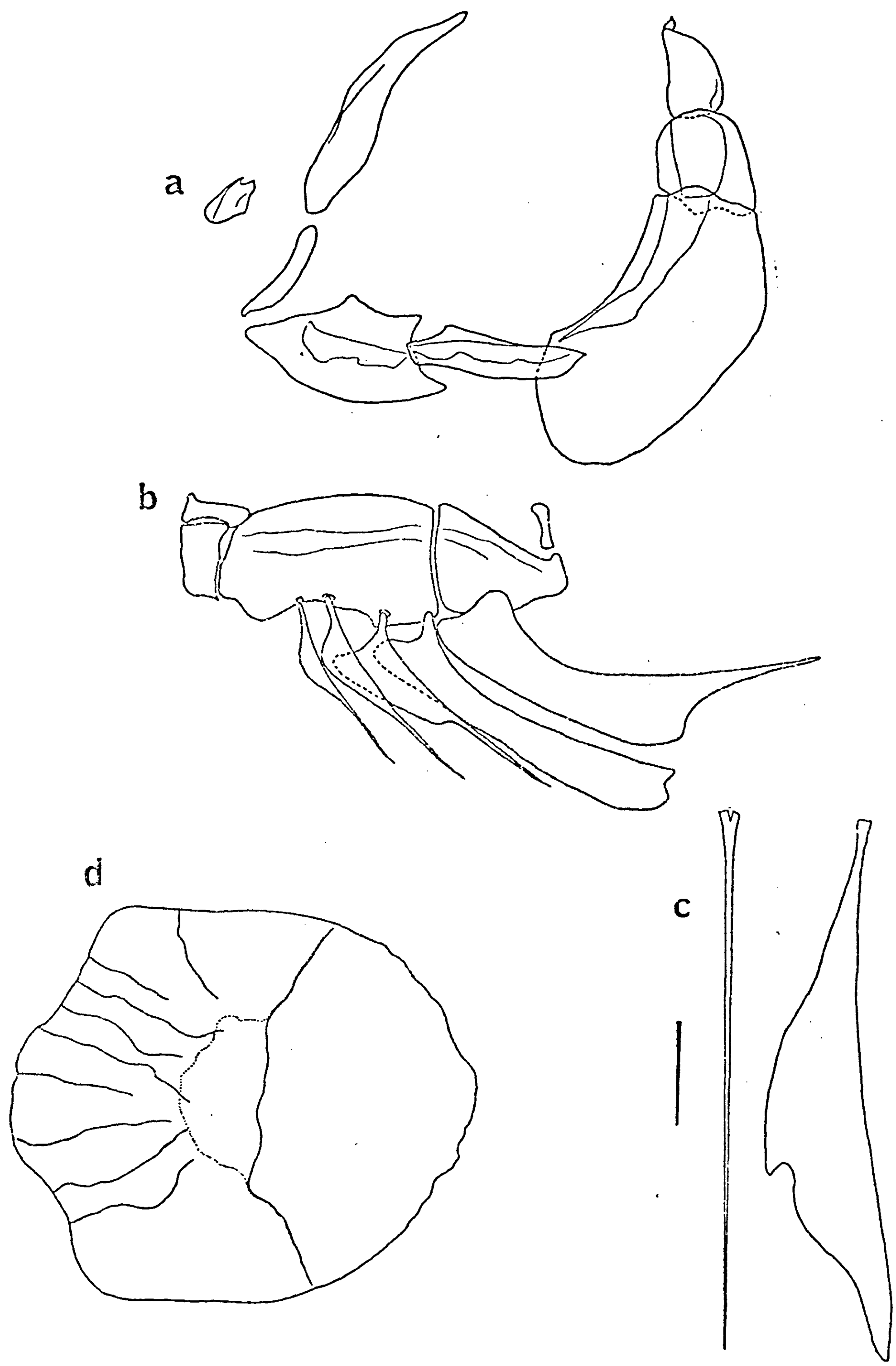


Plate 26. Corica soborna:- a, circumorbital bones; b, hyoid arch; e, urohyal; d, scale (all from BMNH. 1889.2.1.4219-4222, 34.0 mm S.L. for a, b, c and 39.0 mm S.L. for d).

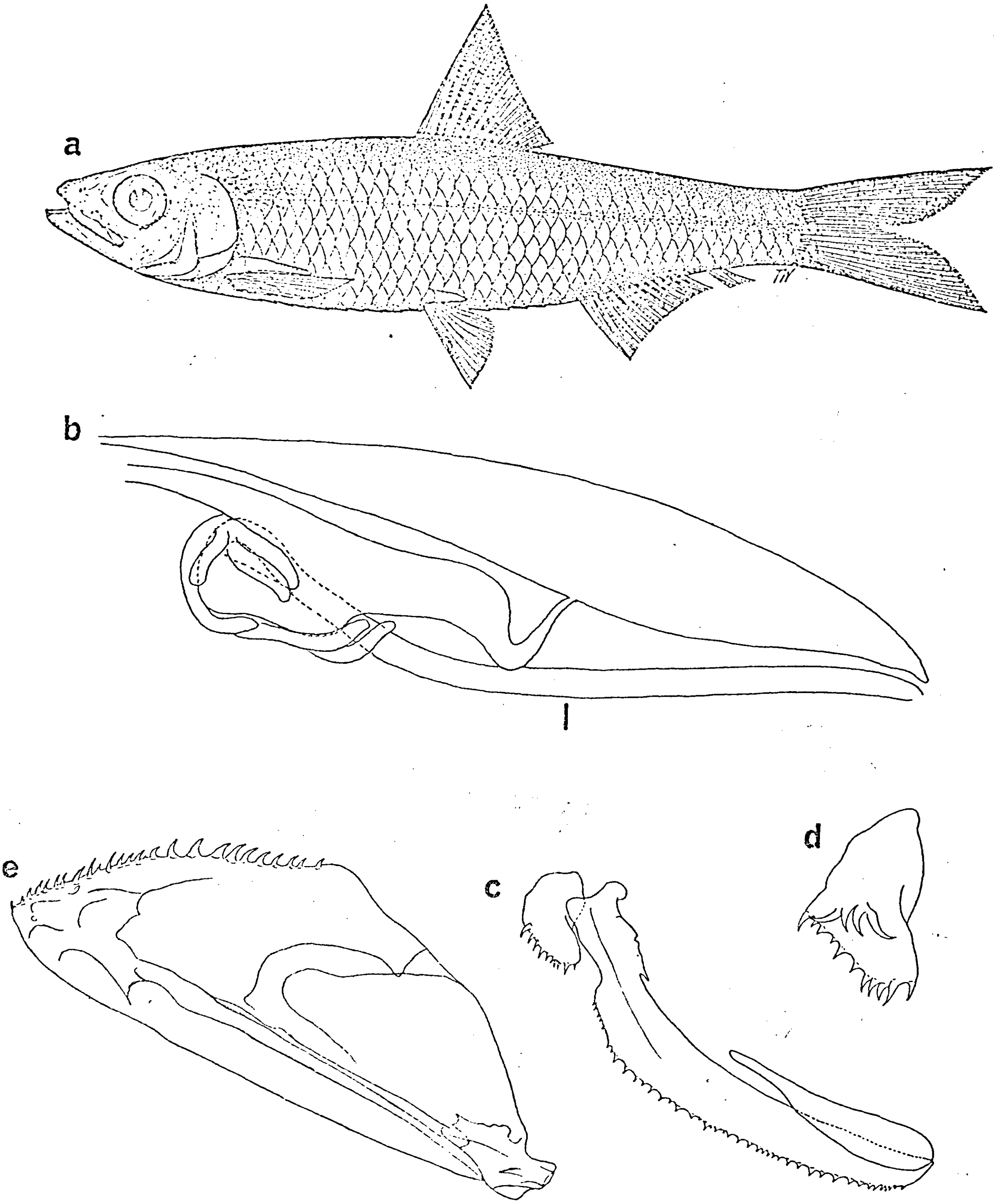


Plate 27. Clupeichthys bleekeri:- a, adult; b, gas bladder and digestive tract; c, e, upper and lower jaws; d, mesial view of right premaxilla (a from BMNH. 1979.3.21.145-151, 58.0 mm S.L.; others from BMNH. 1979.3.21.152, 50.0 mm S.L.).

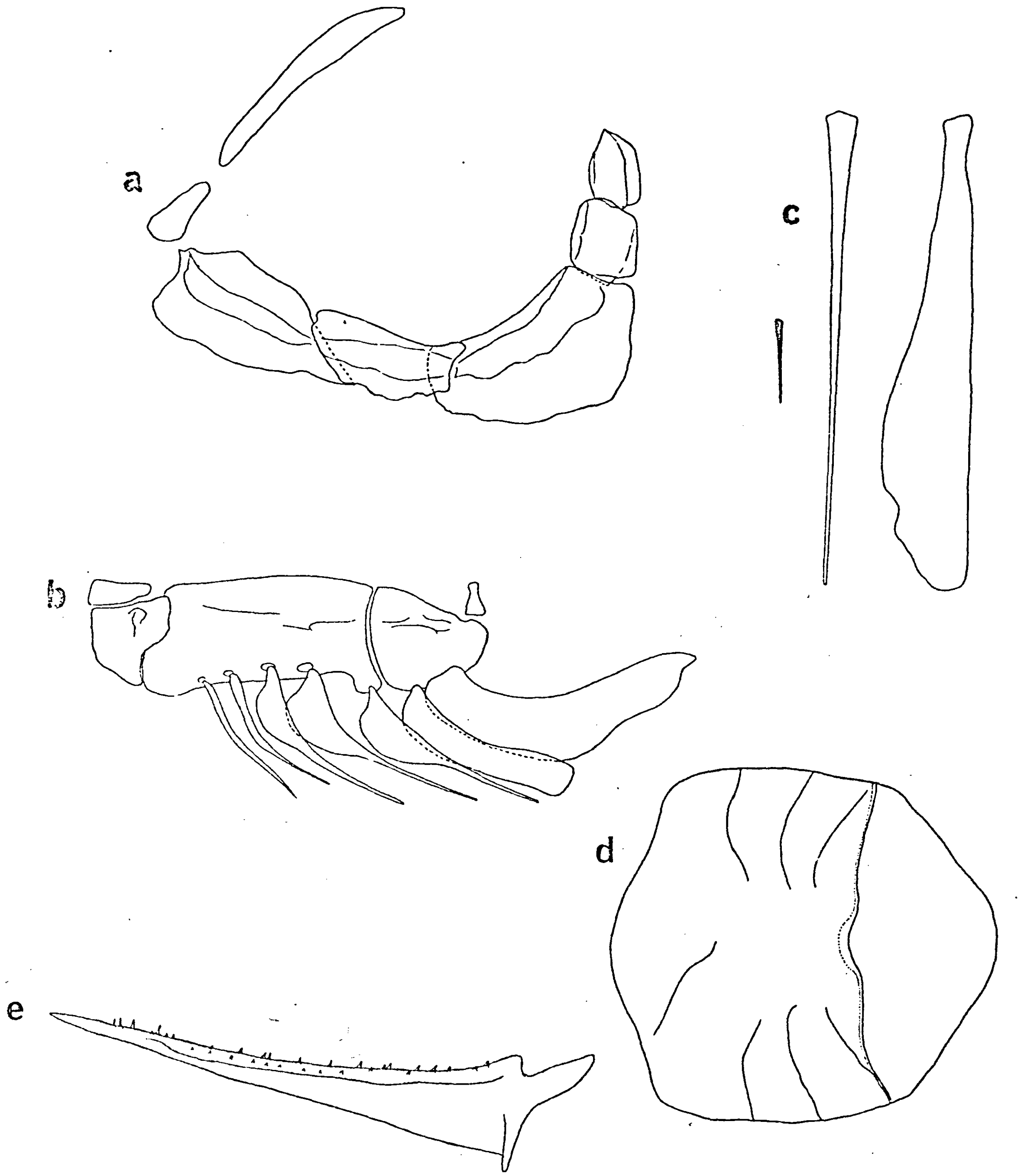


Plate 28. Clupeichthys bleekeri:- a, circumorbital bones; b, hyoid arch; e, urohyal; d, gillraker; e, scales (all from BMNH. 1979.3.21.152, 50.0 mm S.L.).

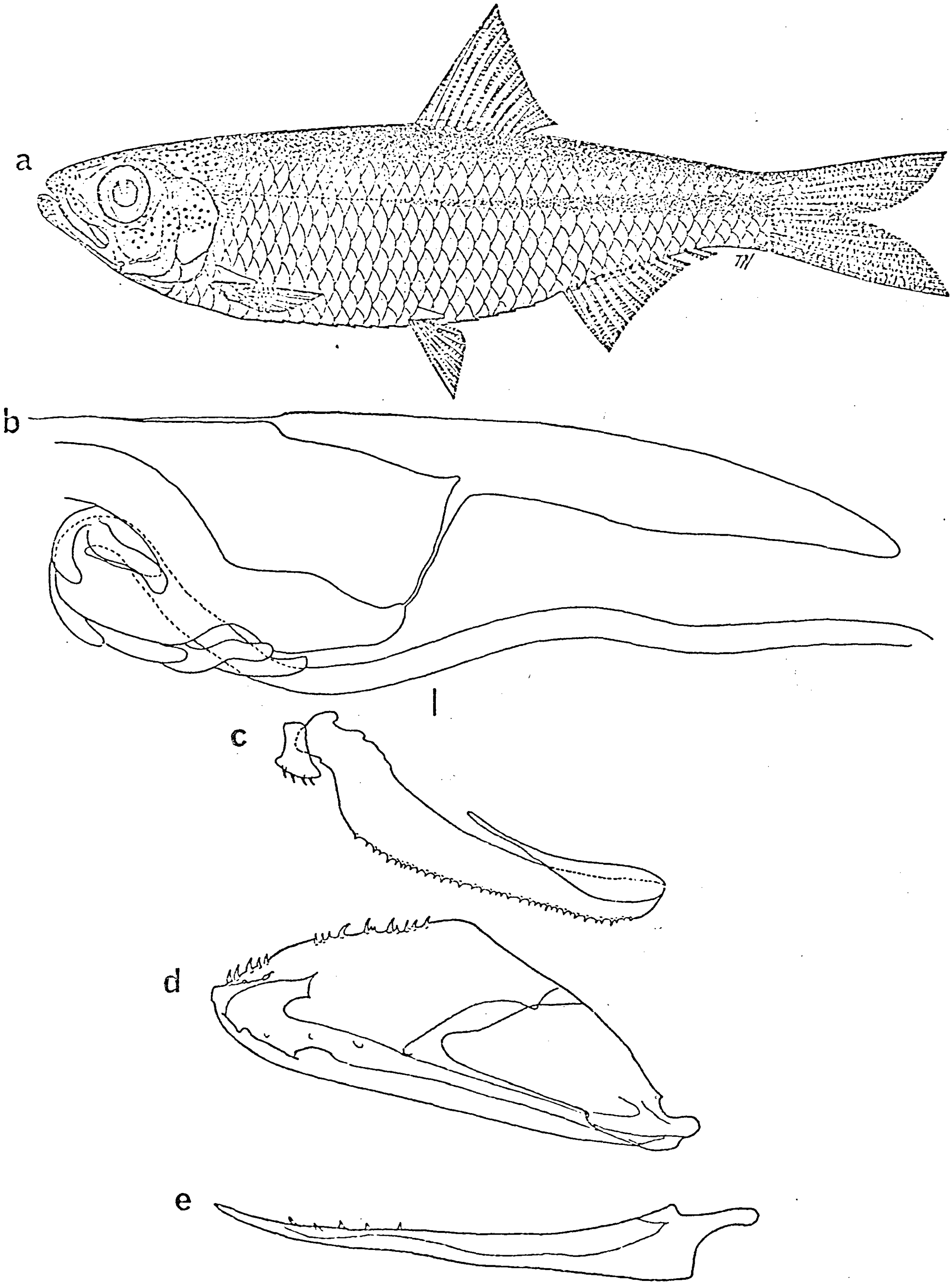


Plate 29. Clupeichthys aesarnensis:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, gillraker (a from KUMF. 2844 a, 43.5 mm S.L., holotype; b from KUMF. 2844 b, 34.0 mm S.L., paratype; others from BMNH. 1979.8.16.80-502, 37.0 mm S.L.).

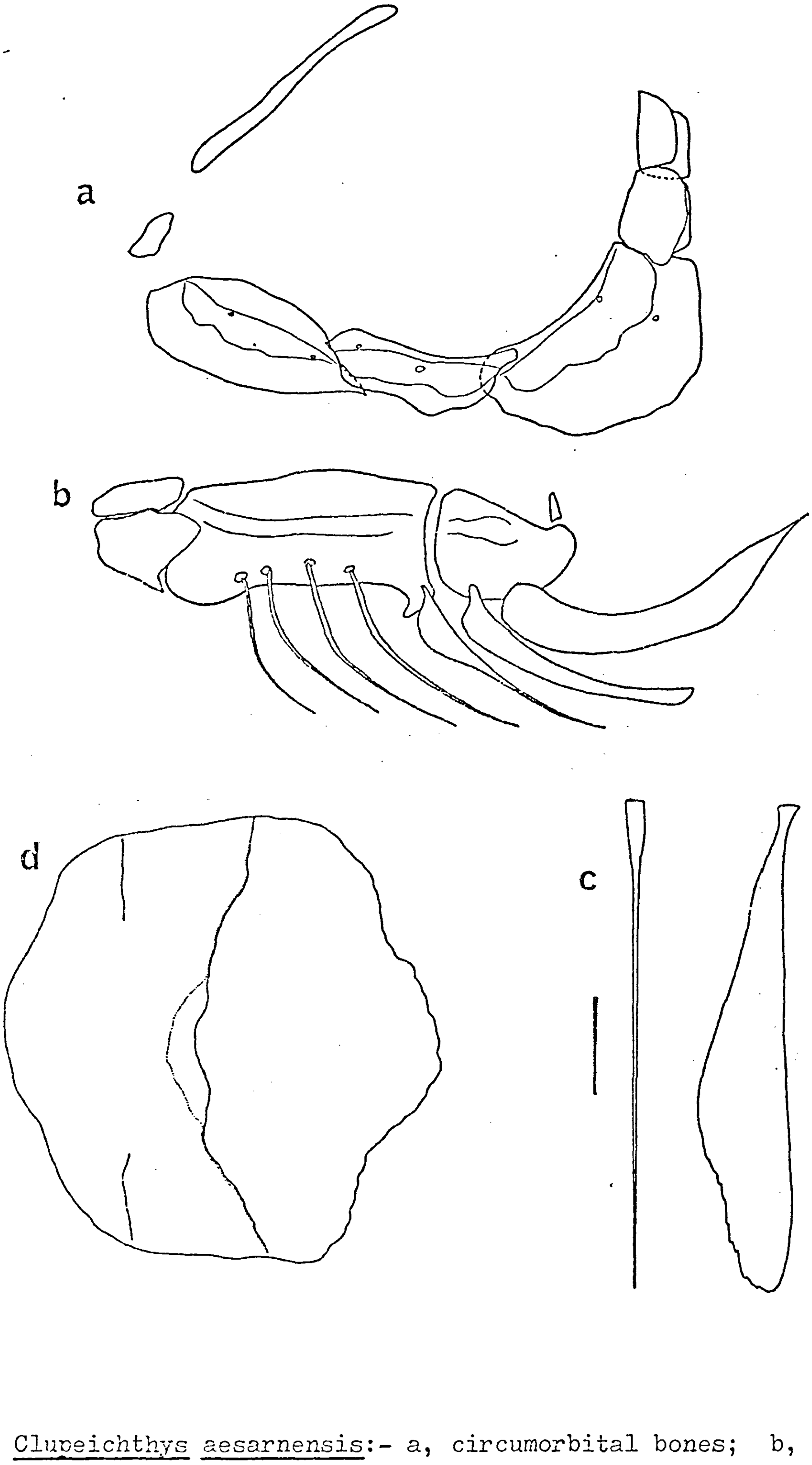


Plate 30. Clupeichthys aesarnensis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale (all from BMNH. 1979.8.16.80-502, 37.0 mm S.L. for a, b, c and 34.0 mm S.L. for d).

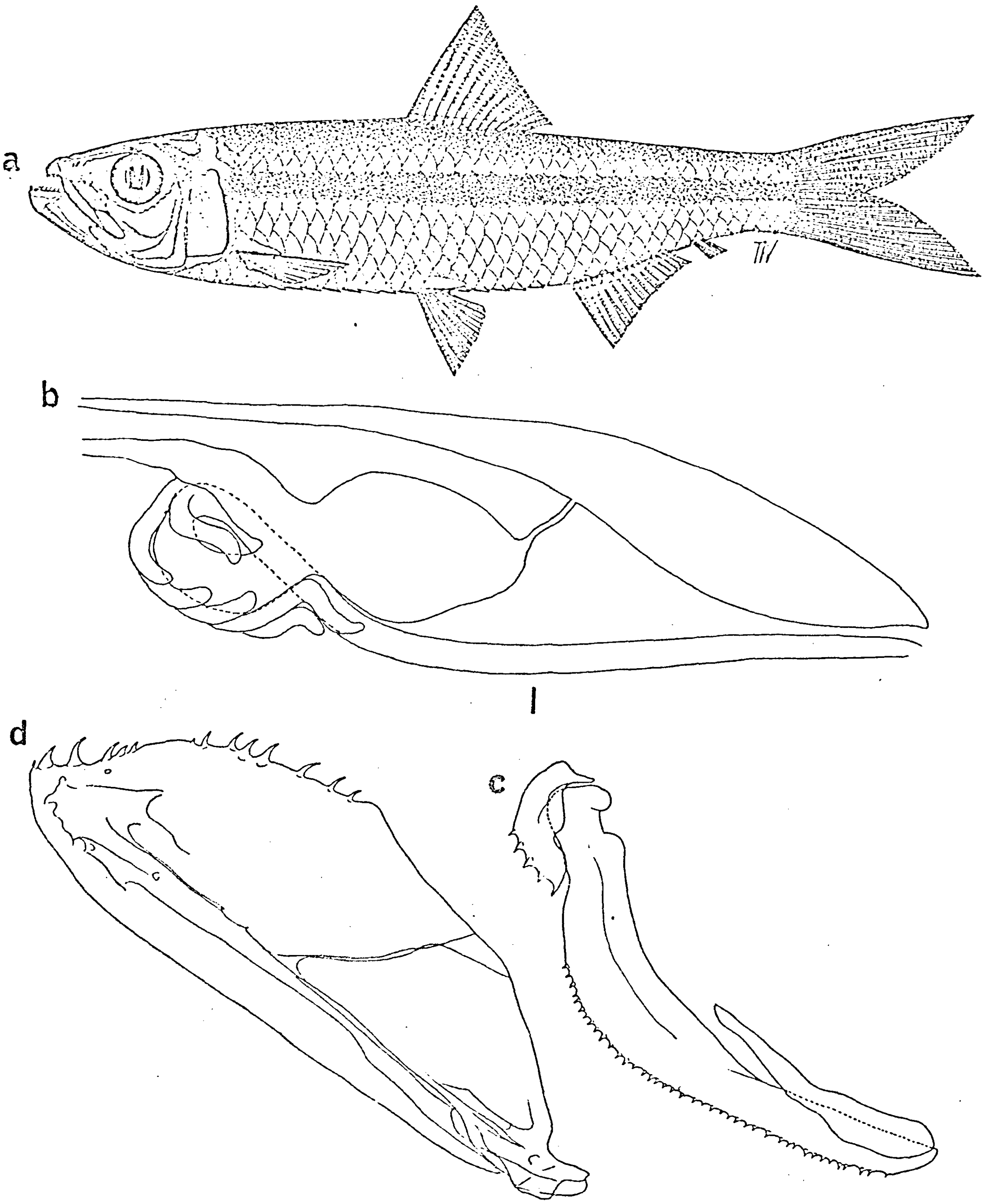


Plate 31. Clupeichthys goniognathus:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1867.11.28.36, 65.2 mm S.L., holotype of Clupeichthys goniognathus; b, c, d from NIFI. uncat. 31.5 mm S.L.).

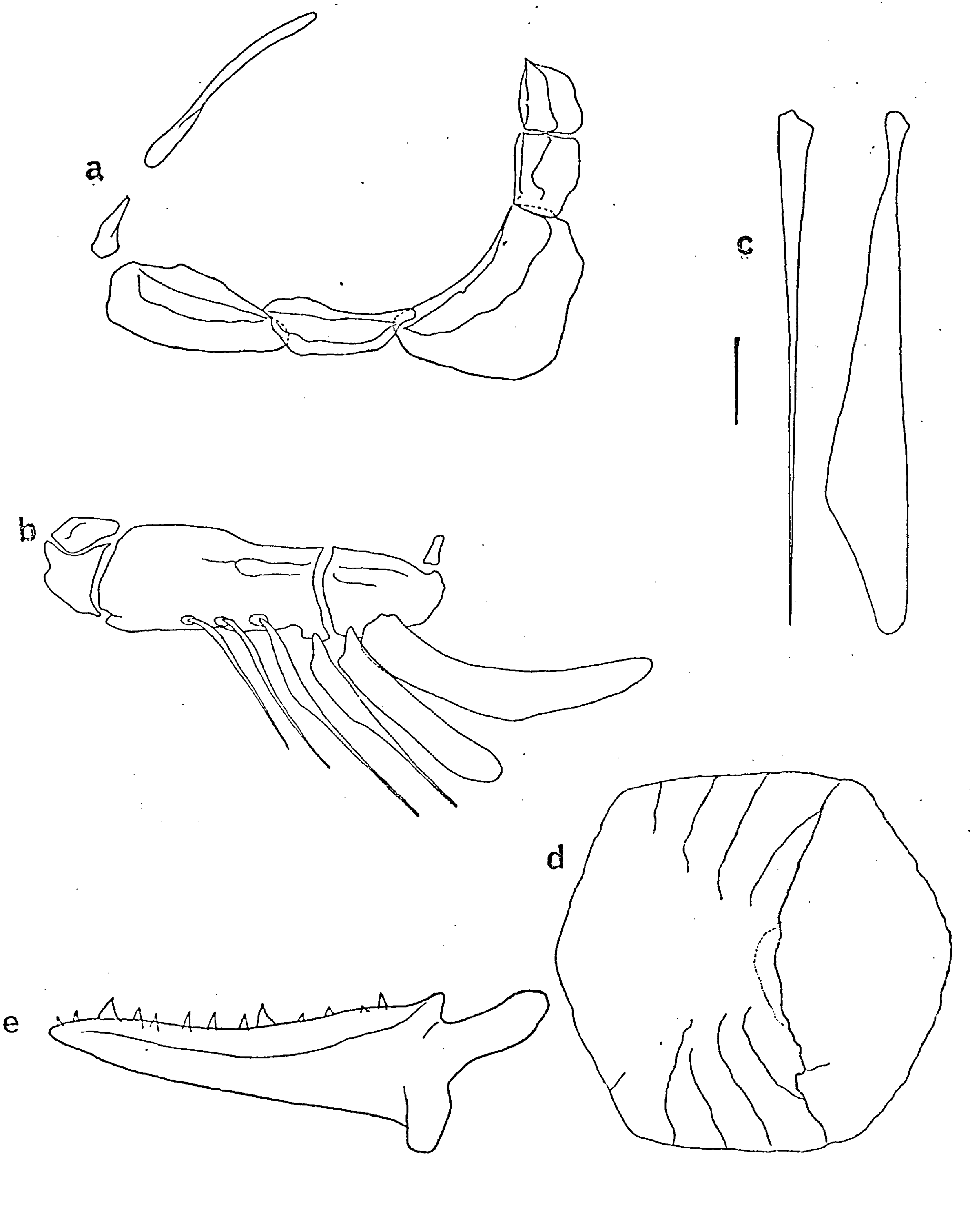


Plate 32. Clupeichthys goniognathus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c from NIFI. uncat., 31.5 mm S.L.; d, e from BMNH. 1867.11.28.36, 65.2 mm S.L., holotype of Clupeichthys goniognathus).

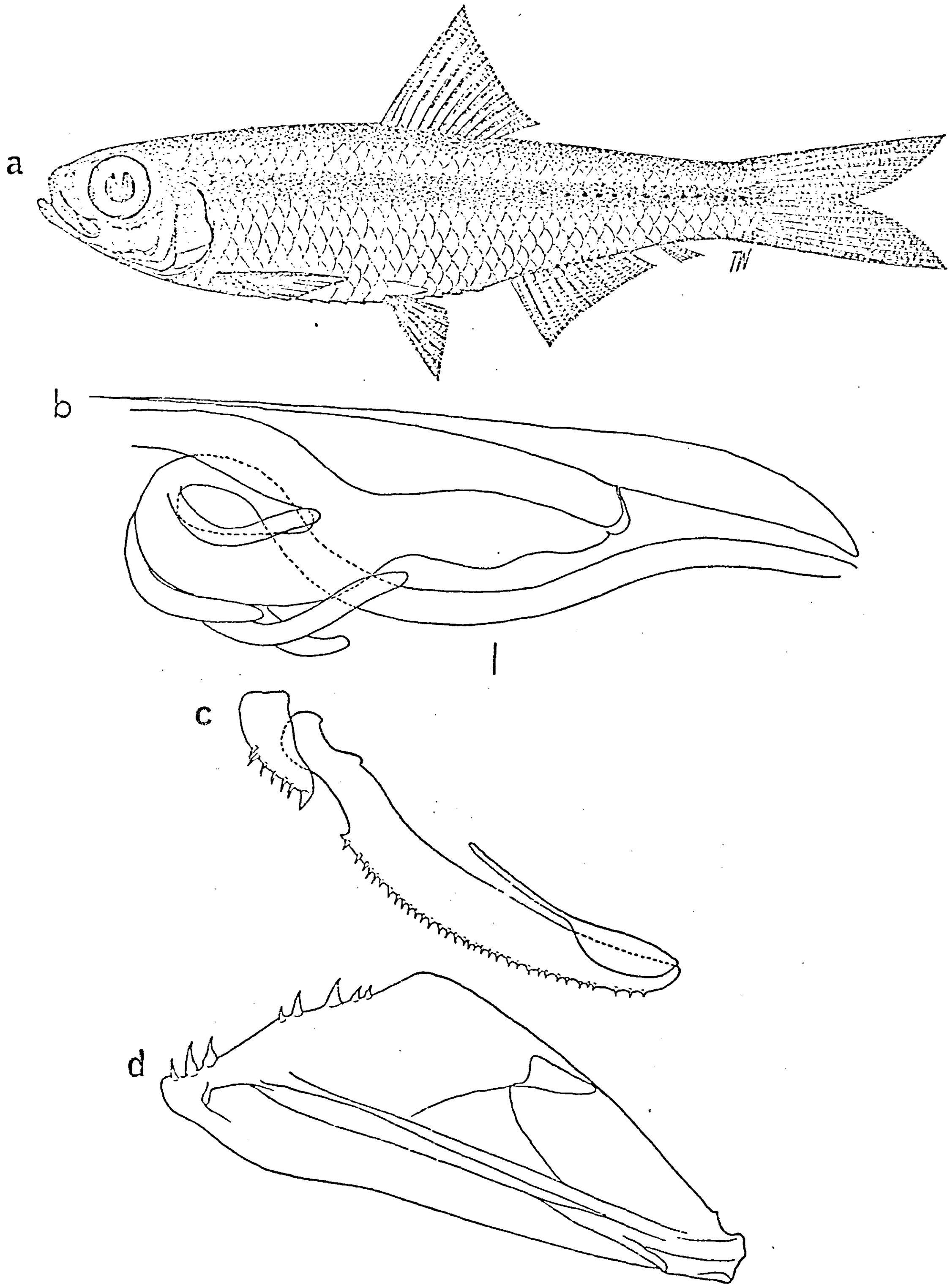


Plate 33. <u>Clupeichthys</u> <u>perakensis</u>:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1935.4.12.13-22, 26.0 mm S.L. for a and 24.9 mm S.L. for others).

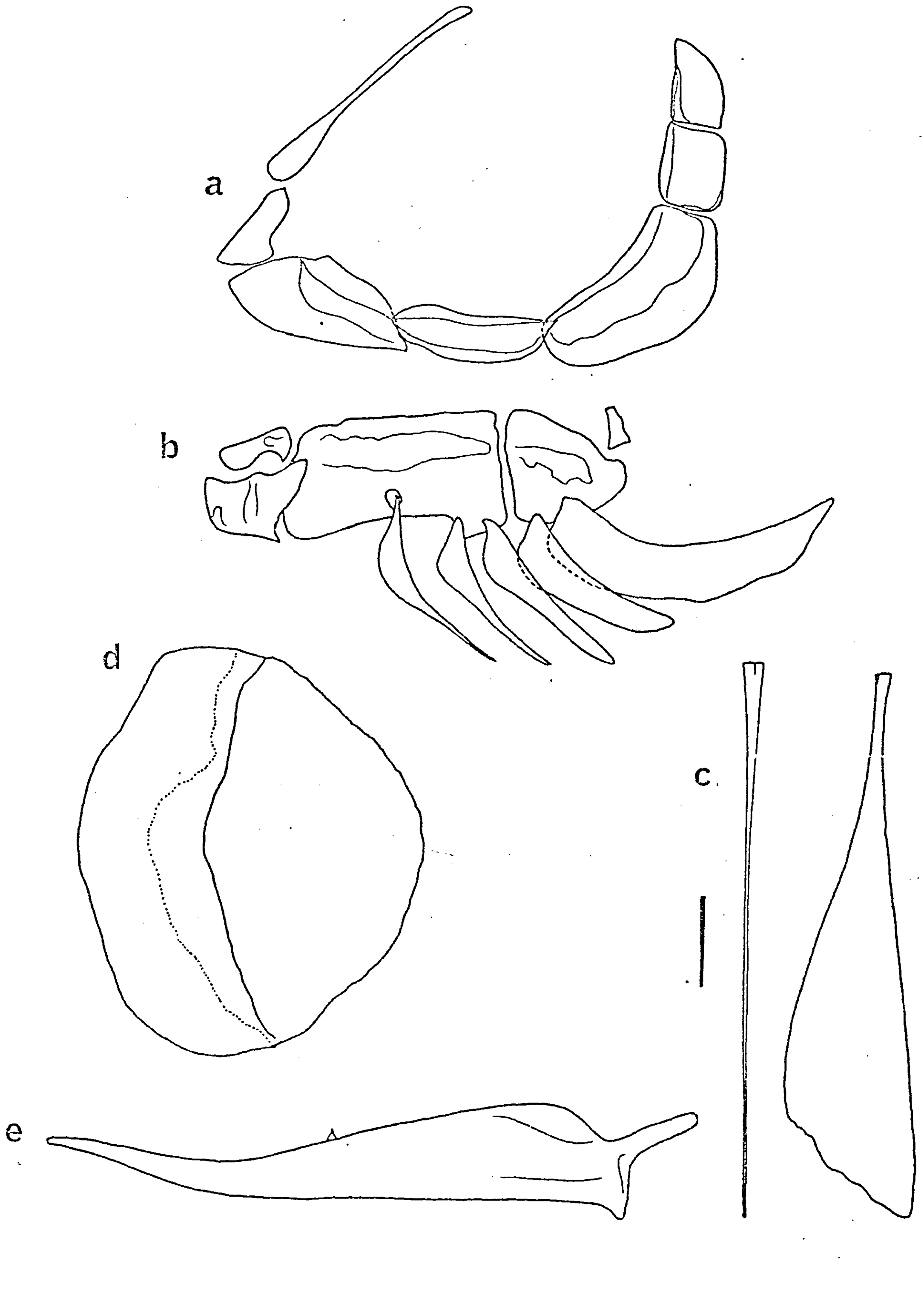


Plate 34. Clupeichthys perakensis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1935.4.12.13-22, 24.9 mm S.L. for a, b, c, e and 26.0 mm S.L. for d).

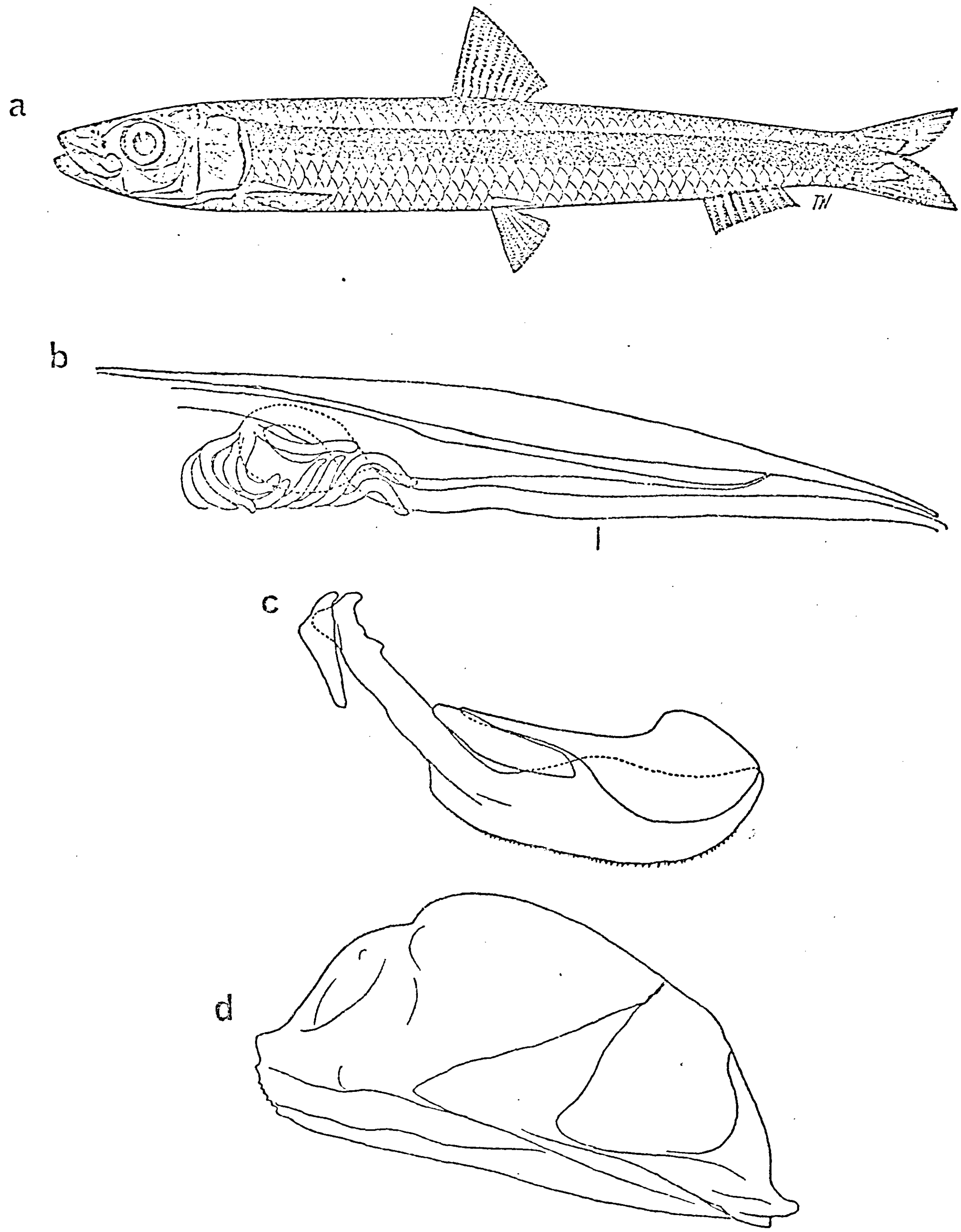


Plate 35. Spratelloides gracilis:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1969.8.20.16-18, 67.0 mm S.L.; others from BMNH. 1969.8.19.56-66, 64.0 mm S.L.).

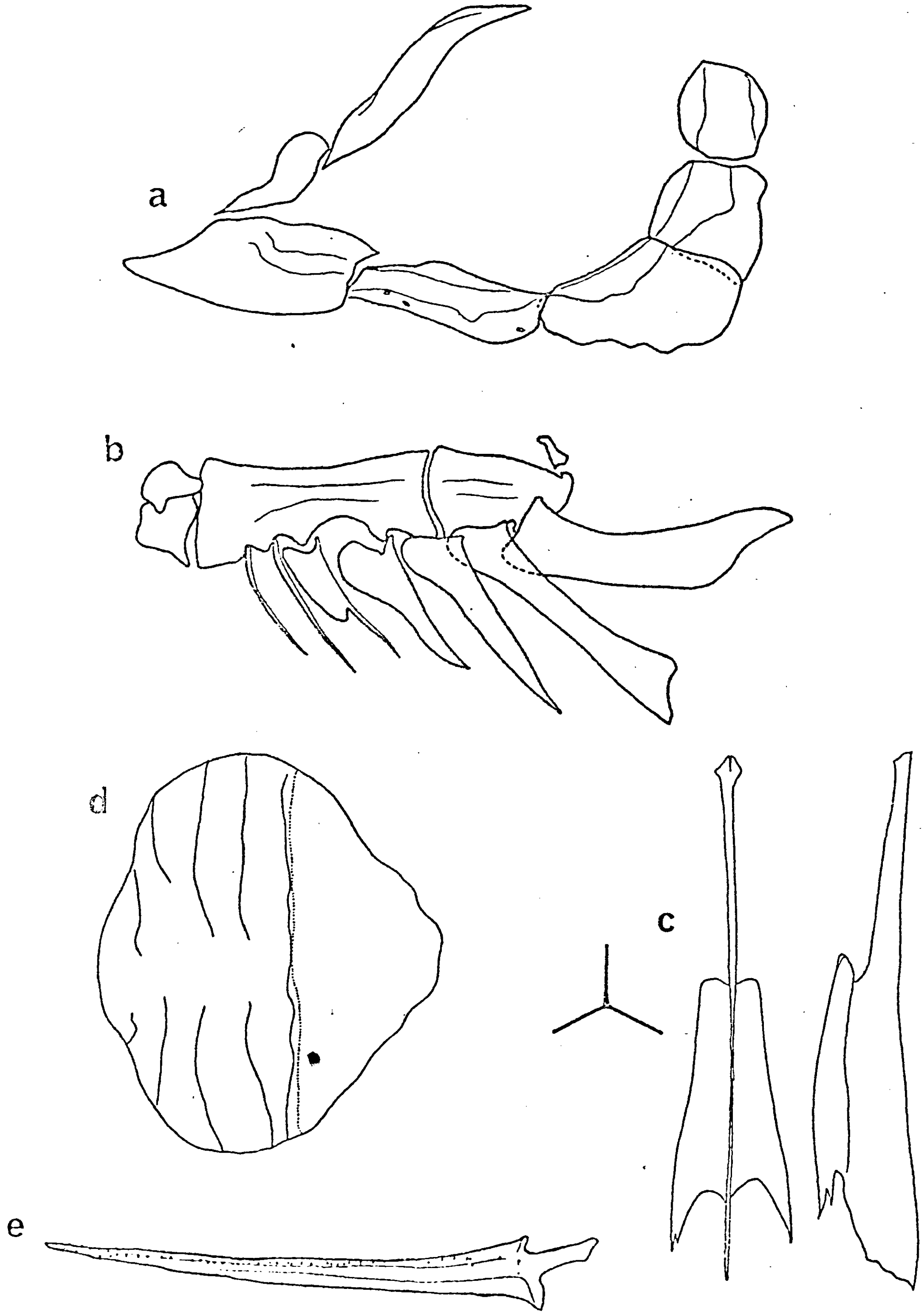


Plate 36. Spratelloides gracilis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; f, gillraker (all from BMNH. 1969.8.19.56-66, 64.0 mm S.L.).

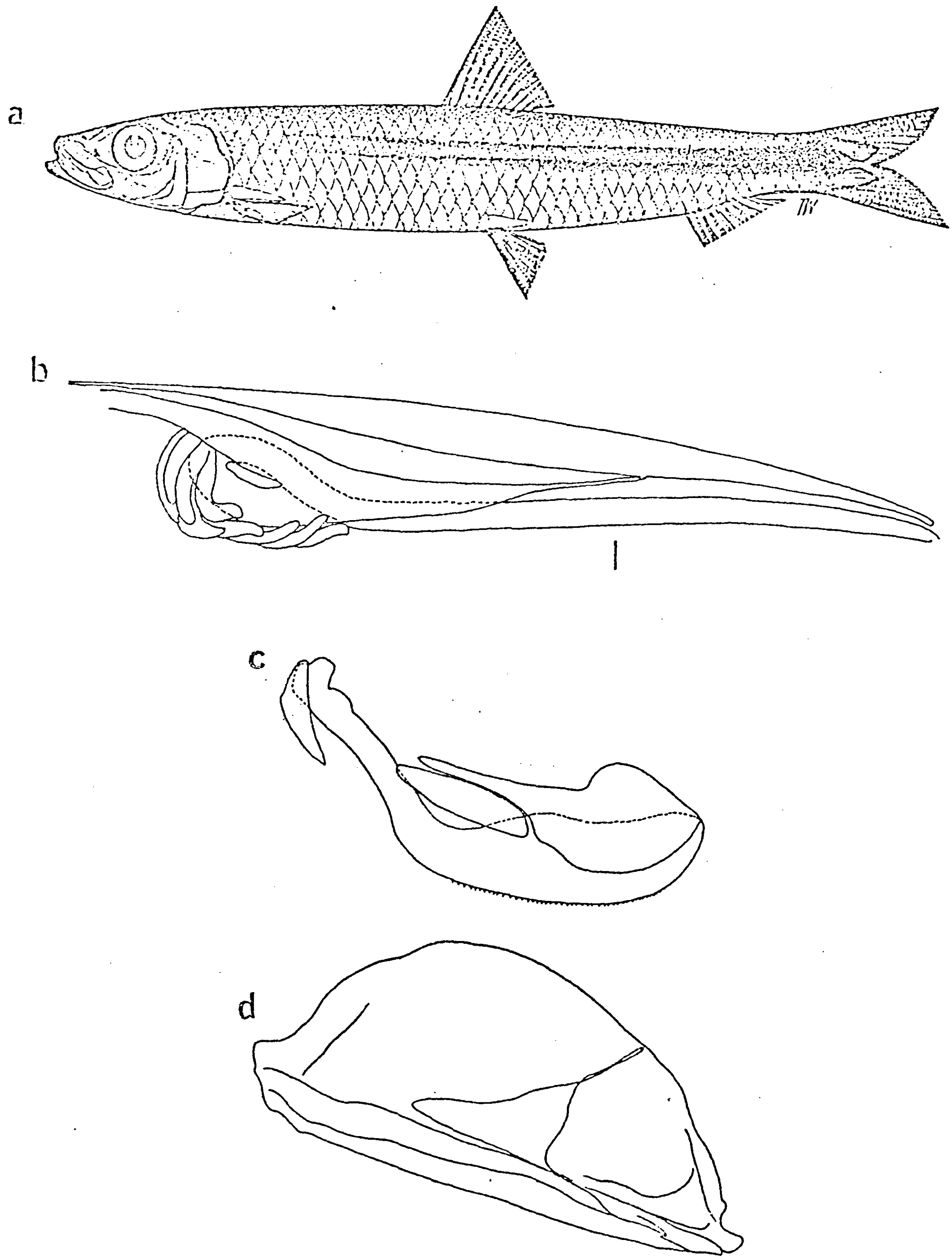


Plate 37. Spratelloides lewisi:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1979.8.16.503, 58.0 mm S.L., holotype; others from BMNH. 1979.8.16.504, 55.0 mm S.L.).

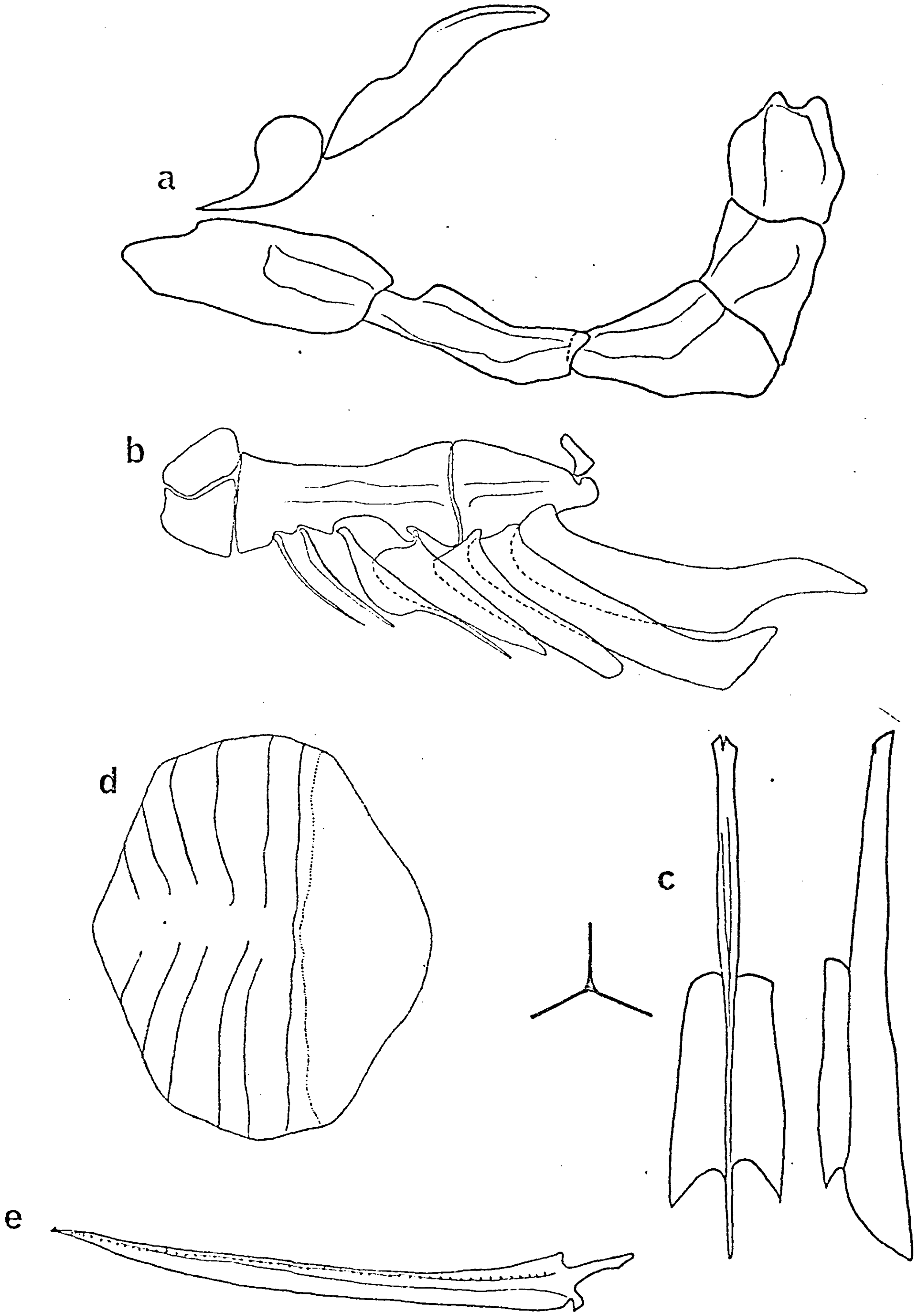


Plate 38. Spratelloides lewisi:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1979.8.16.504, 55.0 mm S.L.).

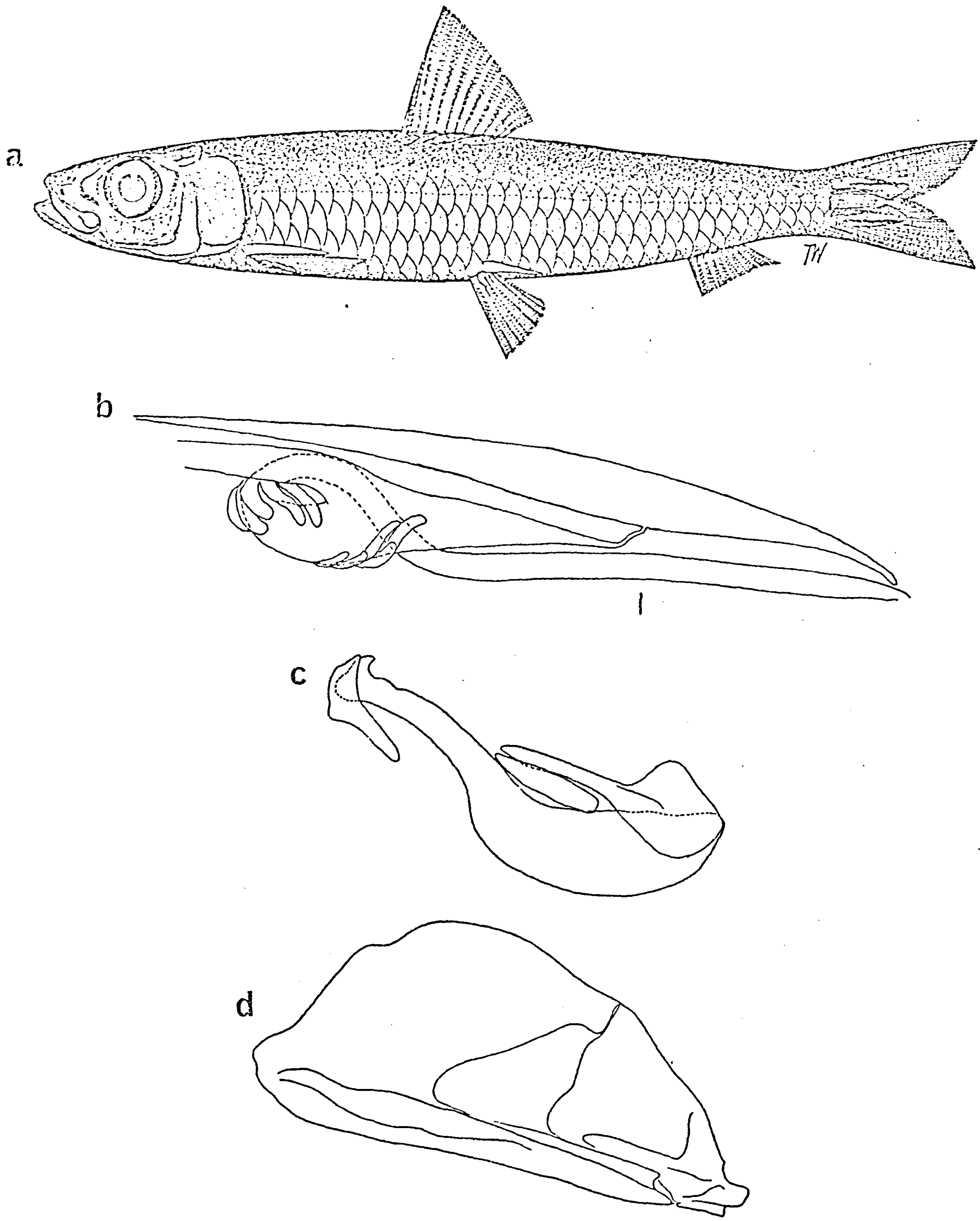


Plate 39. Spratelloides delicatulus:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1934.8.18.4-8, 50.5 mm S.L.; b from BMNH. 1949.11.29.5-26, 36.0 mm S.L.; c from BMNH. 1974.6.24.65-139, 53.0 mm S.L.).

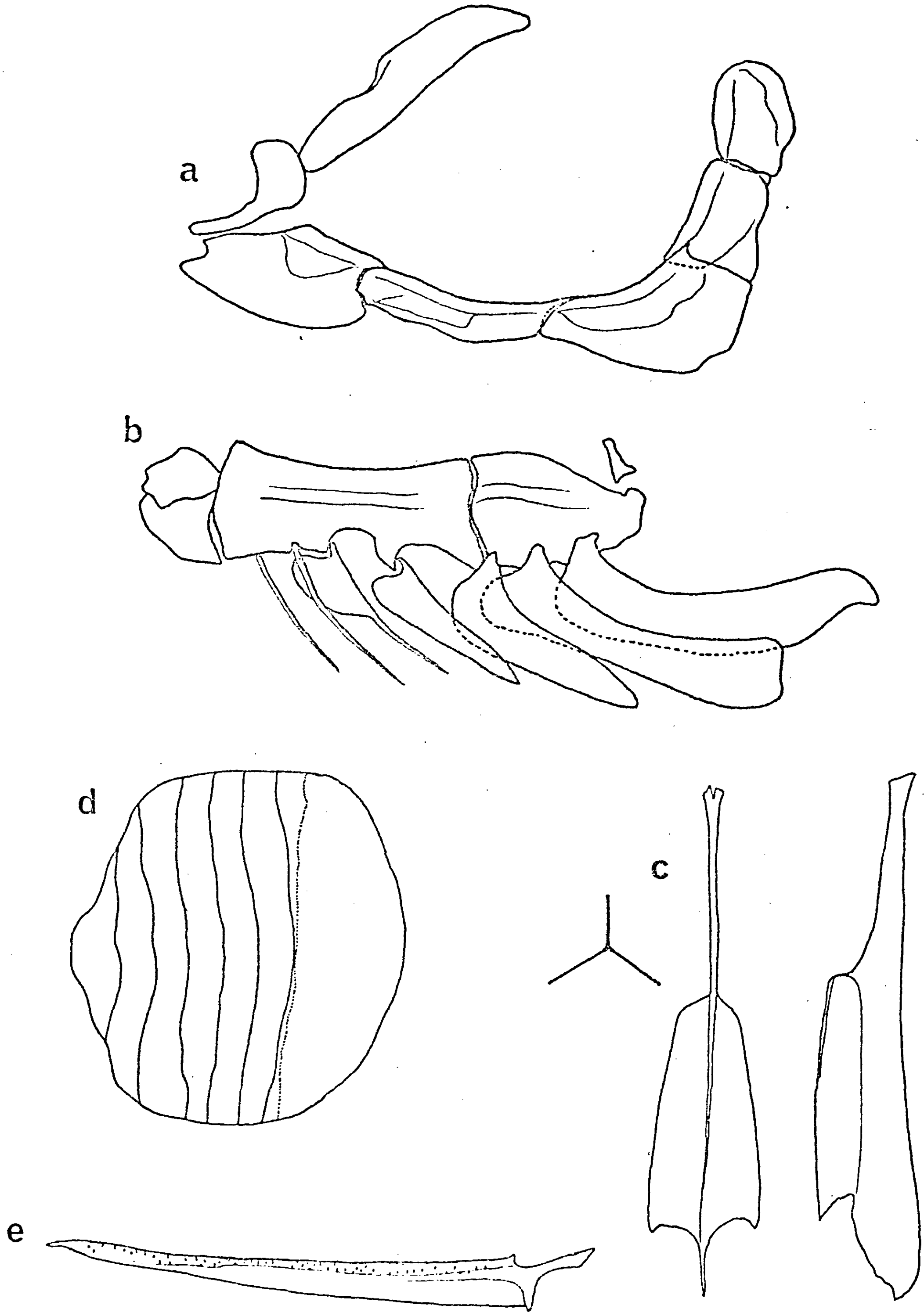


Plate 40. Spratelloides delicatulus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1974.6.24.65-139, 53.0 mm S.L.; d from BMNH. 1979.3.21.343-345, 59.0 mm S.L.).

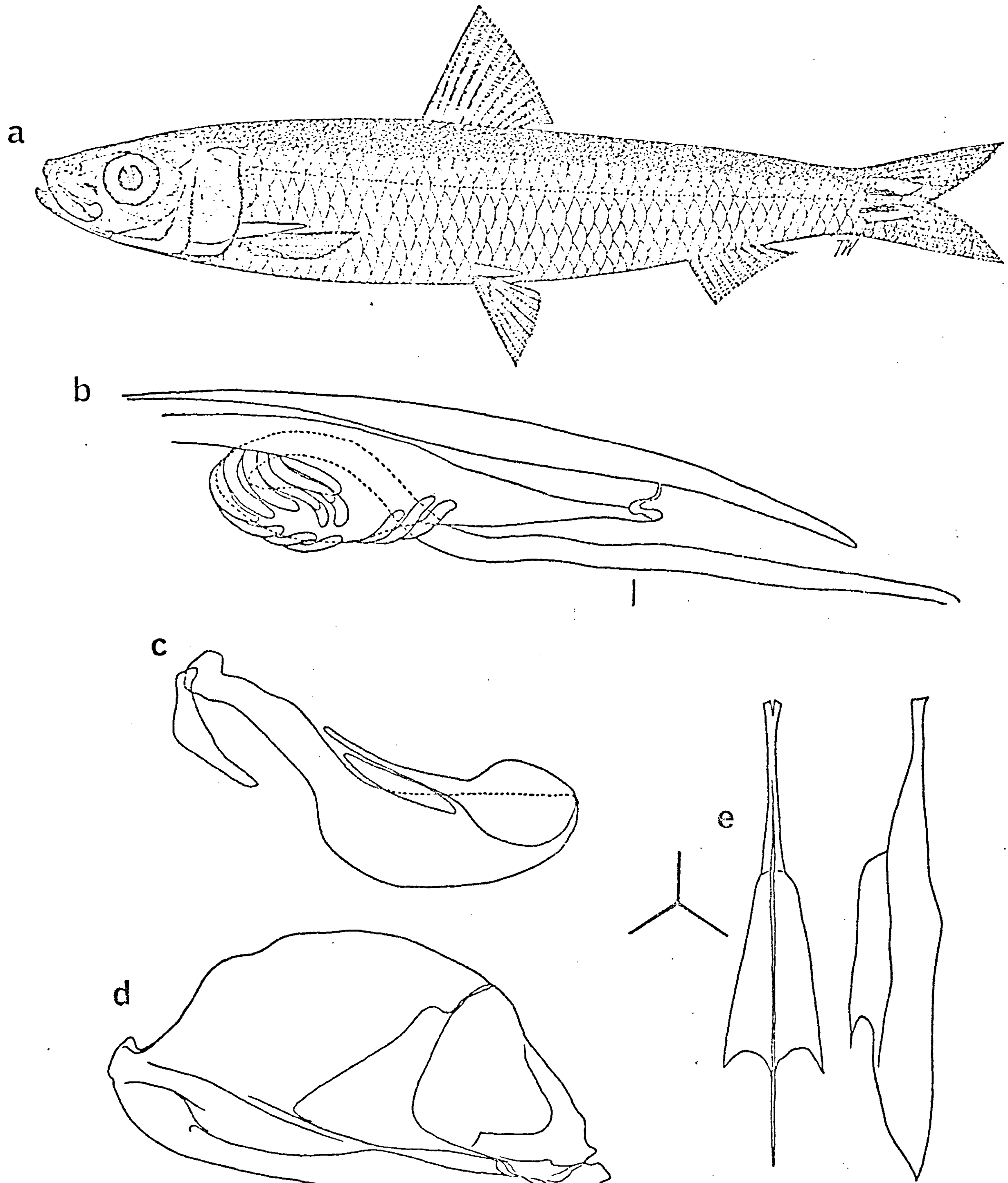


Plate 41. Spratelloides robustus:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, urohyal (all from BMNH. 1855.9.19.1153-1158, 70.0 mm S.L. for a and 69.8 mm S.L. for others).

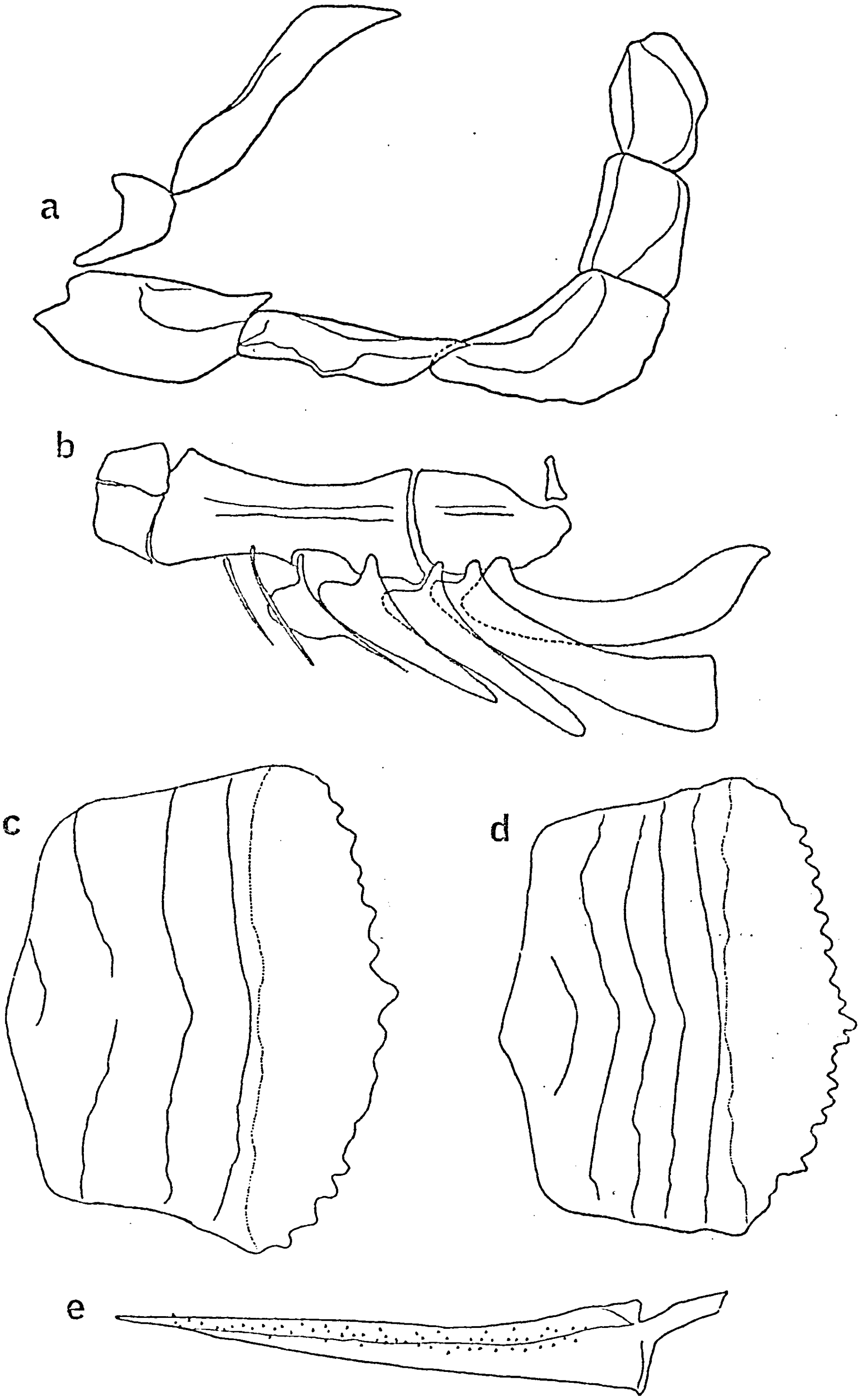


Plate 42. Spratelloides robustus:- a, circumorbital bones; b, hyoid arch; c, d, scales; e, gillraker (a, b, d, e from BMNH. 1855.9.19.1153-1158, 69.8 mm S.L.; c, from BMNH. 1924.4.30.1-8, 60.0 mm S.L.).

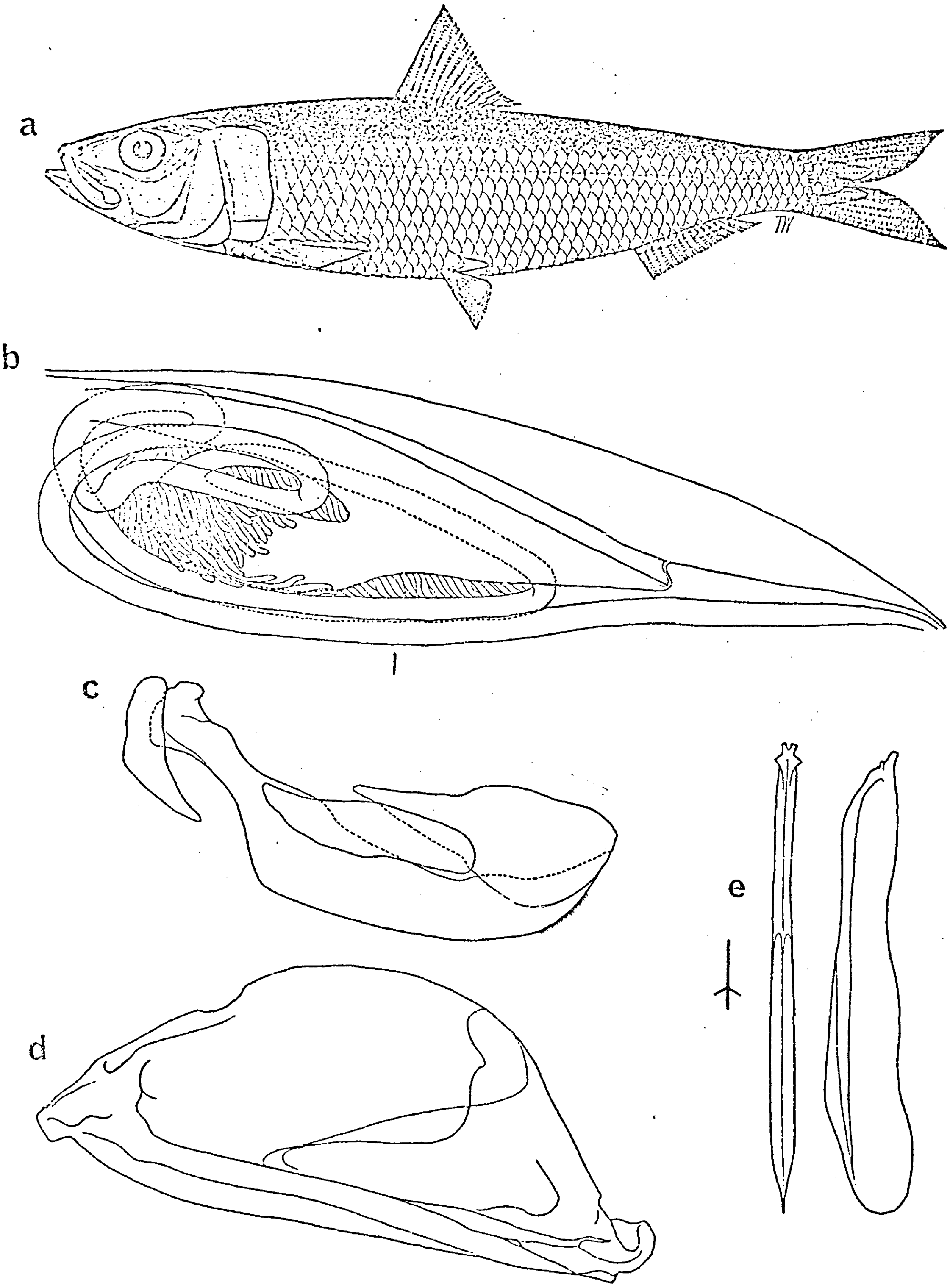


Plate 43. Sardinella (Sardinella) longiceps:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, e, urohyal (a from BMNH. 1889. 2.1.1893-1895, 122.0 mm S.L.; others from BMNH. 1962.3.26.19-36, 135.0 mm S.L.).

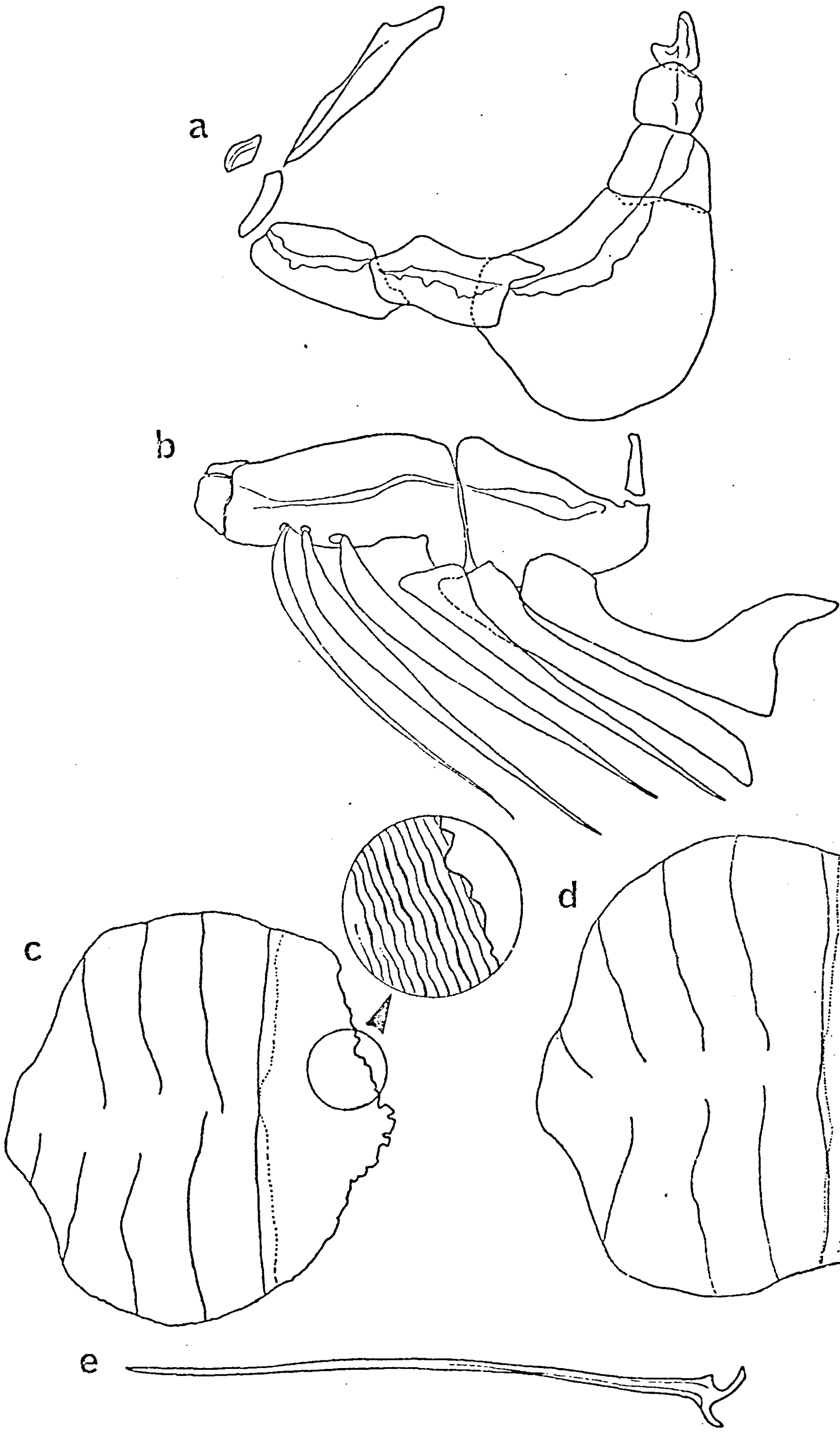


Plate 44. Sardinella (Sardinella) longiceps:- a, circumorbital bones; b, hyoid arch; c, d, scales and enlargement of its posterior margin; e, gill-raker (a, b, c, e from BMNH. 1962.3.26.19-36, 135.0 mm S.L.; d from BMNH. 1889.2.1.1901-1904, 115.0 mm S.L.).

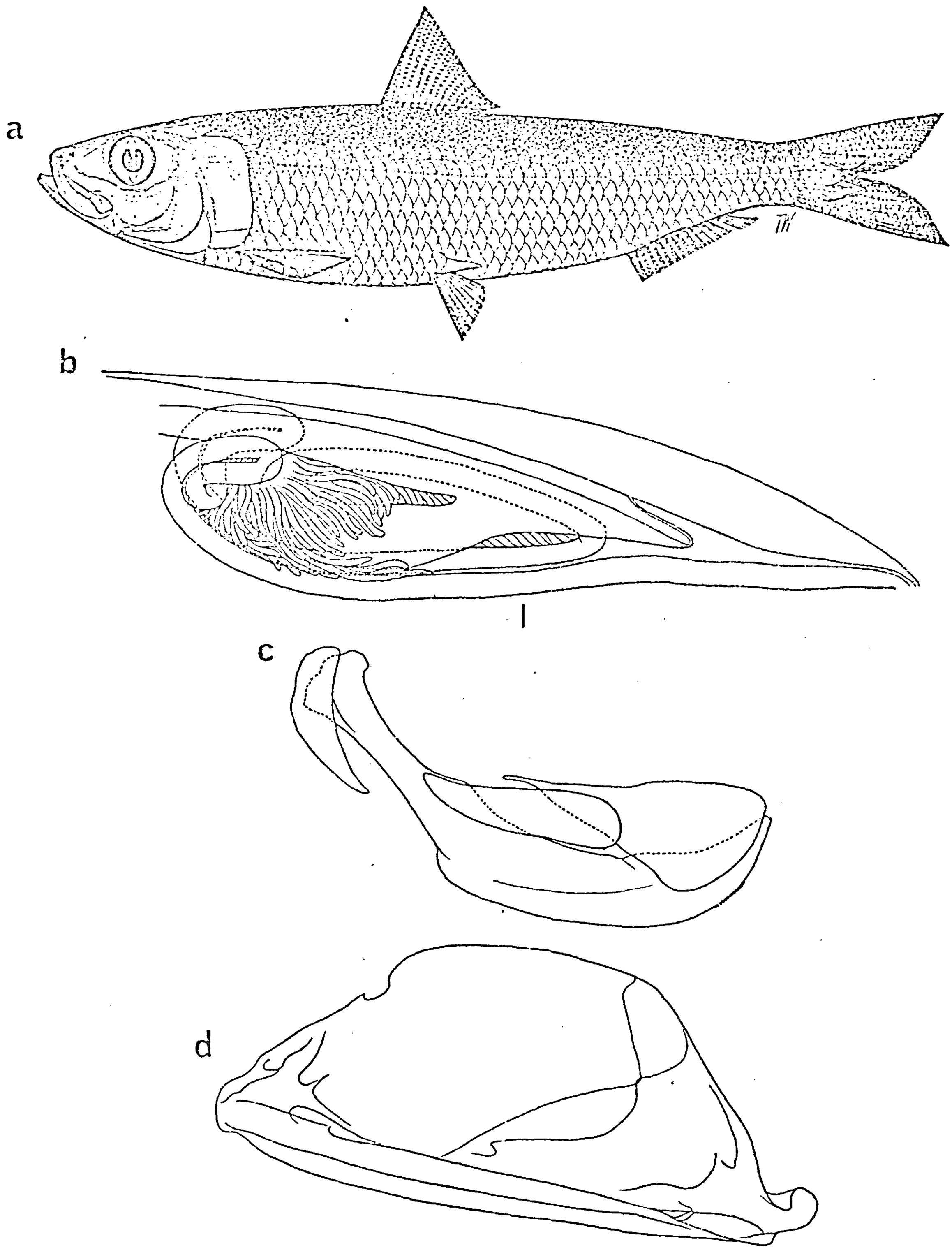


Plate 45. Sardinella (Sardinella) neglecta:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1966.11.16.106, 116.0 mm S.L., holotype; b, from BMNH. 1966.11.16.94-105, 111.0 mm S.L.; paratype; c, d from BMNH. 1966.11.16.82-91, 119.0 mm S.L. paratype).

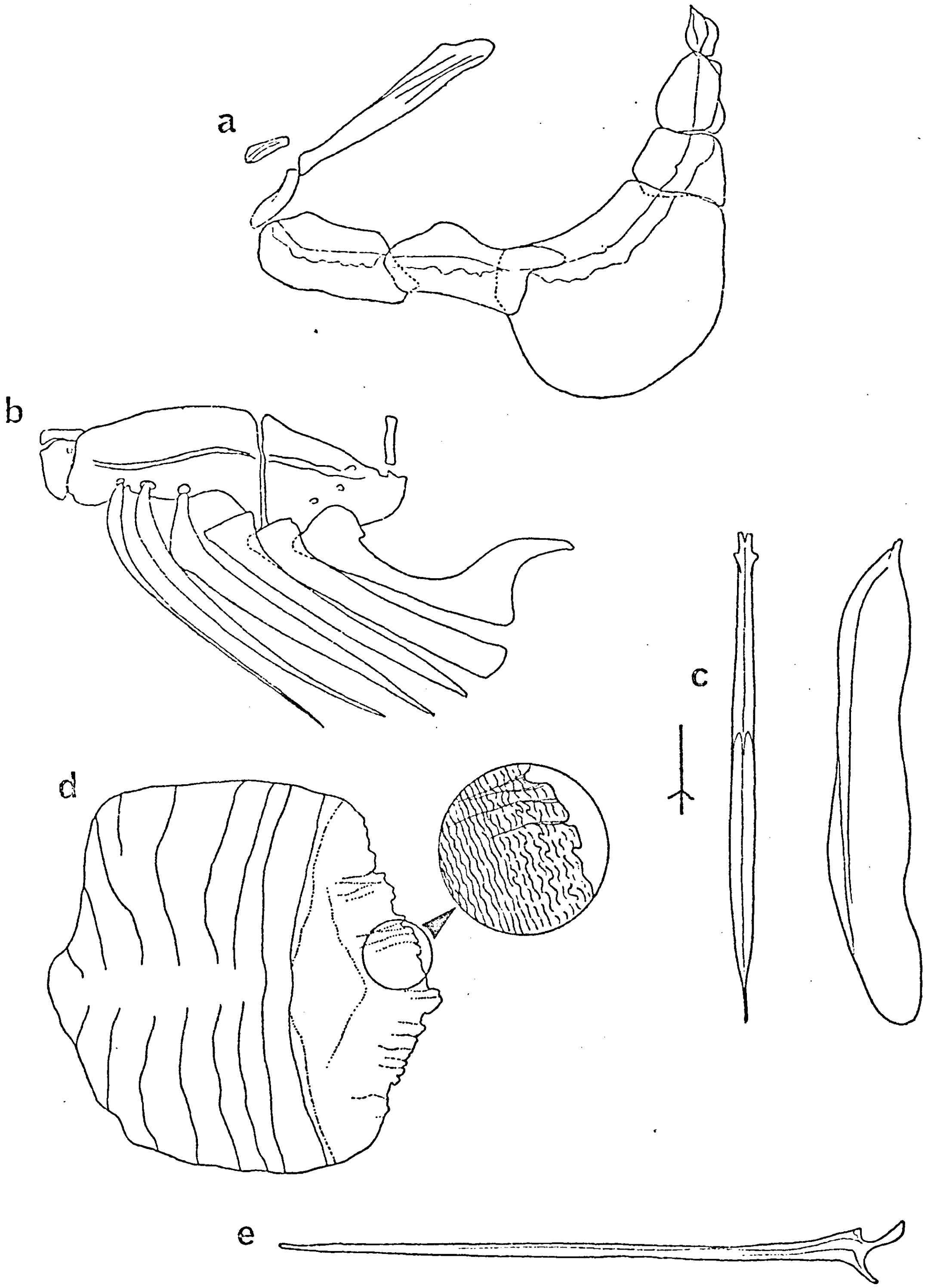


Plate 46. Sardinella (Sardinella) neglecta:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale, and enlargement of its posterior margin; e, gillraker (all from BMNH. 1966.11.16.82-91, 119.0 mm S.L., paratype).

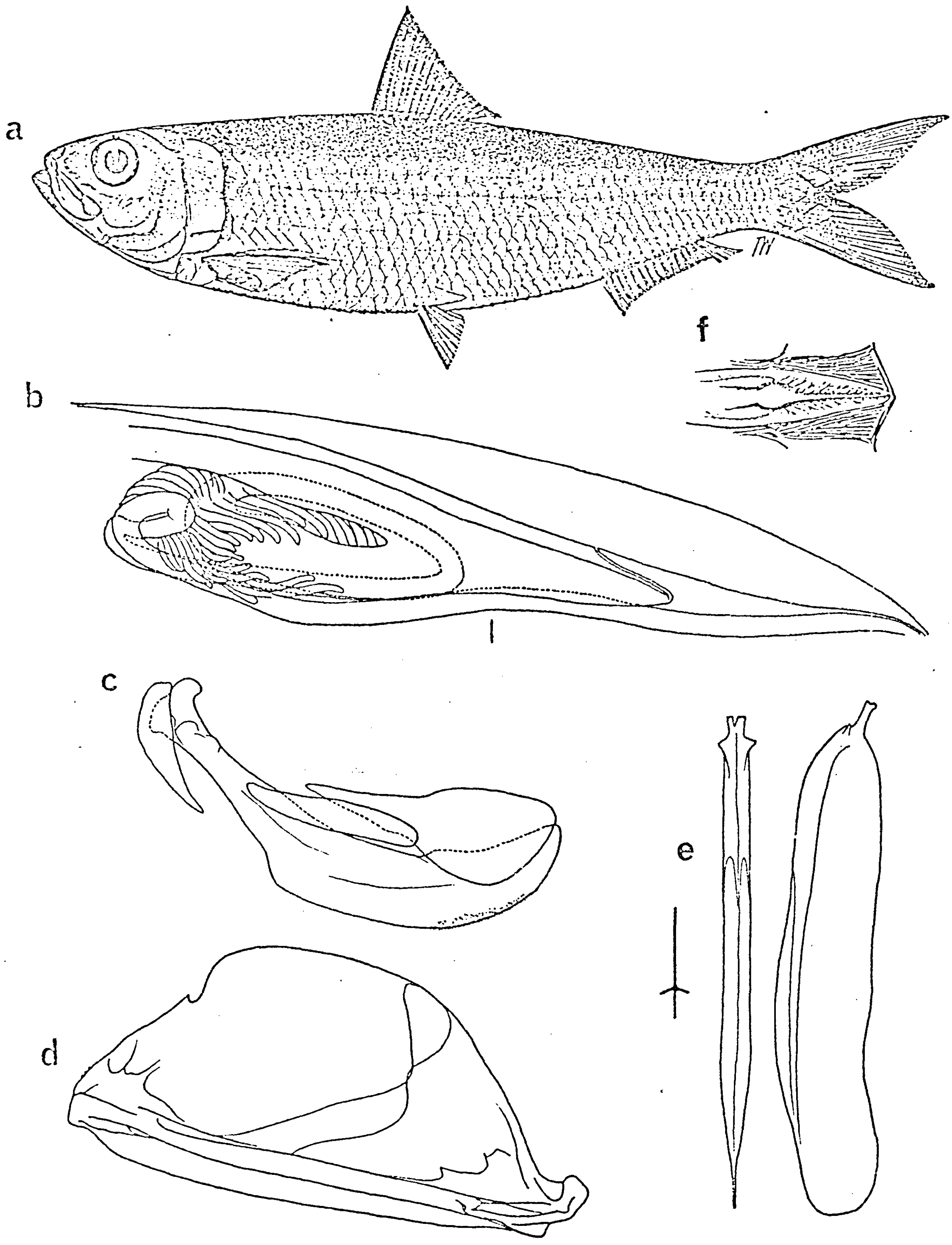


Plate 47. Sardinella (Sardinella) lemuru:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, urohyal; f, frontoparietal striae, (a, f from BMNH. 1979.8.15.36, 149.0 mm S.L.; others from BMNH. 1960.4.7.42-51, 109.0 mm S.L.).

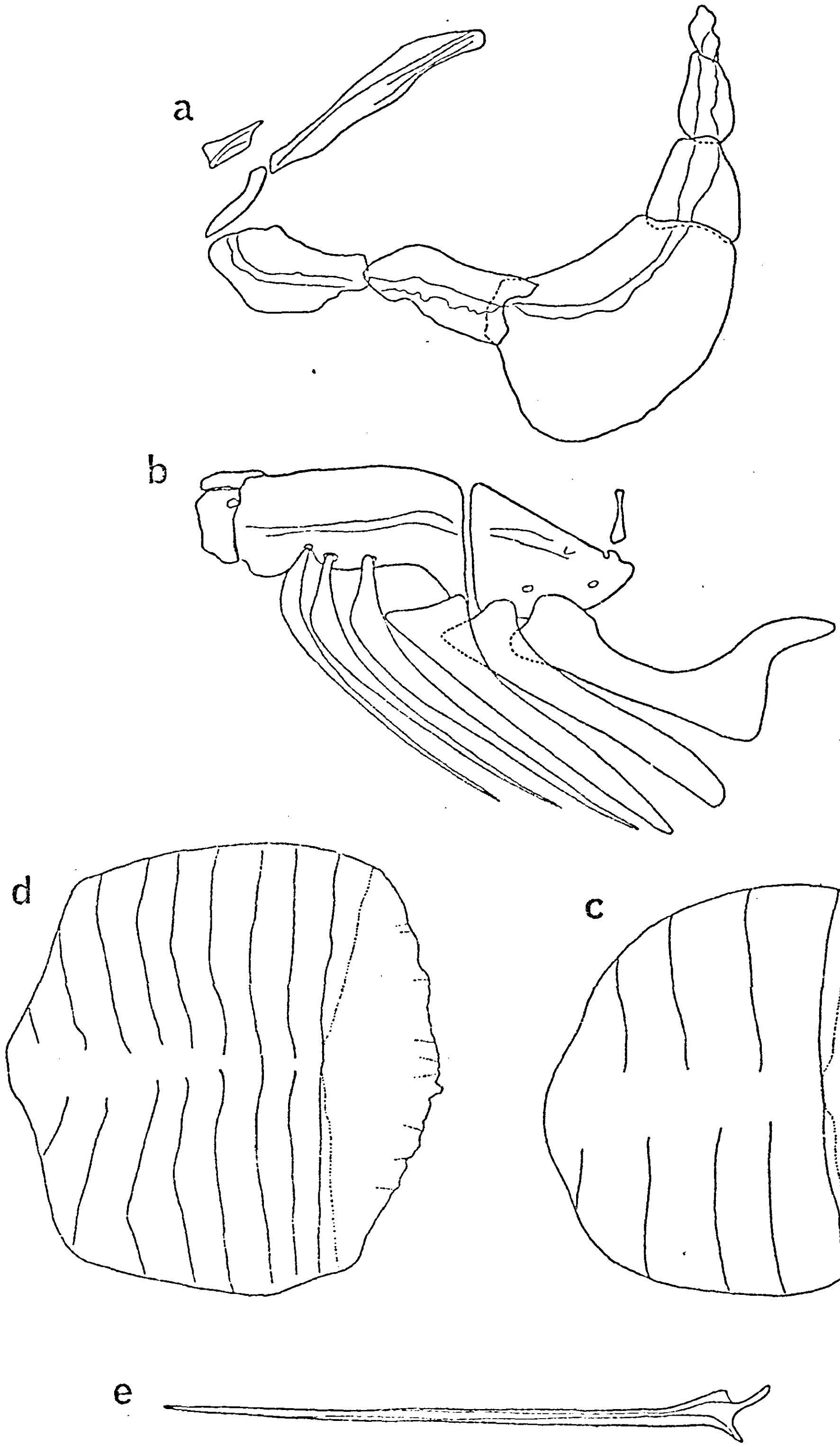


Plate 48. Sardinella (Sardinella) lemuru:- a, circumorbital bones; b, hyoid arch; c, d, scales; e, gillraker (a, b from BMNH. 1960.4.7.42-51, 109.0 mm S.L.; c from BMNH. 1851.12.27.202, 63.0 mm S.L.; d, e from BMNH. 1979.8.15.36, 149.0 mm S.L.).

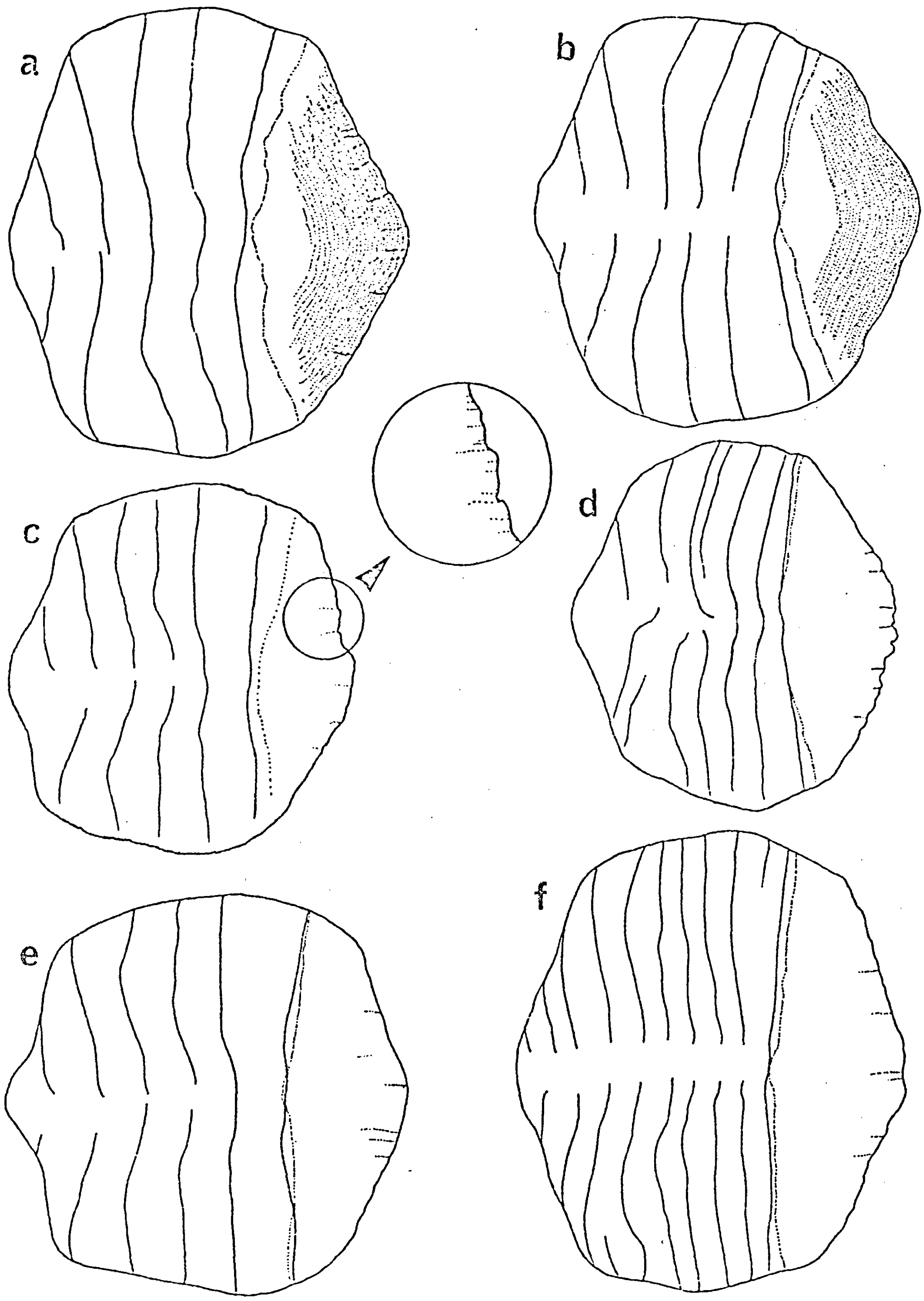


Plate 49. Scales : a, b, of Sardinella (Sardinella) aurita (= form B), a from NMW. 1159, 115.0 mm S.L., type of Clupea brasiliensis; b from BMNH. 1874.7. 457-492, 110.0 mm S.L.; c, d, e, f of Sardinella (Sardinella) aurita (= form A), c, d, e from BMNH. 1970.10.21.62-64, 88.0 mm S.L. for c, e and 155.0 mm S.L. for d; f from MNHN. 663, 205.0 mm S.L., type of Sardinella aurita.

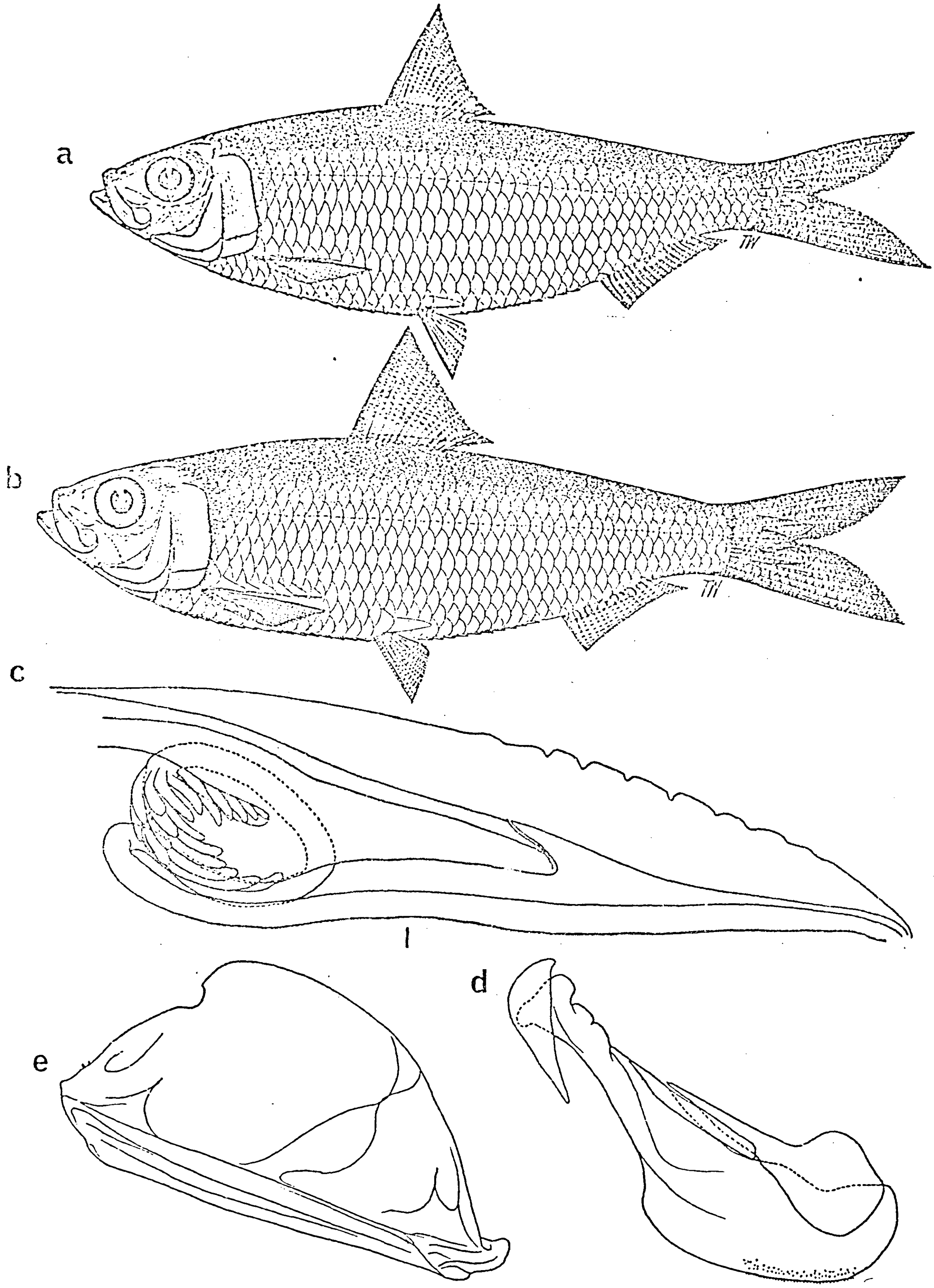


Plate 50. *Sardinella* (*Clupeonia*) *jussieui*:- a, b, adults; from Bombay and Mauritius respectively; c, gas bladder and digestive tract; d, e, upper and lower jaws (a from MNHN. 3753, 123.0 mm S.L. formerly syntype of *Alausa argyrochloris*; b, c, d, e from BMNH. 1937.5.26.1-2, 94.5 mm S.L. for b and 90.5 mm S.L. for c, d, e).

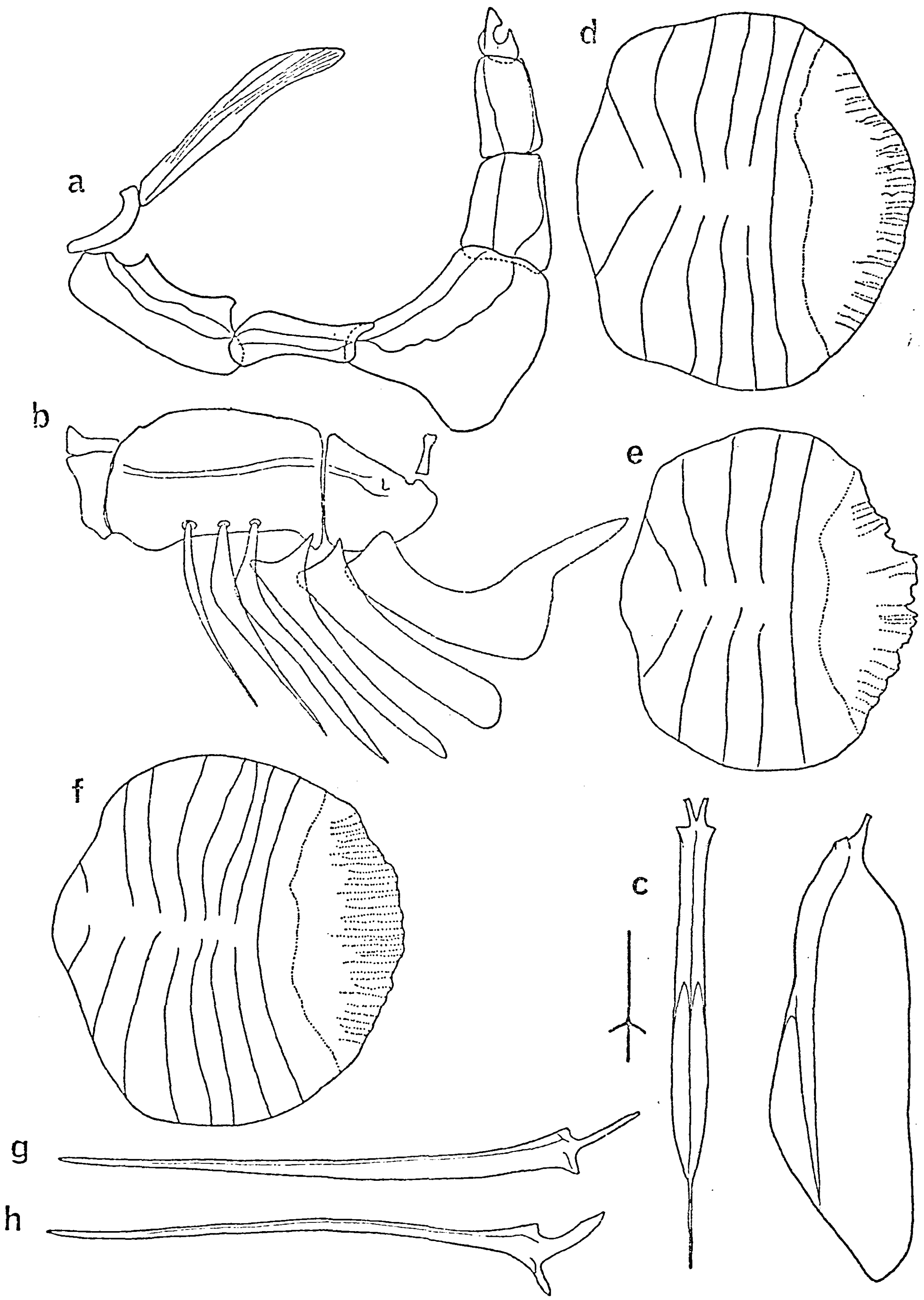


Plate 51. Sardinella (Clupeonia) jussieui:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, f, scales; g, h, gillrakers (a, b, c, e, g from BMNH. 1937.5.26.1-2, 90.0 mm S.L.; d from MNHN. 3753, 123.0 mm S.L., formerly syntype of Alausa argyrochoris; f from MNHN. A. 2208, 144.0 mm S.L., holotype of Clupeonia jussieui).

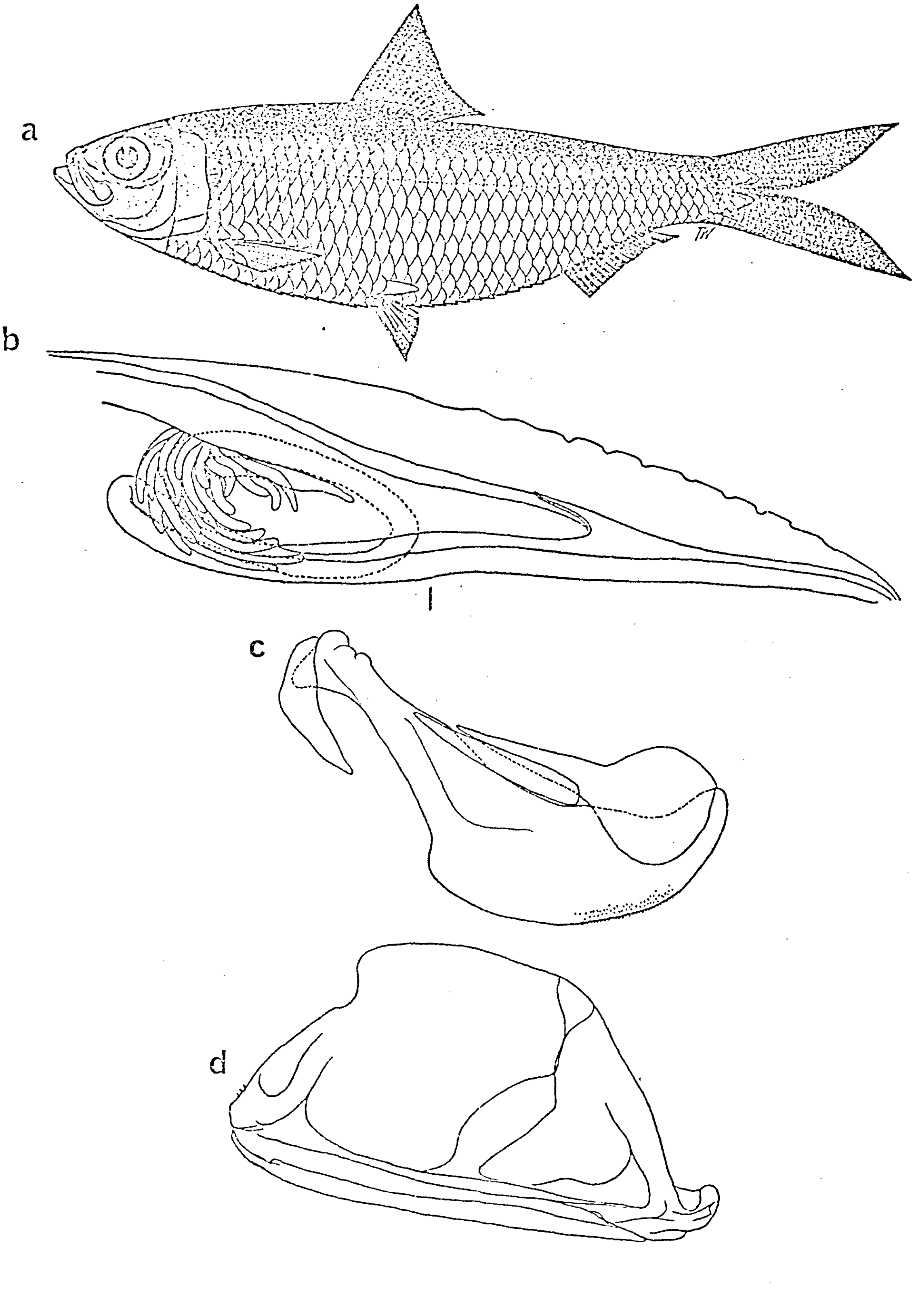


Plate 52. *Sardinella* (*Clupeonia*) *sindensis*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1971.5.21.2-6, 124.0 mm S.L.; others from BMNH. 1971.2.8.118-127, 100.0 mm S.L.).

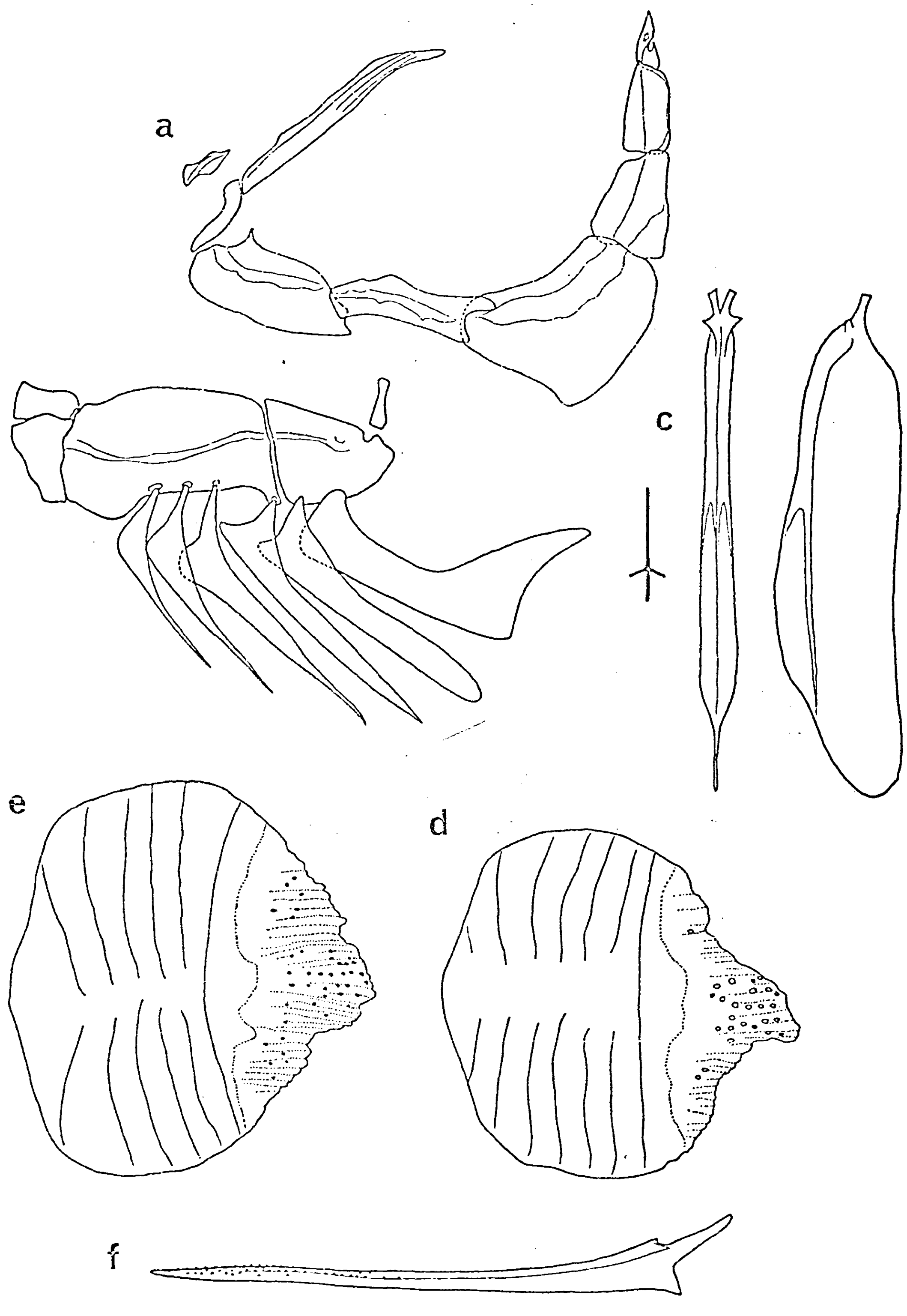


Plate 53. Sardinella (Clupeonia) sindensis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, scales; f, gillraker (a, b, c, f from BMNH. 1971.2.8.118-127, 100.0 mm S.L.; d from BMNH. 1889.2.1.1919-1924, 99.0 mm S.L.; e from BMNH. 1971.5.21.2-6, 124.0 mm S.L.).

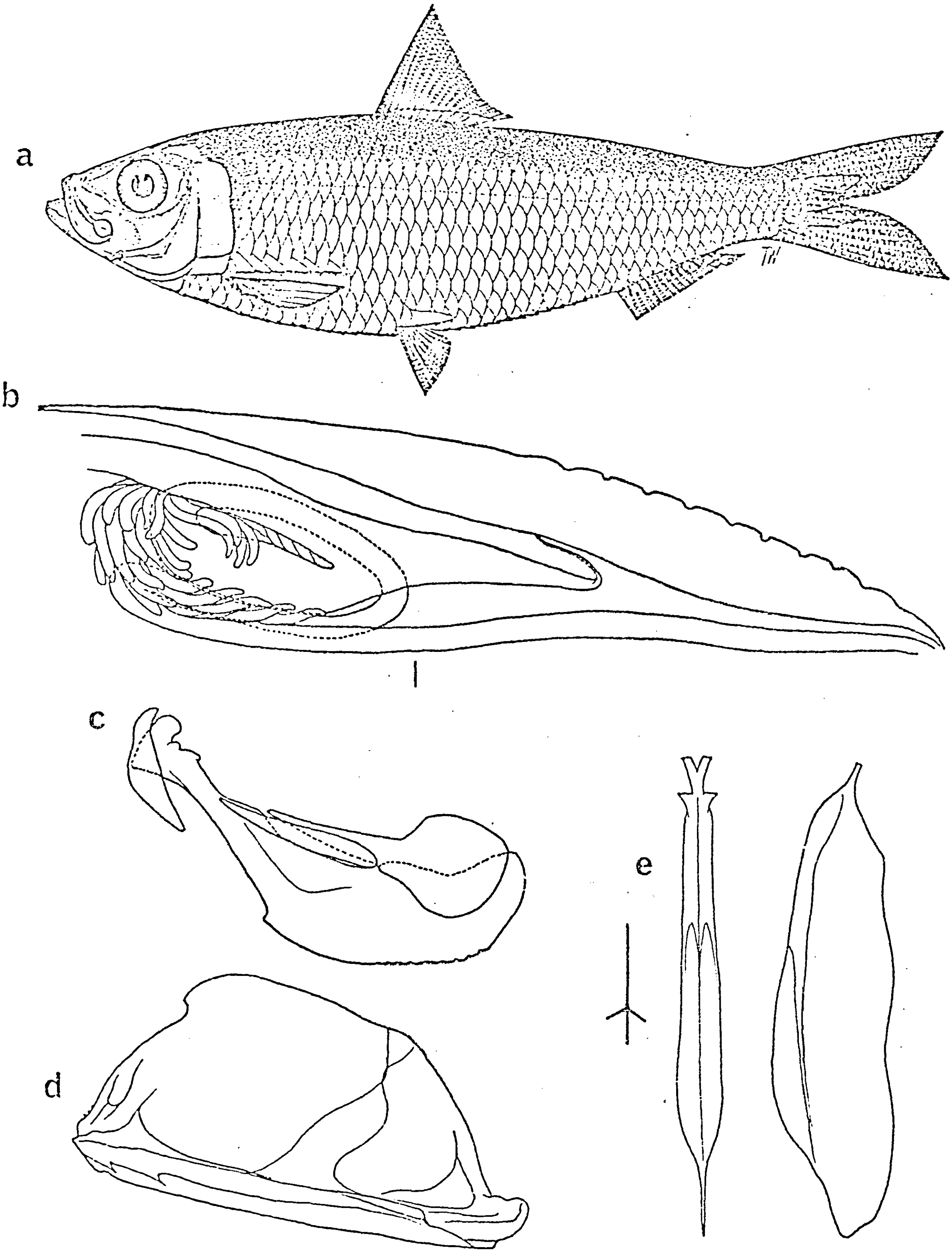


Plate 54. Sardinella (Clupeonia) gibbosa:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, urohyal (a from BMNH. 1898. 4.2.253, 111.0 mm S.L.; others from BMNH. 1960.4.7.1-25, 83.0 mm S.L.).

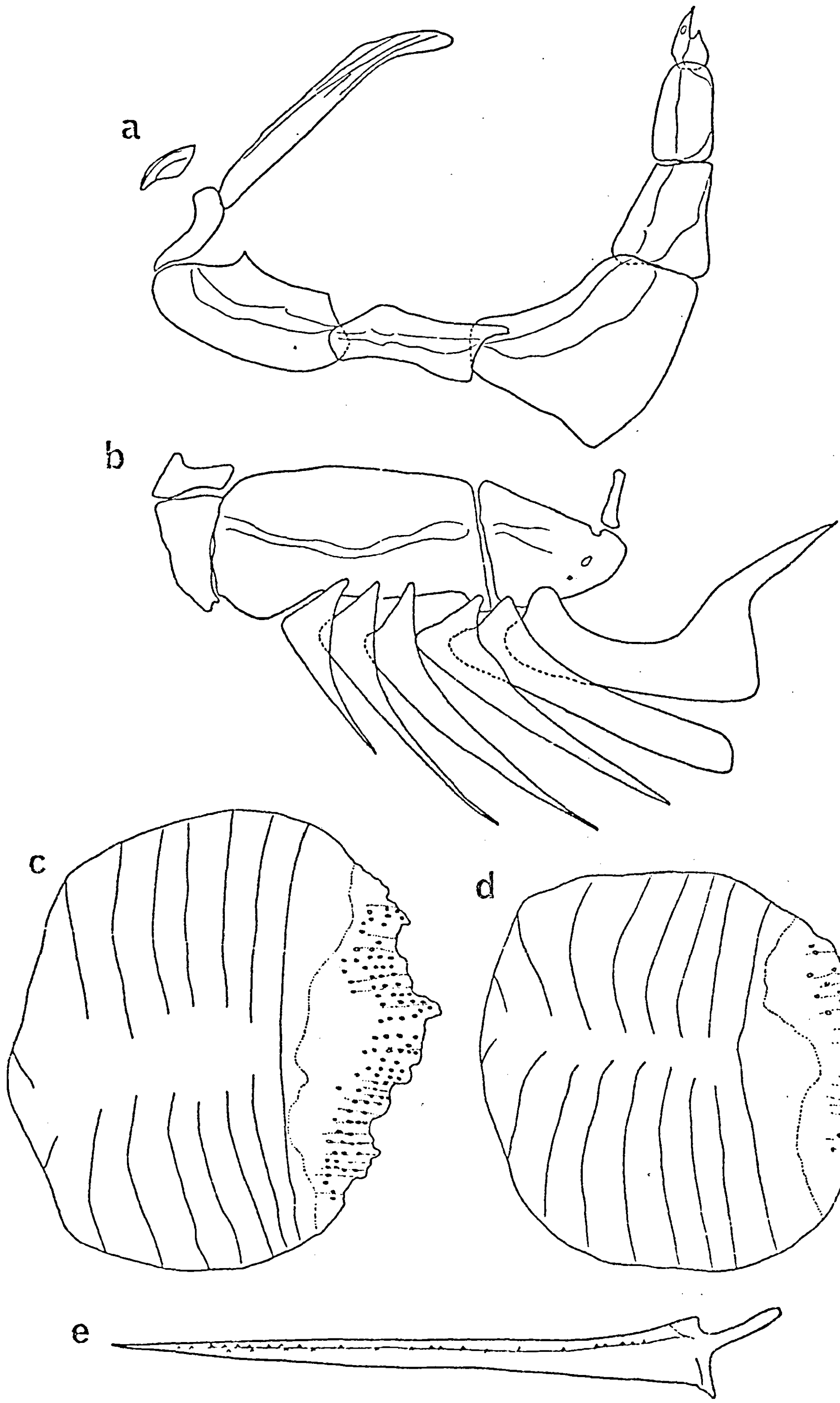


Plate 55. Sardinella (Clupeonia) gibbosa:- a, circumorbital bones; b, hyoid arch; c, d, scales; e, gillraker (a, b, e from BMNH. 1960.4.7.1-25, 83.0 mm S.L.; c from BMNH. 1973.4.5.10, 141.0 mm S.L.; d from BMNH. 1898.4.2.253, 111.0 mm S.L.).

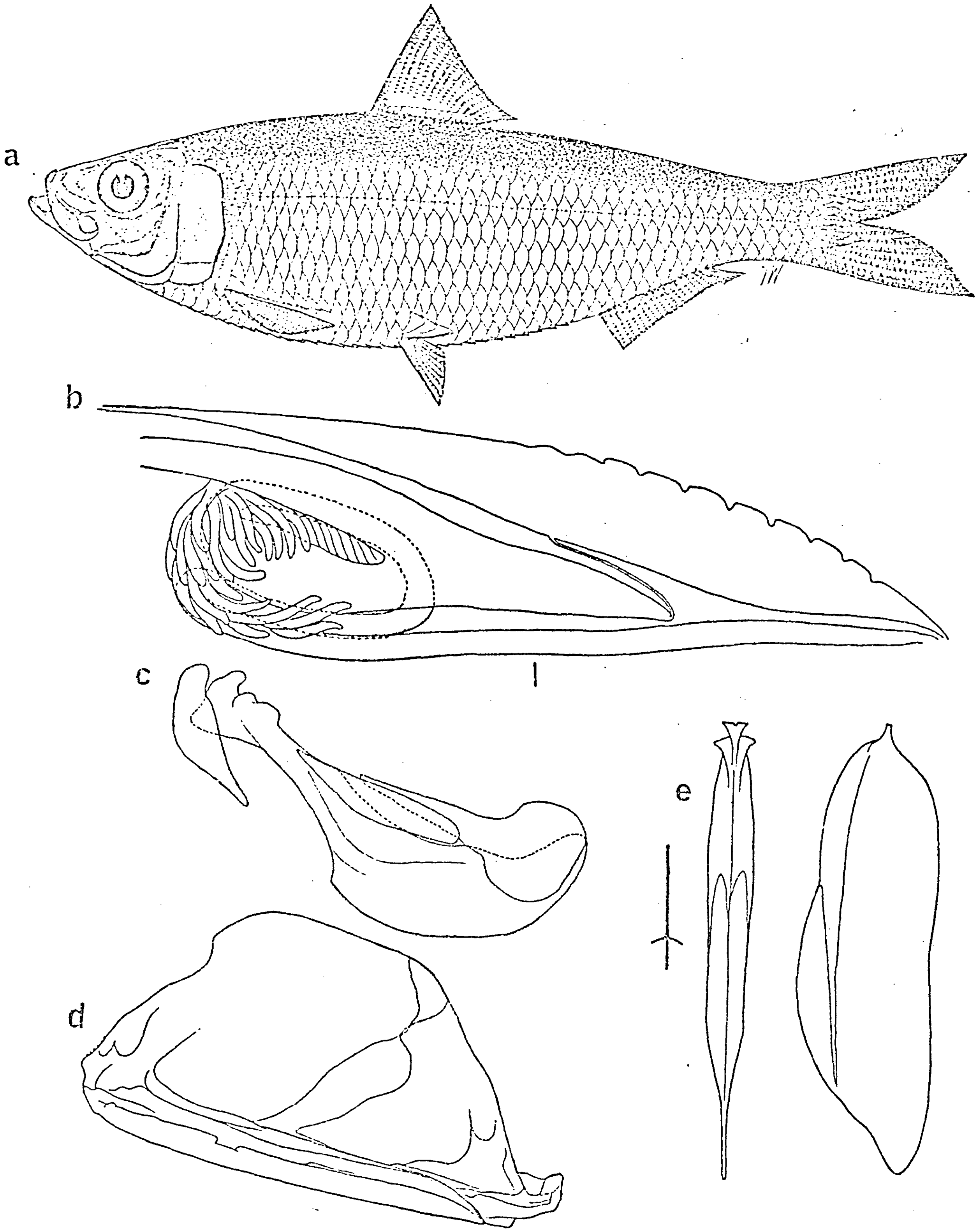


Plate 56. Sardinella (Clupeonia) fimbriata:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, urohyal (a from BMNH. 1889. 2.1.1917, 102.0 mm S.L.; b from BMNH. 1865.7.17.15, 113.0 mm S.L.; c, d, e from BMNH. 1978.8.18.153-154, 123.0 mm S.L.).

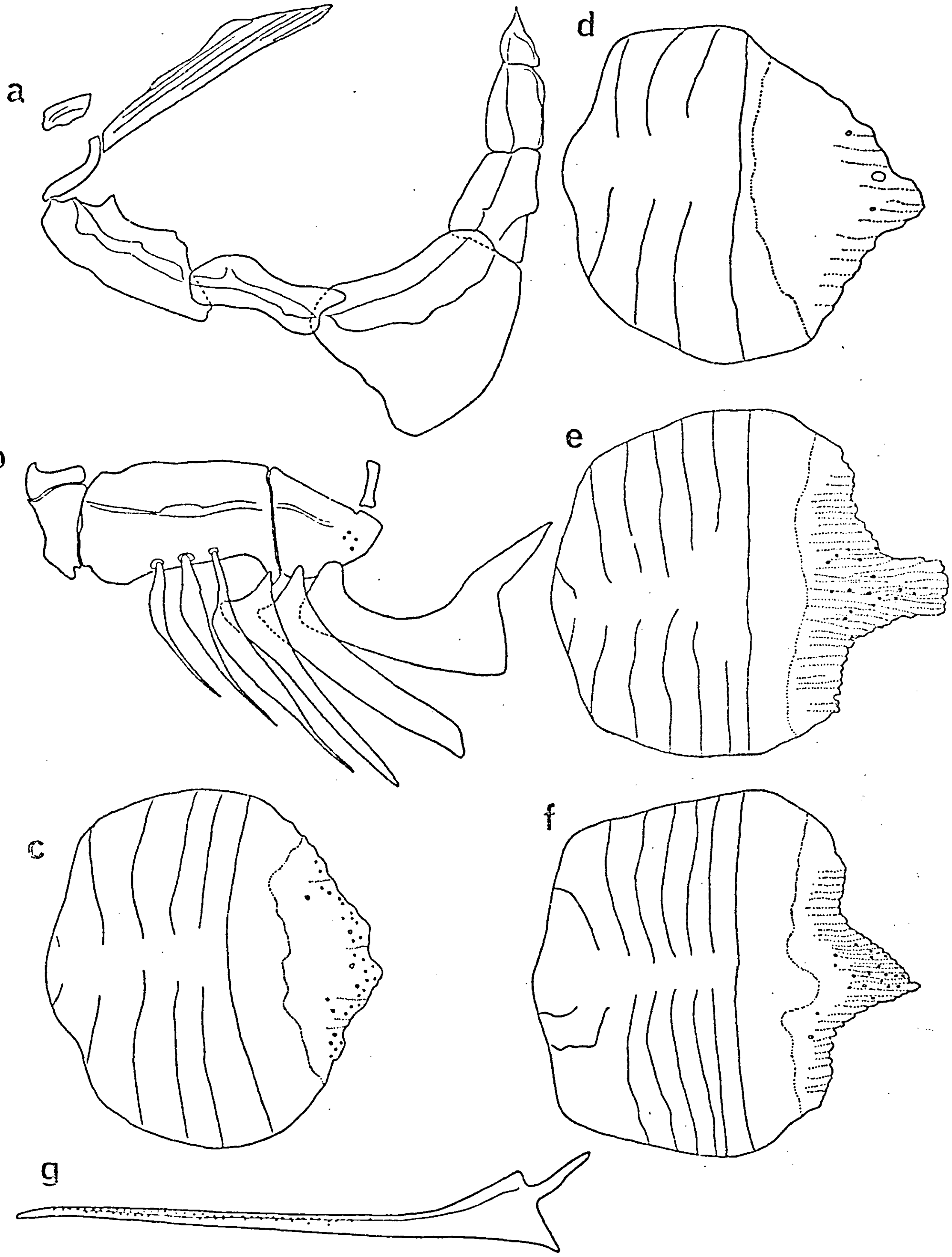


Plate 57. Sardinella (Clupeonia) fimbriata:- a, circumorbital bones; b, hyoid arch; c, d, e, f, scales; g, gillraker (a, b, g from BMNH. 1978.8.18.153-154, 123.0 mm S.L.; c from BMNH. 1974.5.25.8-14, 90.0 mm S.L.; d, e from BMNH. 1889.2.1.1915-1916, 54.0 and 101.0 mm S.L. respectively; f from MNHN. 3227, lectotype of Spratella fimbriata, 120.0 mm S.L.).

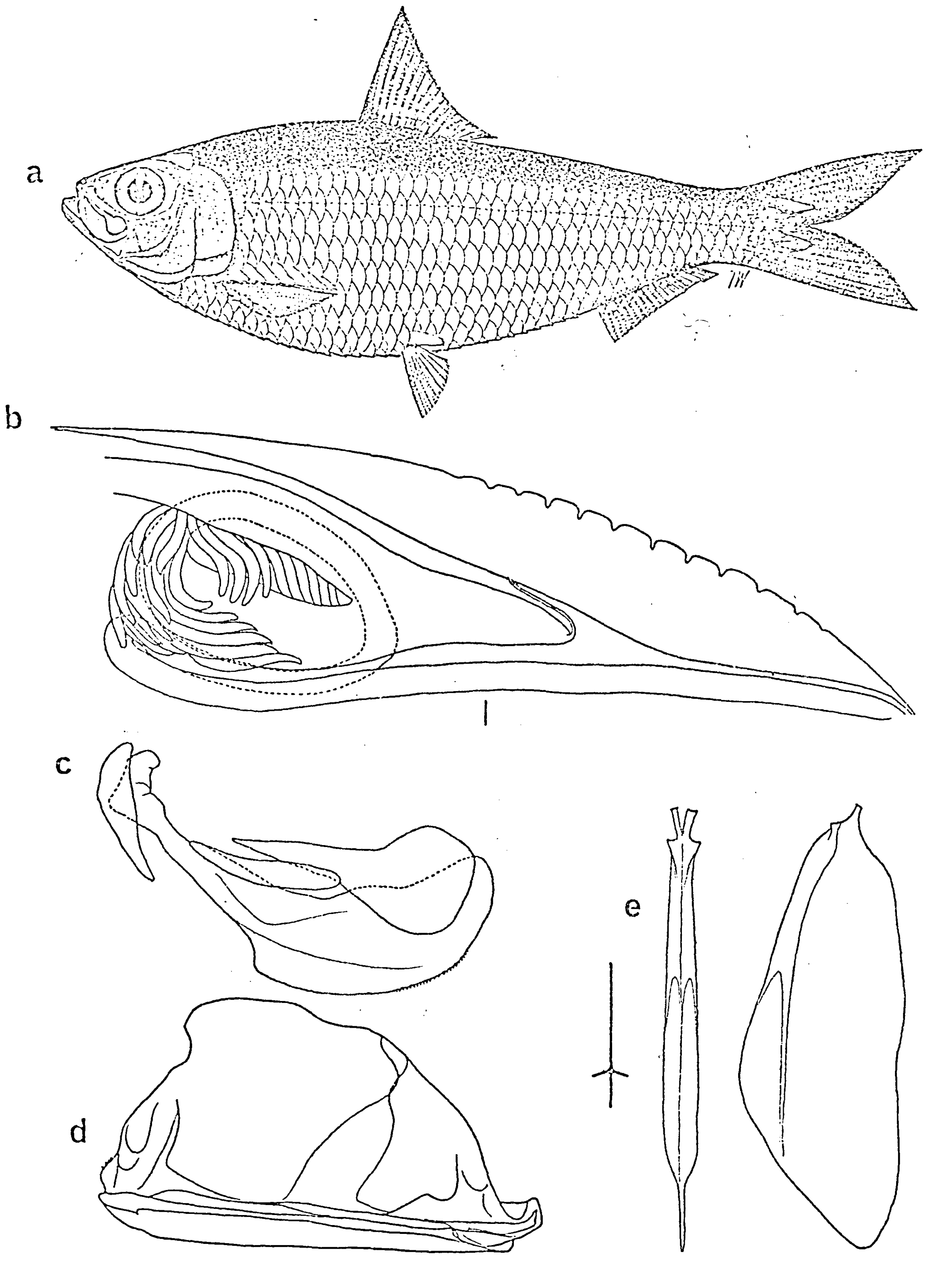


Plate 58. Sardinella (Clupeonia) albella:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, urohyal (a from BMNH. 1965.7.5.15-16, 103.0 mm S.L.; others from BMNH. 1970.4.24.1-20, 86.0 mm S.L.).

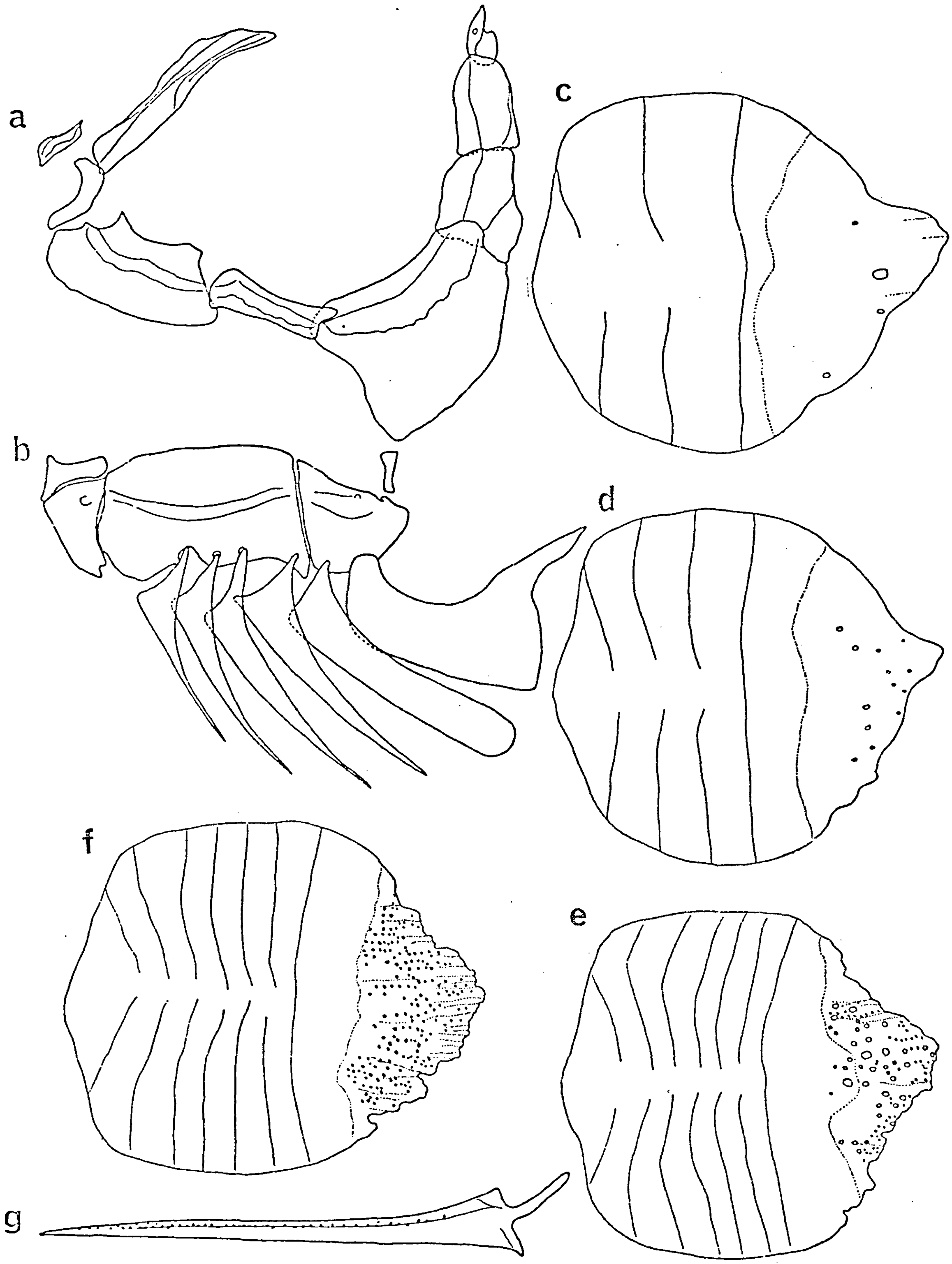


Plate 59. Sardinella (Clupeonia) albella:- a, circumorbital bones; b, hyoid arch; c, d, e, f, scales; g, gillraker (a, b, g from BMNH. 1970.4.24.1-20, 86.0 mm S.L.; c, from BMNH. 1965.7.5.25-28, 38.0 mm S.L.; d from BMNH. 1964. 12.14.125, 51.0 mm S.L.; e from BMNH. 1965.7.15-16, 95.0 mm S.L.; f from BMNH. 1966.11.16.56-70, 118.0 mm S.L.).

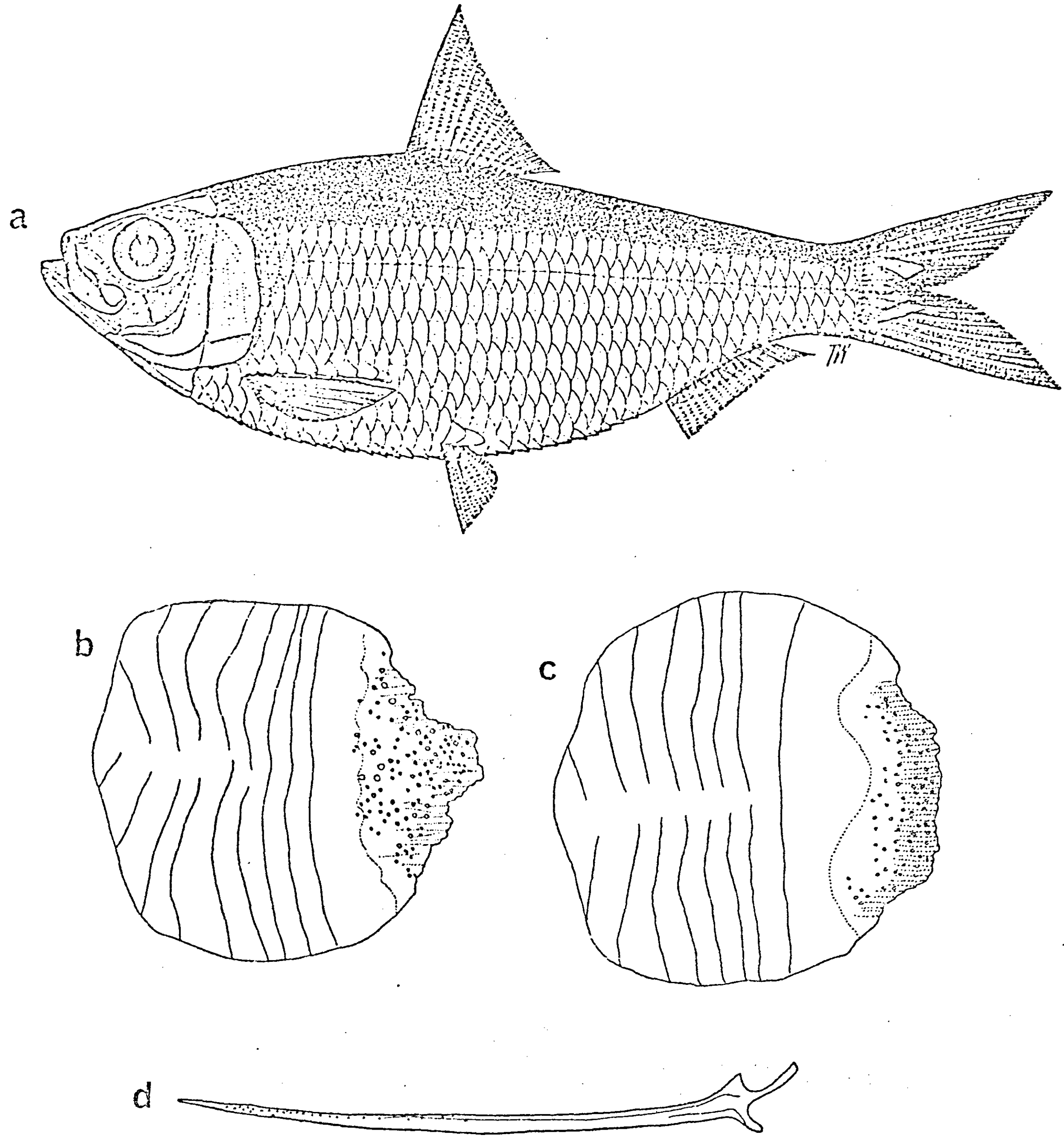


Plate 60. Sardinella (Clupeonia) dayi:- a, adult; b, c, d, scales; d, gillraker (a, b, d from BMNH. 1912.5.2.2, 112.0 mm S.L., holotype of Sardinella dayi; c from SU. 22866, 104.0 mm S.L.).

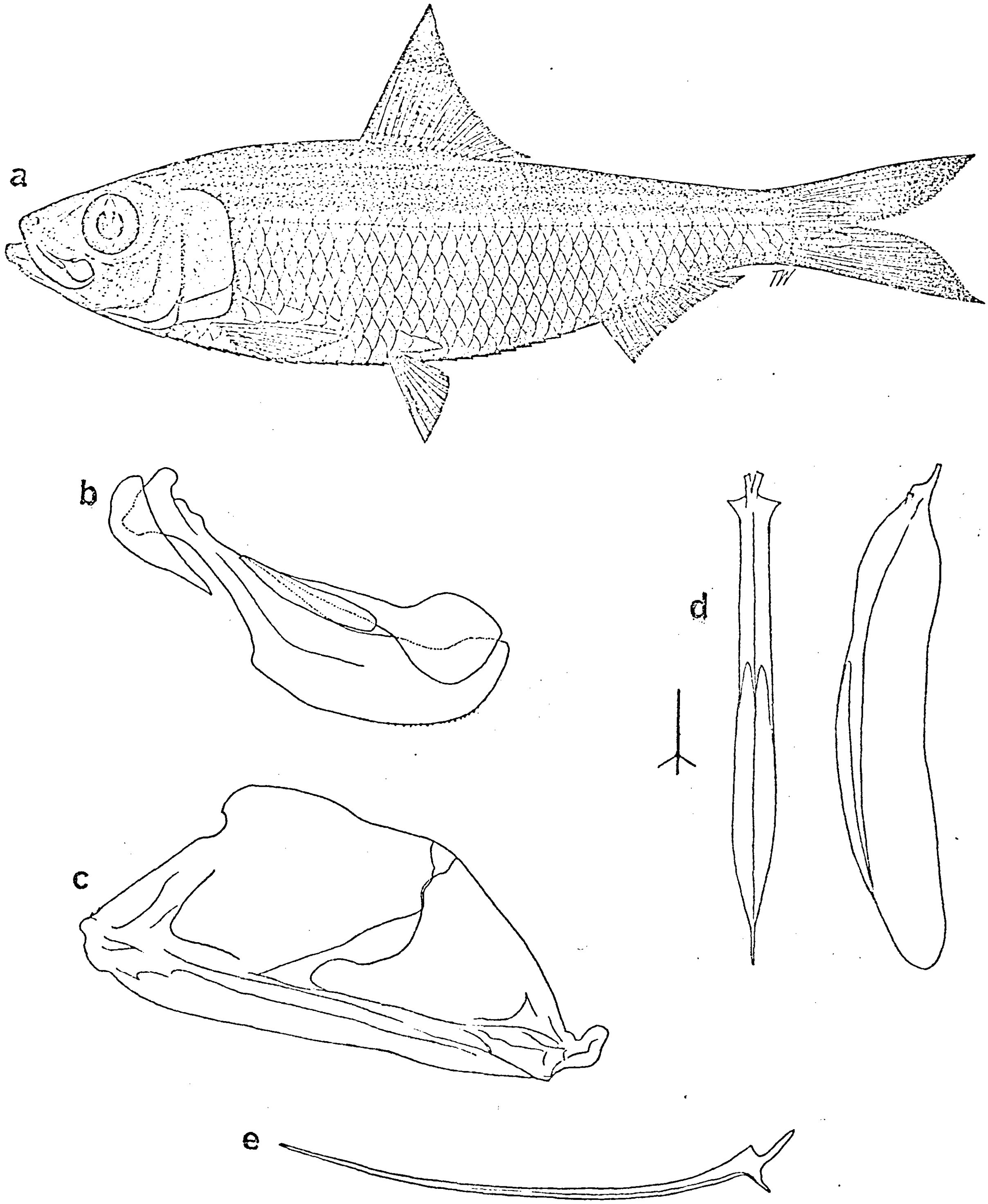


Plate 61. Sardinella (Clupeonia) fijiense:- a, adult; b, c, upper and lower jaws; d, urohyal; e, gillraker (all from BMNH. 1979.3.20.7-8, 100.5 mm S.L. for a, and 114.0 mm S.L. for others).

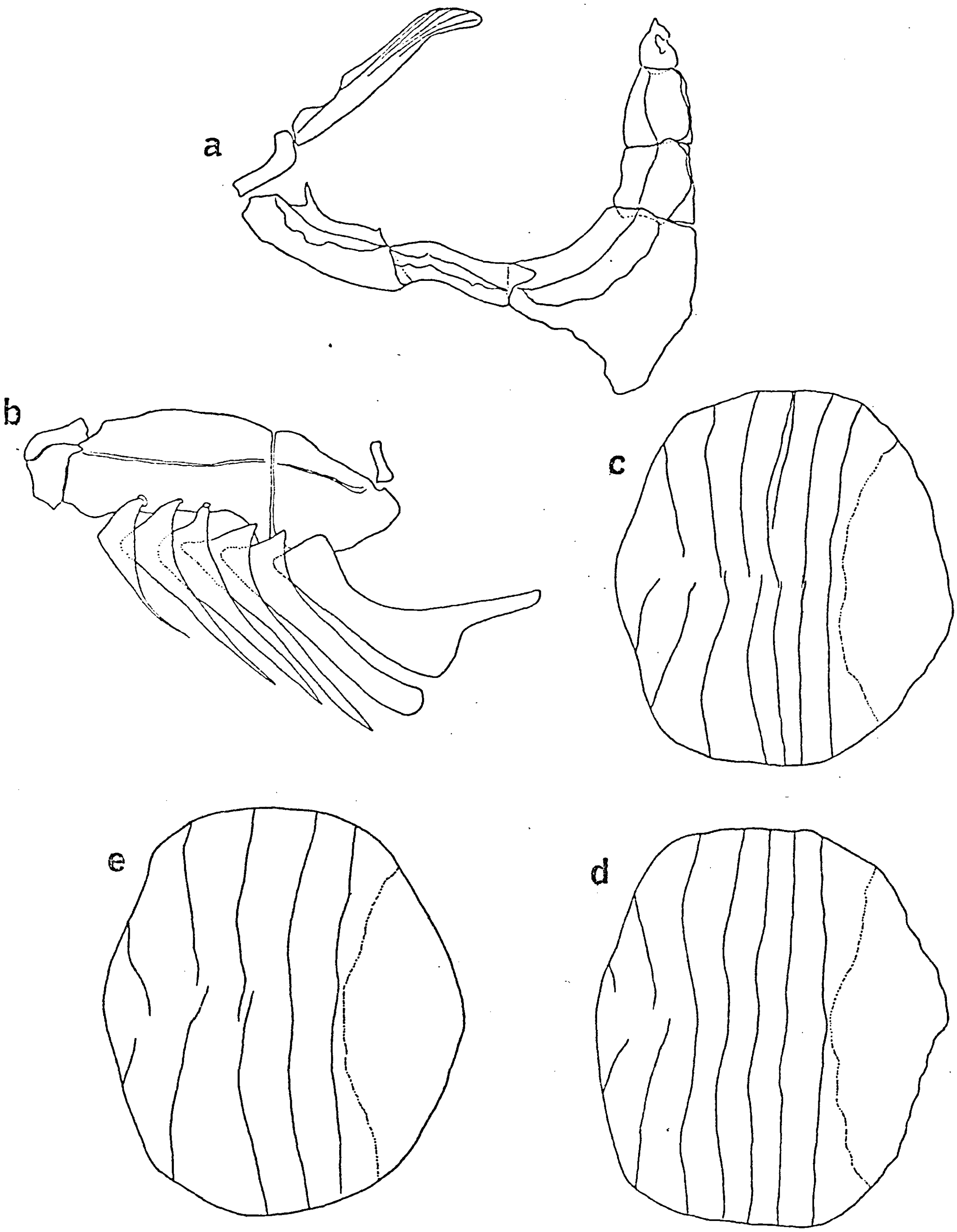


Plate 62. *Sardinella* (*Clupeonia*) *fijiense*:- a, circumorbital bones; b, hyoid arch; c, d, e, scales; (a, b, c, d from BMNH. 1979.3.20.7-8, 114.0 mm S.L.; e, from ANSP. 82799, 62.0 mm S.L.; holotype of *Harengula fijiense*).

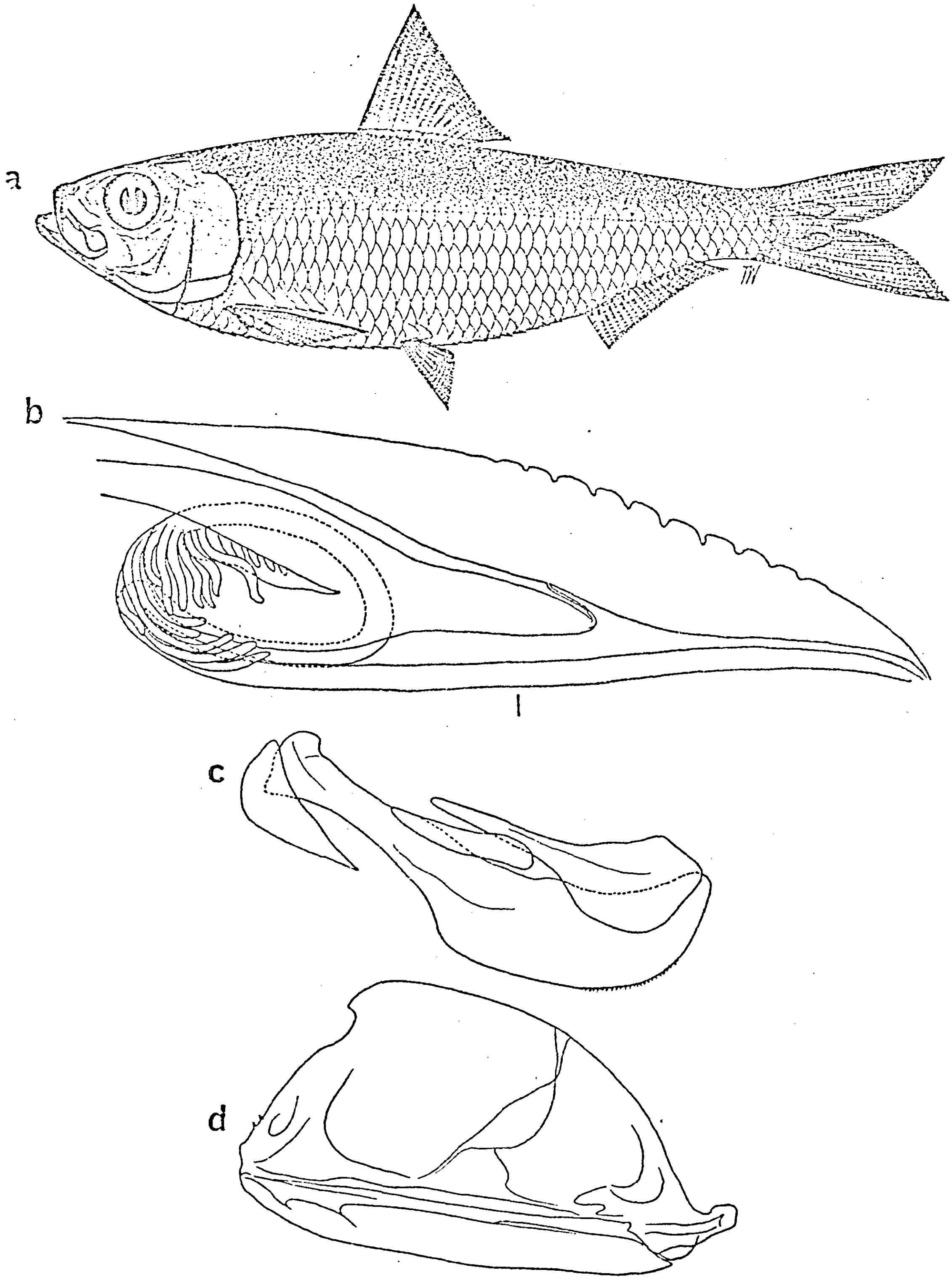


Plate 63. Sardinella (Clupeonia) tawilis:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1933.3.11.5-12, 111.5 mm S.L. for a and 76.0 mm S.L. for others).

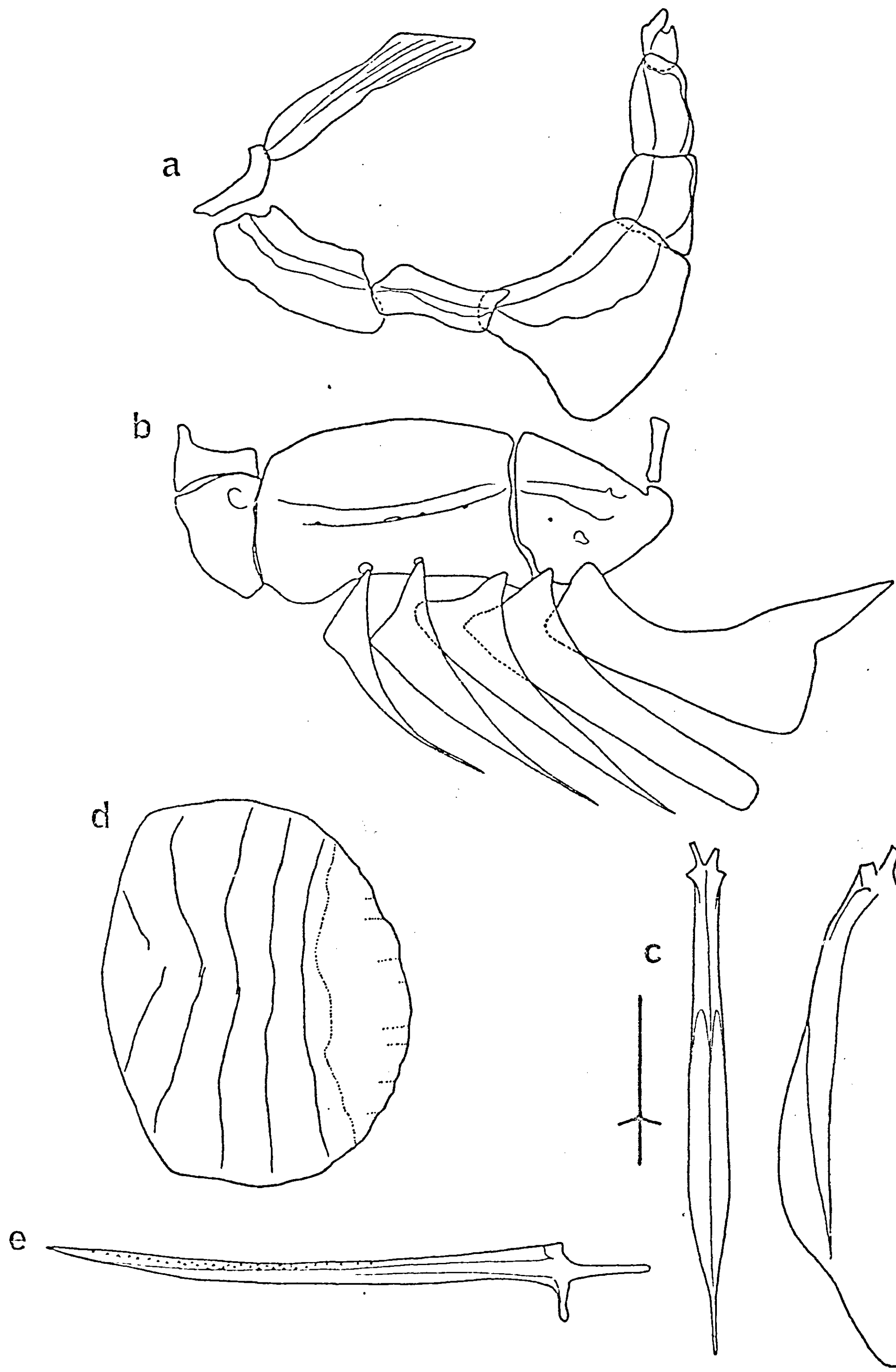


Plate 64. Sardinella (Clupeonia) tawilis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1933.3.11.5-12, 76.0 mm S.L. for a, b, c, e and 94.0 mm S.L. for d.).

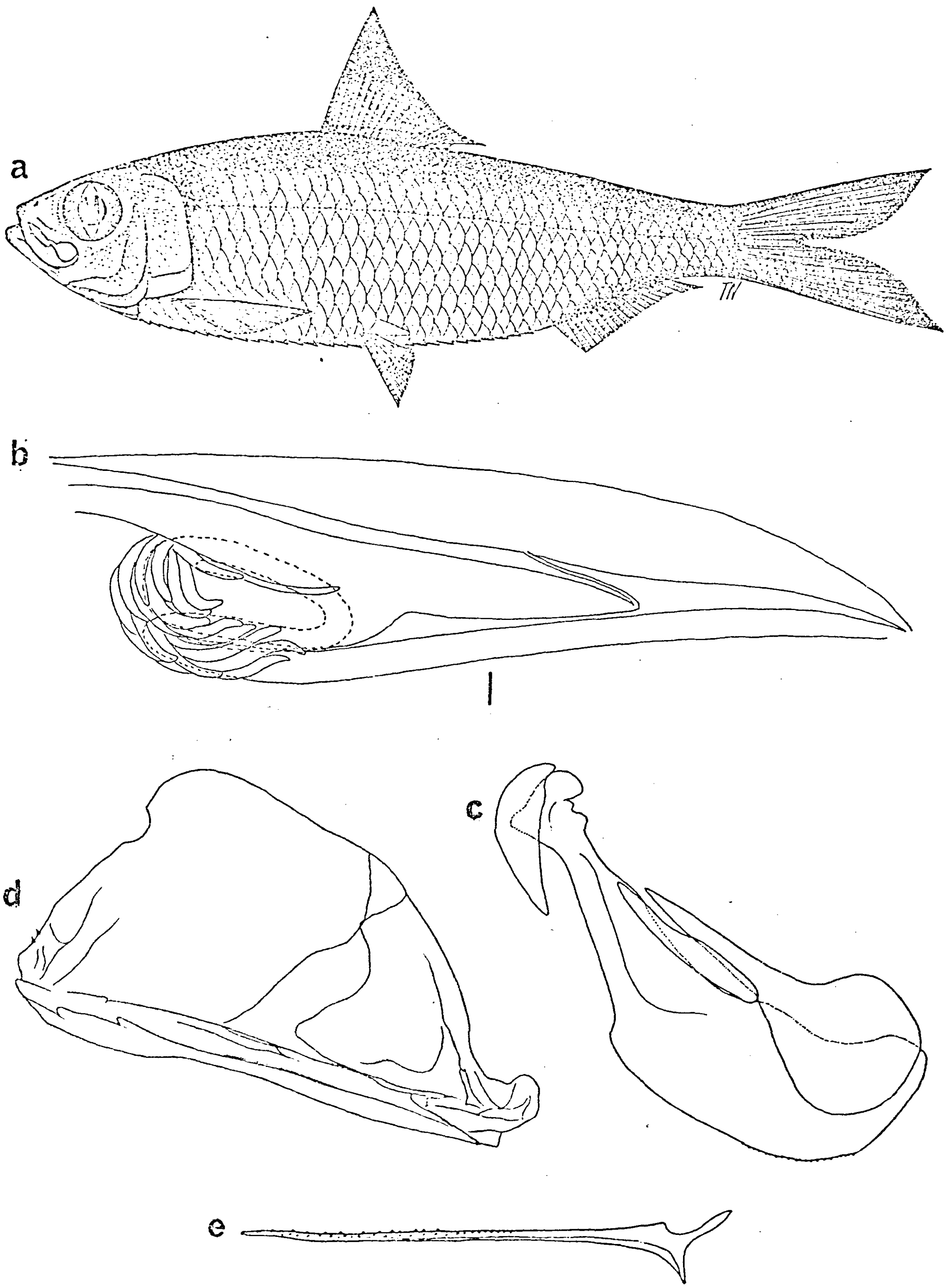


Plate 65. Sardinella (Clupeonia) hualiensis:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, gillraker (a from BMNH. 1979.3.21.332, 119.0 mm S.L.; b, c, d, e from BMNH. 1979.3.21.323-325, 85.5 mm S.L.).

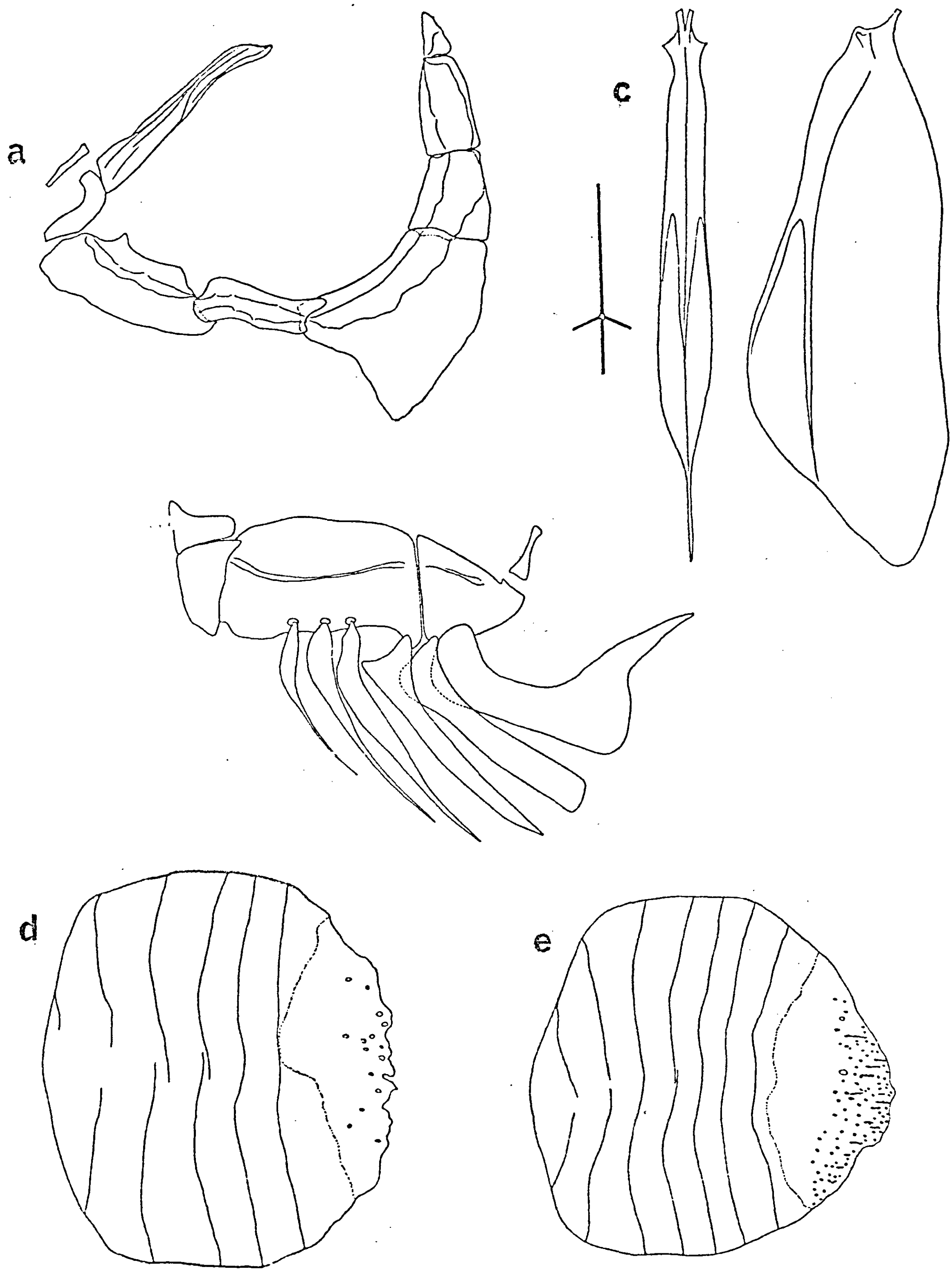


Plate 66. Sardinella (Clupeonia) hualiensis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e scales; (a, b, c from BMNH. 1979.3.21.323-325, 85.5 mm S.L.; d from BMNH. 1979.3.21.327, 83.0 mm S.L.; e from BMNH. 1979.3.21.332, 124.0 mm S.L.).

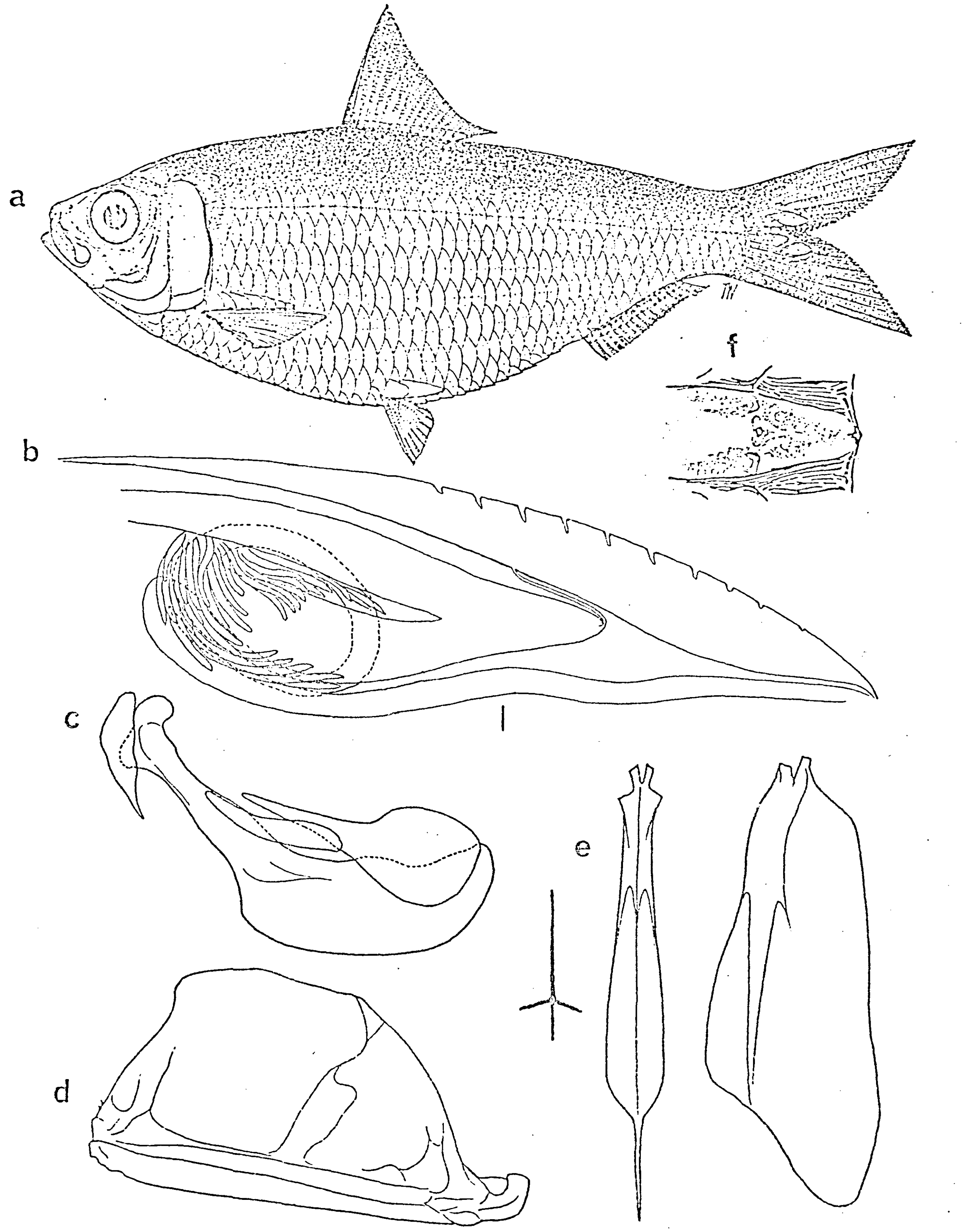


Plate 67. Sardinella (Clupeonia) brachysoma:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, urohyal; f, frontoparietal striae, (a, f from BMNH. 1867.11.28.38, 114.0 mm S.L., lectotype of Sardinella brachysoma; others from BMNH. 1870.6.7.9-10, 126.0 mm S.L.).

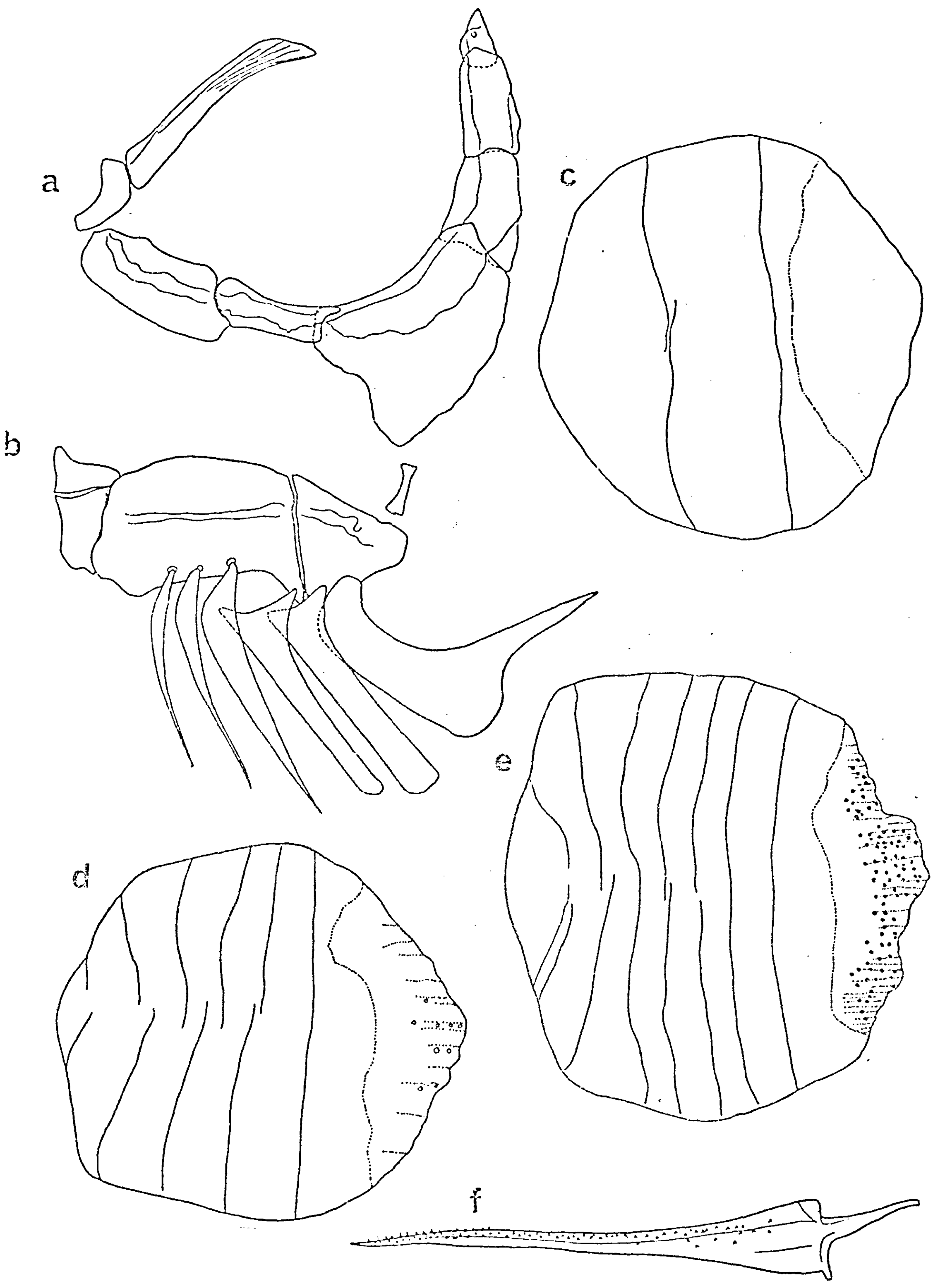


Plate 68. Sardinella (Clupeonia) brachysoma:- a, circumorbital bones; b, hyoid arch; c, d, e, scales; f, gillraker (a, b, f from BMNH. 1870.6.7.9-10, 126.0 mm S.L.; c from MNHN. uncat., 42.0 mm S.L.; d from MNHN. 3716, 58.6 mm S.L., holotype of Meletta schlegelii; e from BMNH. 1867.11.28.29, 124.0 mm S.L., lectotype of Harengula hypselosoma).

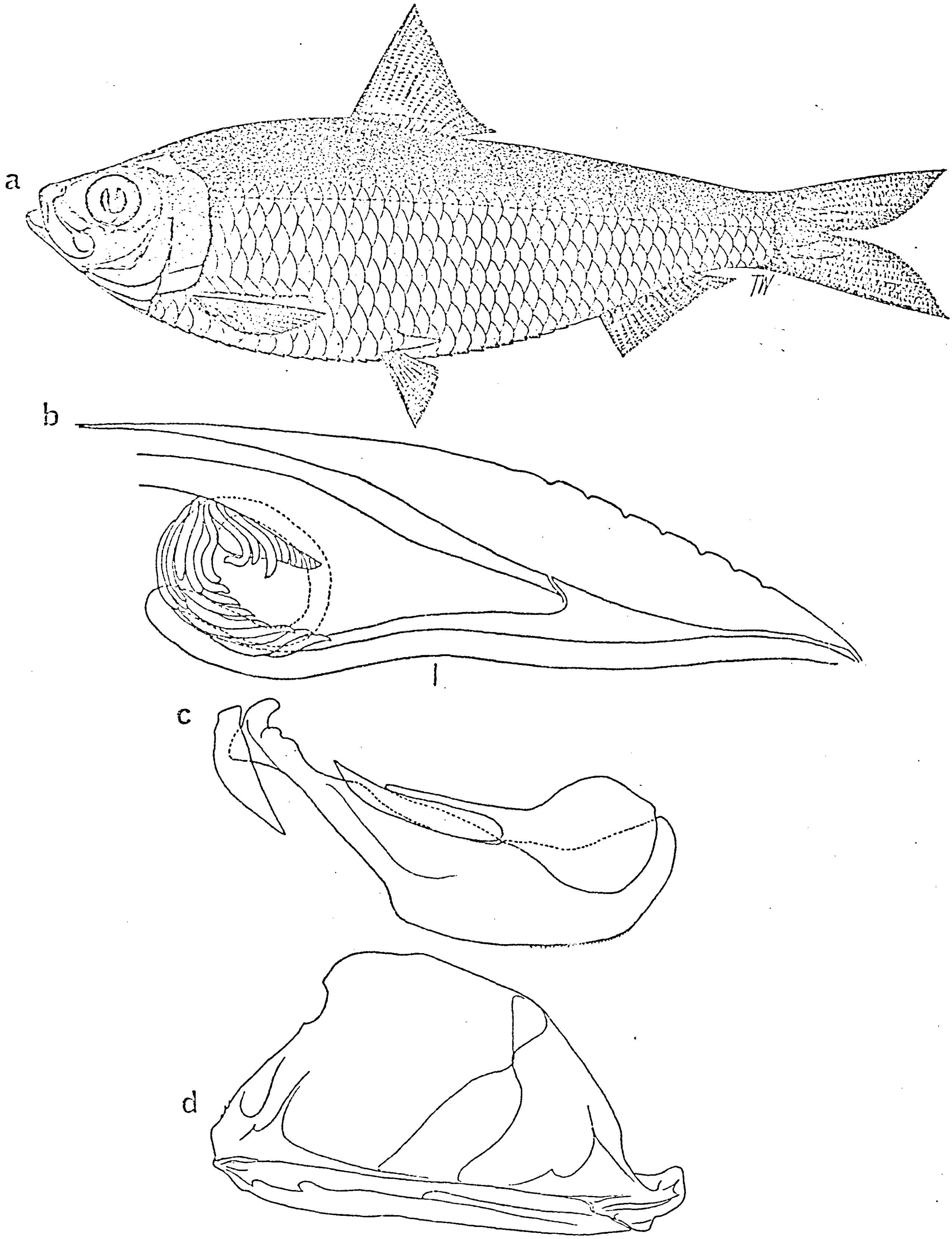


Plate 69. *Sardinella* (*Clupeonia*) *richardsoni*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1965.7.5.1-10, paratypes, 105.0 mm S.L. for a, and 102.0 mm S.L. for others).

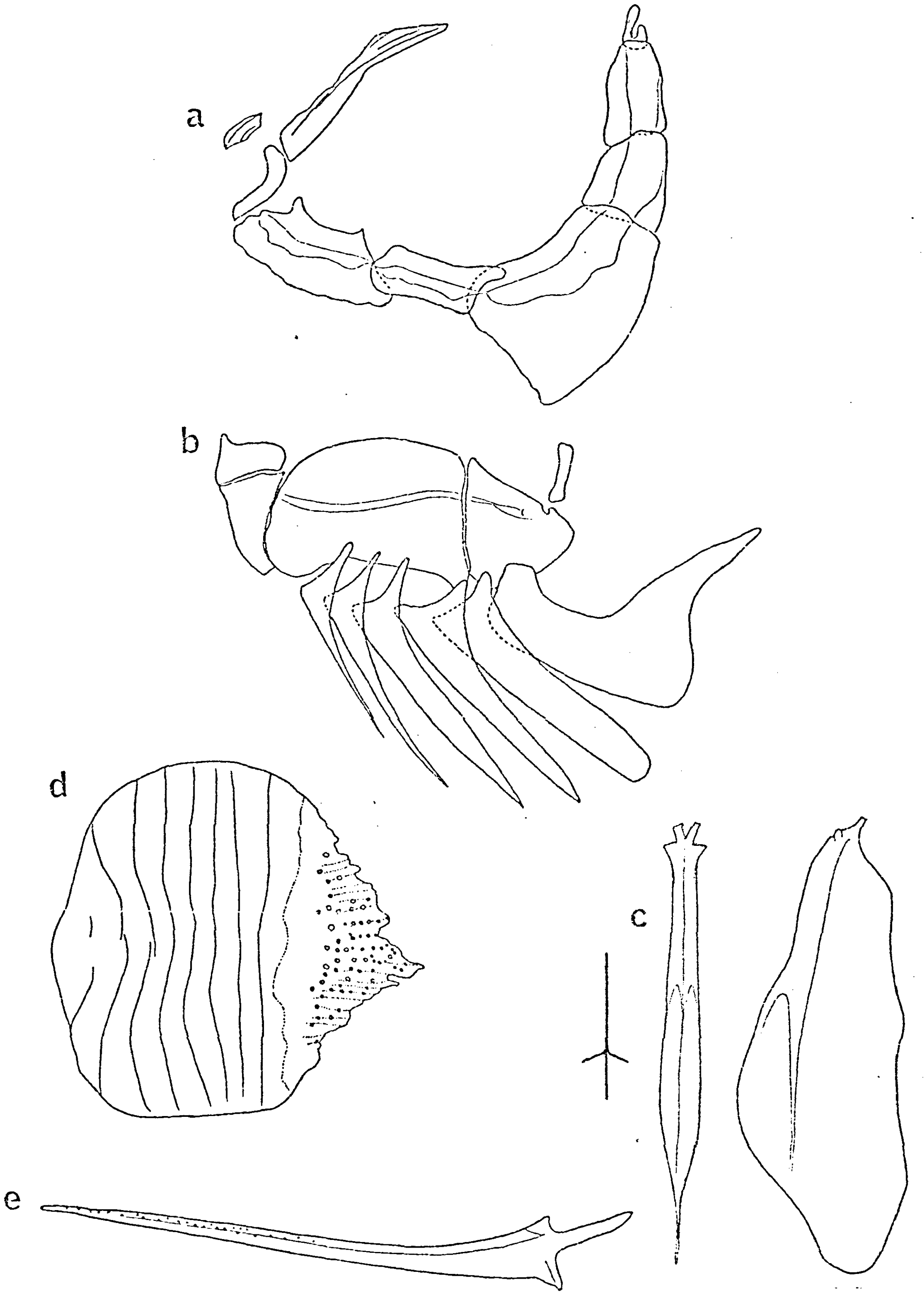


Plate 70. Sardinella (Clupeonia) richardsoni:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1965.7.5. 1-10, 102.0 mm S.L., paratype).

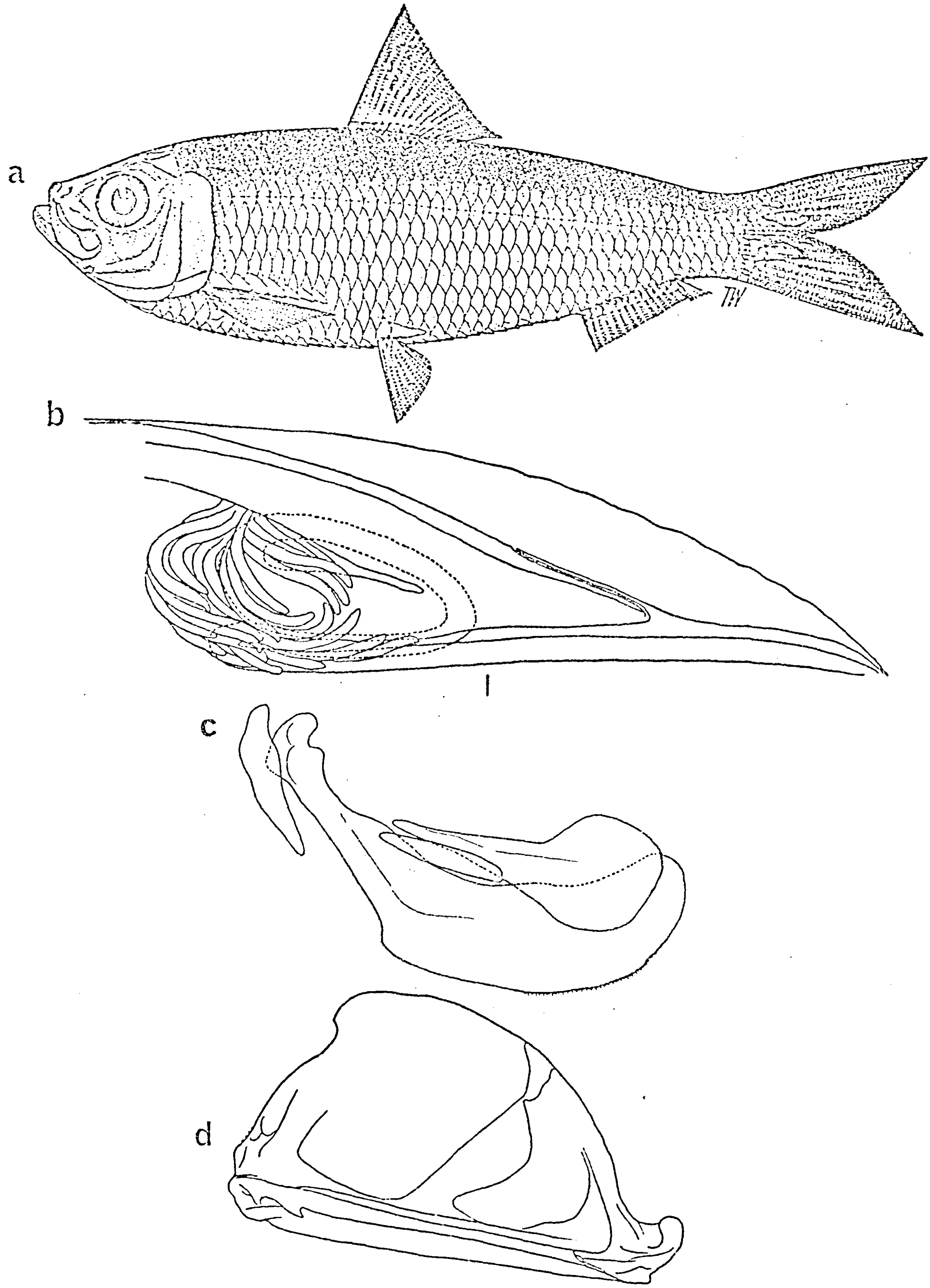


Plate 71. Sardinella (Clupeonia) zunasi:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1928.6.22.2, 88.5 mm S.L., b, c, d from BMNH. 1977.9.6.1-9, 116.0 mm S.L. for b and 114.0 mm S.L. for others).

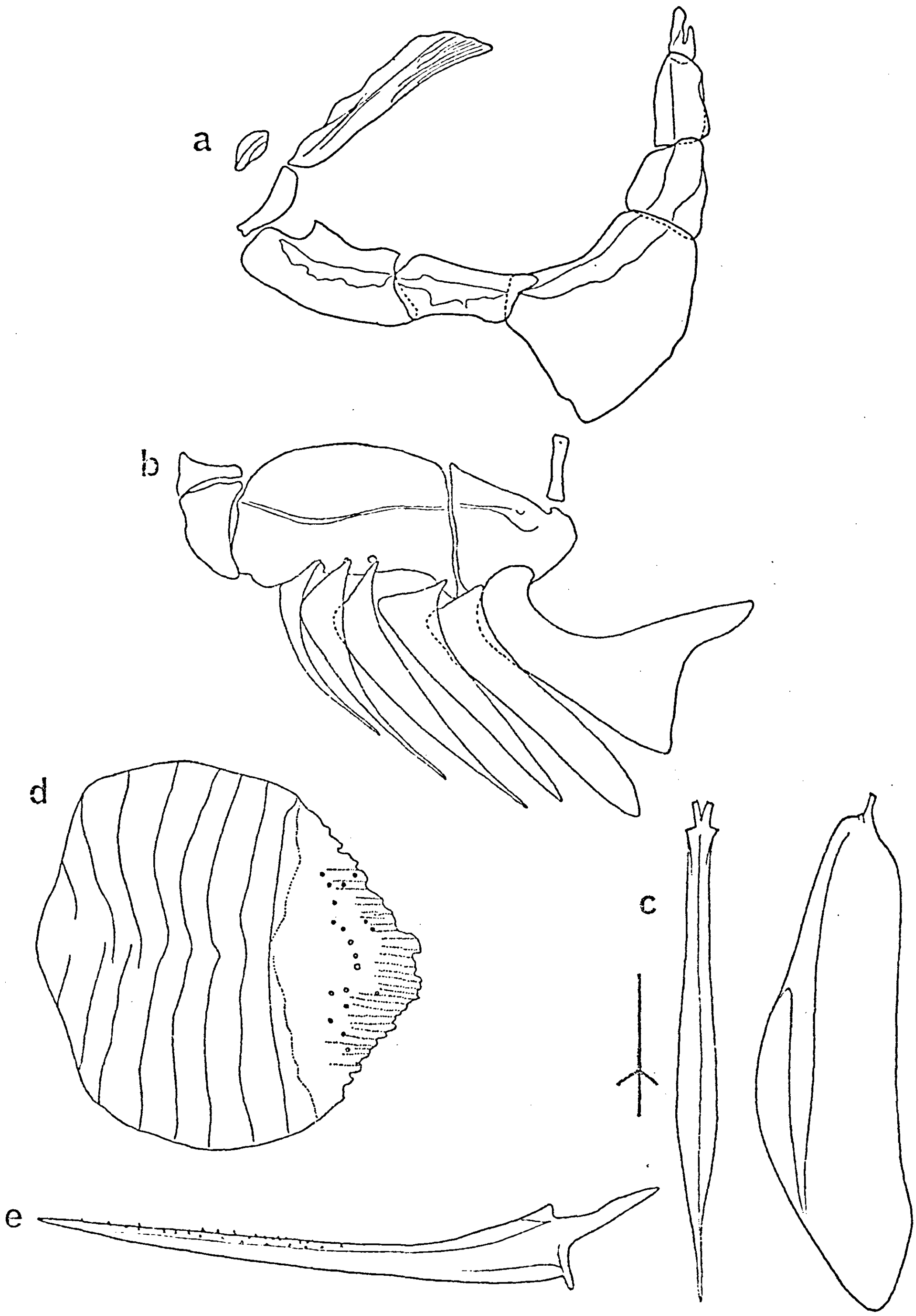


Plate 72. Sardinella (Clupeonia) zunasi:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1977.9.6.1-9, 114.0 mm S.L. for a, b, c, e and 110.0 mm S.L. for d).

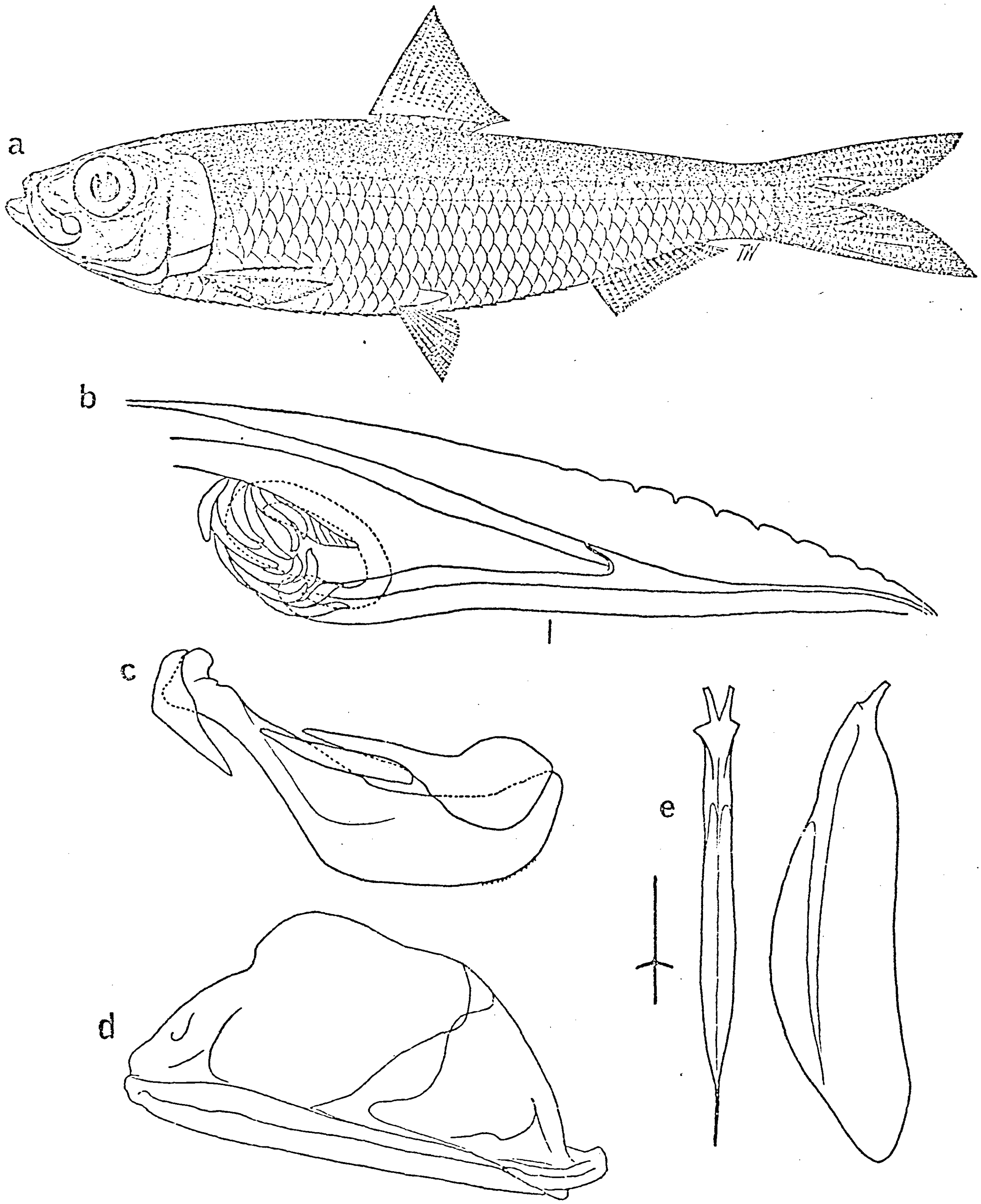


Plate 73. Sardinella (Clupeonia) marquesensis:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, urohyal (all from BMNH. 1965. 1.25.21-22, 83.5 mm S.L. for a and 79.5 mm S.L. for others).

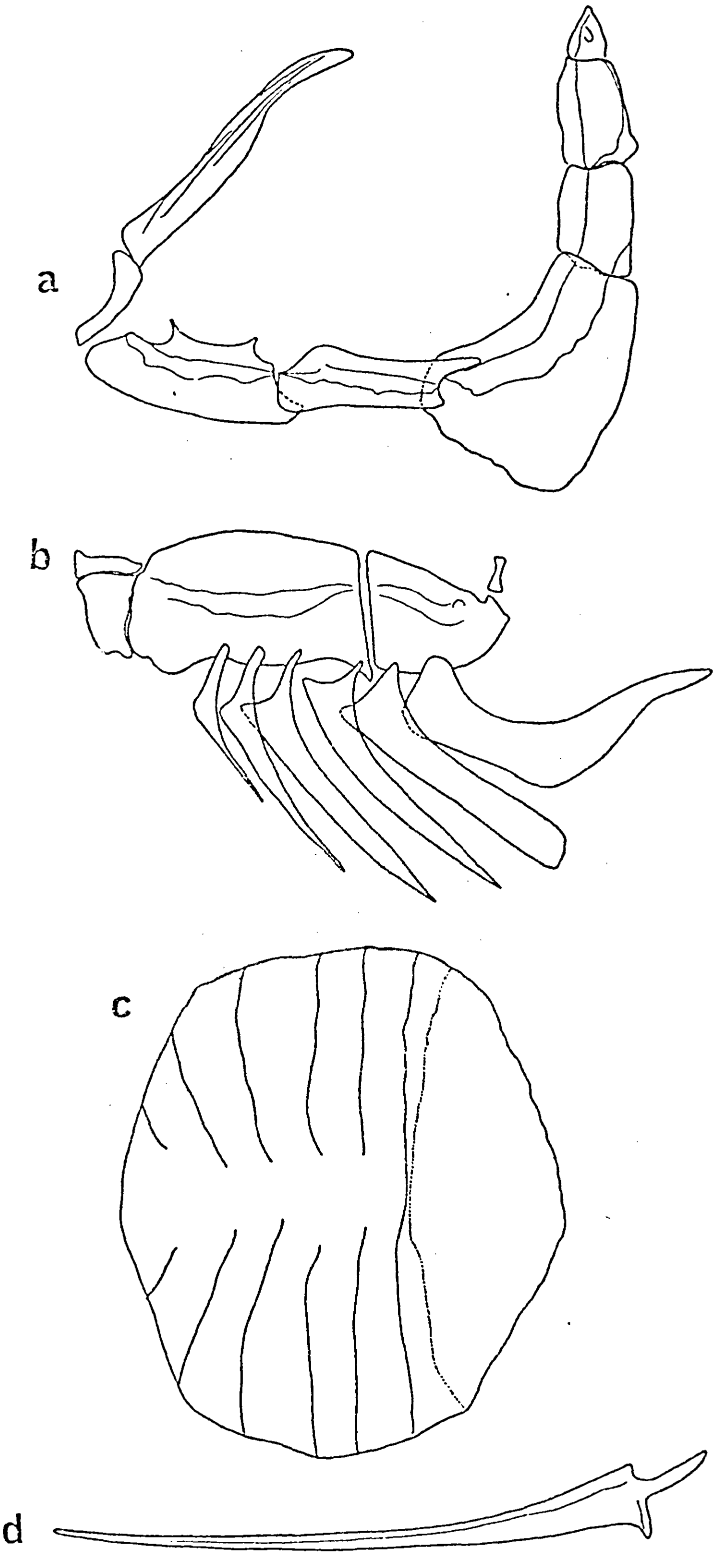


Plate 74. *Sardinella* (*Clupeonia*) *marquesensis*:- a, circumorbital bones; b, hyoid arch; c, scales; d, gillraker (all from BMNH. 1965.1.25.21-22, 79.5 mm S.L.).

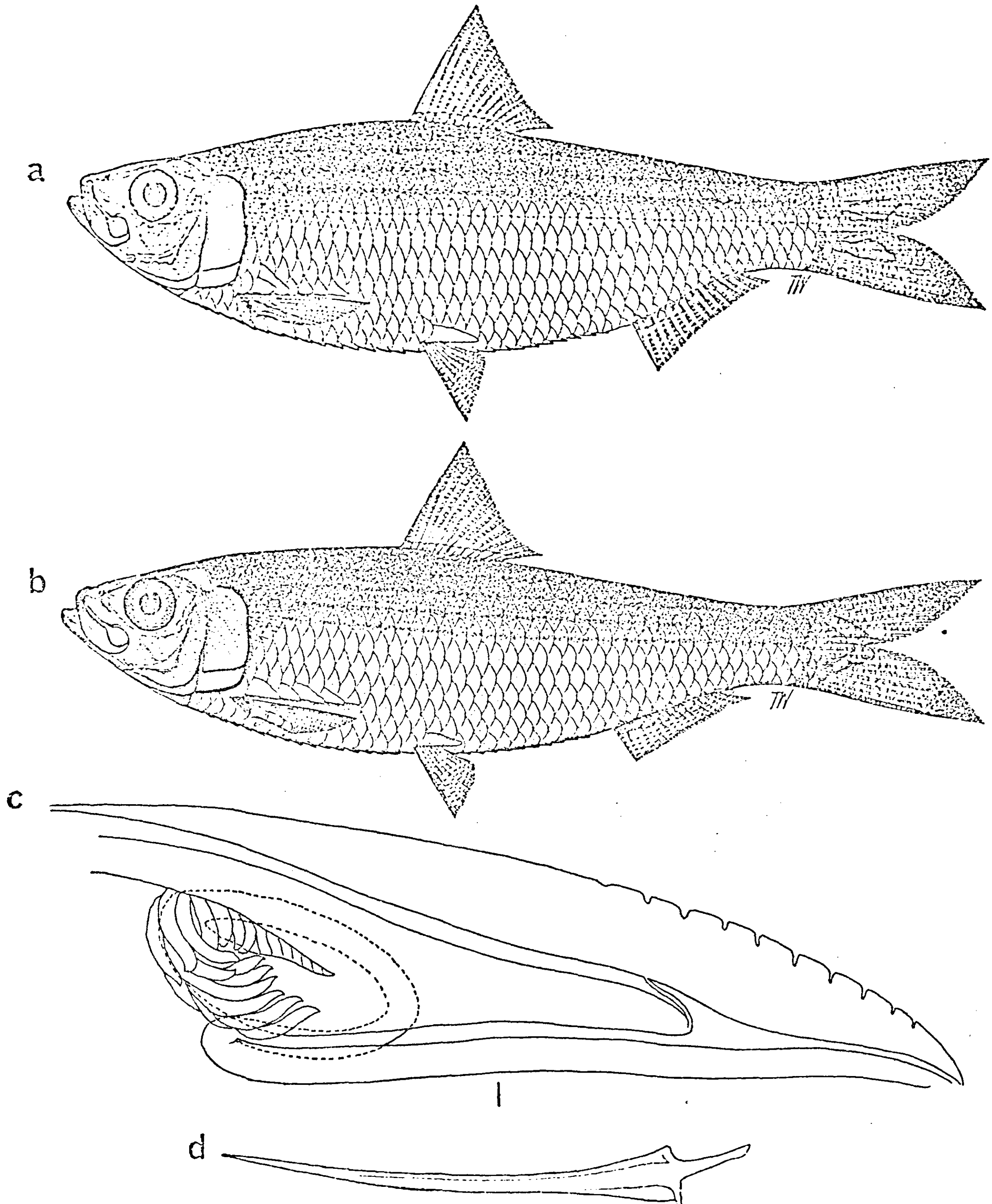


Plate 75. Sardinella (Clupeonia) melanura:- a, b, adults; West Indian Ocean an Samoan forms respectively; c, gas bladder and digestive tract; d, gillraker (a from RUSI. 1321.6, 114.0 mm S.L.; b from BMNH. 1970.5.27.14, 93.0 mm S.L.; c, d from BMNH. 1872.4.6.52, 80.5 mm S.L.).

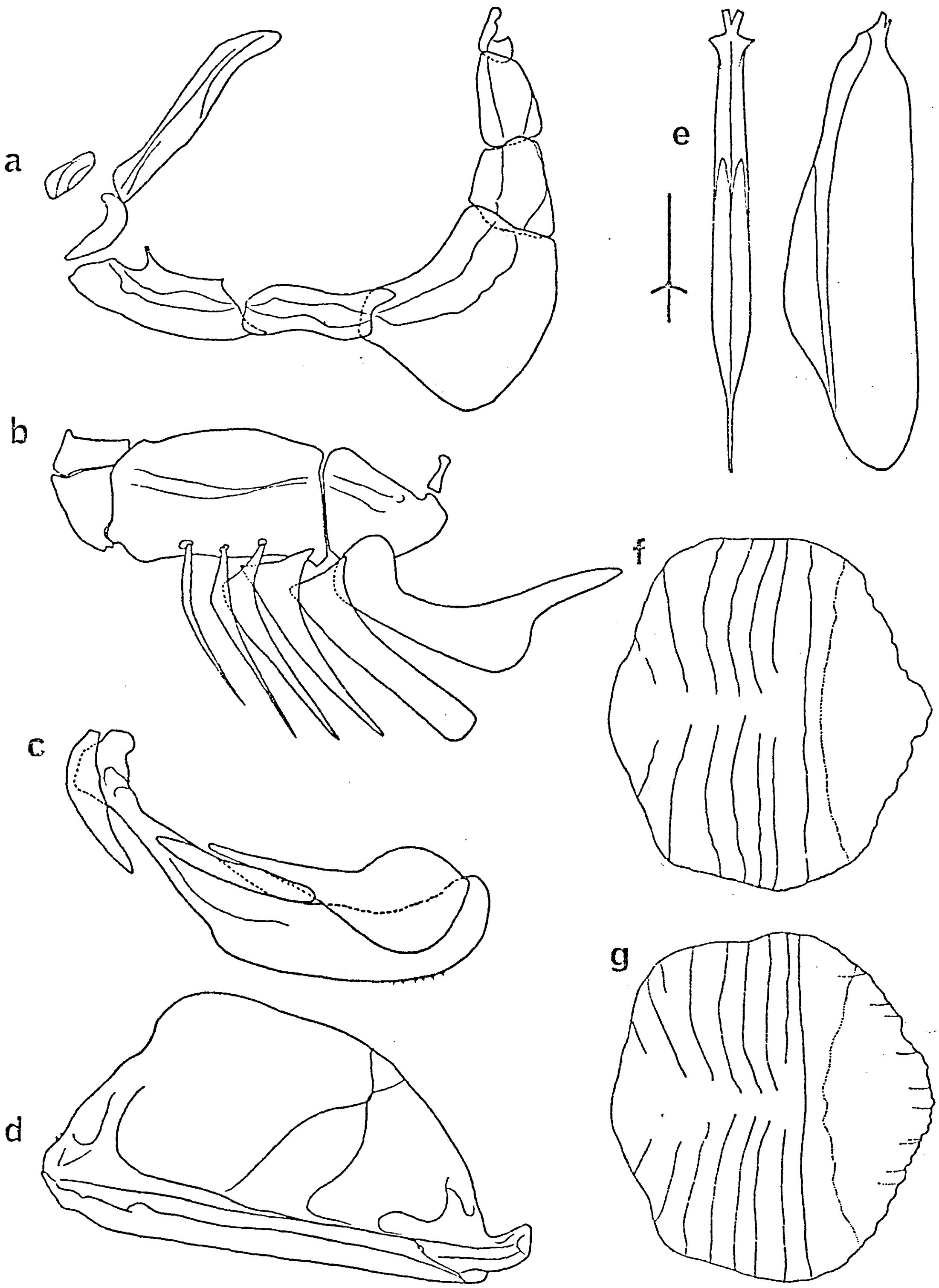


Plate 76. Sardinella (Clupeonia) melanura:- a, circumorbital bones; b, hyoid arch; c, d, upper and lower jaws; e, urohyal; f, g, scales (a, b, c, d, e from BMNH. 1872.4.6.52, 80.5 mm S.L.; f from SU. 25031, 102.0 mm S.L., holotype of Sardinella nigricaudata; g from BMNH. 1979.8.16.841, 106.0 mm S.L.)

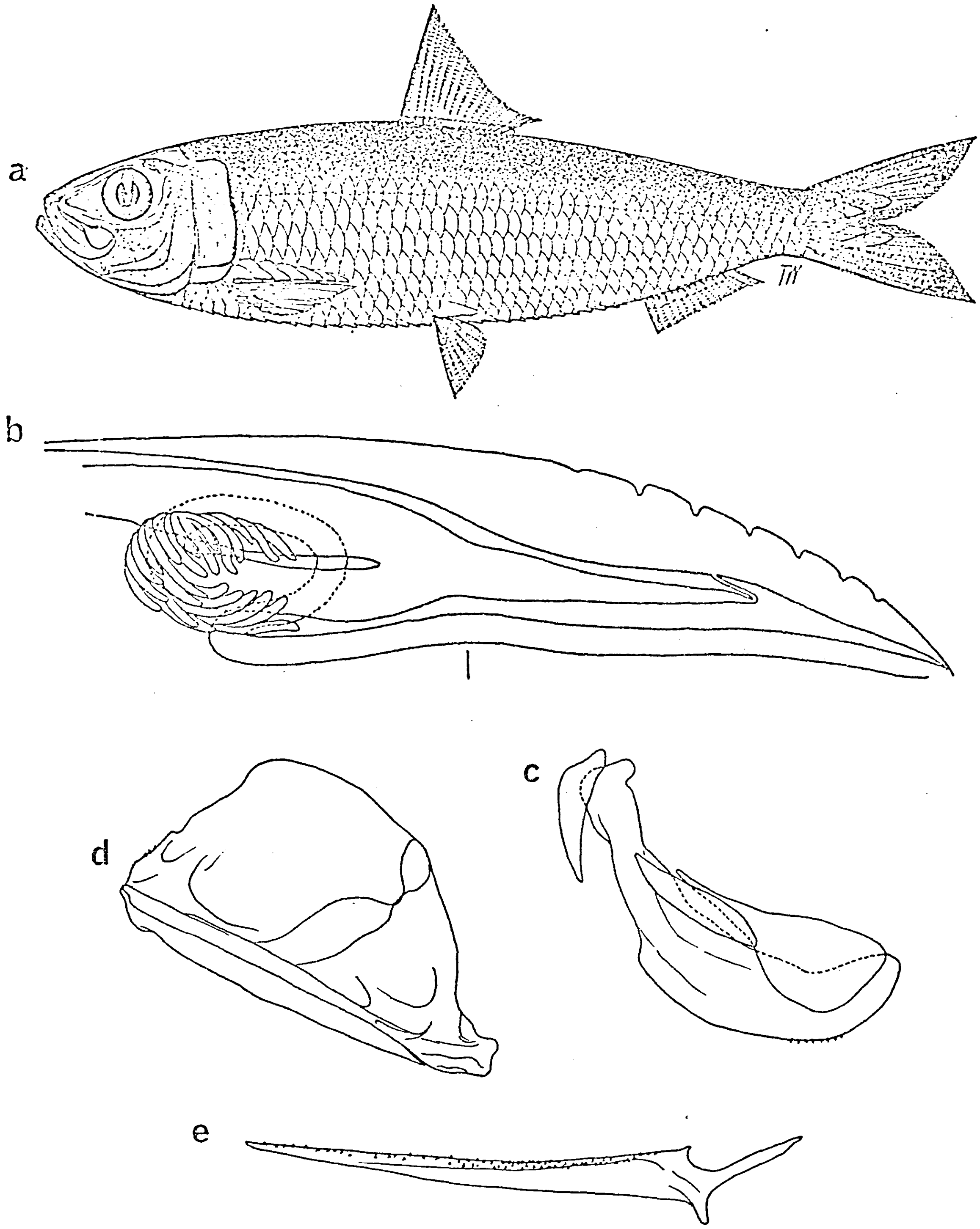


Plate 77. Sardinella (Clupeonia) atricauda:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, gillraker (a from BMNH. 1858.4.21.290-291, 117.0 mm S.L.; b, c, d, e from BMNH. 1979.8.17.14, 125.0 mm S.L.).

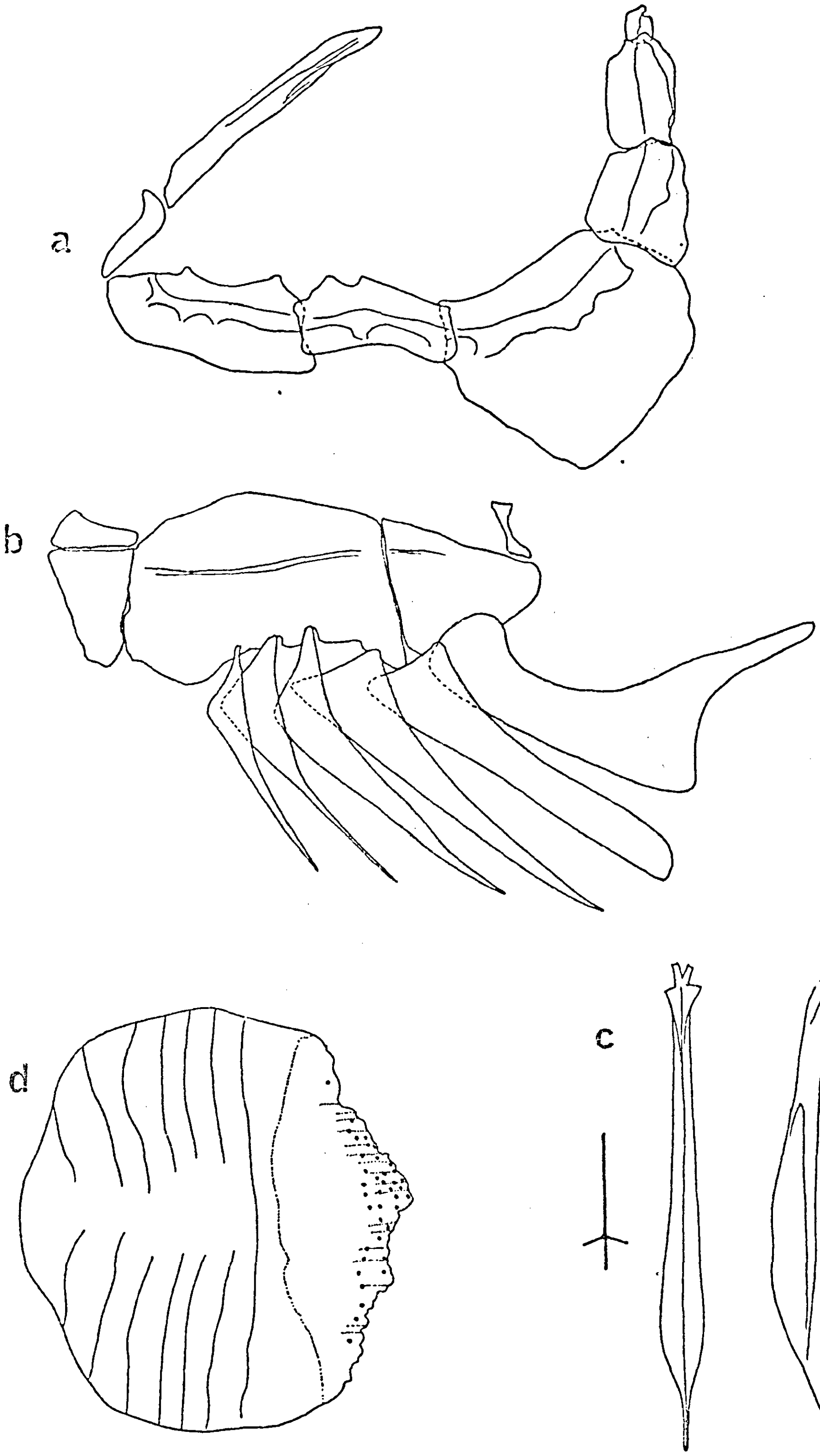


Plate 78. Sardinella (Clupeonia) atricauda:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale (all from BMNH. 1979.8.17.14, 125.0 mm S.L.).

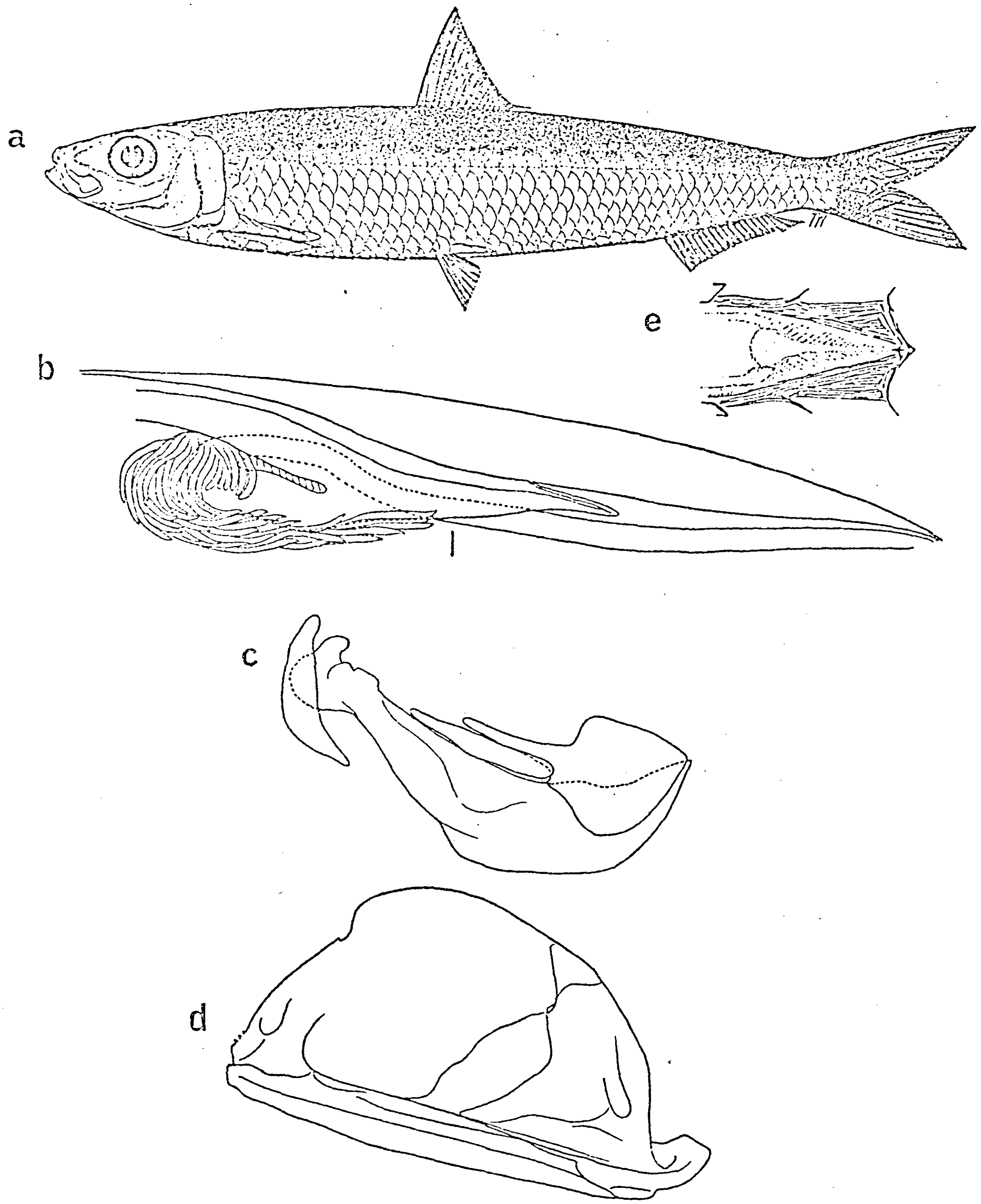


Plate 79. Amblygaster sirm:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, frontoparietal striae, (a, e from BMNH. 1867. 11.28.40, 176.0 mm S.L.; b, c, d from BMNH. 1966.11.16.204-213, 150.0 mm S.L. for b and 125.0 mm S.L. for c, d).

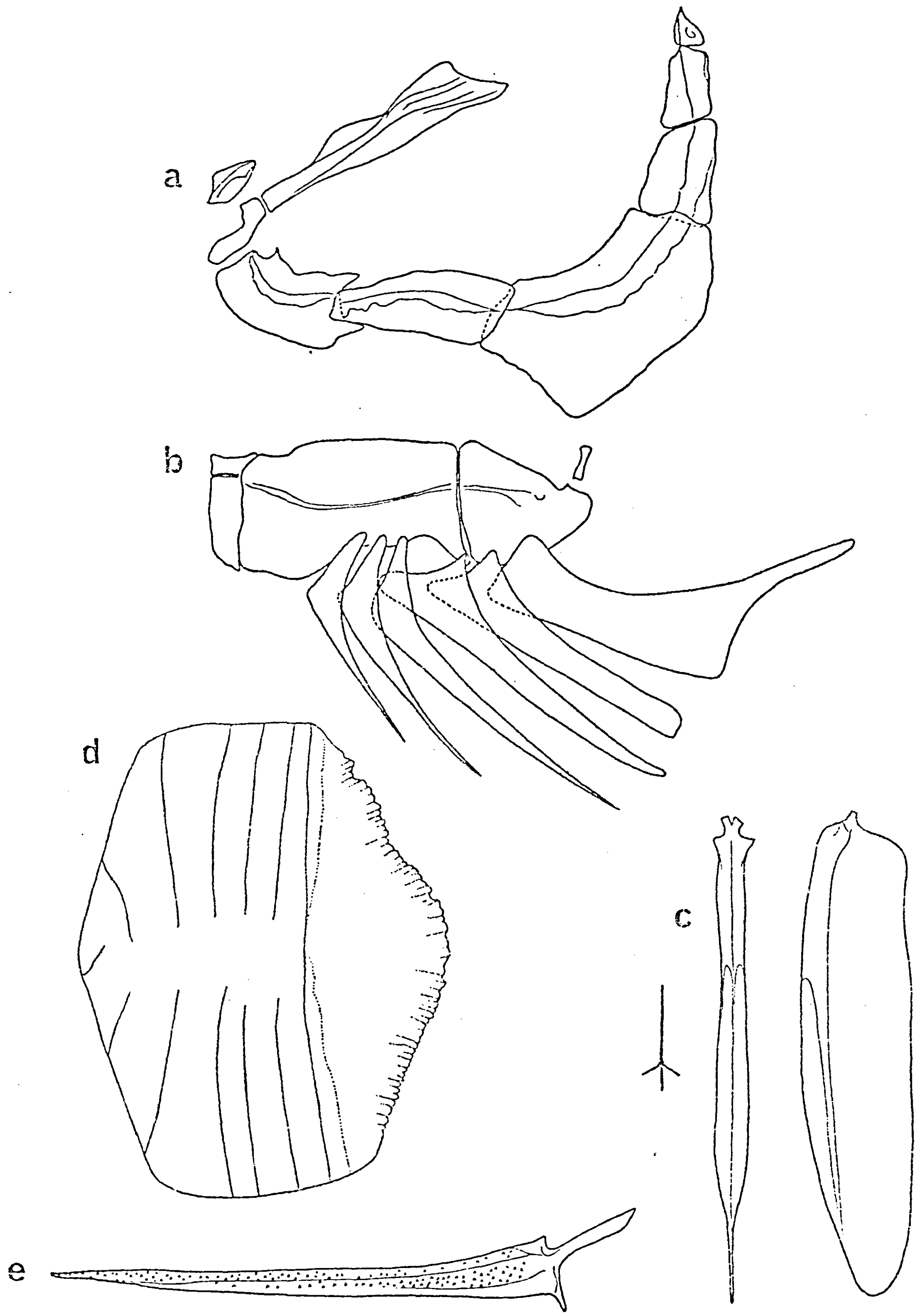


Plate 80. Amblygaster sirm:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1966.11.16.204-213, 125.0 mm S.L.; d from BMNH. 1927.4.14.2-3, 181.0 mm S.L.).

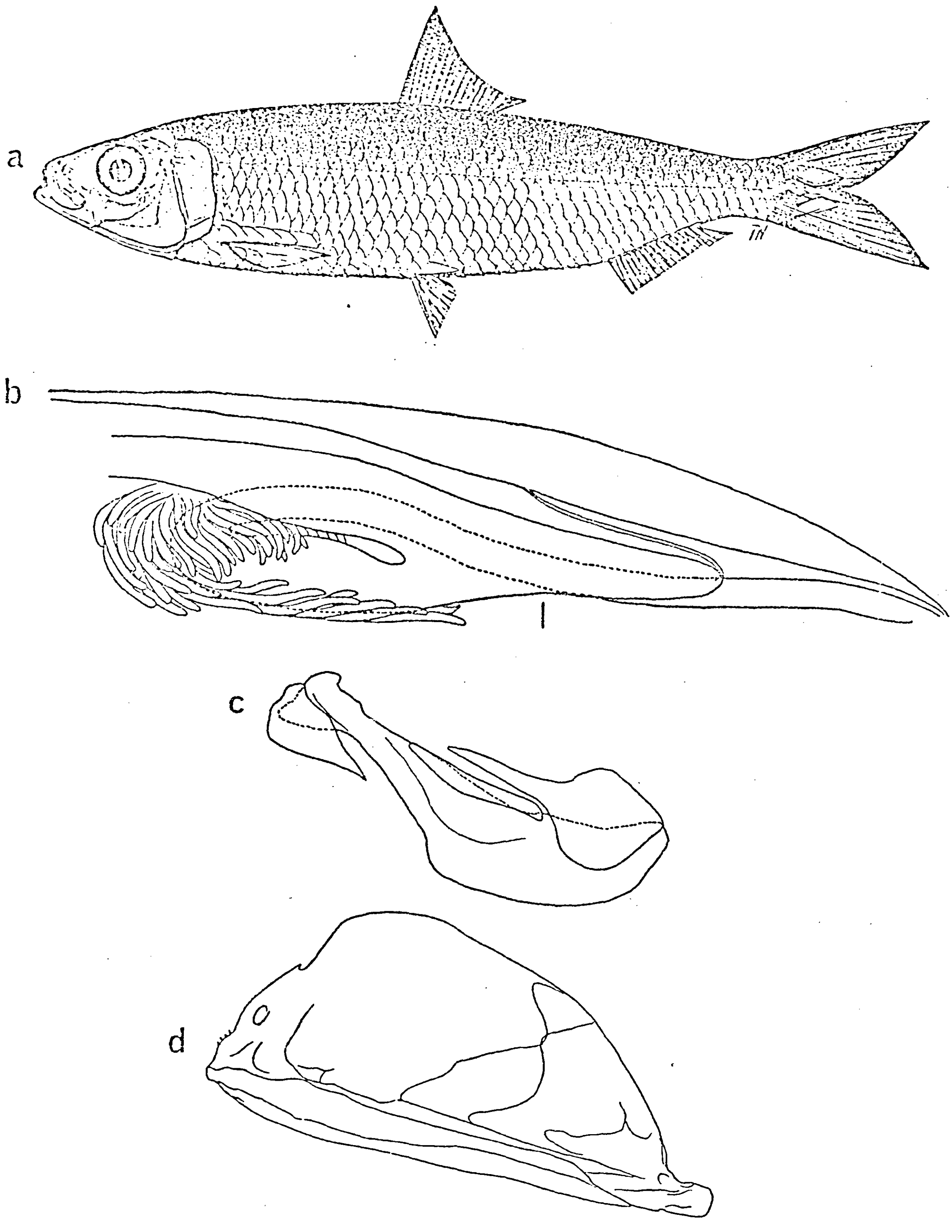


Plate 81. Amblygaster clupeoides:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a, b from BMNH. 1889.2.1.1987, 150.0 mm S.L.; c, d from BMNH. 1936.10.21.1, 102.0 mm S.L.).

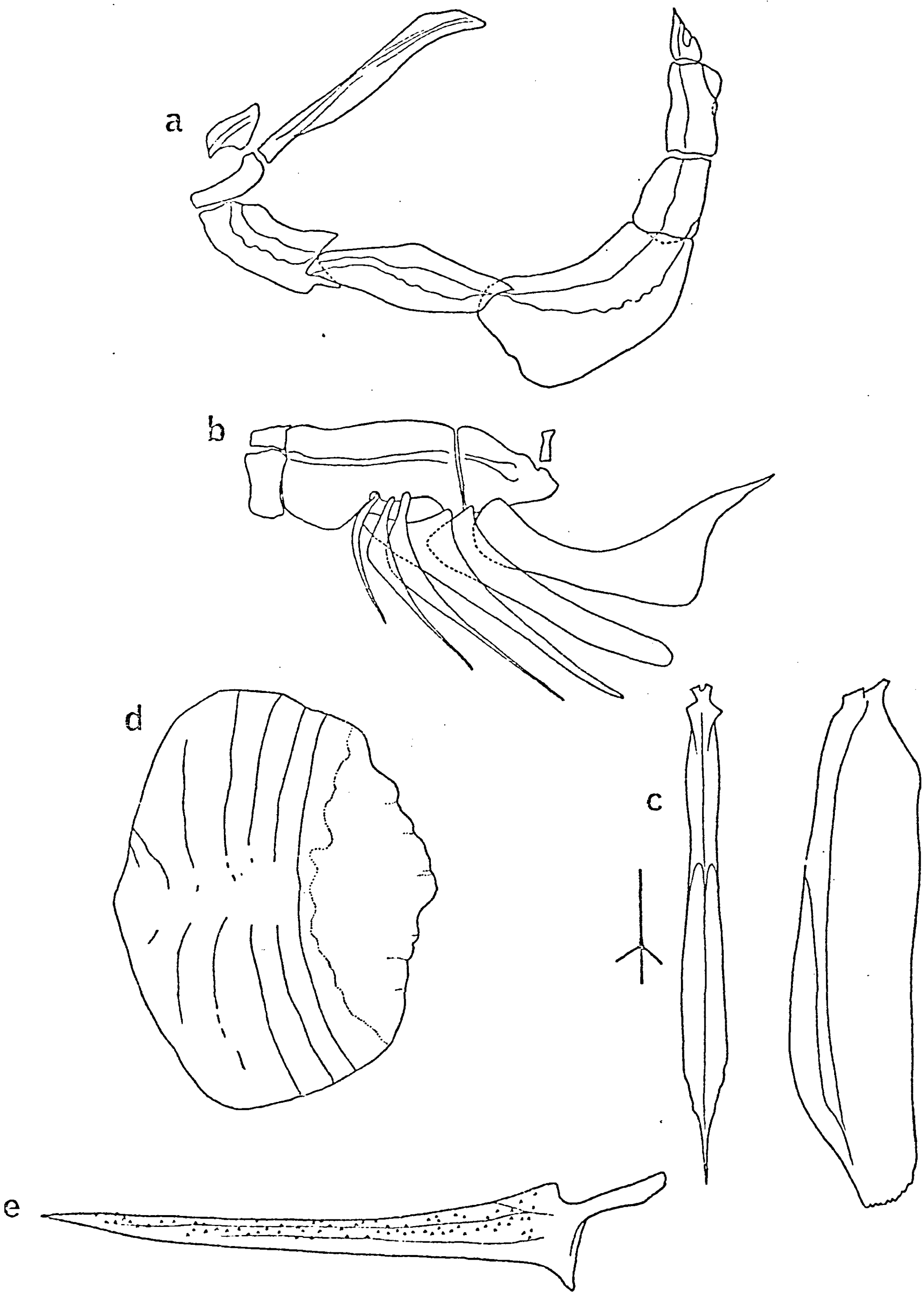


Plate 82. Amblygaster clupeoides:- a, circumorbital bones; a, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1936.10.21.1, 102.0 mm S.L.; d from BMNH. 1889.2.1.1987, 150.0 mm S.L.).

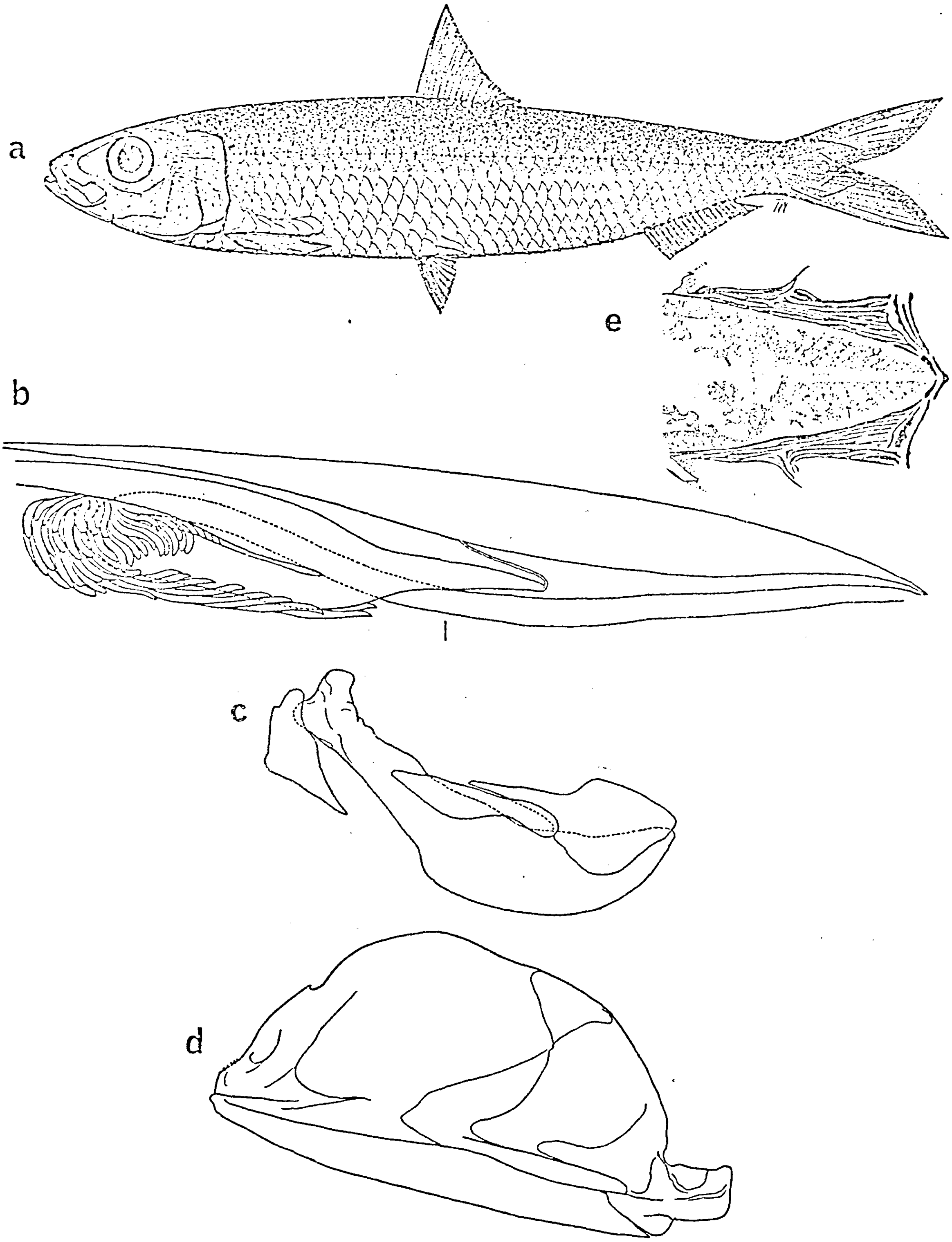


Plate 83. Amblygaster leiogaster:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, e, frontoparietal striae, (a, e from MFLB. uncat., 184.0 mm S.L., b, c, d from BMNH. 1973.4.5.12-19, 194.0 mm S.L. for b and 213.0 mm S.L. for c, d).

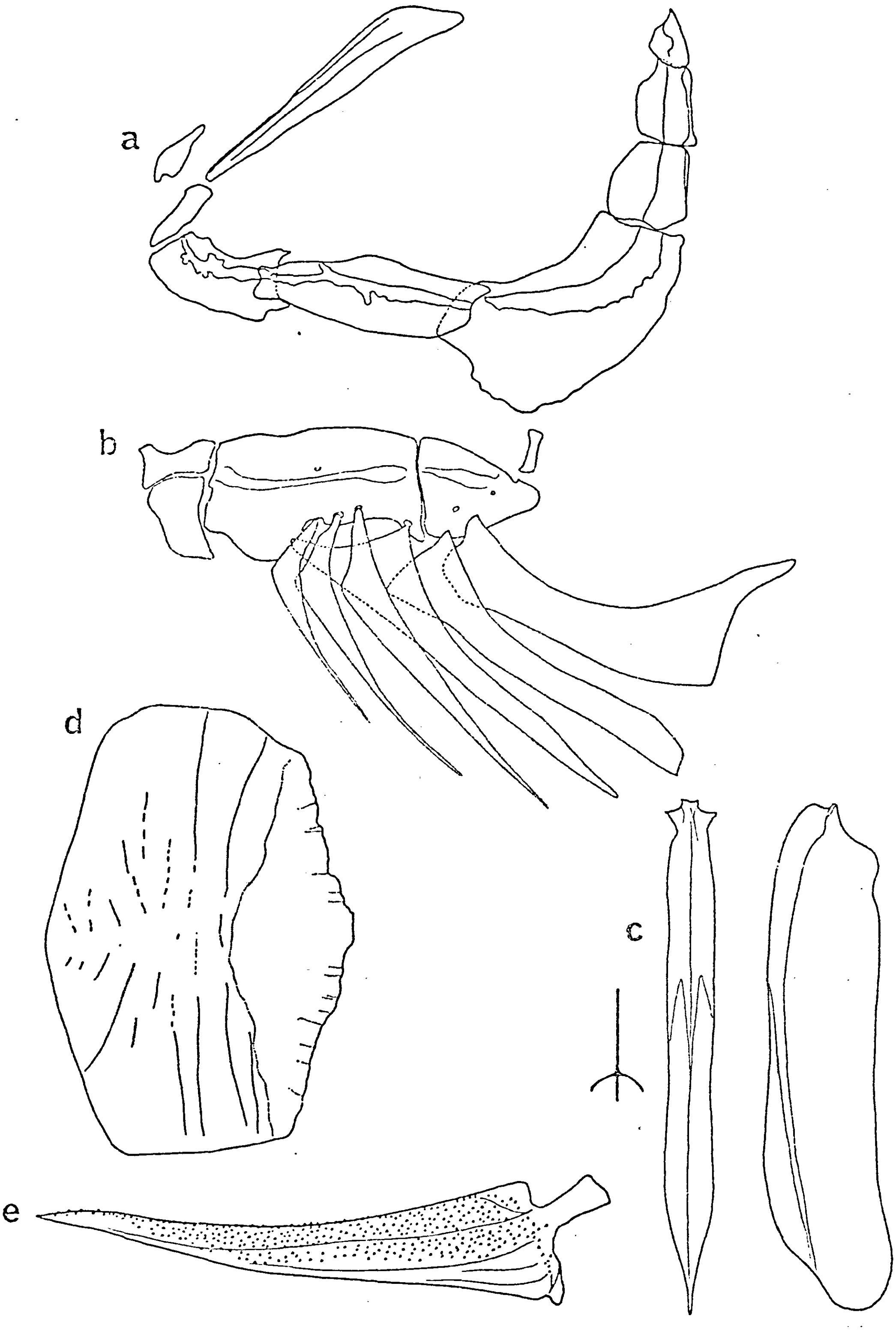


Plate 84. Amblygaster leiogaster:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1973.4.5.12-19, 213.0 mm S.L.; d from BMNH. 1867.11.28.39, 215.0 mm S.L.).

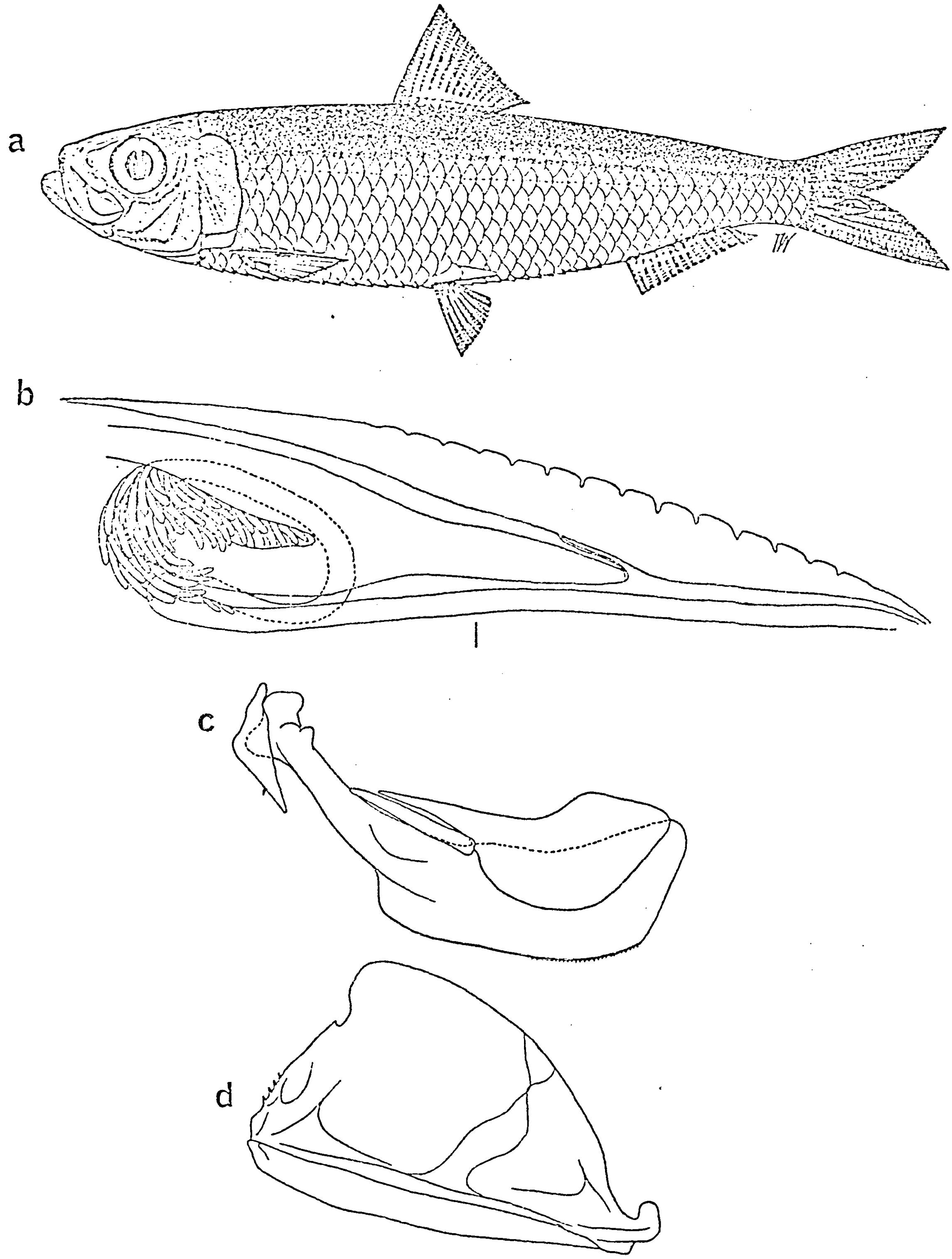


Plate 85. Herklotsichthys quadrimaculatus:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1933.3.11.19, 112.0 mm S.L.; b, c, d from BMNH. 1974.8.19.1-12, 100.0 mm S.L.).

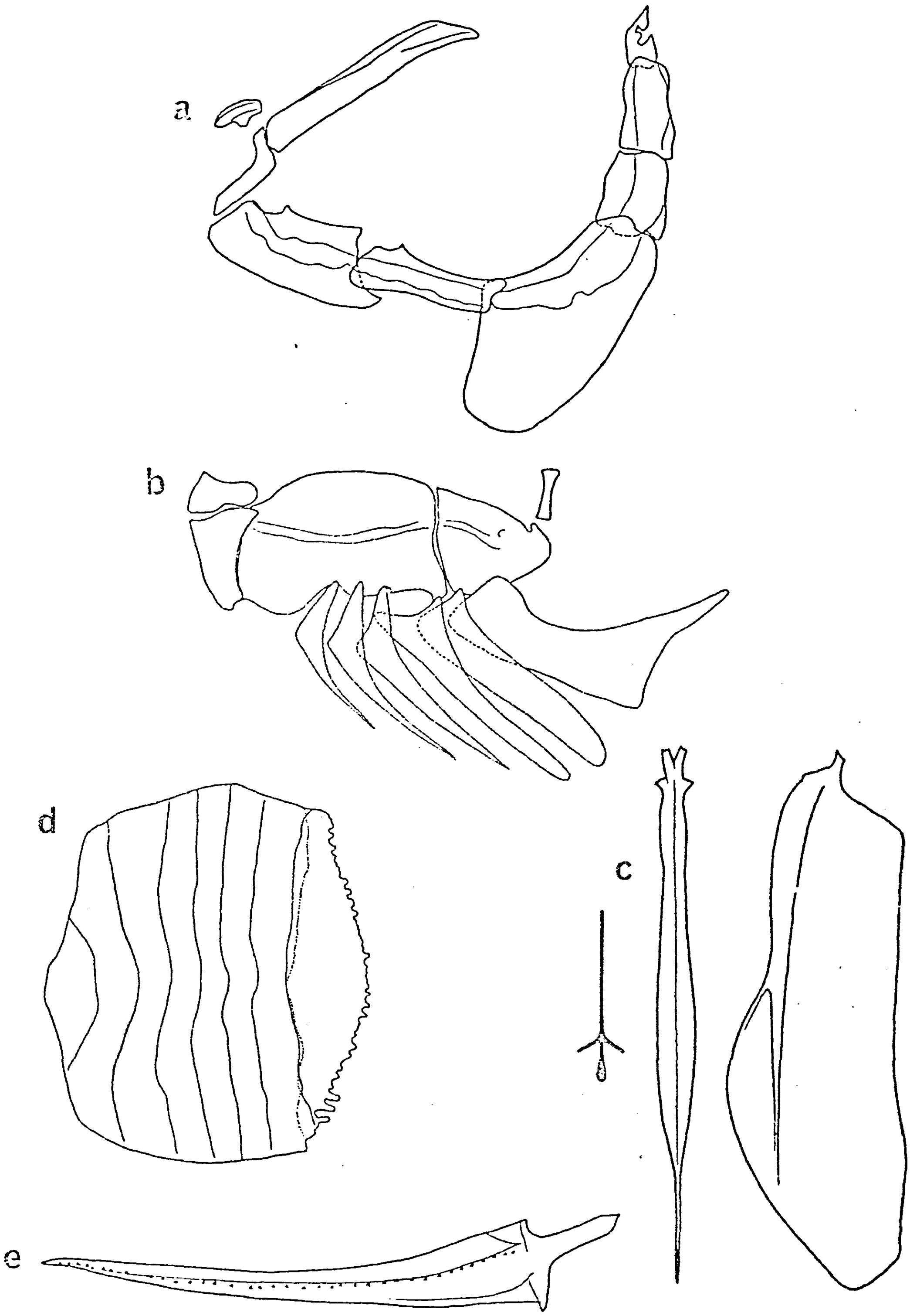


Plate 86. Herklotsichthys quadrimaculatus:- a, circumorbital bones; b, hyoid arch; c, urohyal, d, scale; e, gillraker (a, b, c from BMNH. 1974.8.19.1-12, 100.0 mm S.L.; d from BMNH. 1867.11.28.30, 108.0 mm S.L.; e from BMNH. 1965. 4.4.39-46, 84.0 mm S.L.).

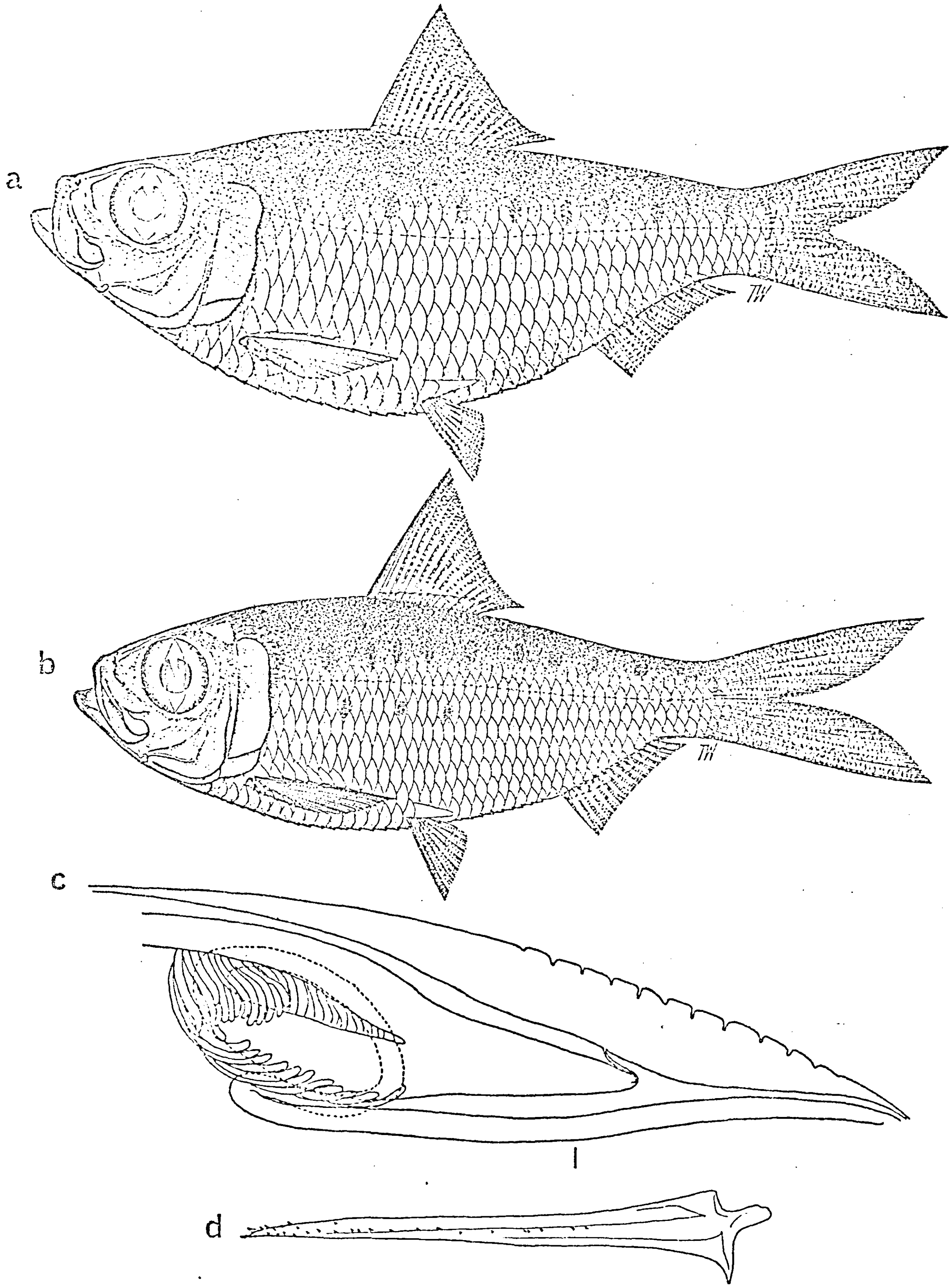


Plate 87. Herklotsichthys koningsbergeri:- a, b, adults of two different pattern of spots along flanks; c, gas bladder and digestive tract; d, gillraker (a from BMNH. 1935.9.14.1, 75.0 mm S.L., others from BMNH. 1979.3.21.341, 100.0 mm S.L.).

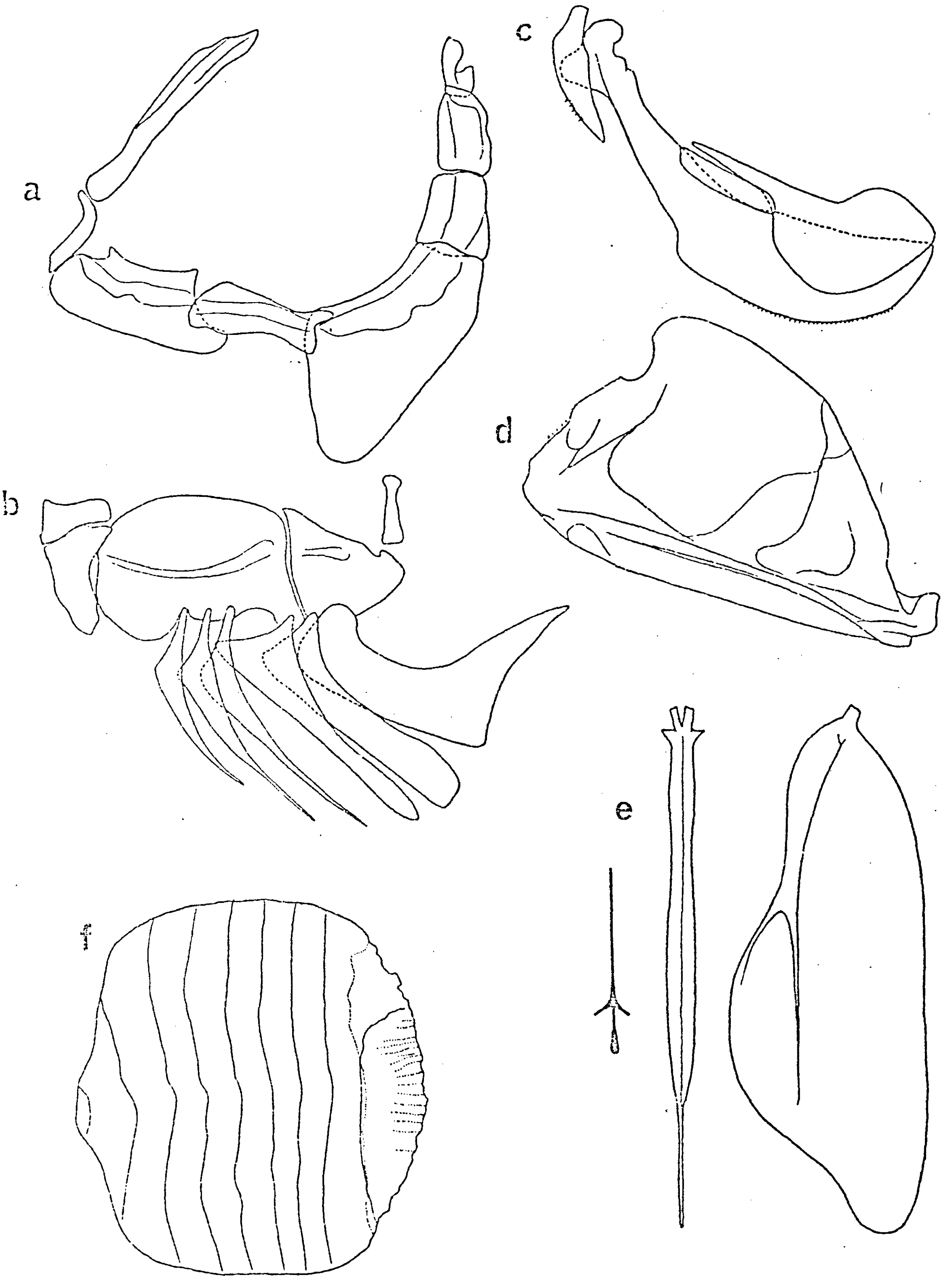


Plate 88. *Herklotsichthys koningbergeri*:- a, circumorbital bones; b, hyoid arch; c, d, upper and lower jaws; e, urohyal; f, scale (a, b, c, d, e from BMNH. 1979.3.21.341, 100.0 mm S.L.; f from BMNH. 1887.5.16.8, 95.0 mm S.L.).

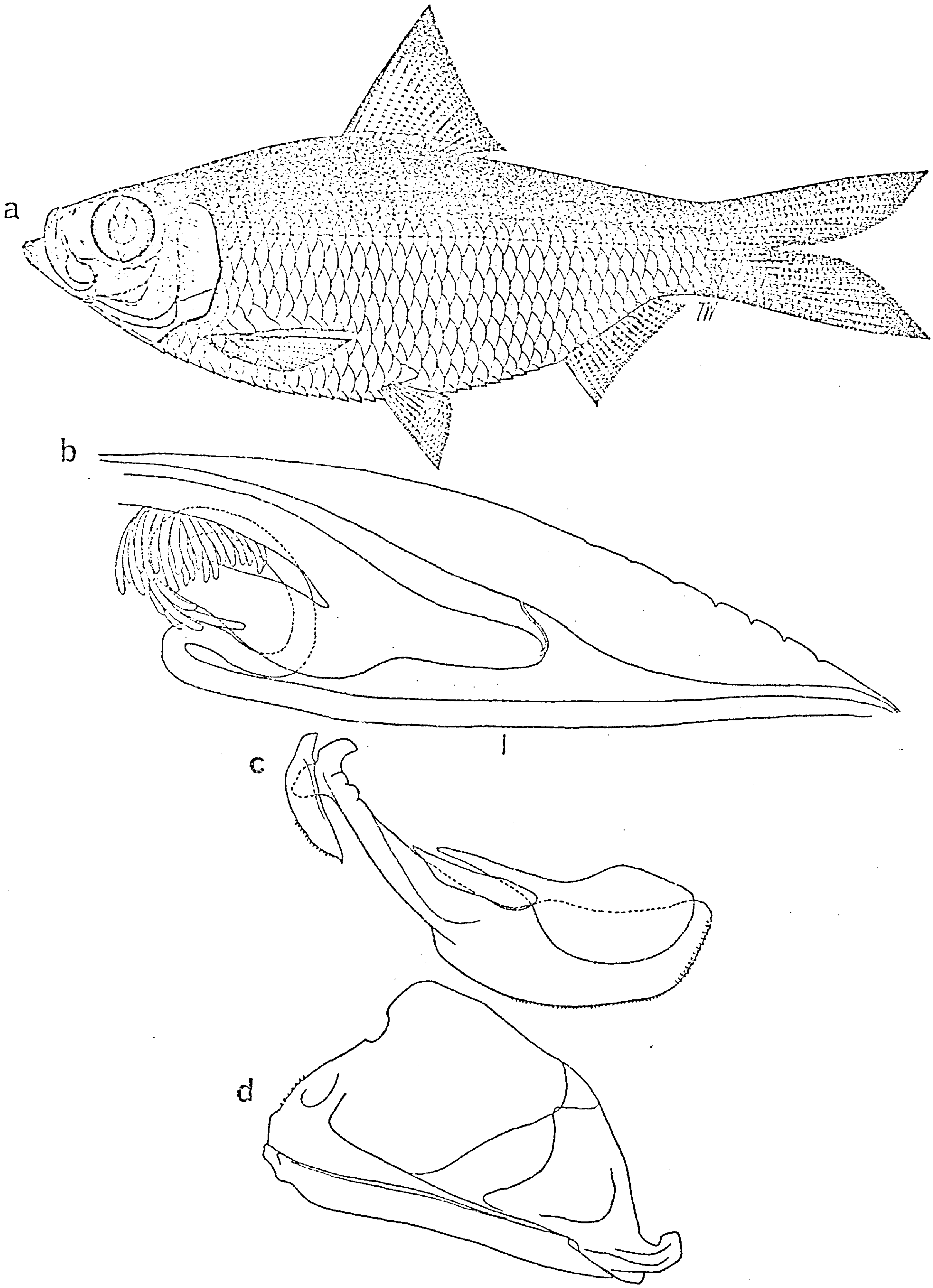


Plate 89. Herklotsichthys castelnaui:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1927.2.10.5-7, 93.0 mm S.L.; b, c, d from BMNH. 1914.8.20.15-16, 111.0 mm S.L.).

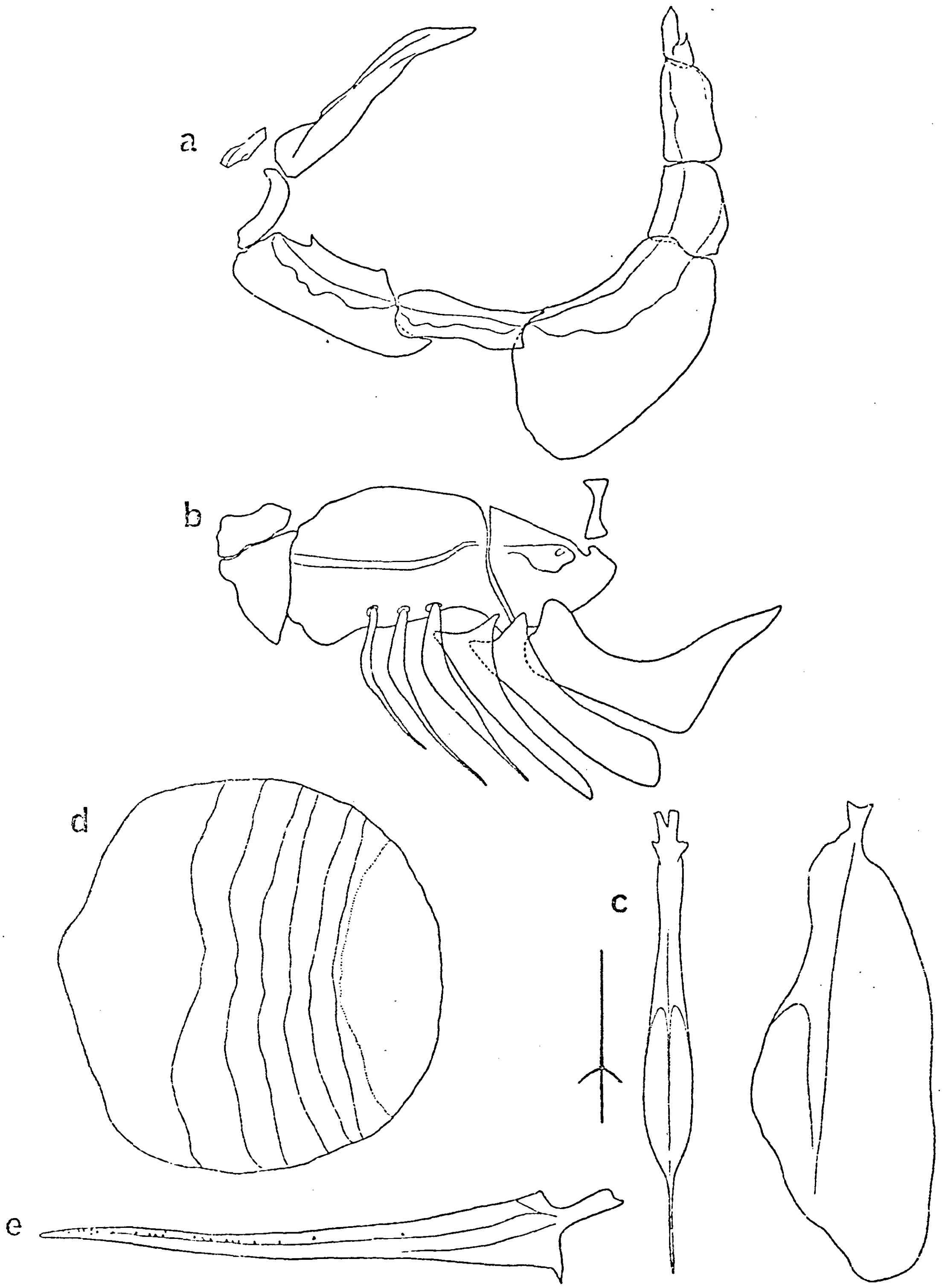


Plate 90. Herklotsichthys castelnaui:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1914. 8.20.15-16, 111.0 mm S.L.; d from BMNH. 1890.9.23.262-266, 140.0 mm S.L.).

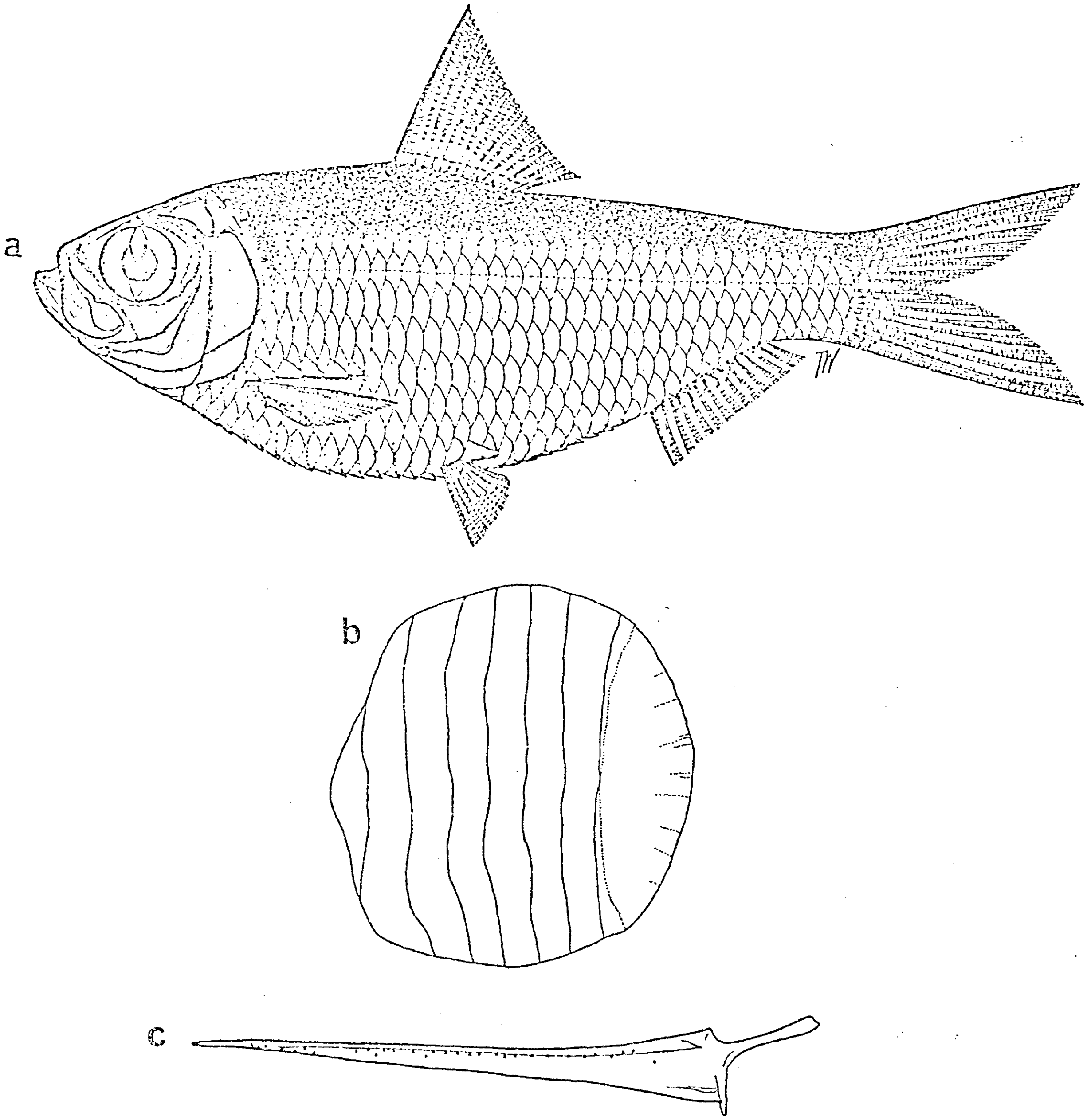


Plate 91. *Herklotsichthys gotoi*:- a, adult; b, scale; c, gillraker (all from BMNH. 1913.12.9.179, 63.0 mm S.L., holotype).

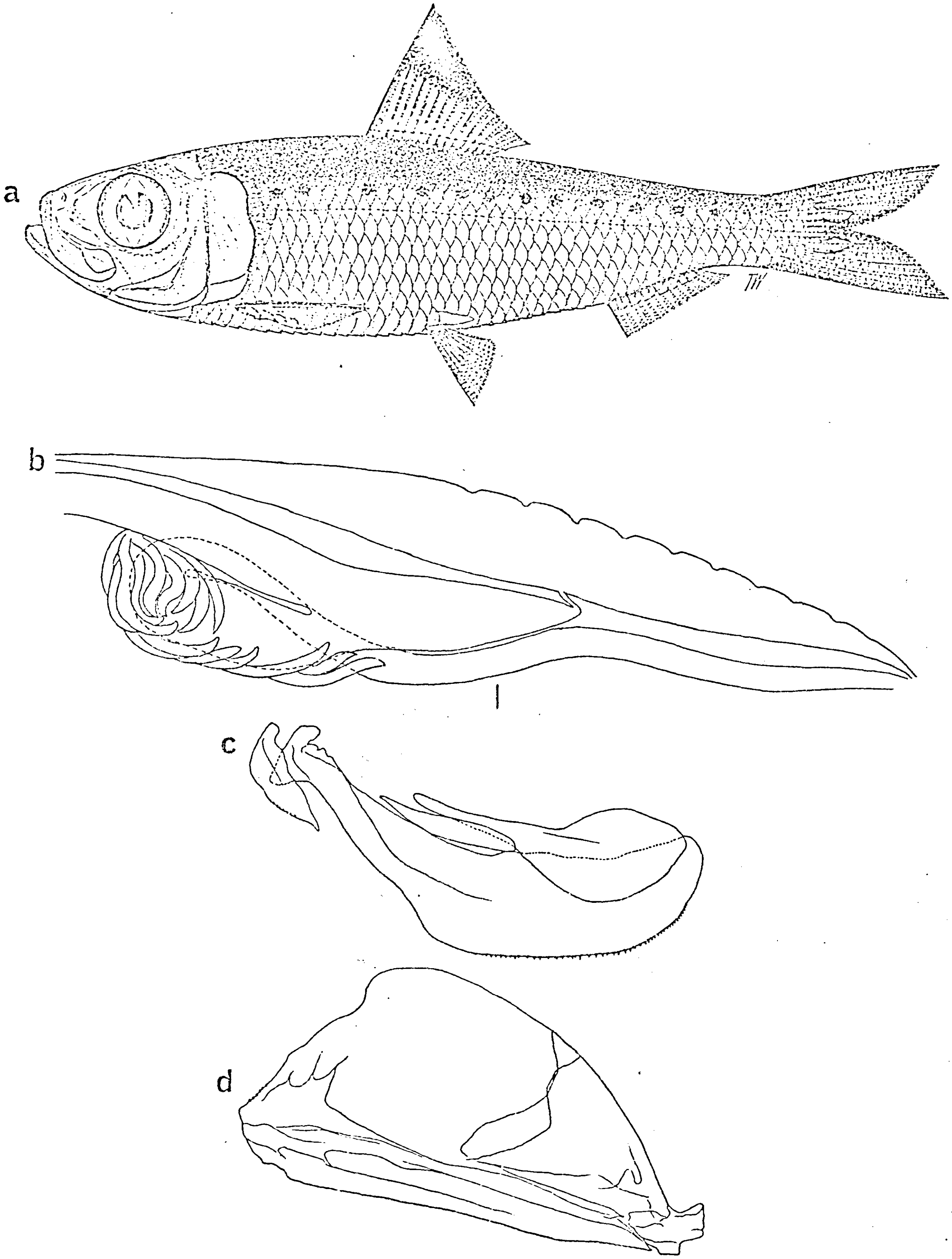


Plate 92. Herklotsichthys lossei:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1976.8.19.78, 69.0 mm S.L., holotype; b from BMNH. 1976.8.19.64-77, paratypes, 71.0 mm S.L.; c, d from BMNH. 1976.8.19.51-63, paratypes, 65.0 mm S.L.).

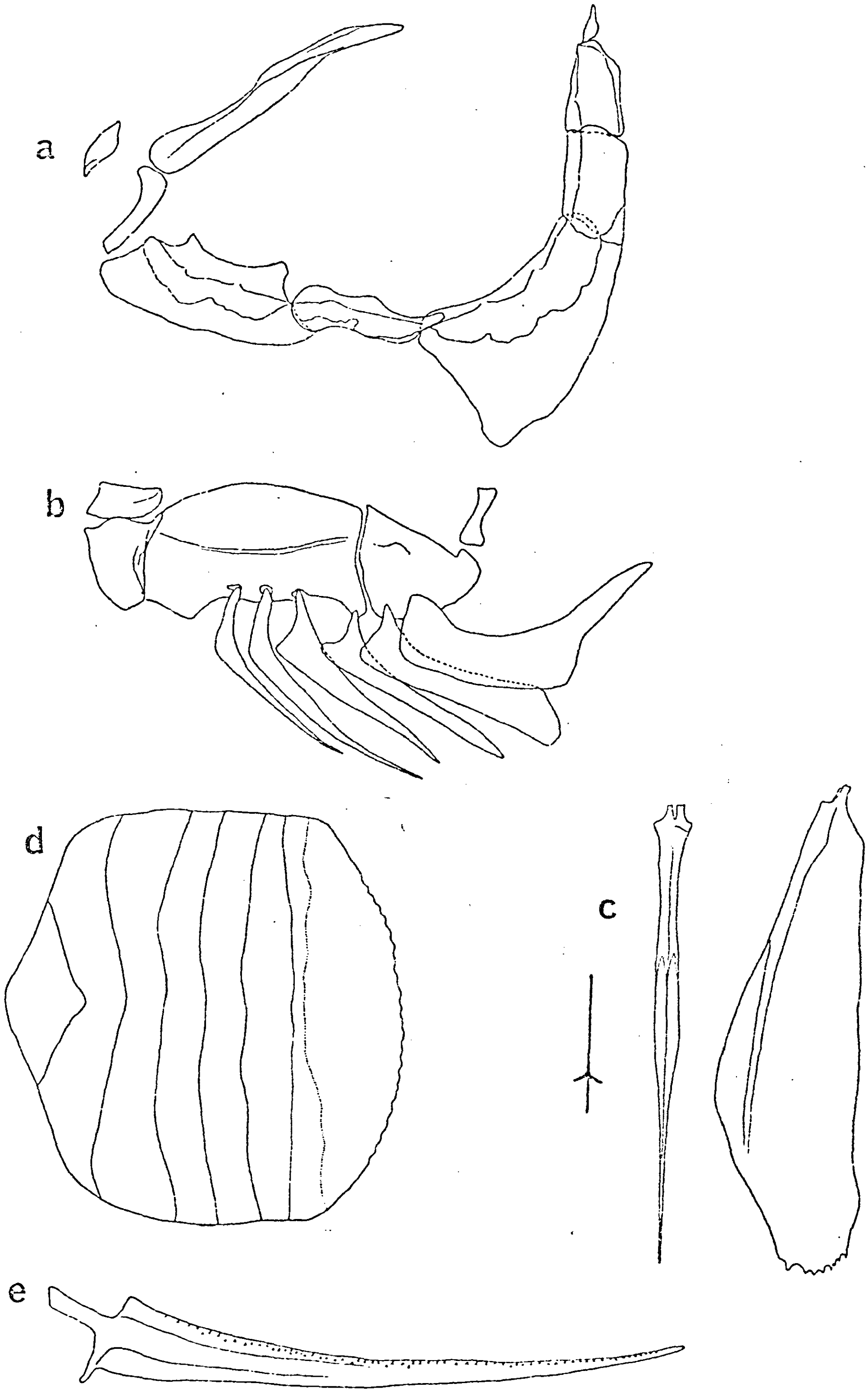


Plate 93. Herklotsichthys lossei:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e gillraker (all from BMNH. 1976.8.19.51-63, paratypes, 65.0 mm S.L.).

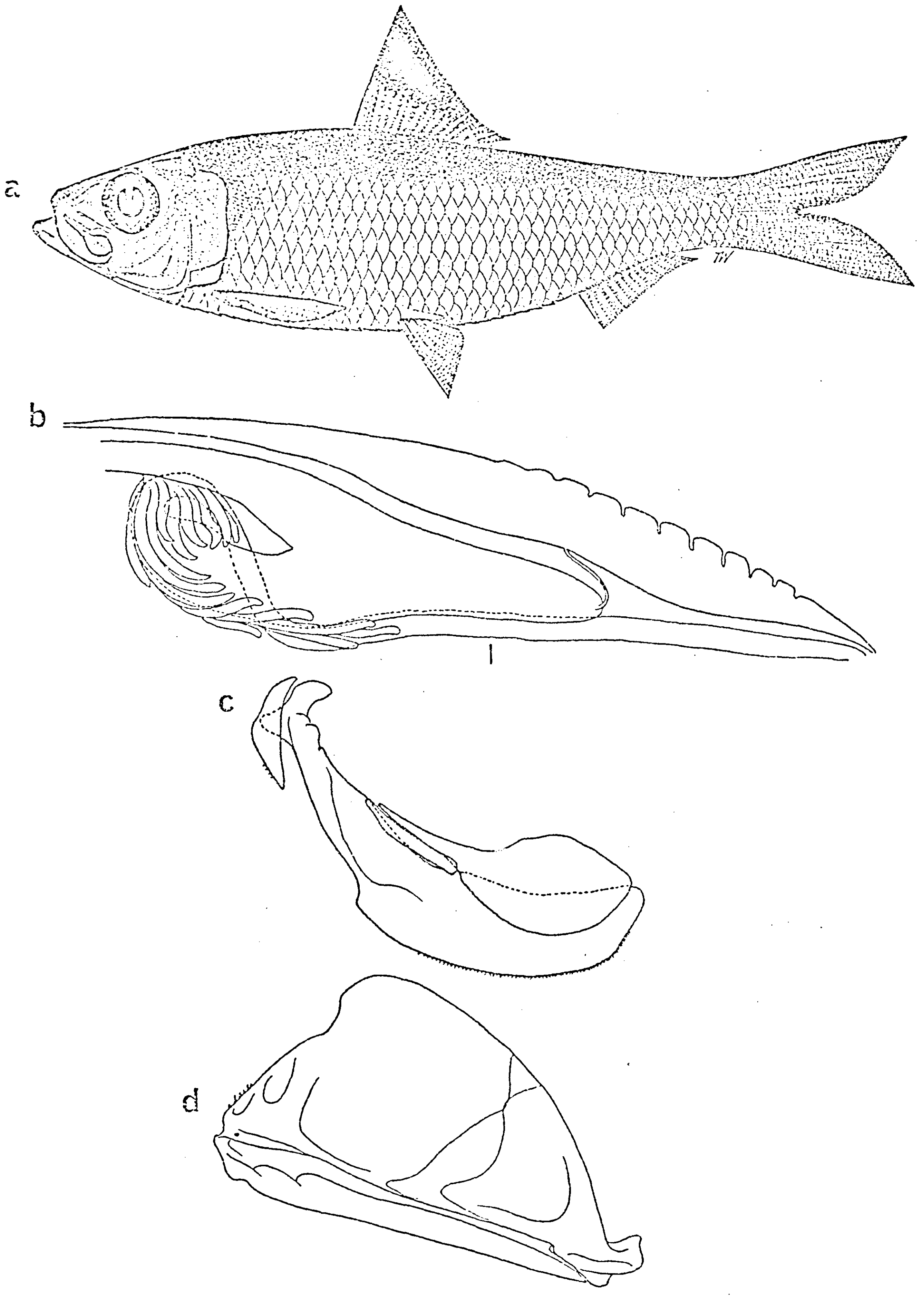


Plate 94. Herklotsichthys spilura:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1966.11.16.222-229, 83.0 mm S.L.; b, c, d from BMNH. 1964.12.14.25-54, 72.0 mm S.L.).

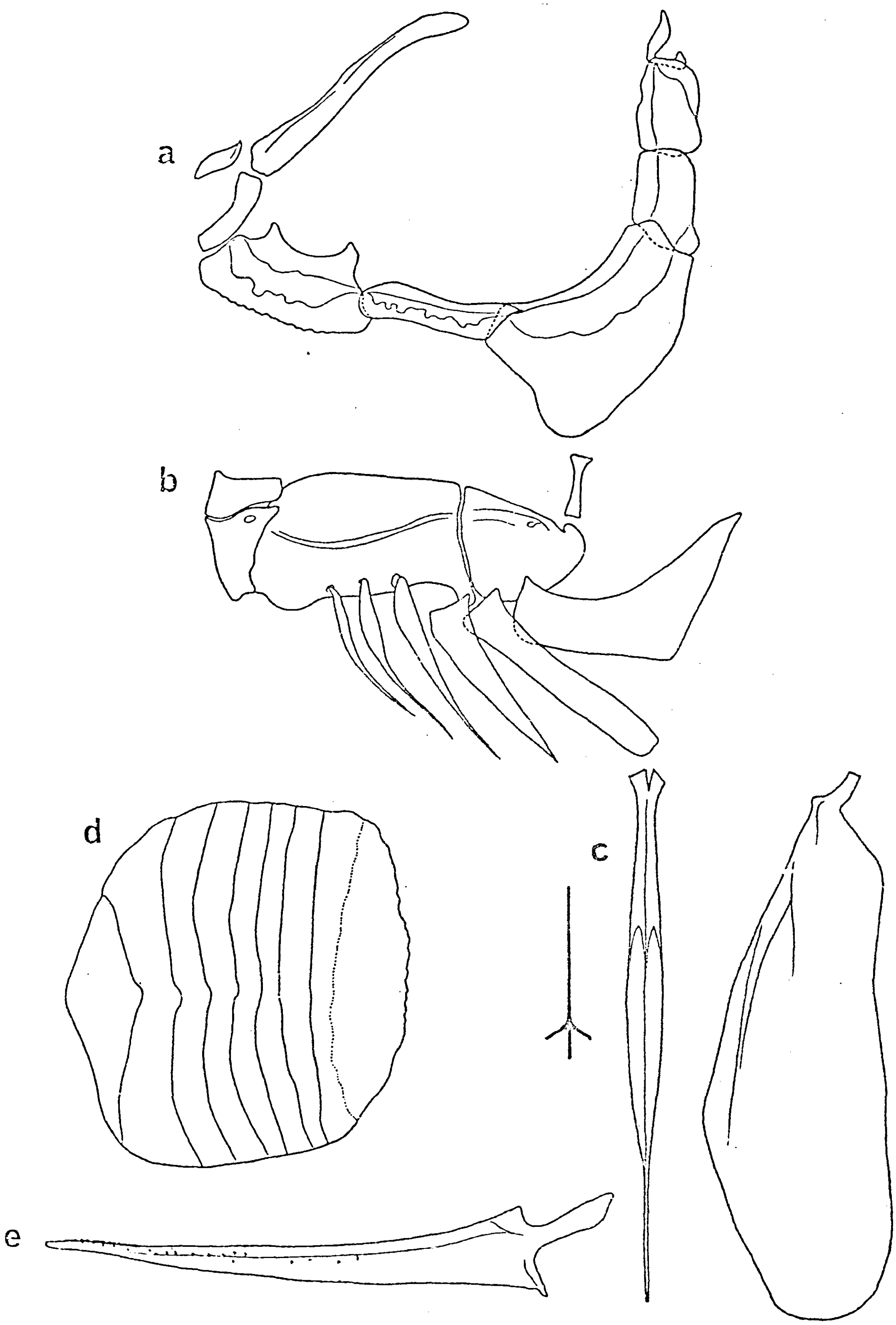


Plate 95. Herklotsichthys spilura:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1964.12.14.25-54, 72.0 mm S.L. for a, b, c, e and 79.0 mm S.L. for d).

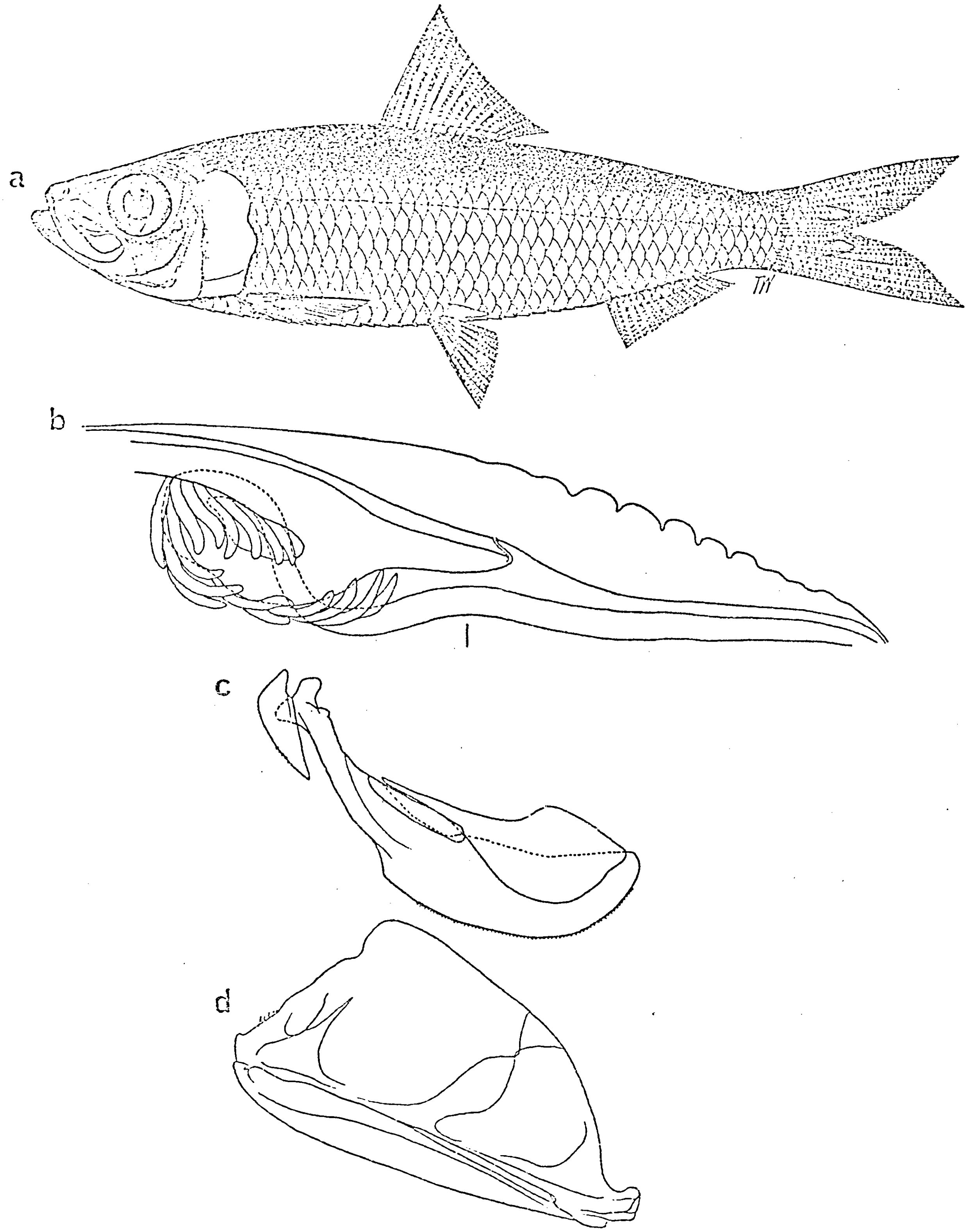


Plate 96. *Herklotsichthys punctatus*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1871.4.13.30, 67.0 mm S.L. for a, 64.0 mm S.L. for others).

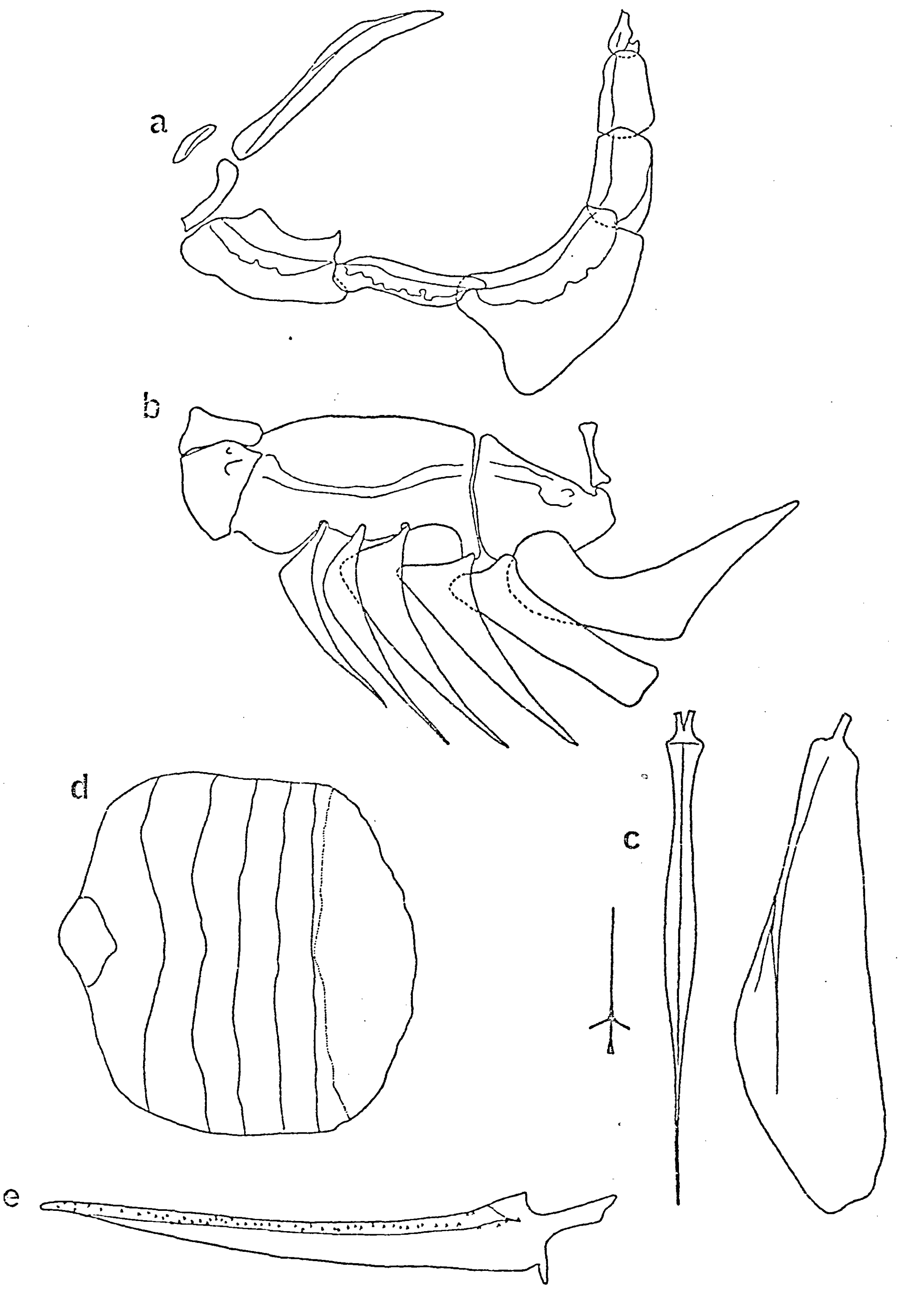


Plate 97. Herklotsichthys punctatus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1871.4.13.30, 64.0 mm S.L.; d from BMNH. 1965.4.4.1-38, 59.0 mm S.L.).

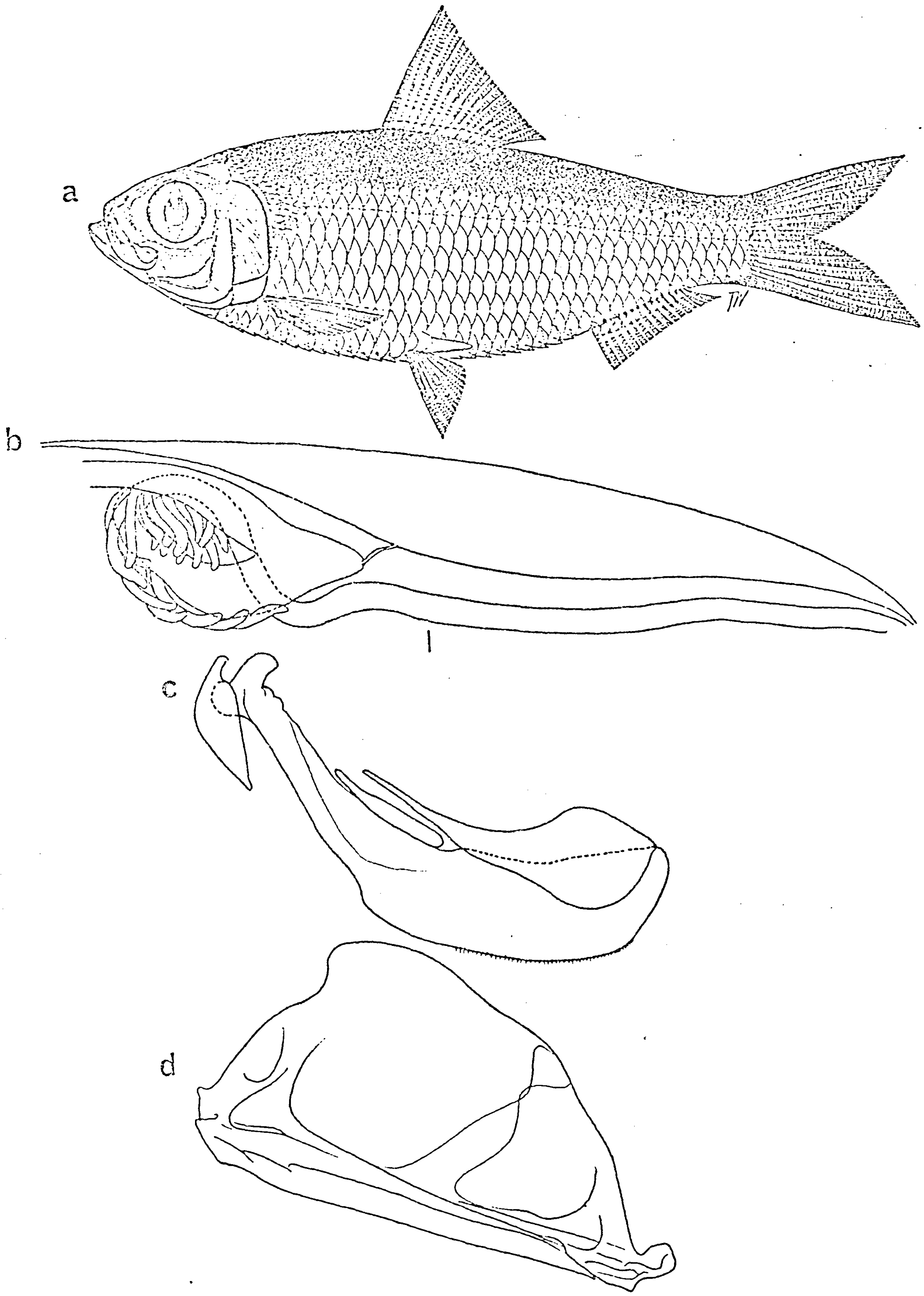


Plate 98. Herklotsichthys dispilonotus:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1966.2.28.21-23, 73.0 mm S.L. for a and 65.0 mm S.L. for others).

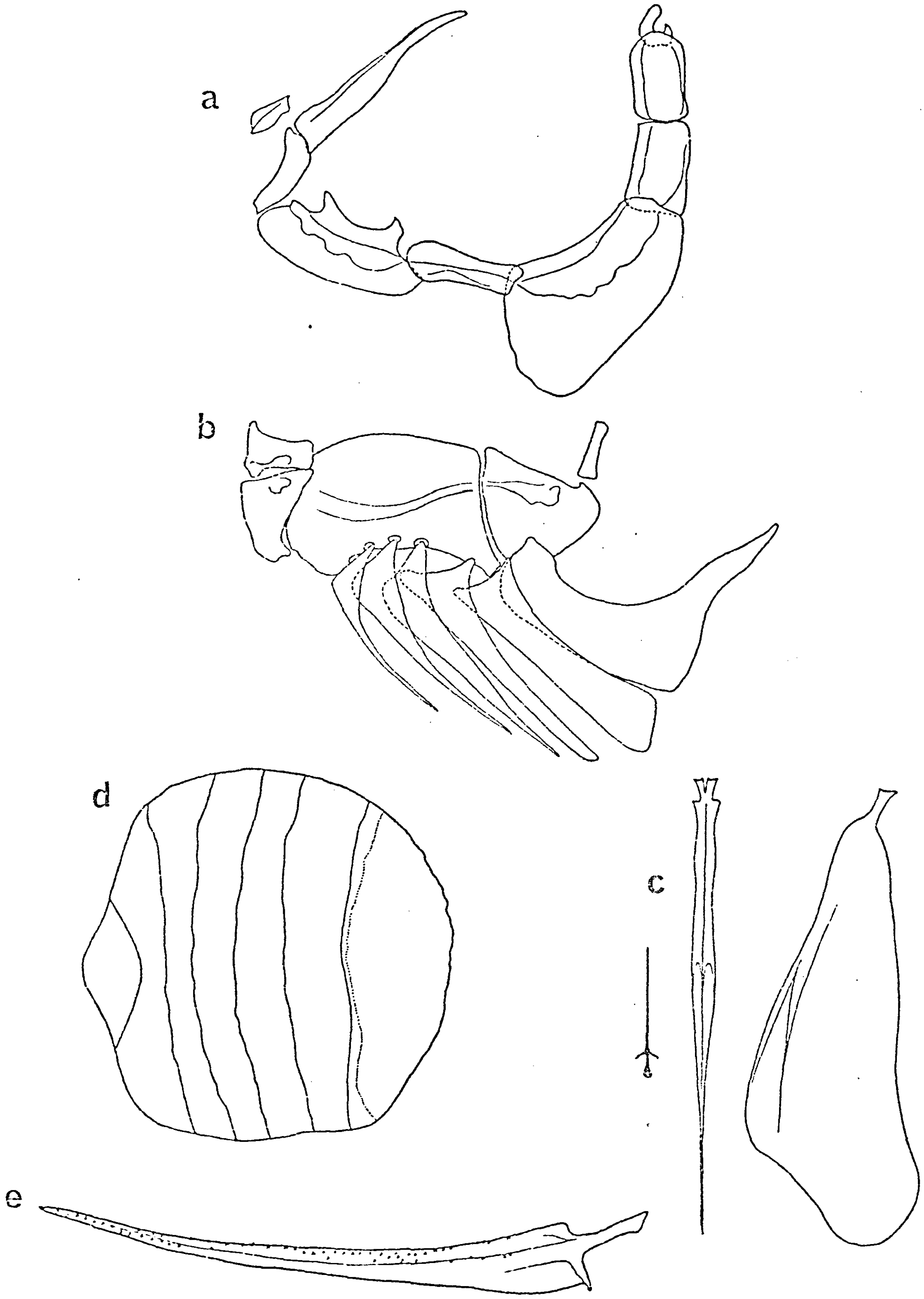


Plate 99. Herklotsichthys dispilonotus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1966.2.28. 21-23, 65.0 mm S.L.; d from BMNH. 1966.11.20.3, 73.5 mm S.L.).

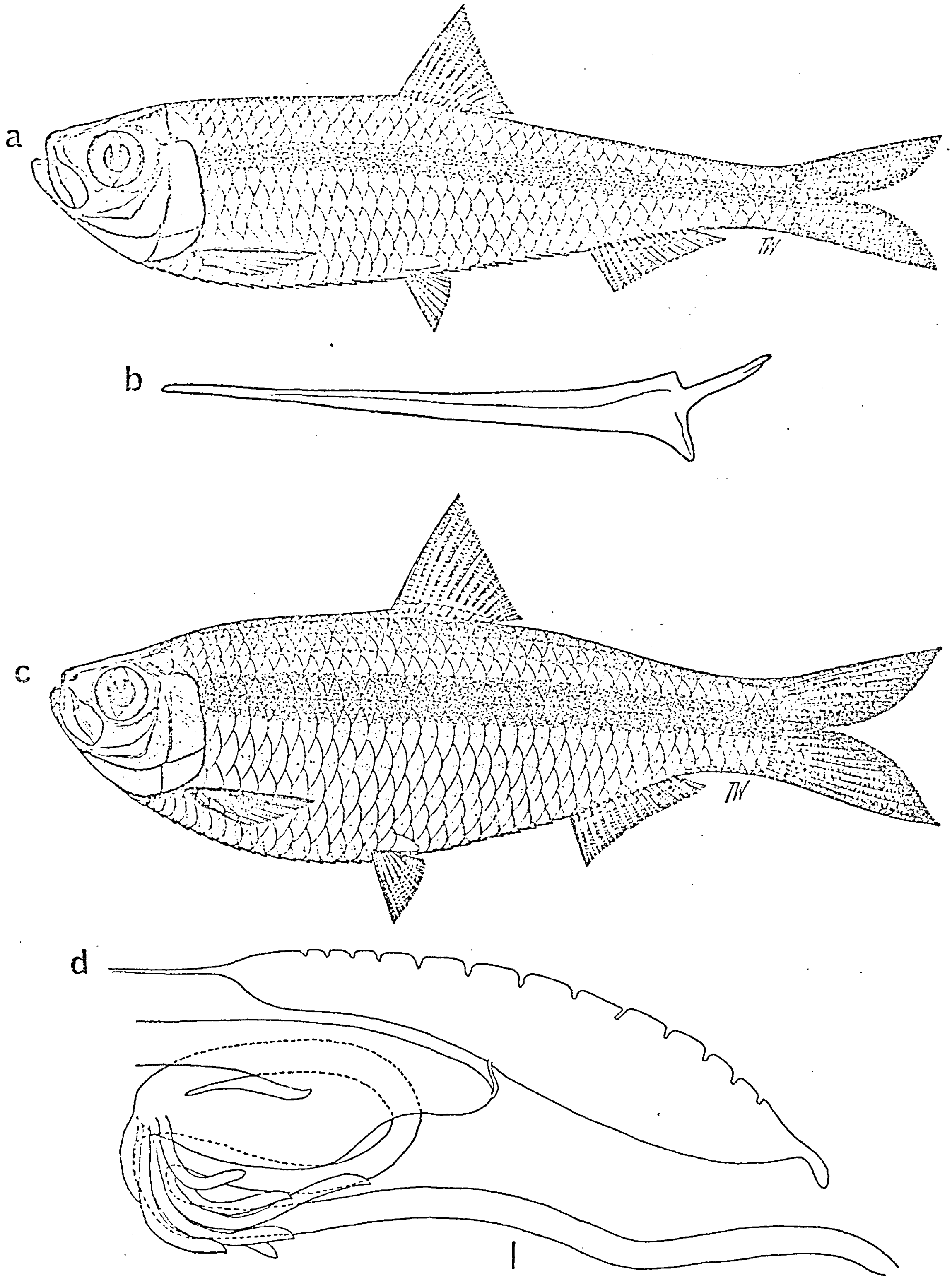


Plate 100. Escualosa elongata:- a, adult; b, gillraker (a, b from BMNH. 1973.1.18.1, 64.5 mm S.L., holotype).
Escualosa thoracata:- c, adult; d, gas bladder and digestive tract; (c from BMNH. 1967.11.13.24-25, 79.0 mm S.L.; d from BMNH. 1979.8.16.36, 68.0 mm S.L.).

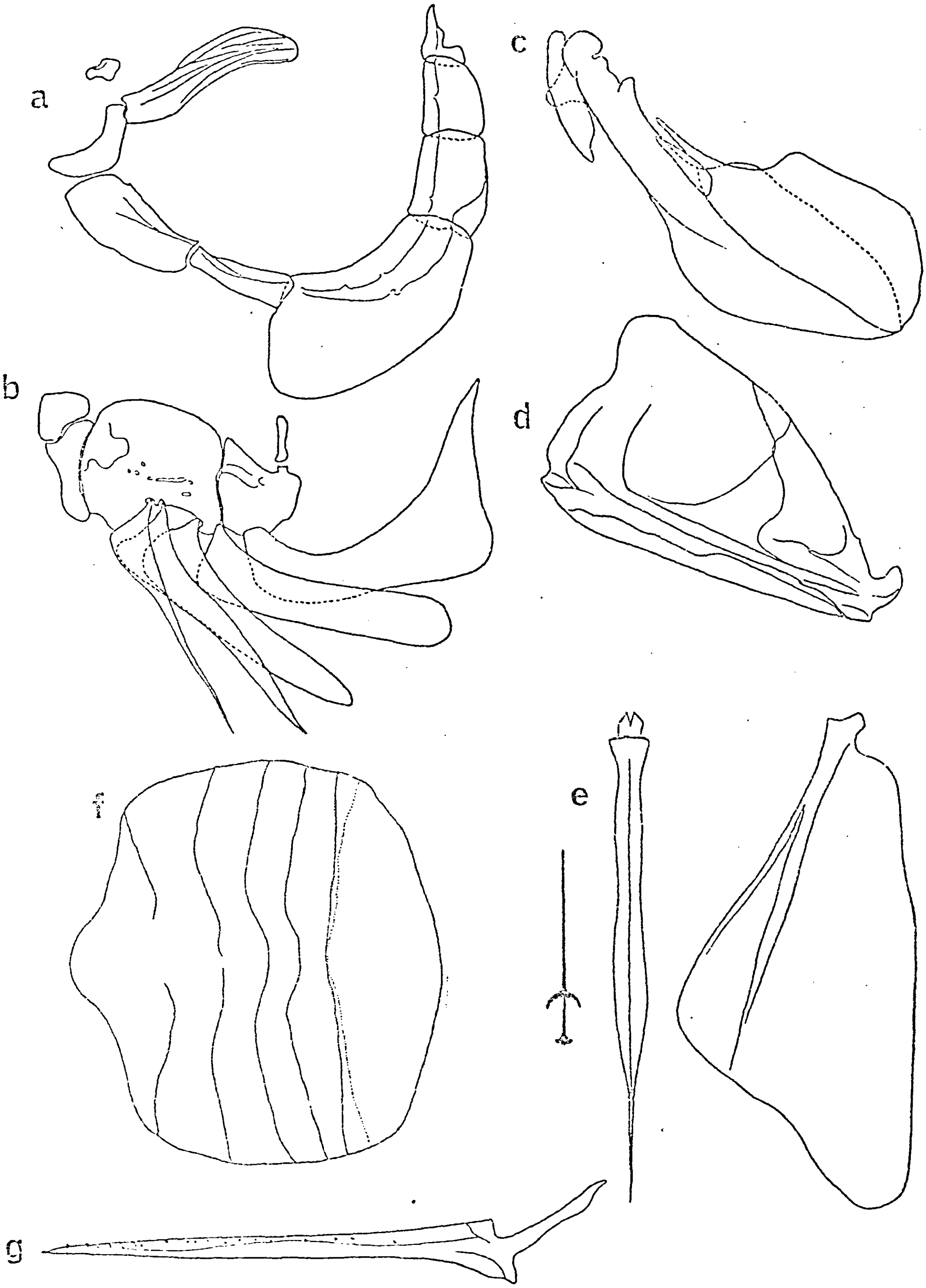


Plate 101. Escualosa thoracata:- a, circumorbital bones; b, hyoid arch; c, d, upper and lower jaws; e, urohyal; f, scale; g, gillraker (all from BMNH. 1979.8.16.36, 68.0 mm S.L.).

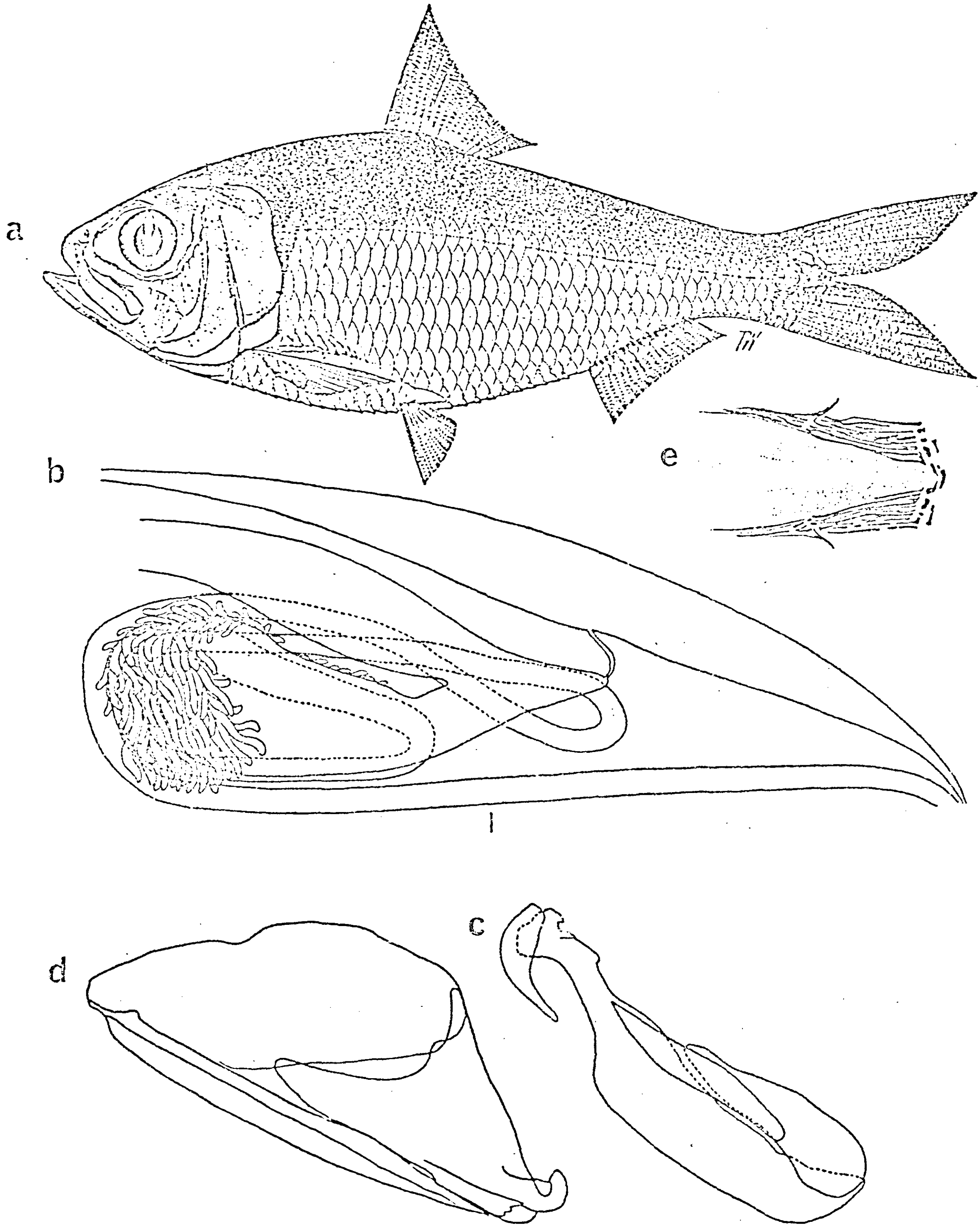


Plate 102. *Hilsa kelee*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws;e frontoparietal striae, (a, b, c, d from BMNH. 1973. 6.4.15-19, 141.0 mm S.L. for a and 128.0 mm S.L. for b, c, d; e from BMNH. 1966.2.28.24-25, 130.0 mm S.L.).

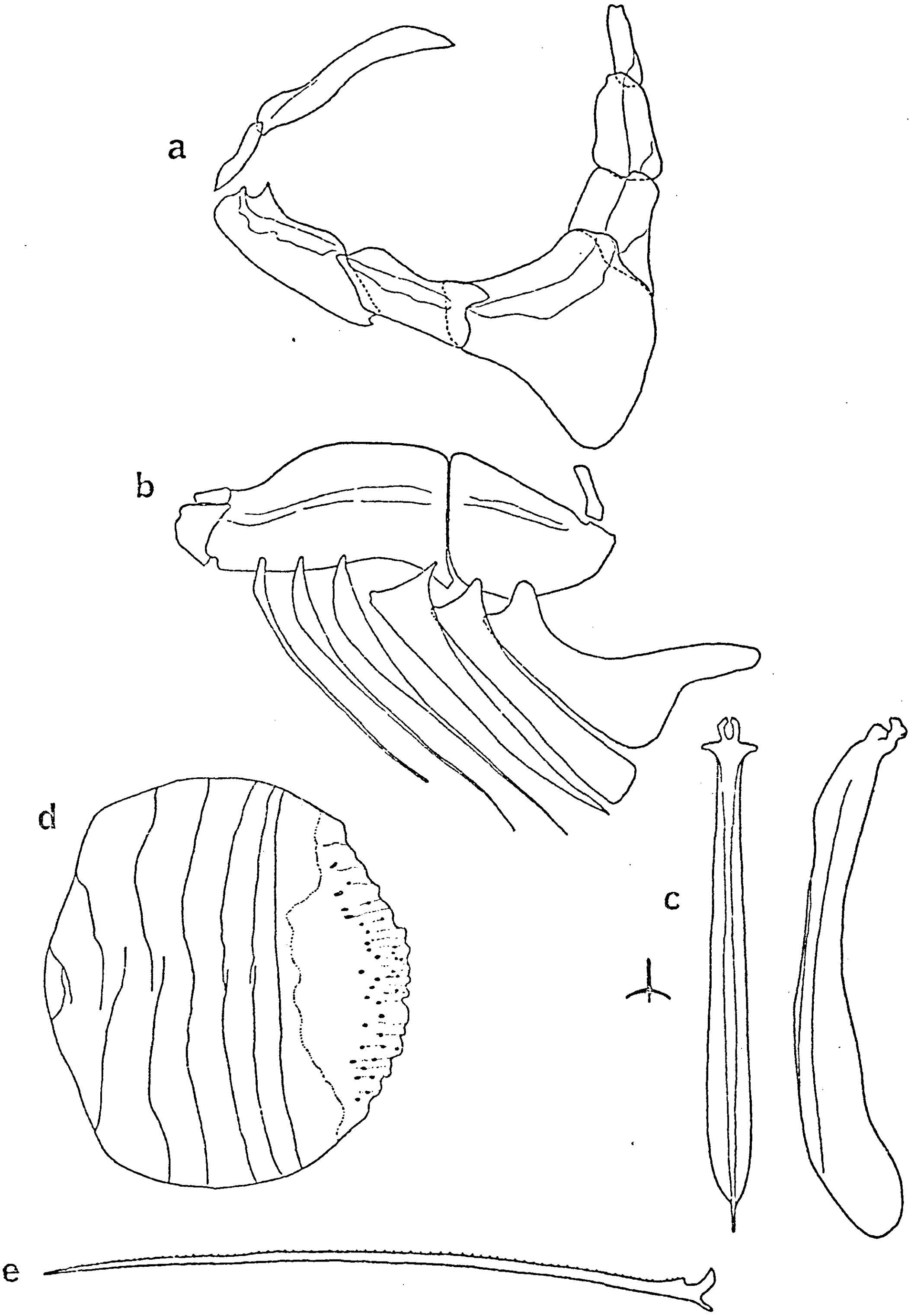


Plate 103. Hilsa kelee:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1973.6.4.15-19, 128.0 mm S.L.; d from BMNH. 1966.2.28.24-25, 120.0 mm S.L.).

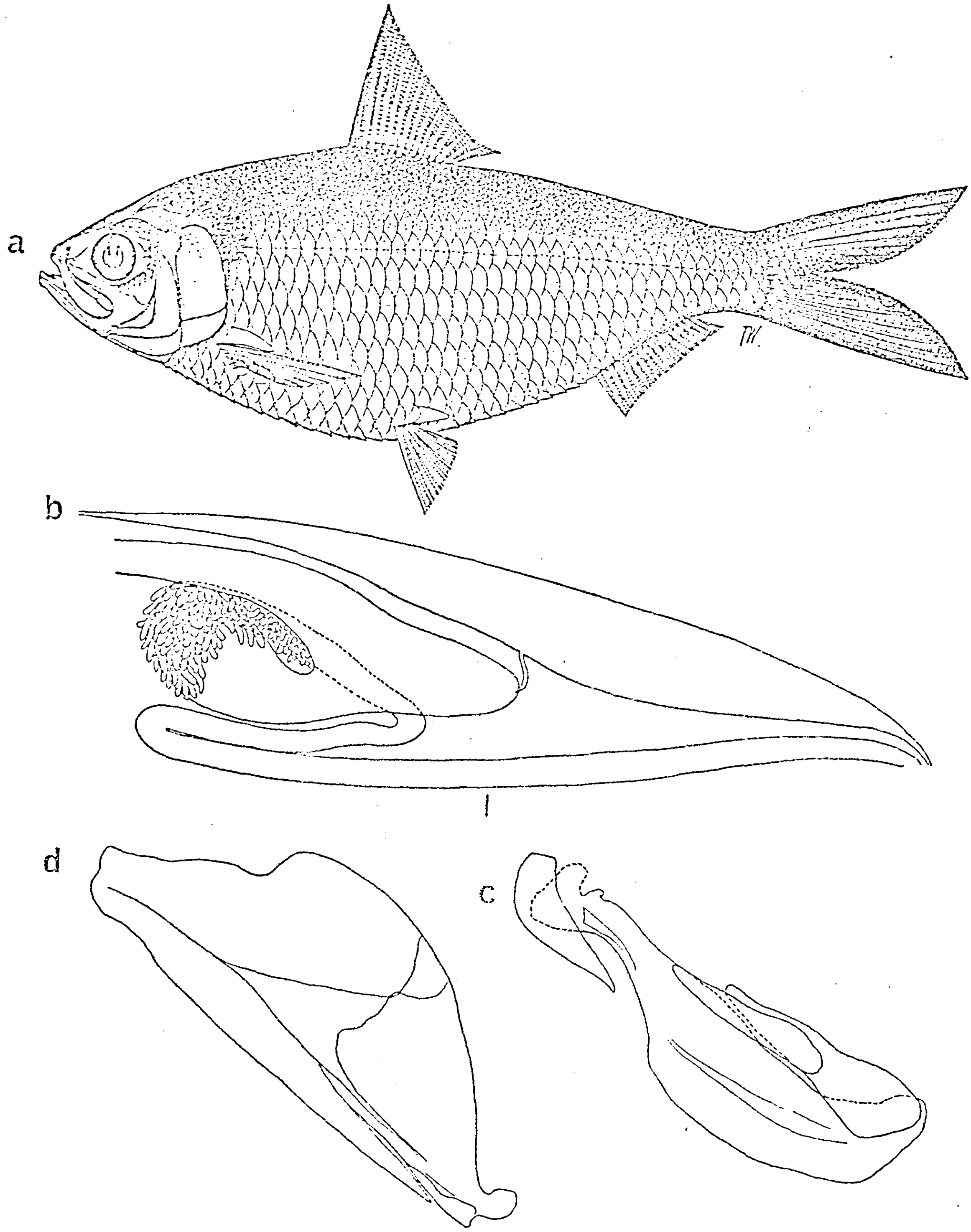


Plate 104. *Tenualosa toli*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1858.8.15.68-69, 109.0 mm S.L. for a and 85.0 mm S.L. for others).

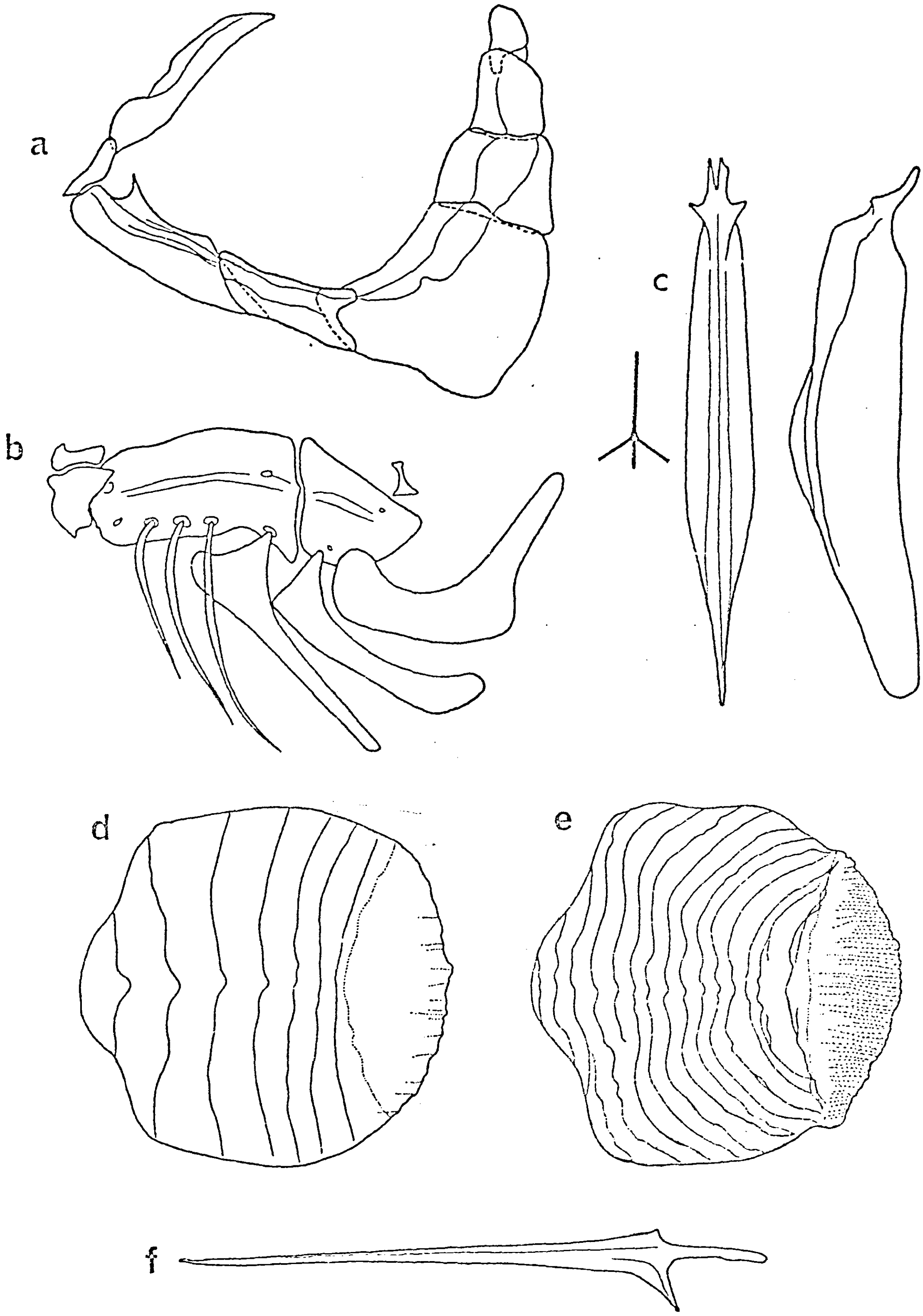


Plate 105. Tenualosa toli:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, scales; f, gillraker (a, b, c, d, f from BMNH. 1858.8.15.68-69, 85.0 mm S.L. for a, b, c, f and 109.0 mm S.L. for d; e from BMNH. 1889.2.1.2018-2019, 280.0 mm S.L.).

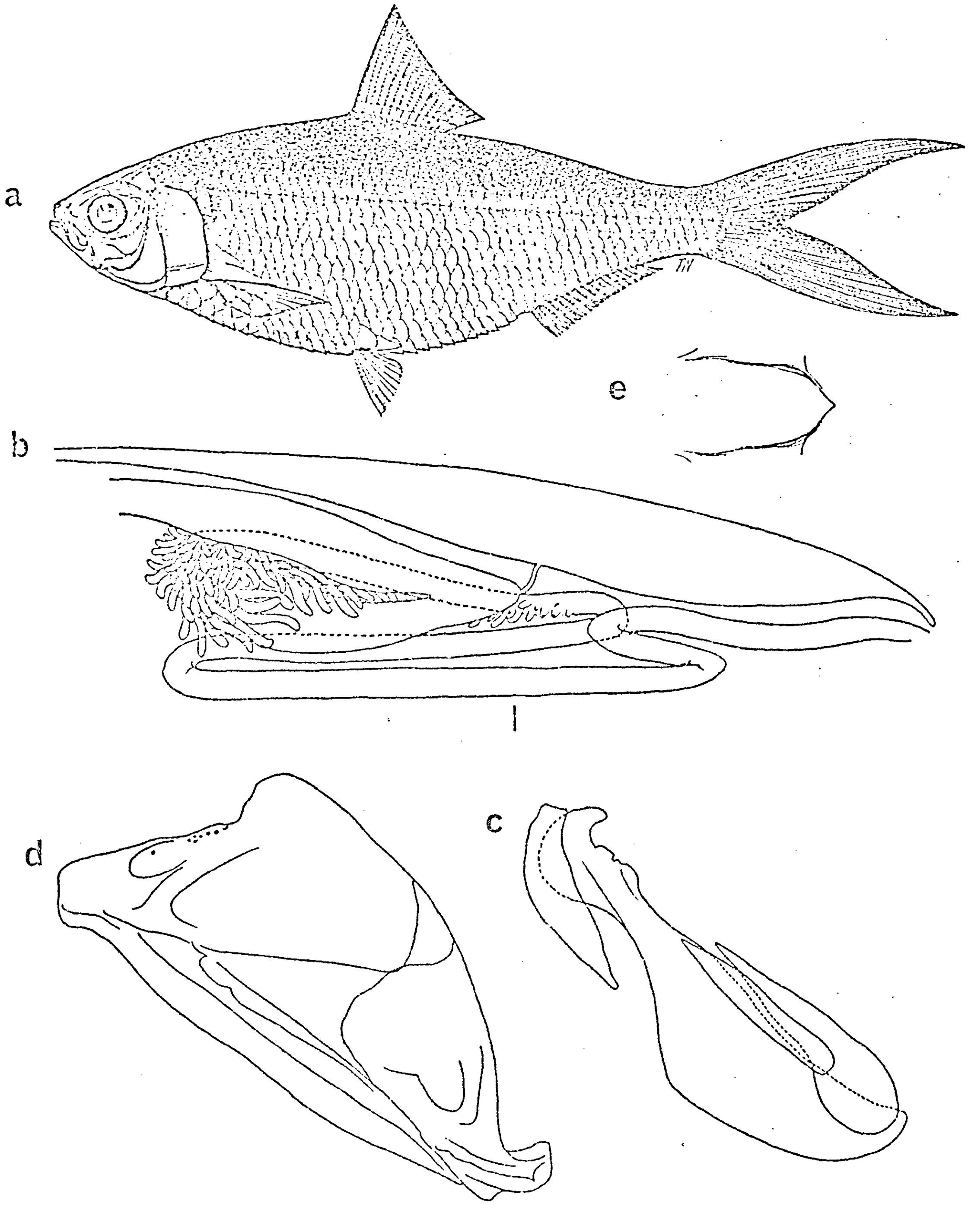


Plate 106. Tenualosa macrura:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, frontoparietal striae, (all from BMNH. 1895. 2.28.72, 146.0 mm S.L.).

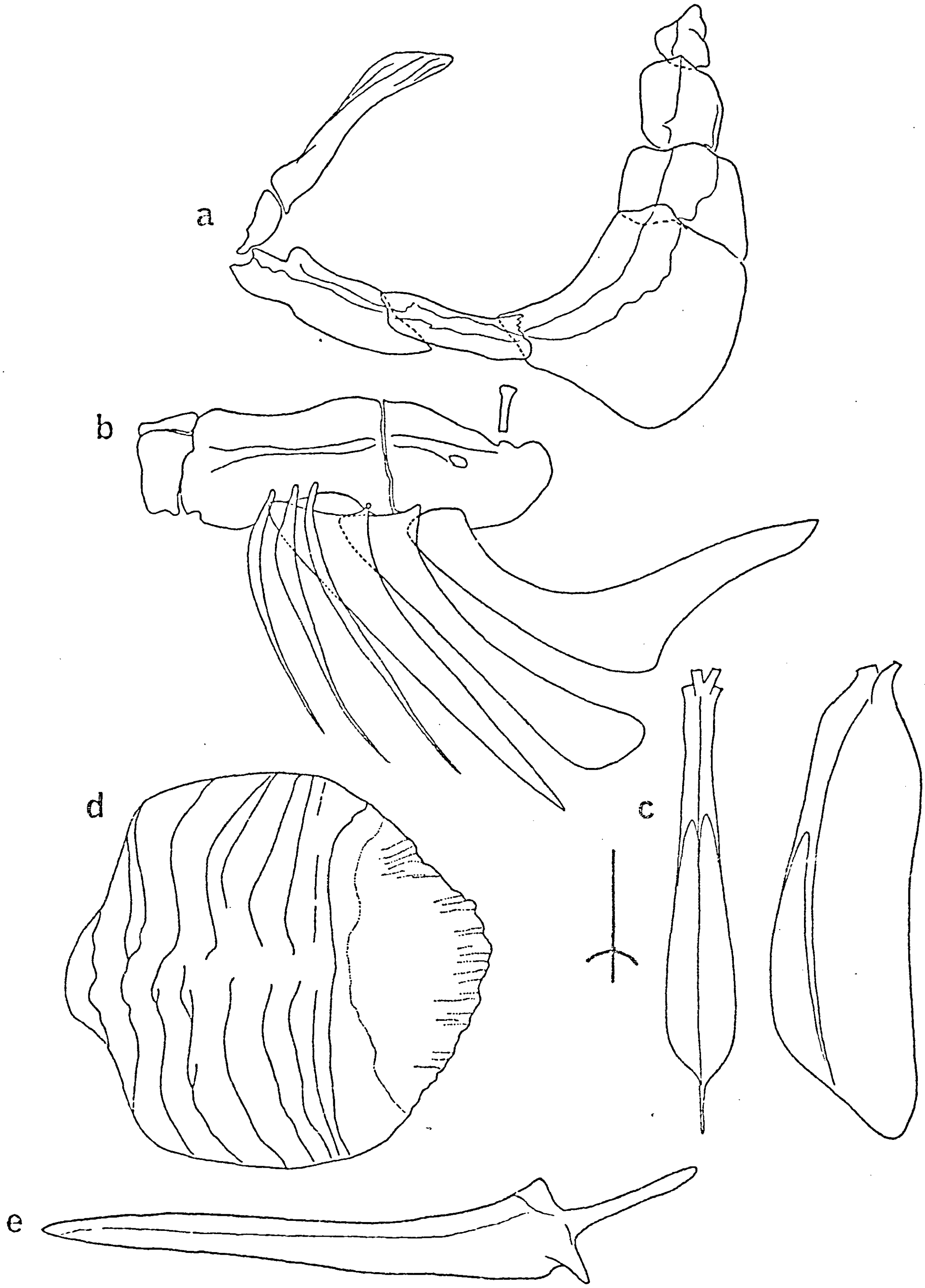


Plate 107. Tenualosa macrura:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, c from BMNH. 1895.2.28.72, 145.0 mm S.L.; others from BMNH. 1868.6.9.2, 158.0 mm S.L.).

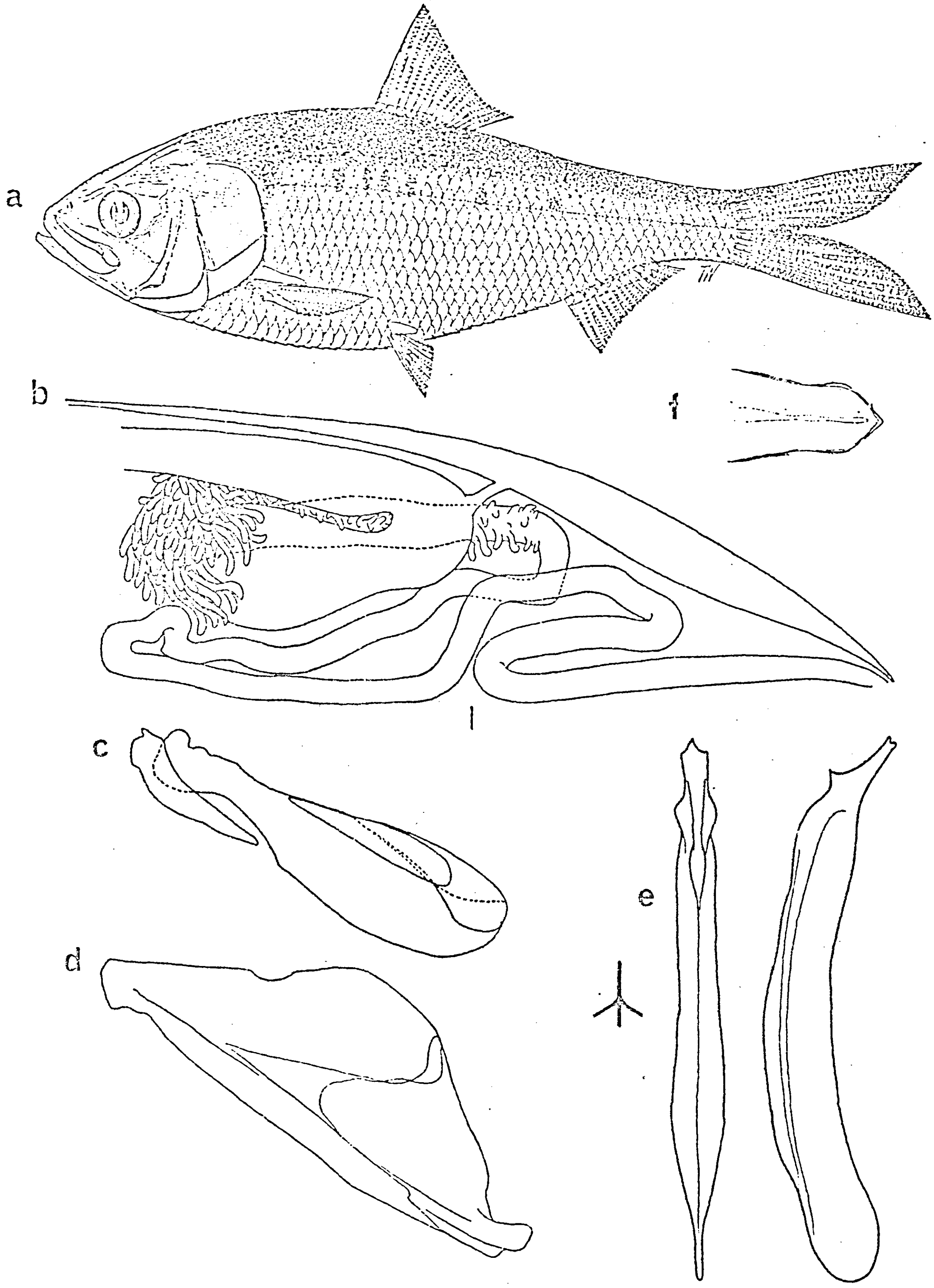


Plate 108. Tenualosa reevesii:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, urohyal; f, frontoparietal striae, (a from BMNH. 1965.7.5.23-24, 145.0 mm S.L.; others from BMNH. 1979.8.15. 31-32, 122.0 mm S.L.).

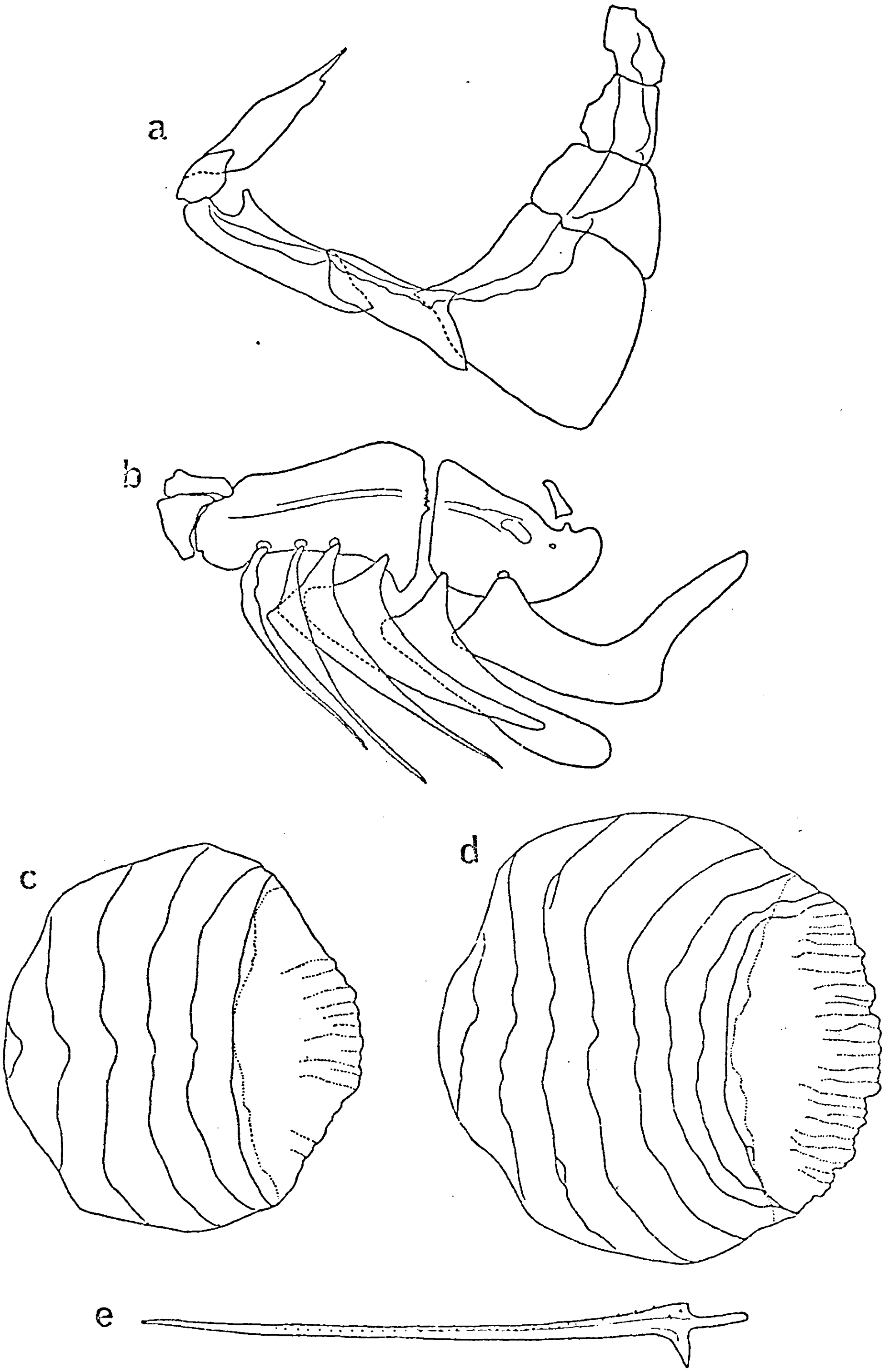


Plate 109. *Tenualosa reevesii*:- a, circumorbital bones; b, hyoid arch; c, d, scales; e, gillraker (a, b, c, e from BMNH. 1979.8.15.31-32, 122.0 mm S.L.; d from BMNH. 1965.7.5.23-24, 192.0 mm S.L.).

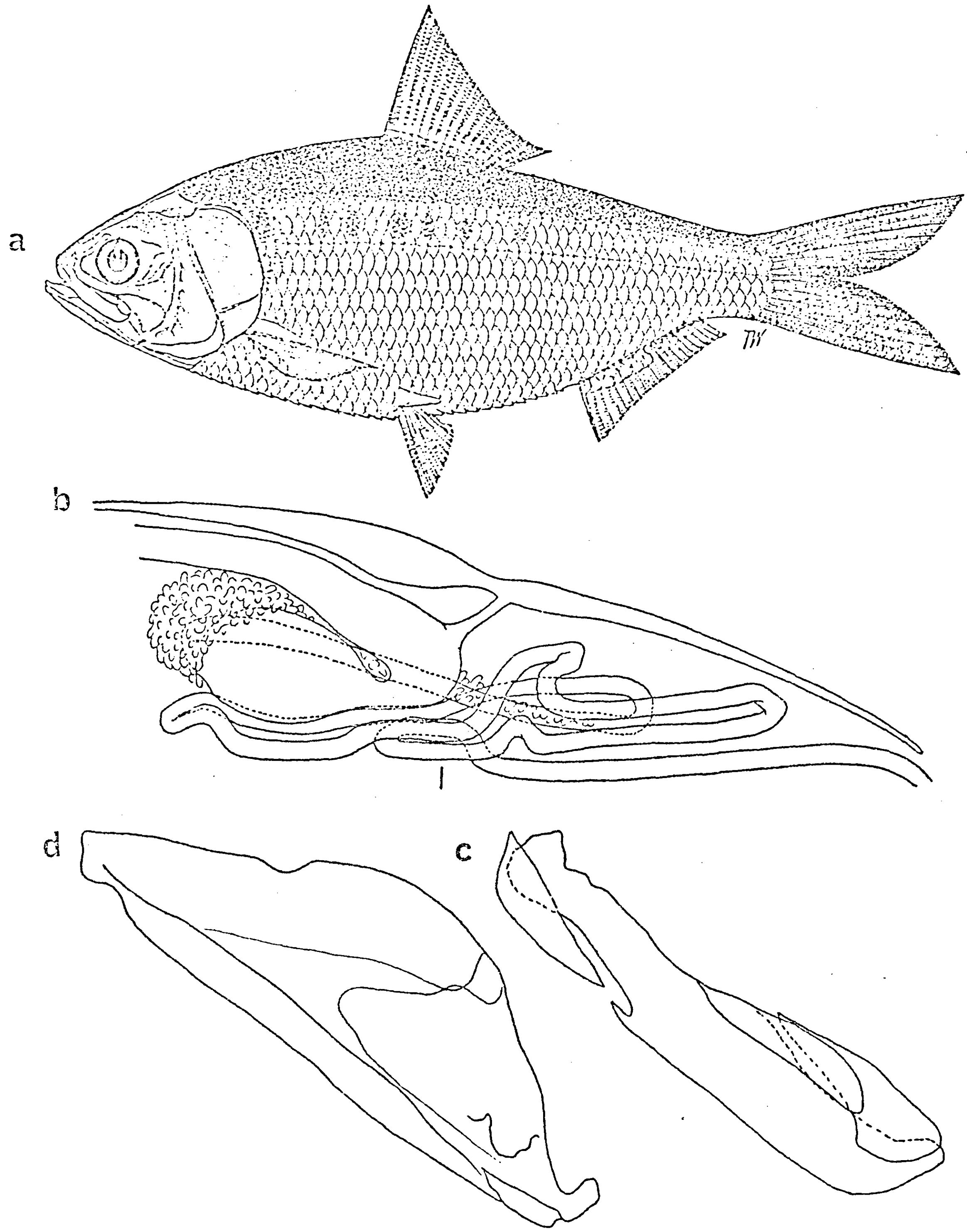


Plate 110. <u>Tenualosa</u> <u>ilisha</u>:- a, lateral view; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1891.11.30.396-401, 144.0 mm S.L.; others from BMNH. 1923.6.30.1-10, 140.0 mm S.L.).

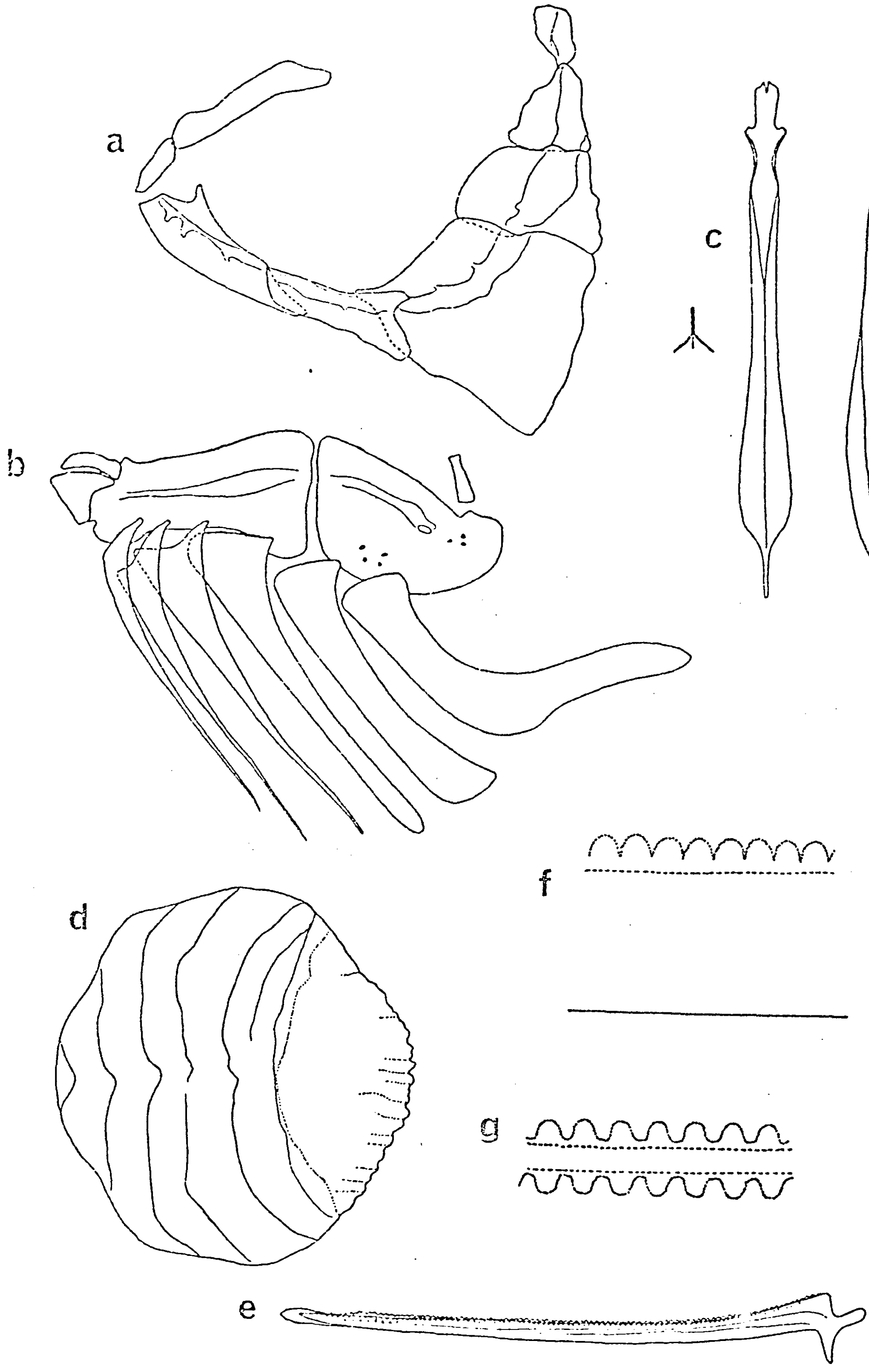


Plate 111. *Tenualosa ilisha*:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker; f, enlargement of lateral view of middle part of gillraker to show middle row of fleshy tubercles; g, enlargement of top view of middle part of gillraker to show arrangement of lateral rows of fleshy tubercles (all from BMNH. 1923.6.30.1-10, 140.0 mm S.L. for a, b, c, e, f, g and 137.0 mm S.L. for d.).

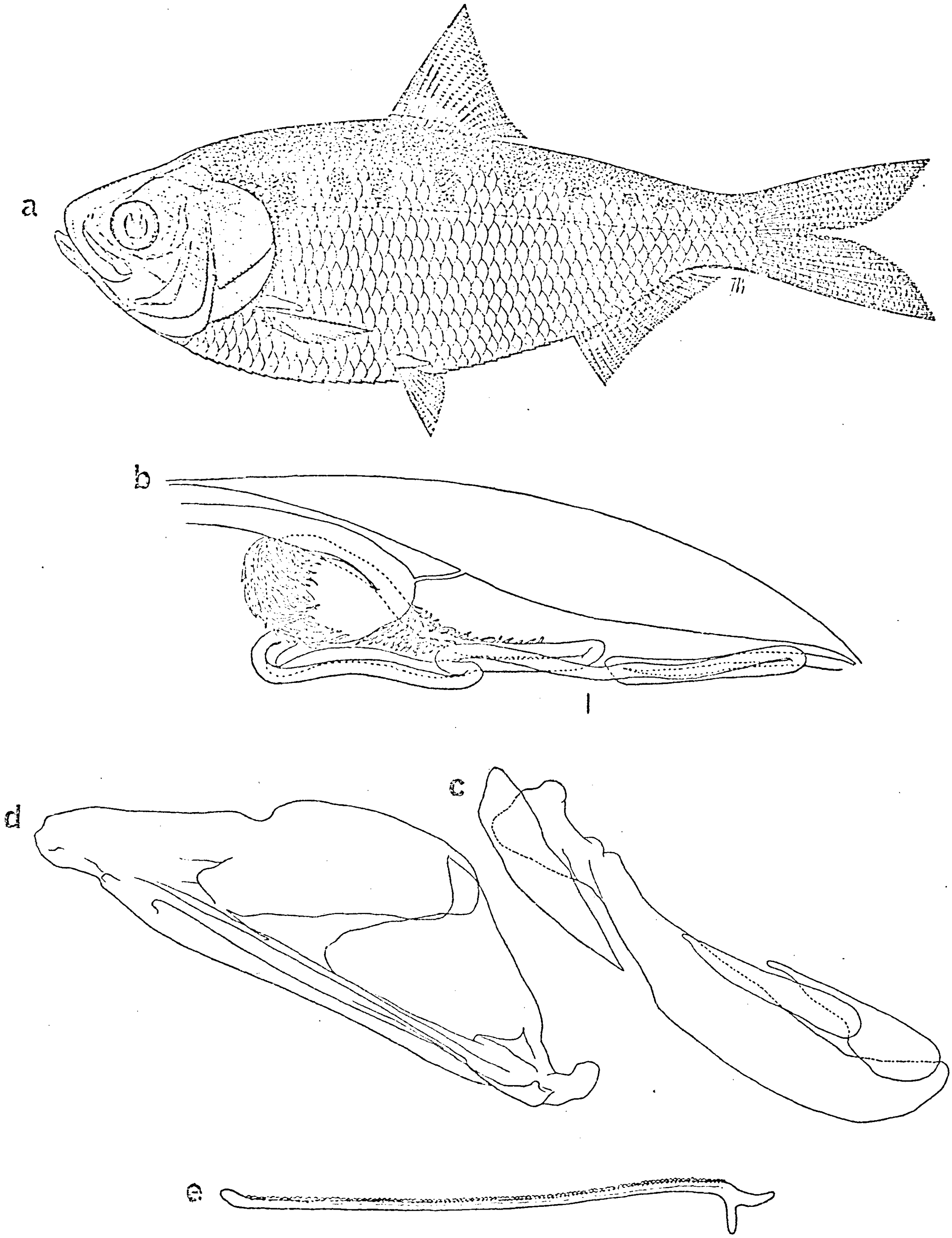


Plate 112. Tenualosa thibaudeaui:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, gillraker (a, e from KUMF. 2845b, 129.0 mm S.L.; b, c, d from NIFI. uncat., 127.0 mm S.L.).

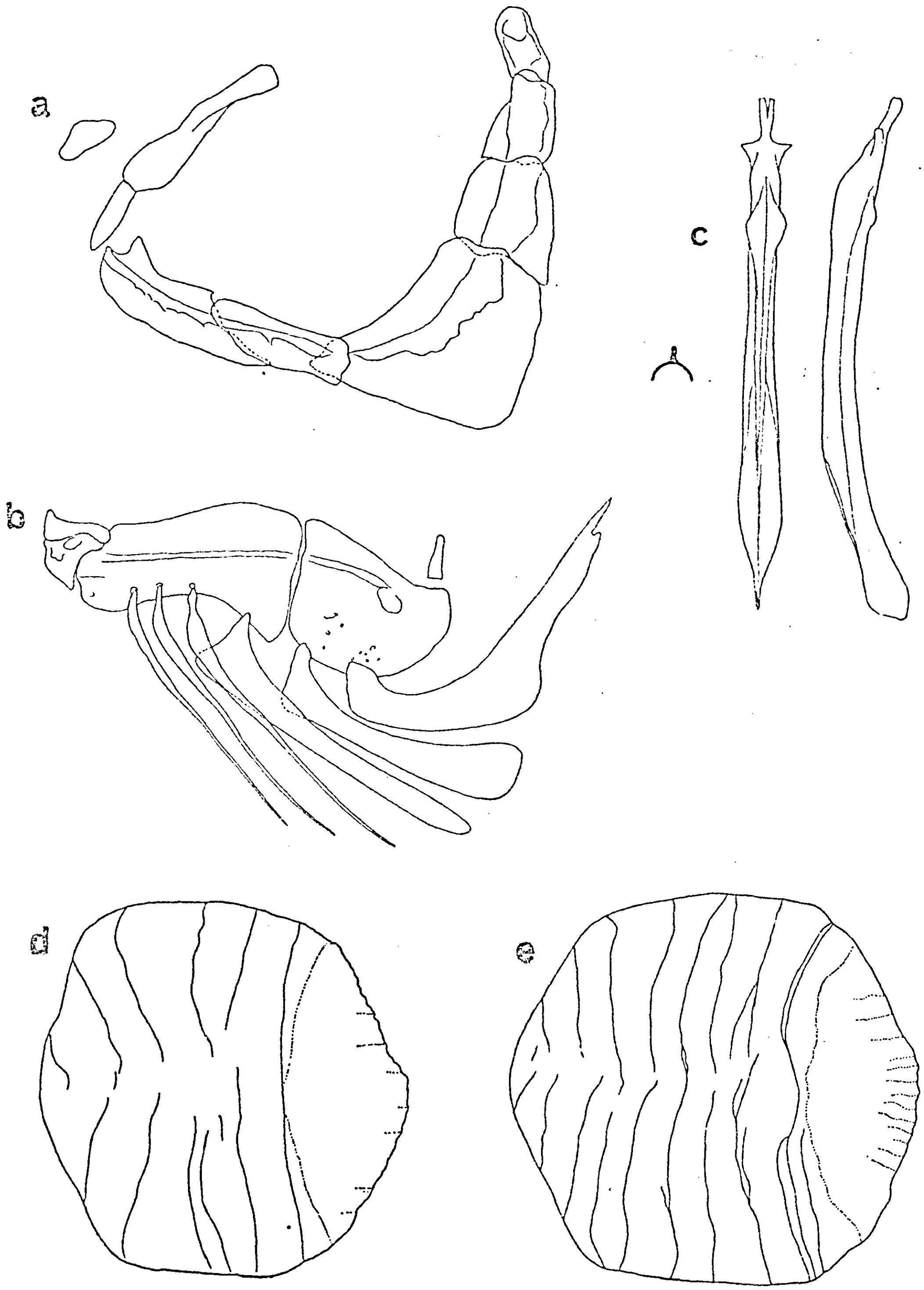


Plate 113. Tenualosa thibaudeaui:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, scales (a, b, c from NIFI. uncat., 127.0 mm S.L.; d from KUMF. 2845b, 129.0 mm S.L.; e from NIFI. uncat., 217.0 mm S.L.).

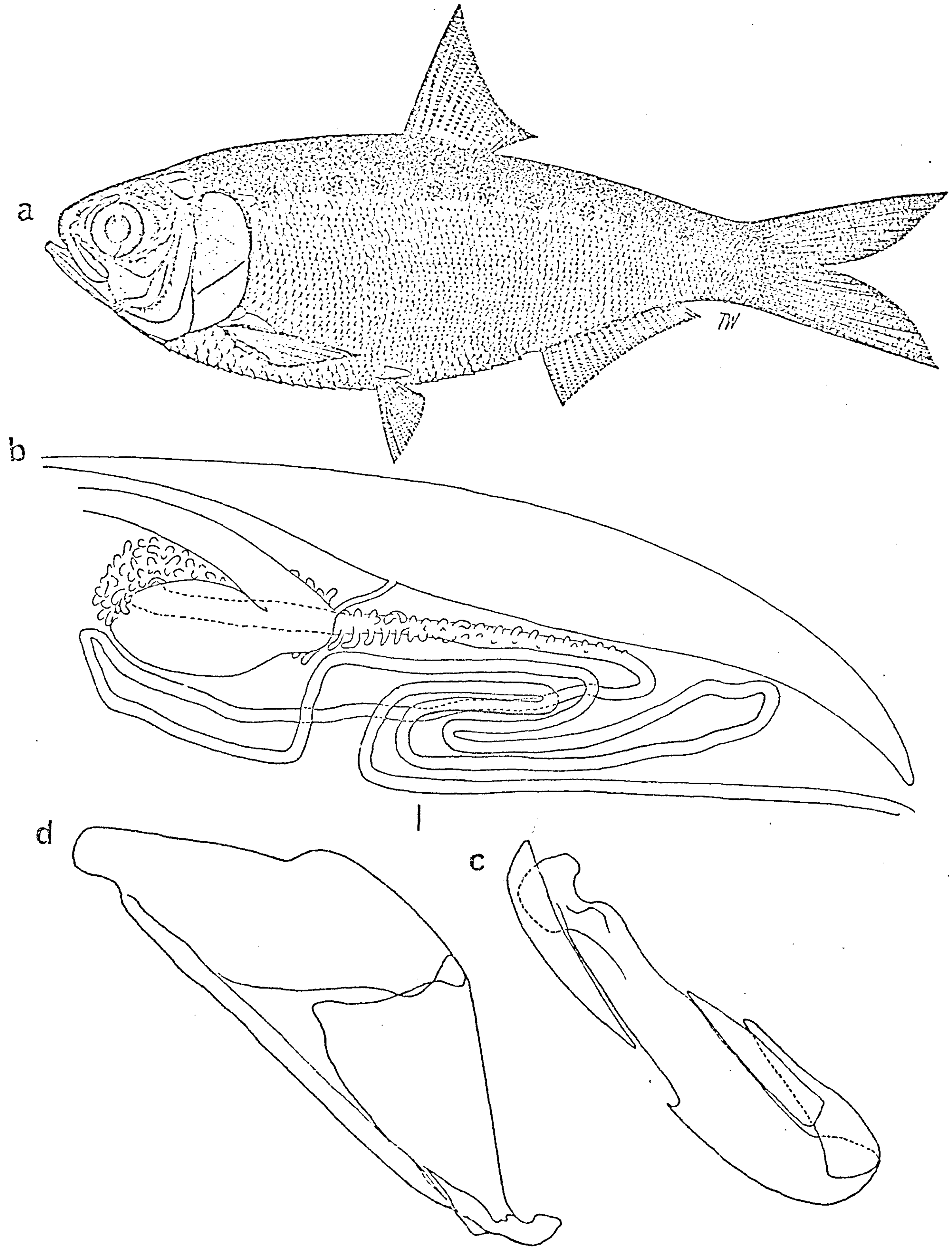


Plate 114. Gudusia chapra:- a, adult; b, gas bladder and intestinal tract; c, d, upper and lower jaws (a, b from BMNH. 1973.6.4.20-24, 113.0 mm S.L. for a and 104.0 mm S.L. for b; c, d from BMNH. 1934.10.17.1-6, 94.0 mm S.L.).

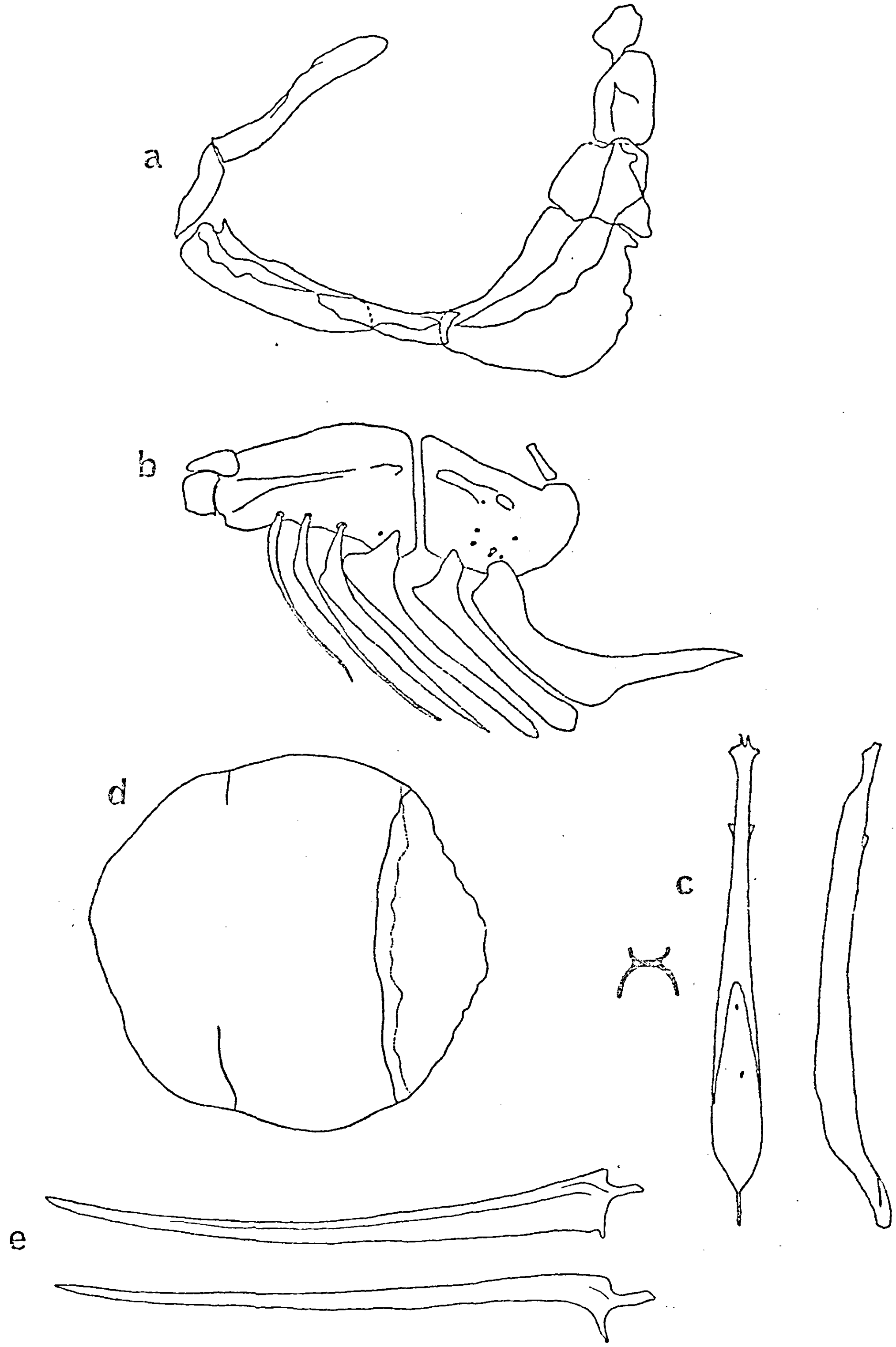


Plate 115. <u>Gudusia chapra</u>:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, broader and slender types of gillraker (all from BMNH. 1934.10.17.1-6, 94.0 mm S.L. for a, b, c, e and 139.0 mm S.L. for d).

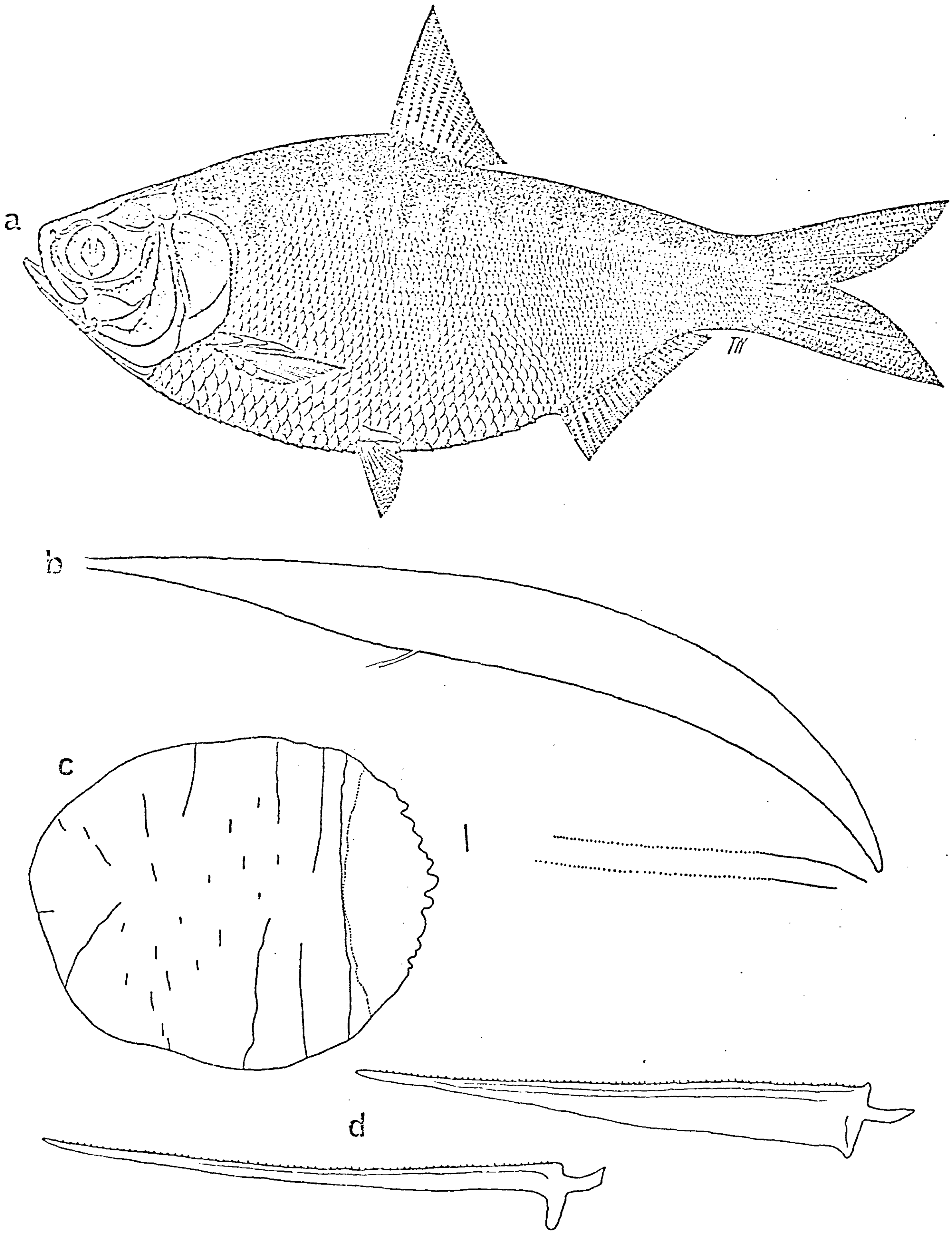


Plate 116. Gudusia variegata:- a, adult; b, swimbladder (digestive tract of this single BMNH specimen was removed); c, scale; d, broader and slender types of gillraker (all from BMNH. 1870.6.14.38, 154.0 mm S.L.).

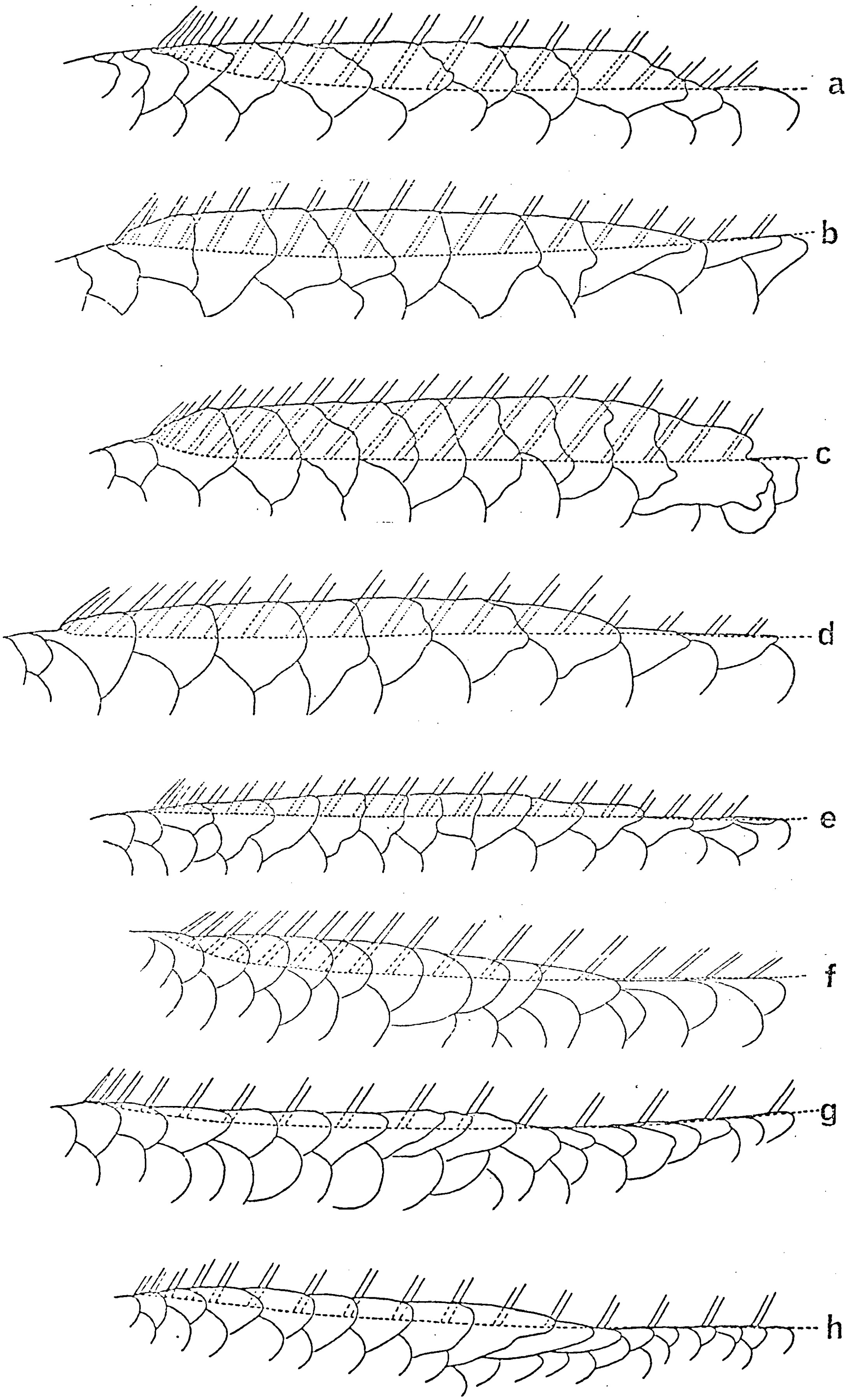


Plate 117. Diagrammatic representation of dorsal scaly sheaths in species of Alosinae : a, *Hilsa kelae*; b, *Tenualosa toli*; c, *T. macrura*; d, *T. reevesii*; e, *T. ilisha*; f, *T. thibaudeaui*; g, *Gudusia chapra*; h, *G. variegata*.

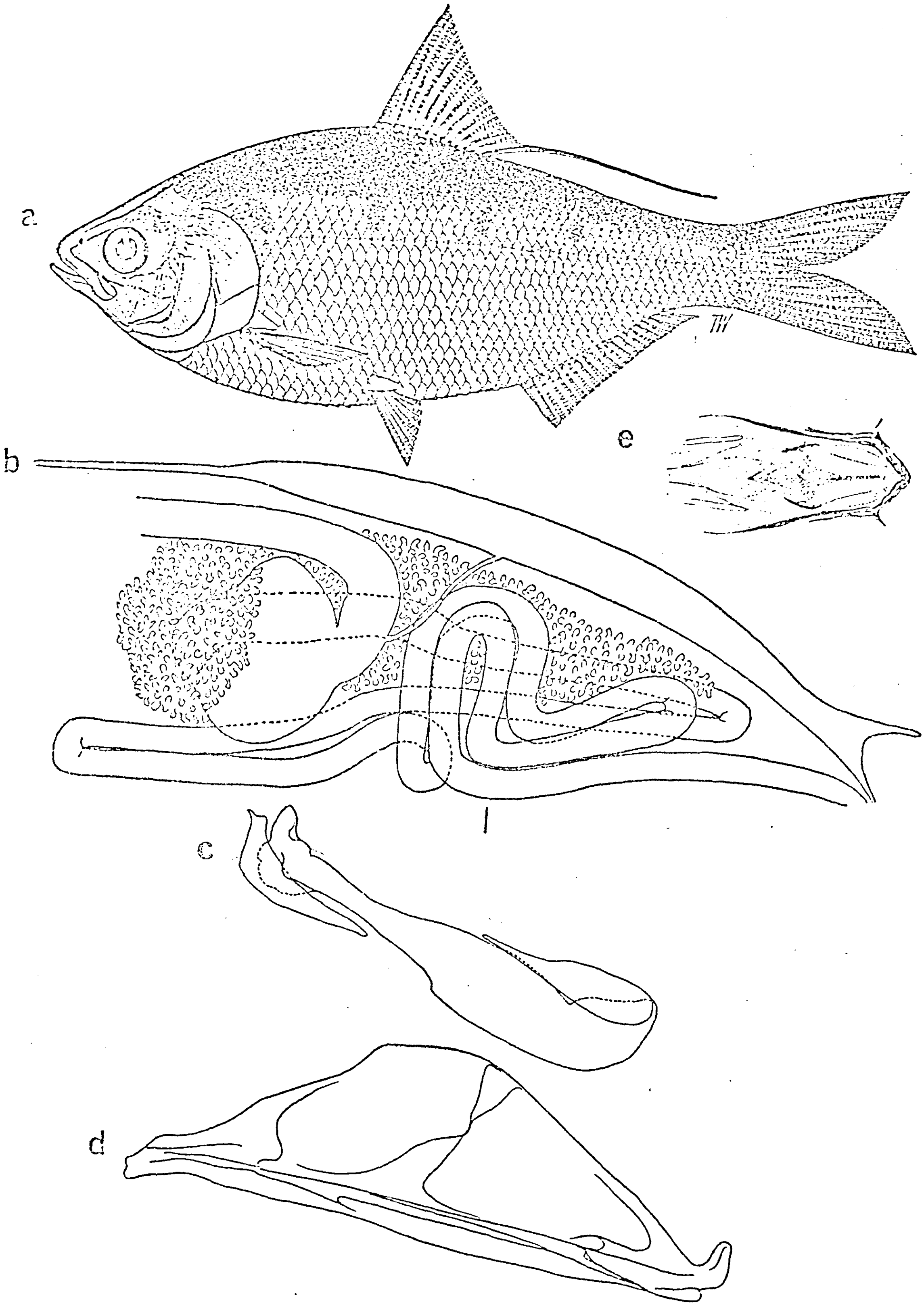


Plate 118. *Clupanodon thrissa*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e frontoparietal striae (all from BMNH. 1979.8.15.33-35, 147.0 mm S.L. for a and 112.0 mm S.L. for others).

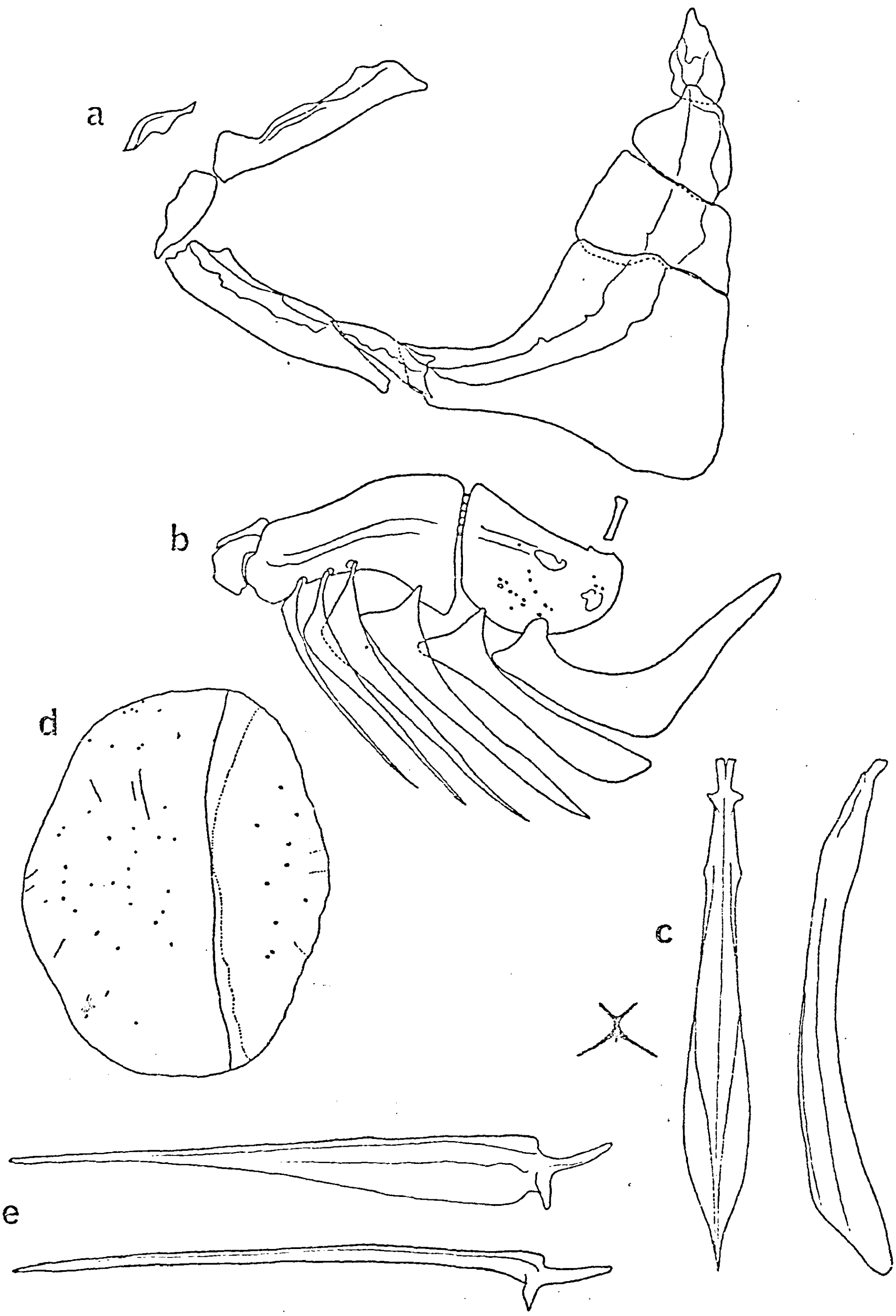


Plate 119. Clupanodon thrissa:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, broader and slender types of gillraker (all from BMNH. 1979.8.15.33-35, 112.0 mm S.L. for a, b, c, e and 147.0 mm S.L. for d).

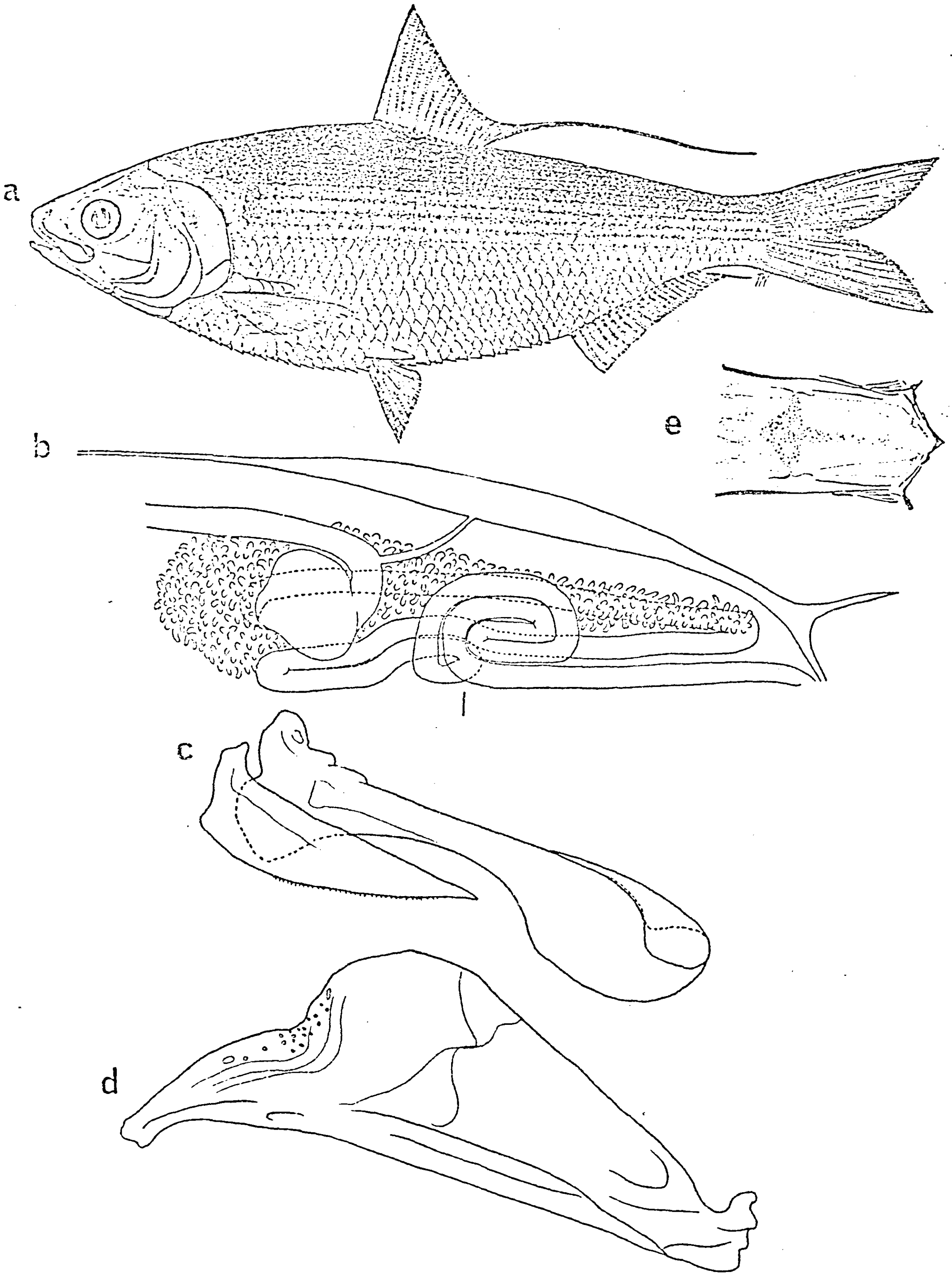


Plate 120. Konosirus punctatus:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, frontoparietal striae (a, e from BMNH. 1979.7.5.9, 173.0 mm S.L.; others from BMNH. 1874.1.16.48, 152.0 mm S.L.)

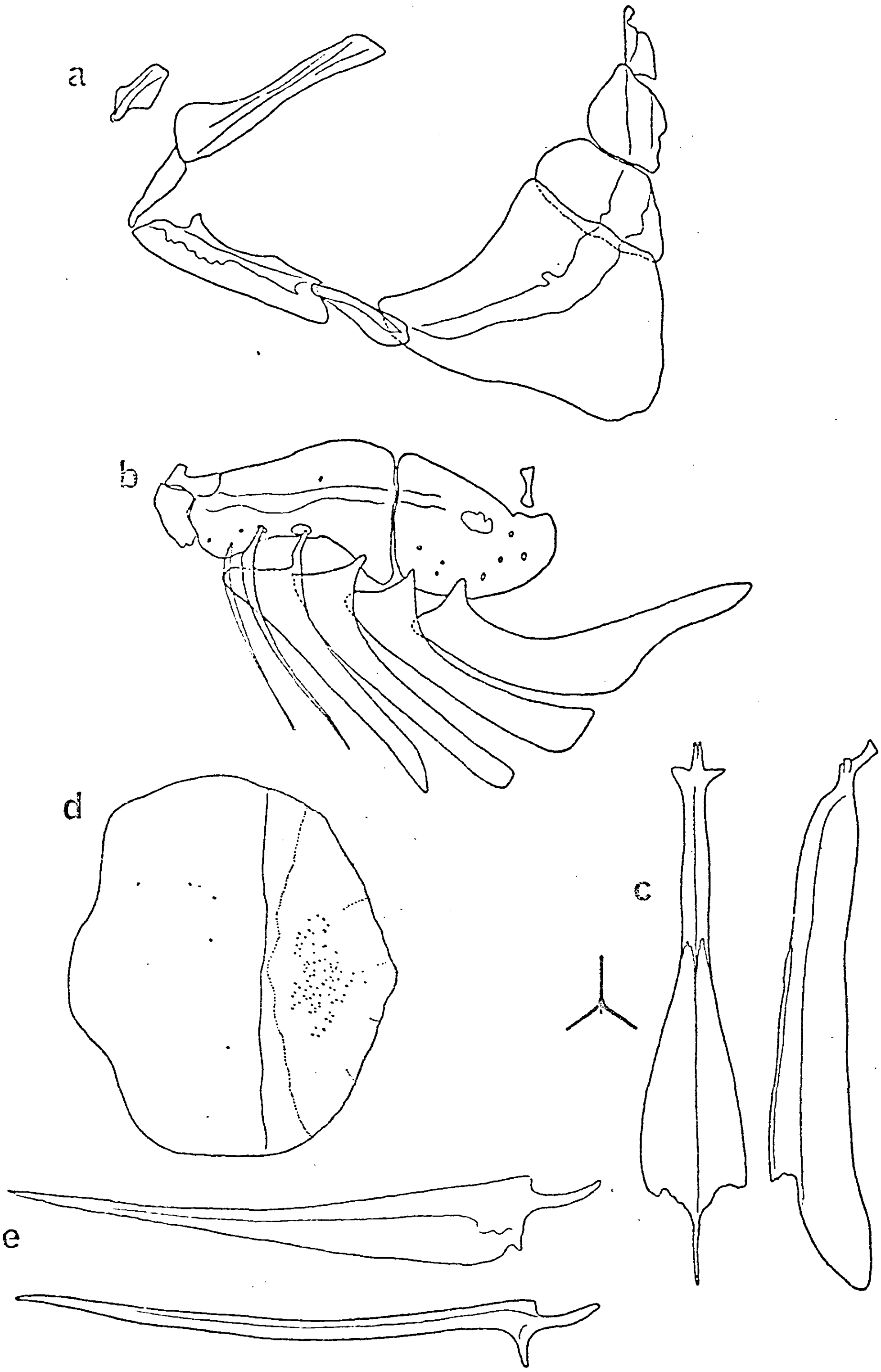


Plate 121. Konosirus punctatus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, broader and slender types of gillraker (a, b, c, e from BMNH. 1874.1.16.48, 152.0 mm S.L.; d from BMNH. 1974.2.2.72-80, 189.0 mm S.L.).

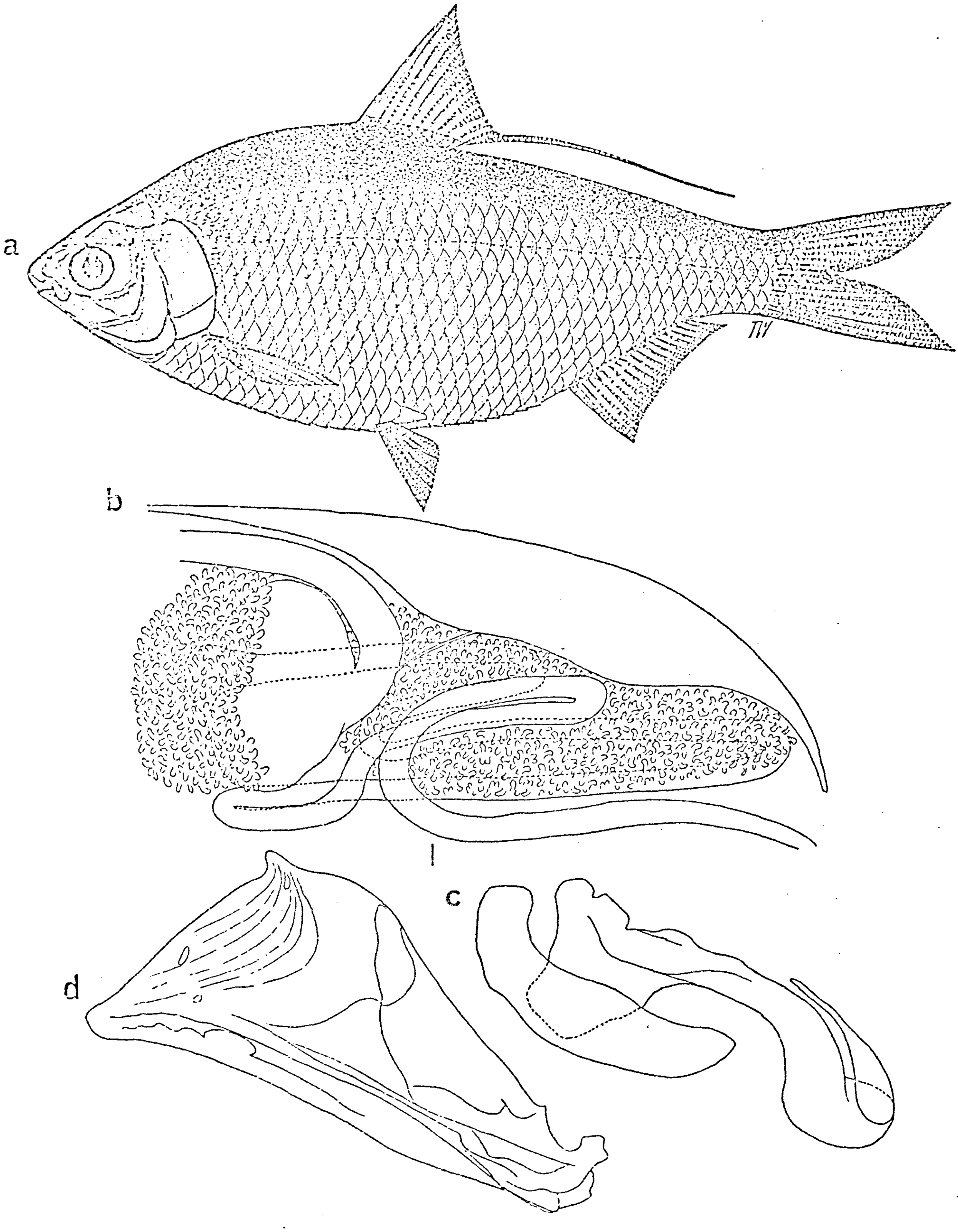


Plate 122. Nematalosa erebi:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1897.1.20.59-63, 118.0 mm S.L., holotype of Chatoessus horni; others from BMNH. 1879.5.14.623-630, 73.0 mm S.L.

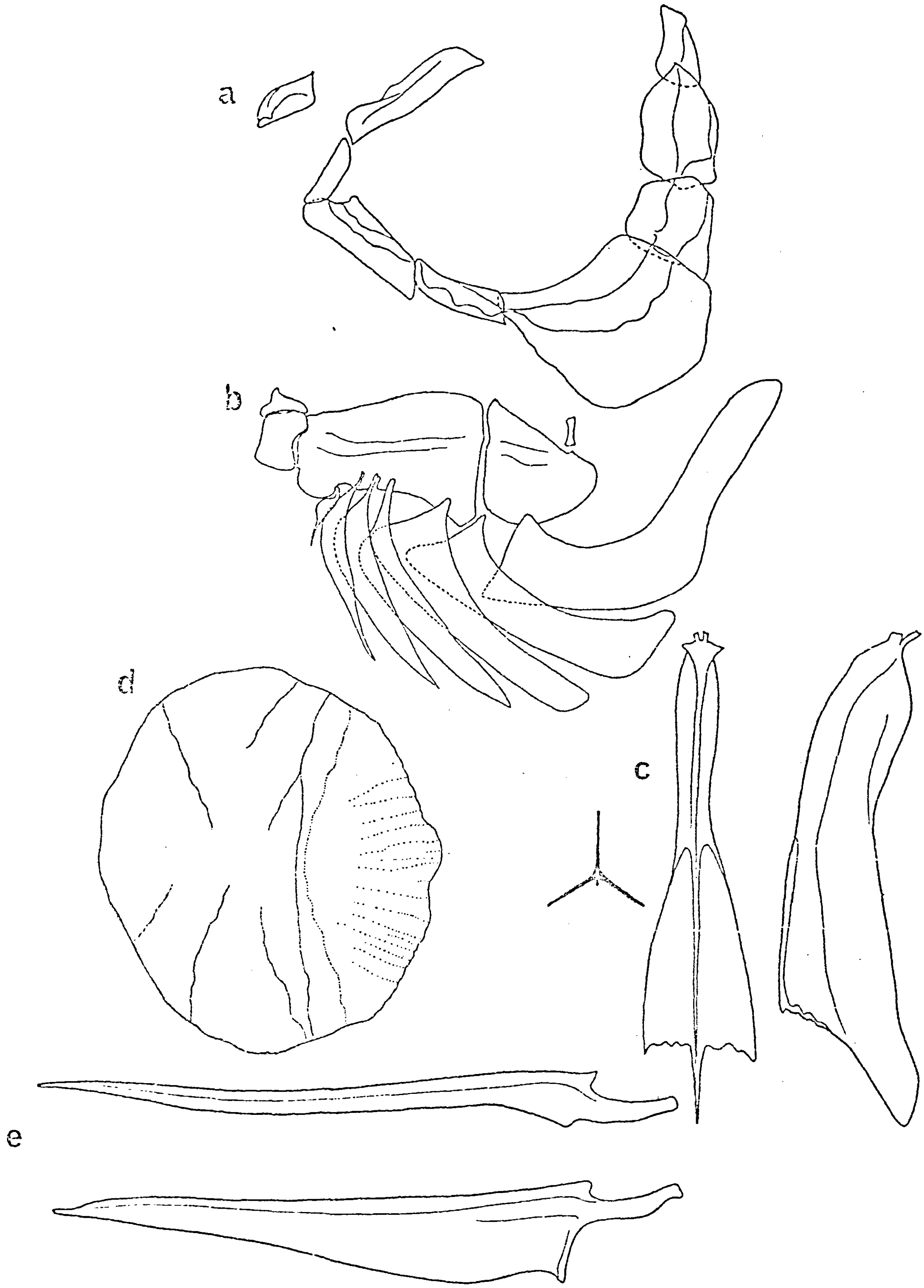


Plate 123. Hematalosa erebi:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, slender and broader types of gillraker (a, b, c, e from BMNH. 1879.5.14.623-630, 73.0 mm S.L.; d from BMNH. 1912.11.28.38.42, 123.0 mm S.L.).

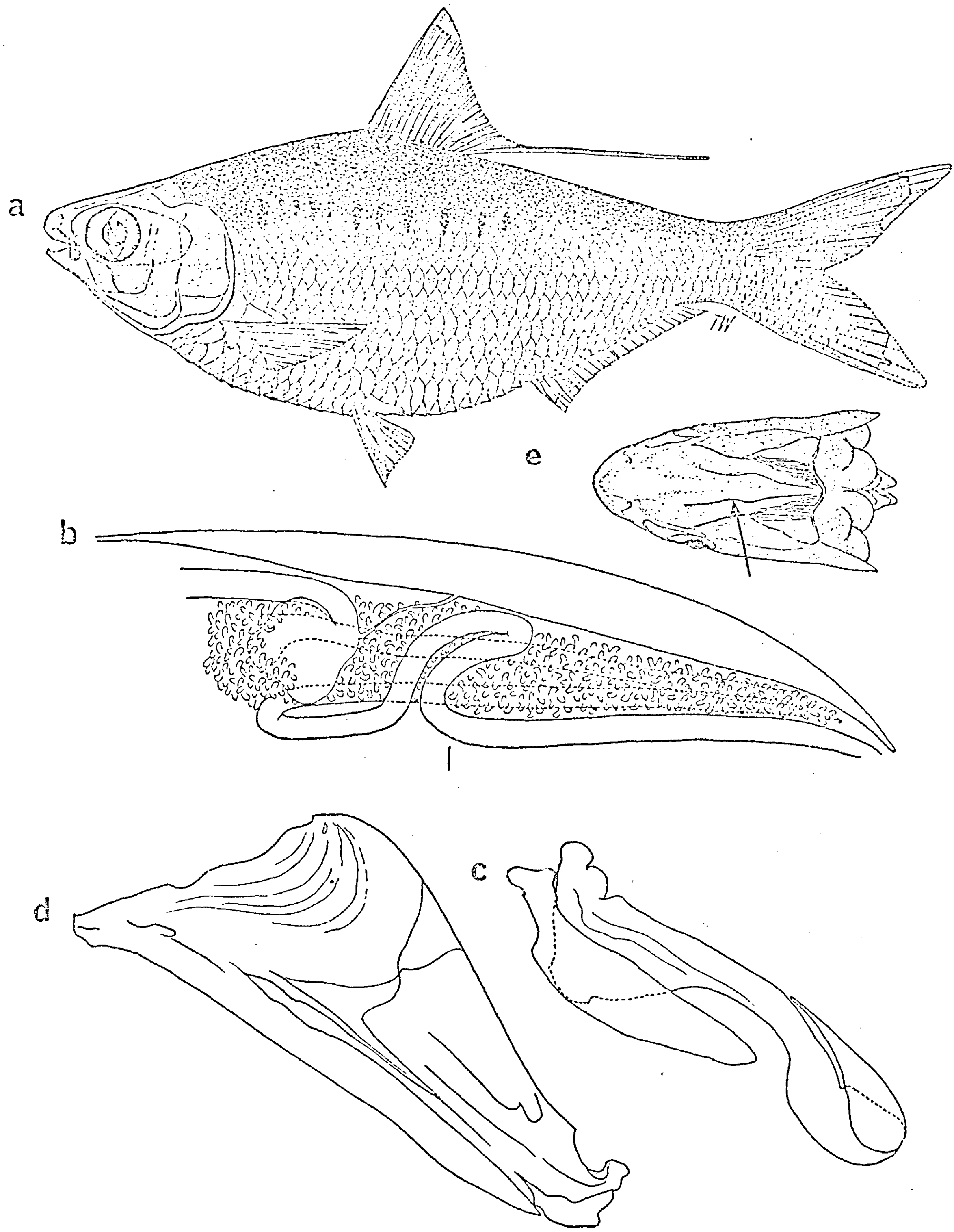


Plate 124. Nematalosa chanpole:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, frontoparietal striae and gelatineous plate on top of head indicated by arrow (a, e from BMNH. 1971.10.4.1., 118.0 mm S.L., paratype of Nematalosa galatheae; others from BMNH. 1889.2.1.1877, 124.0 mm S.L.).

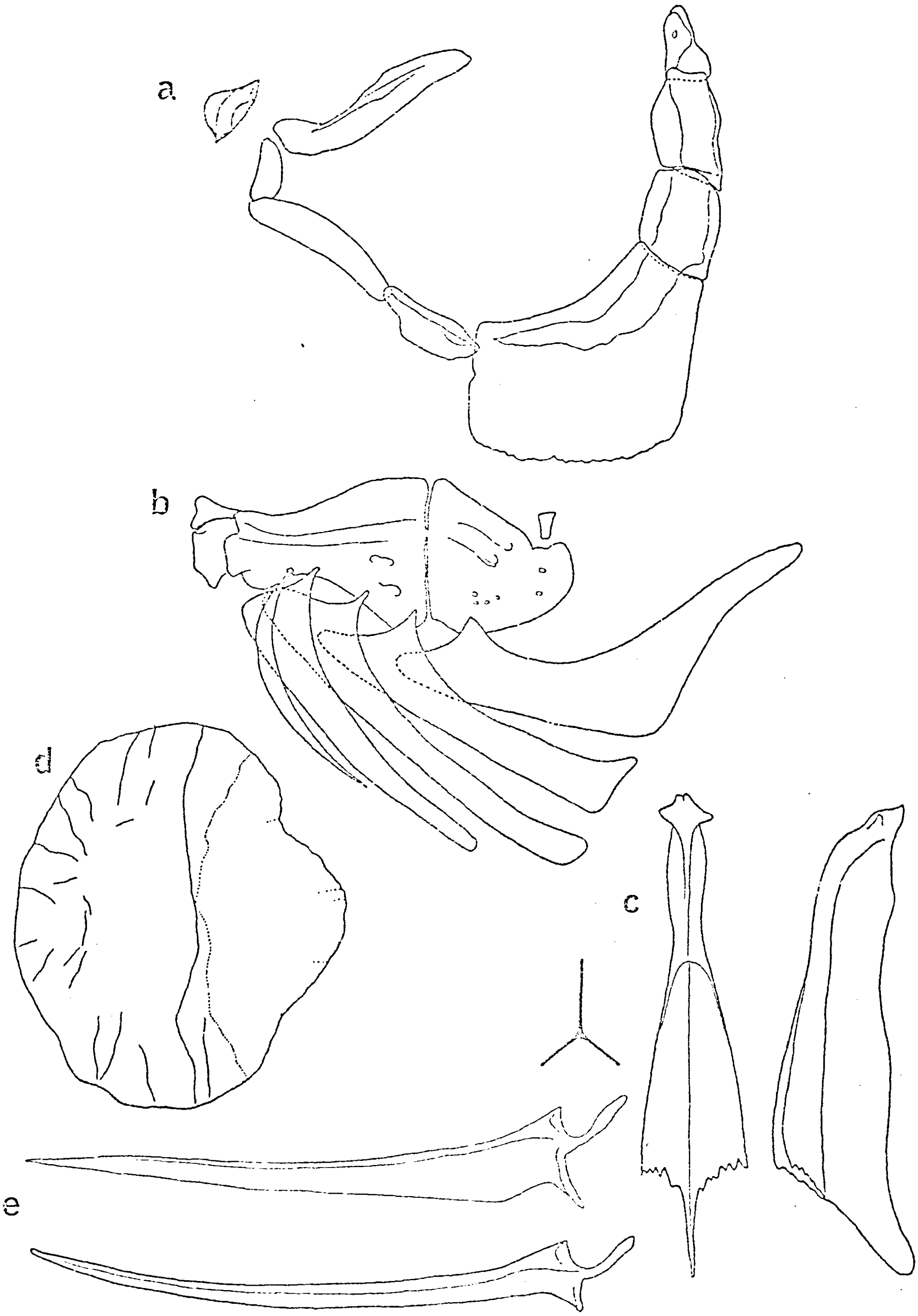


Plate 125. _Nematalosa chanpole_:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, broader and slender types of gillraker (all from BMNH. 1889.2.1.1877, 124.0 mm S.L.).

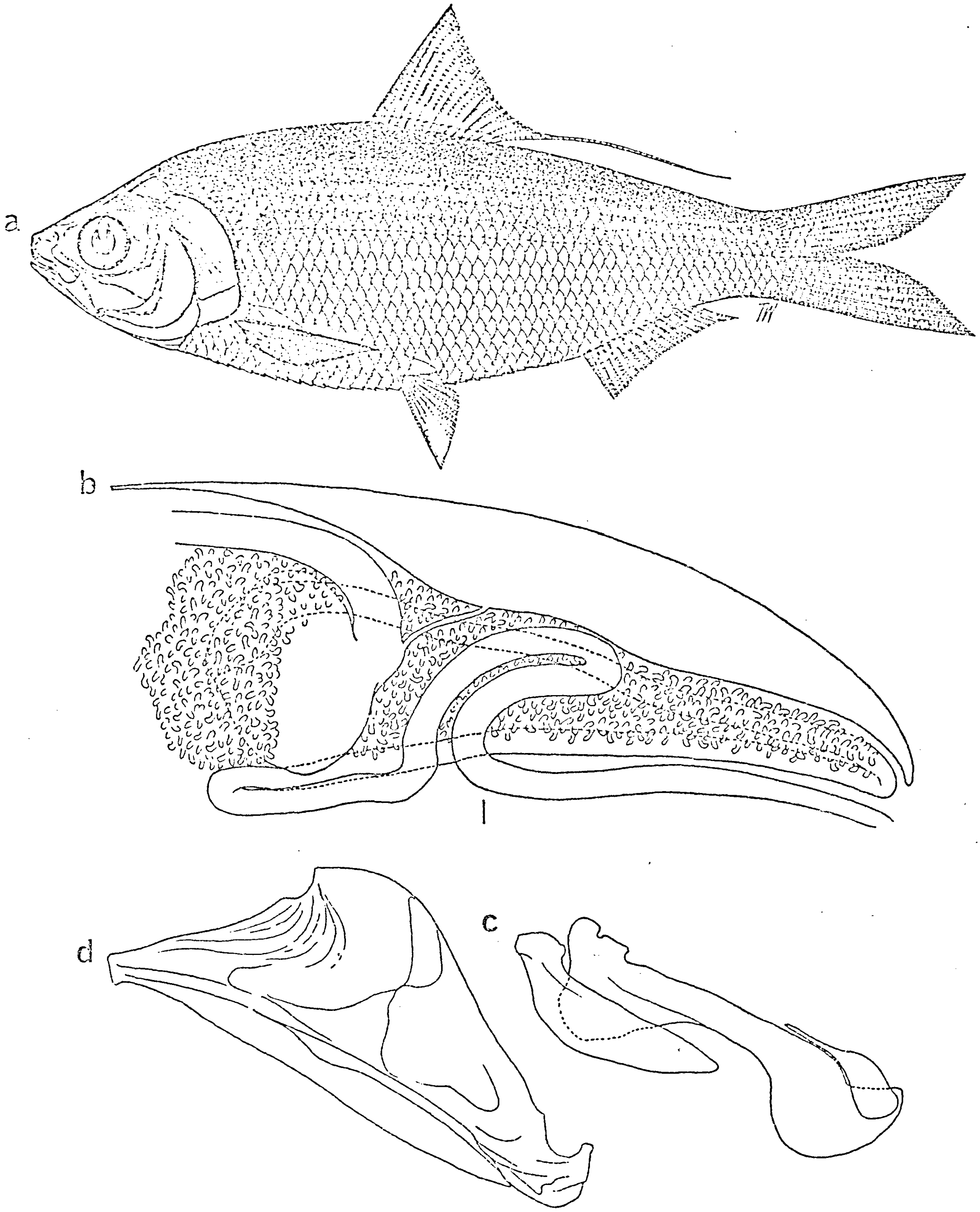


Plate 126. Nematalosa arabica:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1962.3.13.1-6, 102.0 mm S.L. for a and 99.0 mm S.L. for others).

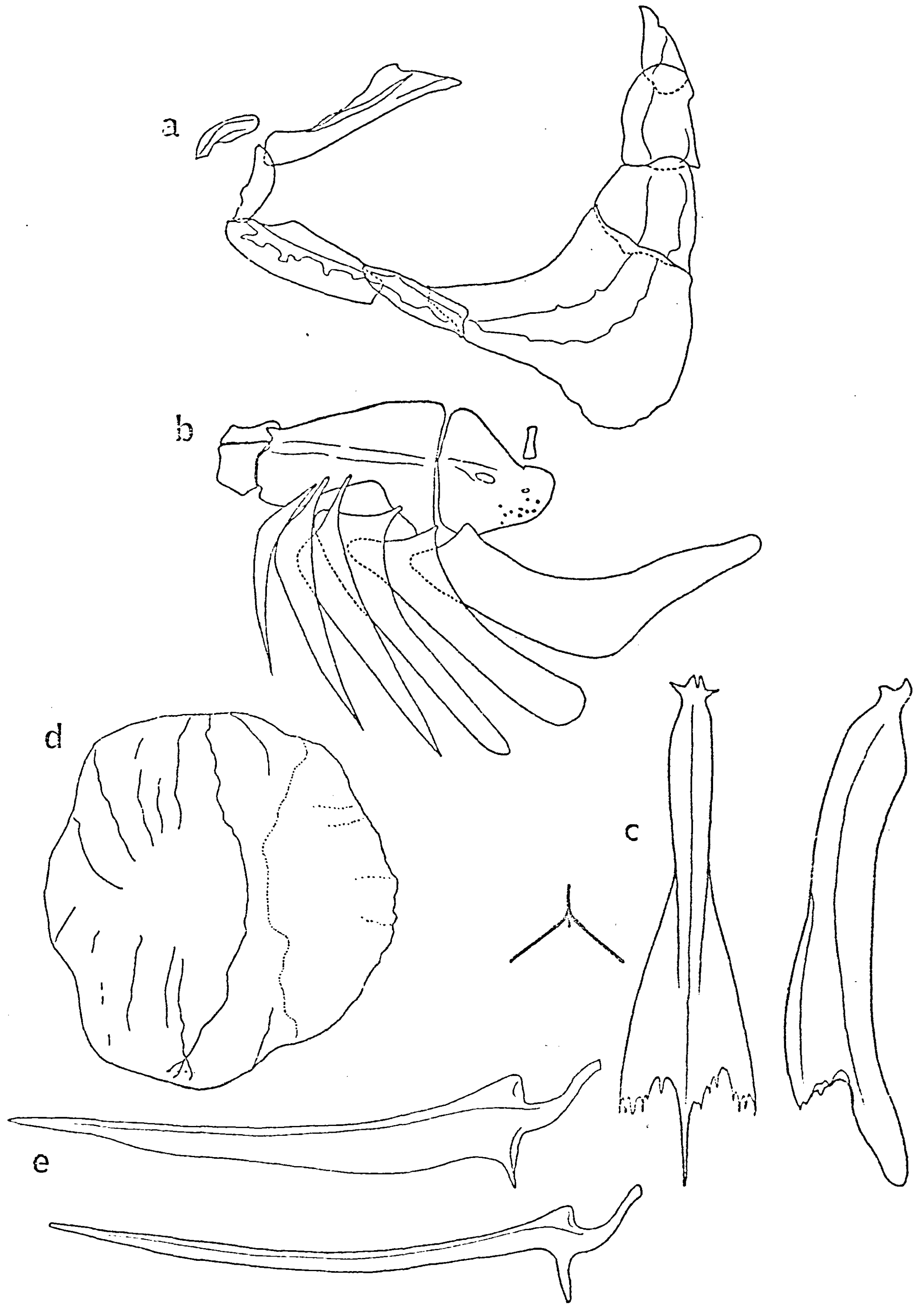


Plate 127. Nematalosa arabica:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, broader and slender types of gillraker (a, b, c, e from BMNH. 1962.3.13.1-6, 99.0 mm S.L.; d from BMNH. 1945.12.31.14, 153.0 mm S.L.).

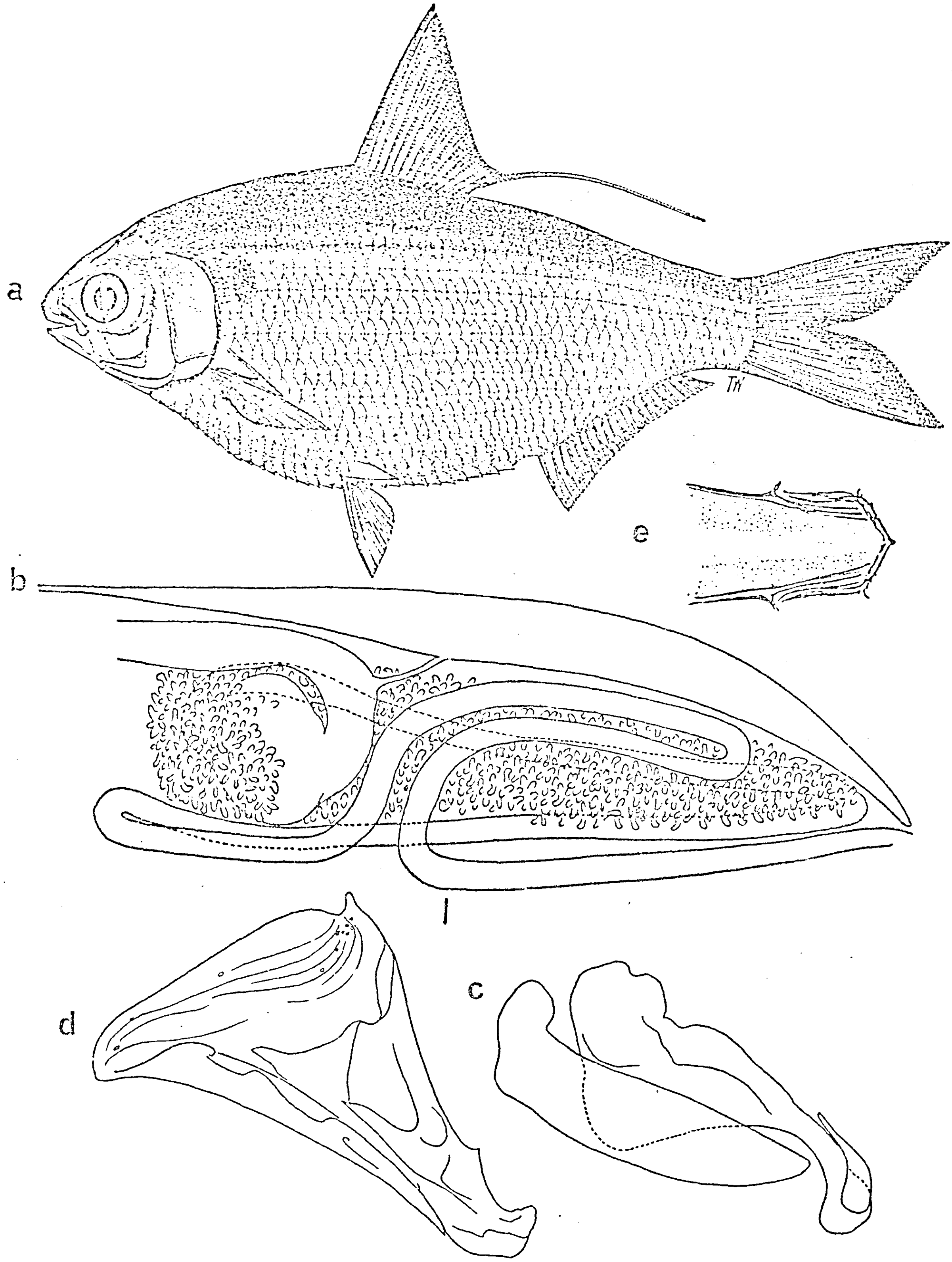


Plate 128. *Nematalosa come*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, frontoparietal striae (a, e from BMNH. 1844. 2.21.69, 130.0 mm S.L.; others from BMNH. 1979.7.5.10, 132.0 mm S.L.).

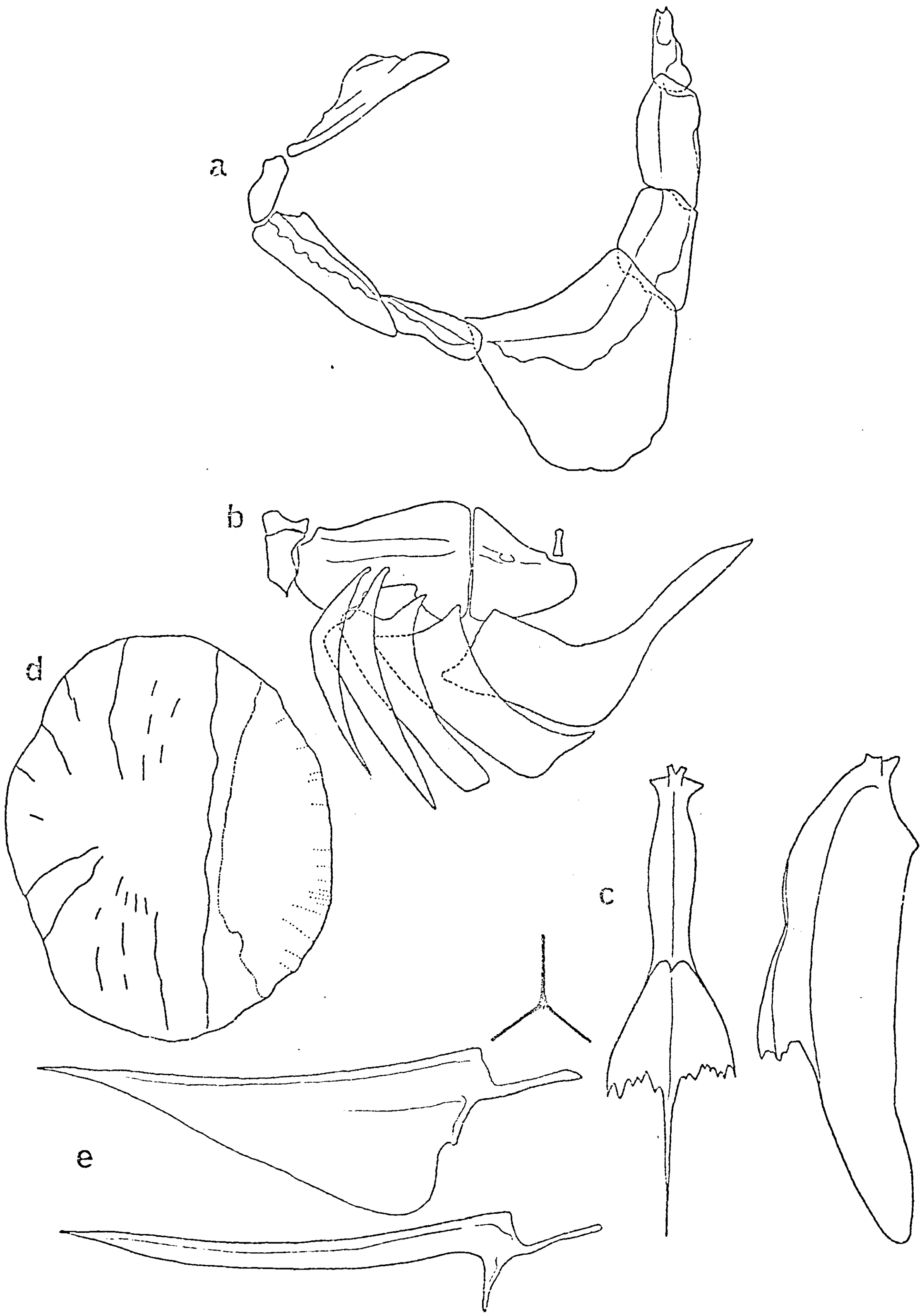


Plate 129. Nematalosa come:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, broader and slender types of gillraker (all from BMNH. 1979.7.5.10, 132.0 mm S.L.).

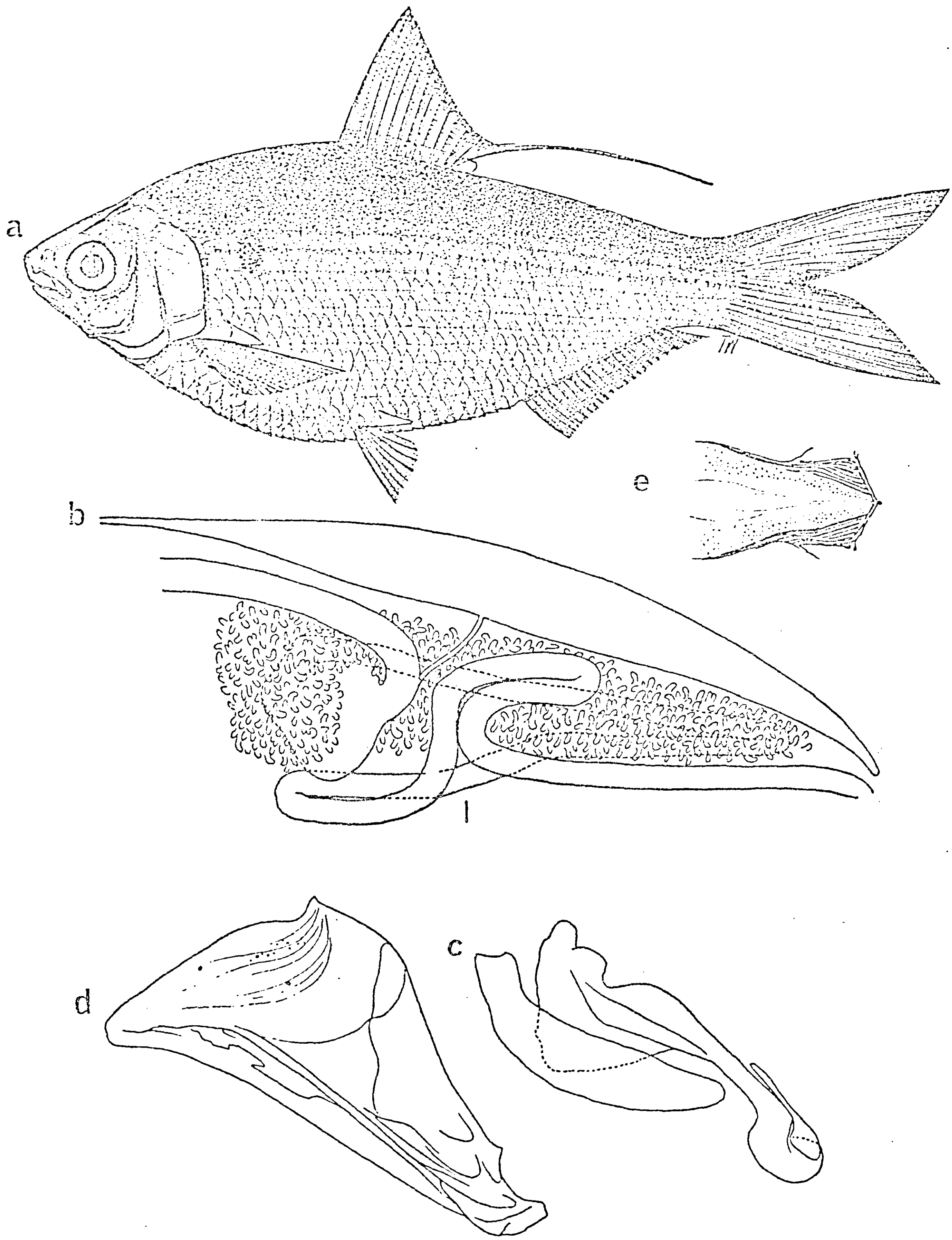


Plate 130. Nematalosa nasus:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, frontoparietal striae (all from BMNH. 1979. 8.15.37-38, 96.5 mm S.L. for a, e and 101.0 mm S.L. for others).

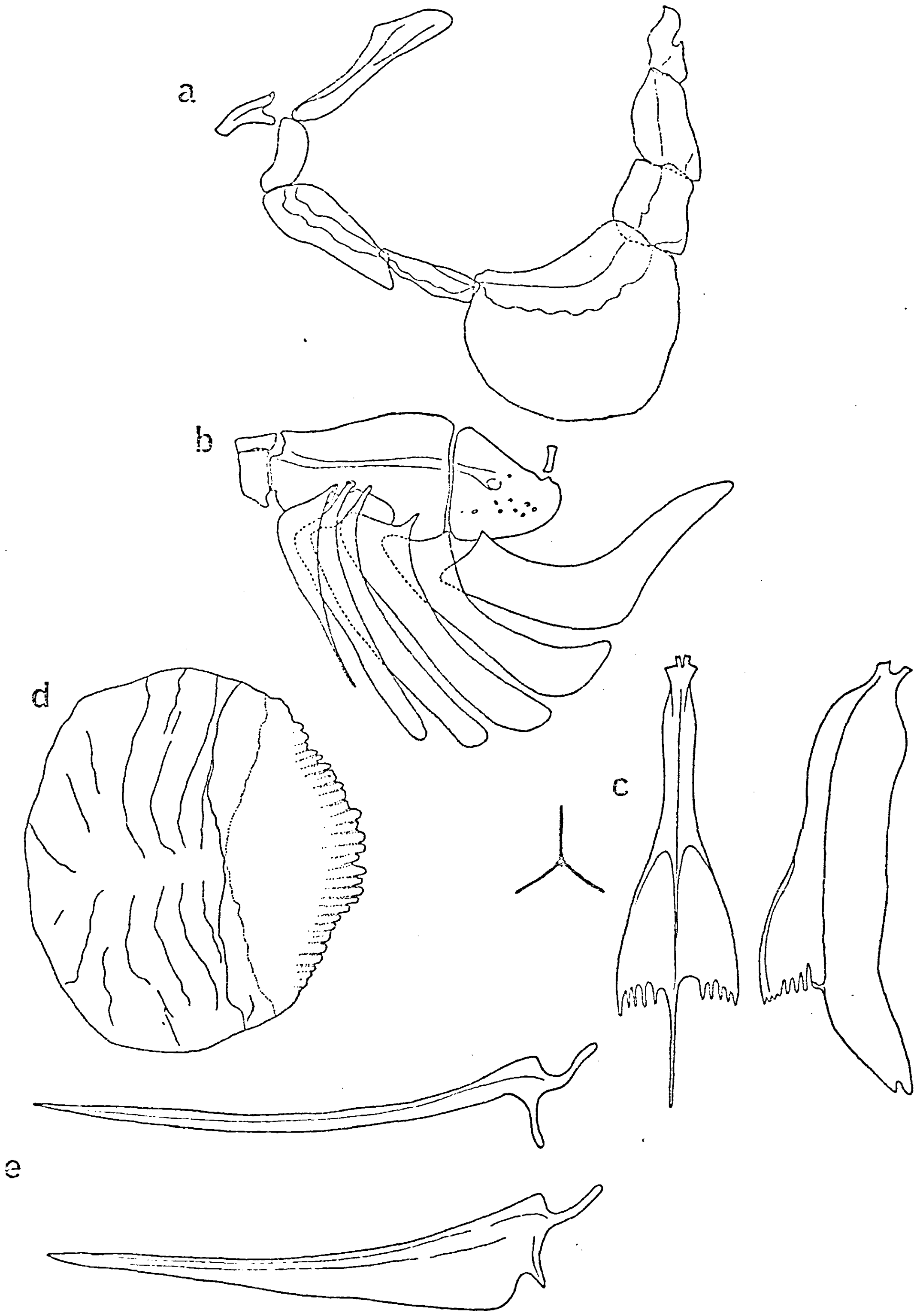


Plate 131. Nematalosa nasus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, slender and broader types of gillraker, (a, b, c, from BMNH. 1973.6.4.25-29, 112.0 mm S.L.; d from BMNH. 1974.2.2.72-73, 145.0 mm S.L.; e from BMNH. 1979.8.15.37-38, 101.0 mm S.L.).

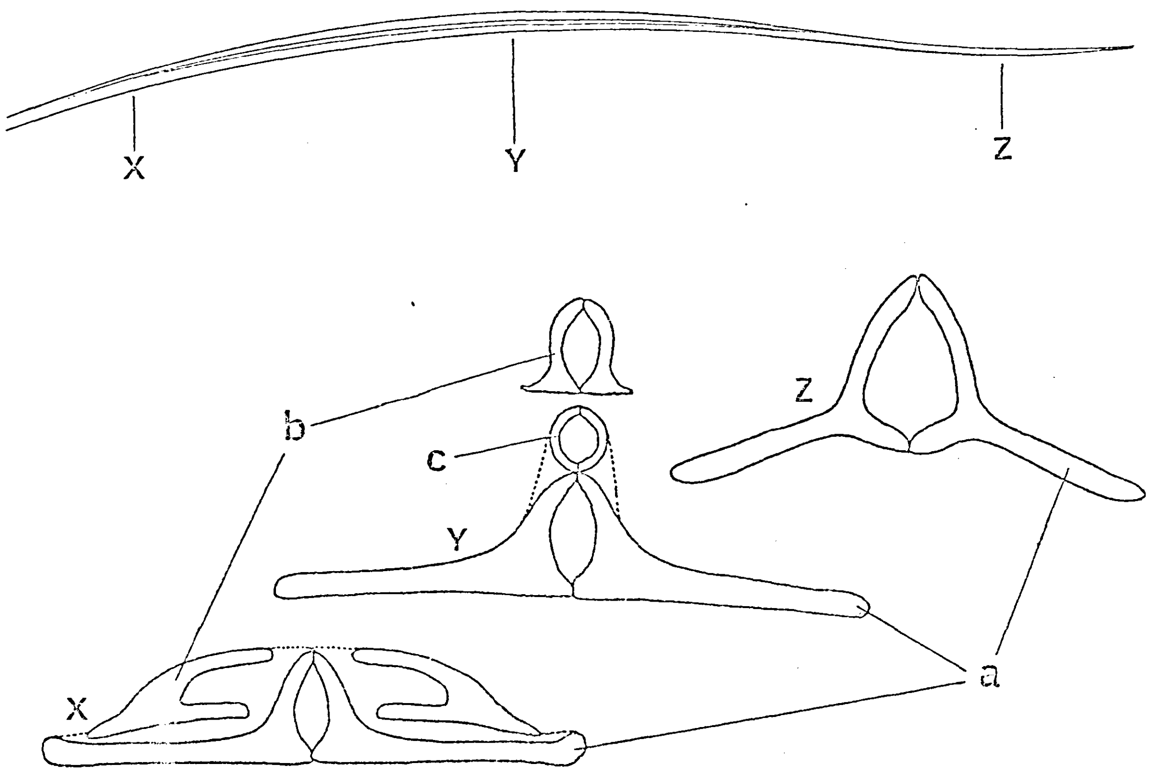


Plate 132. Diagrammatic illustration showing cross-sections of dorsal filament of representative Nematalosa nasus; x, y and z refer to studied positions a, primary branch; b, secondary (upper) branch; c, tertiary (middle) branch, emerged from primary branch.

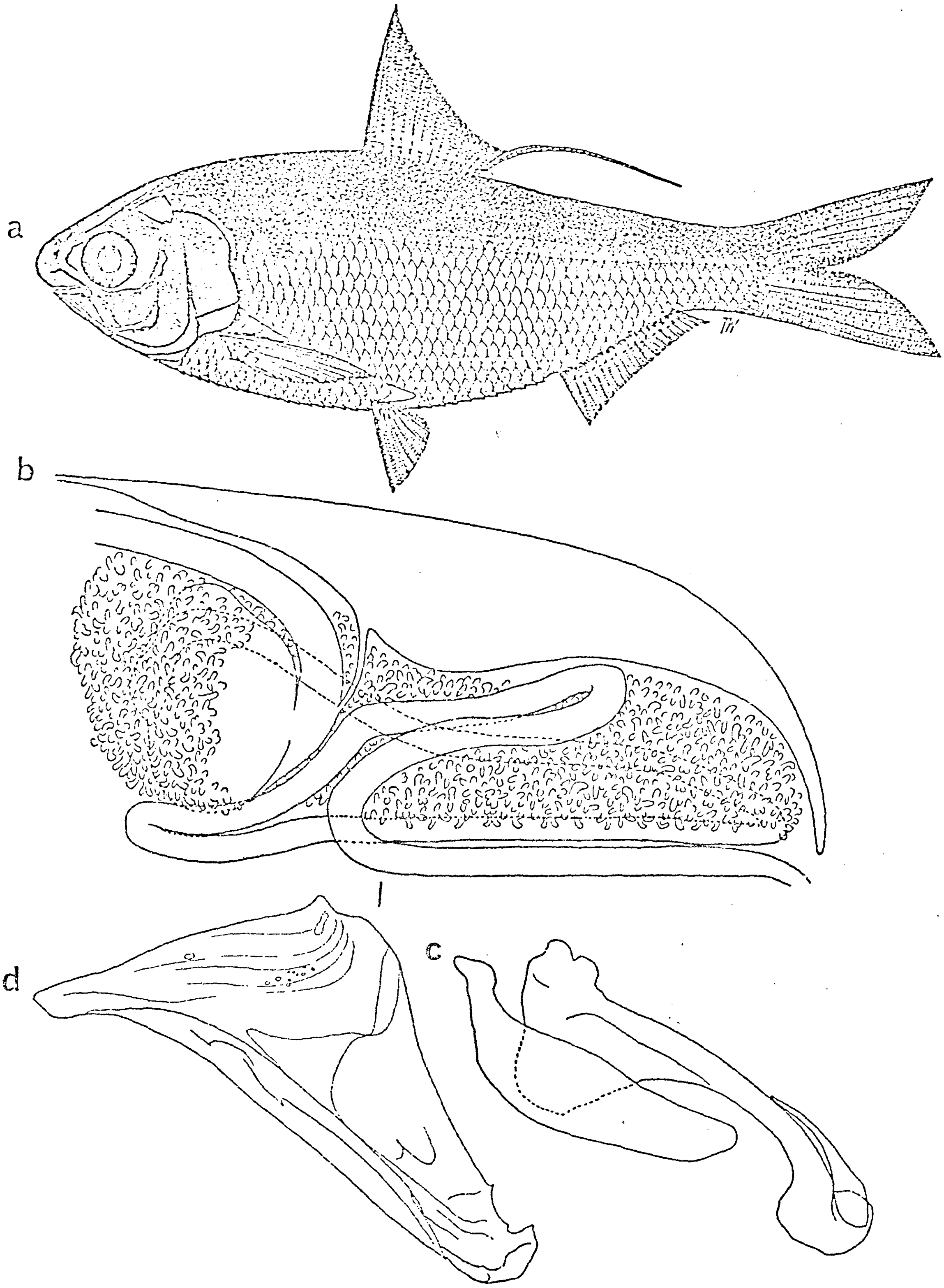


Plate 133. Nematalosa japonica:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1965.7.5.35-44, 72.0 mm S.L. for a and 73.0 mm S.L. for others).

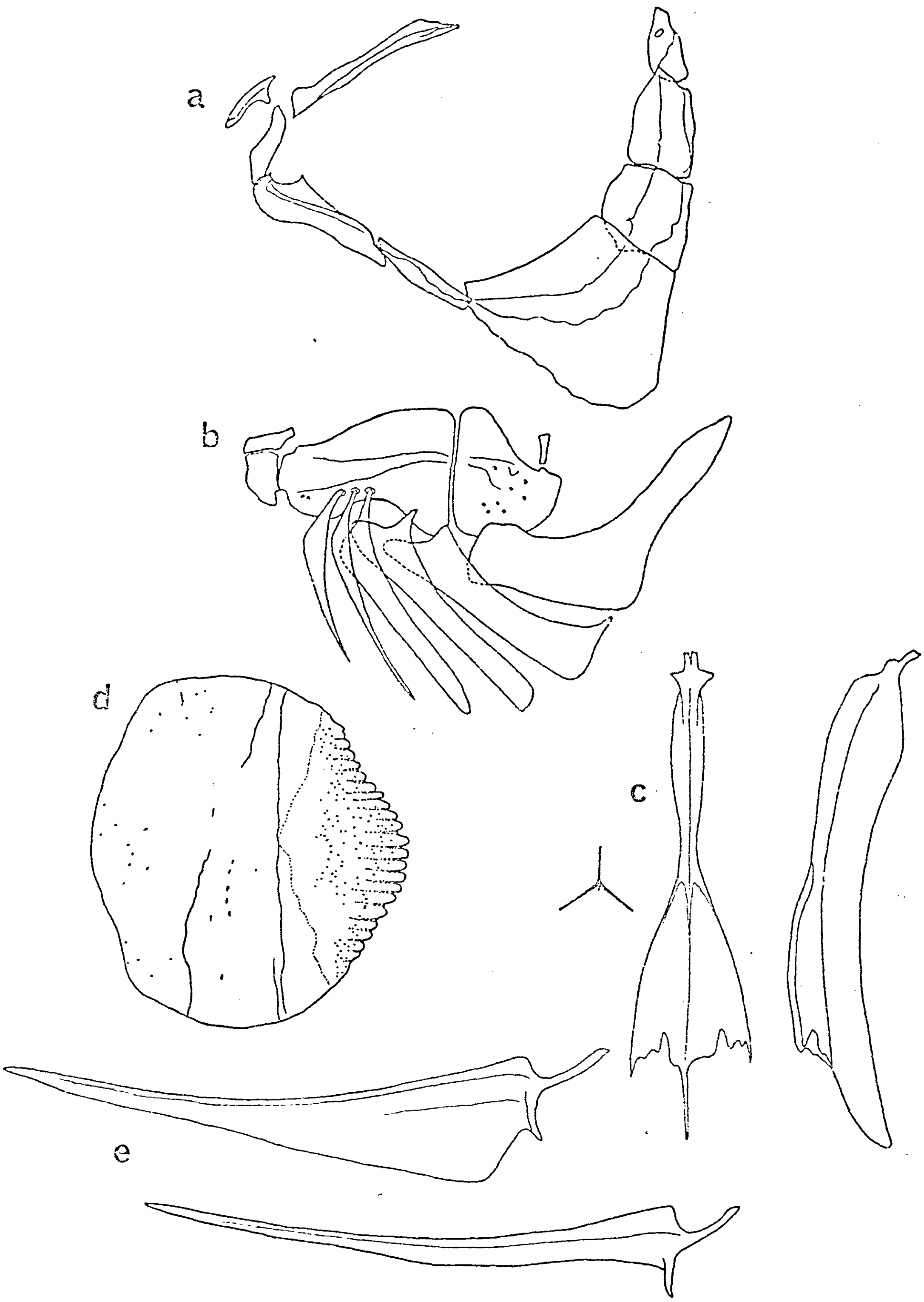


Plate 134. *Nematalosa japonica*:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, broader and slender types of gillraker (a, b, c, e from BMNH. 1965.7.5.35.44, 73.0 mm S.L.; d from BMNH. 1974.2.2.74-77, 152.0 mm S.L.).

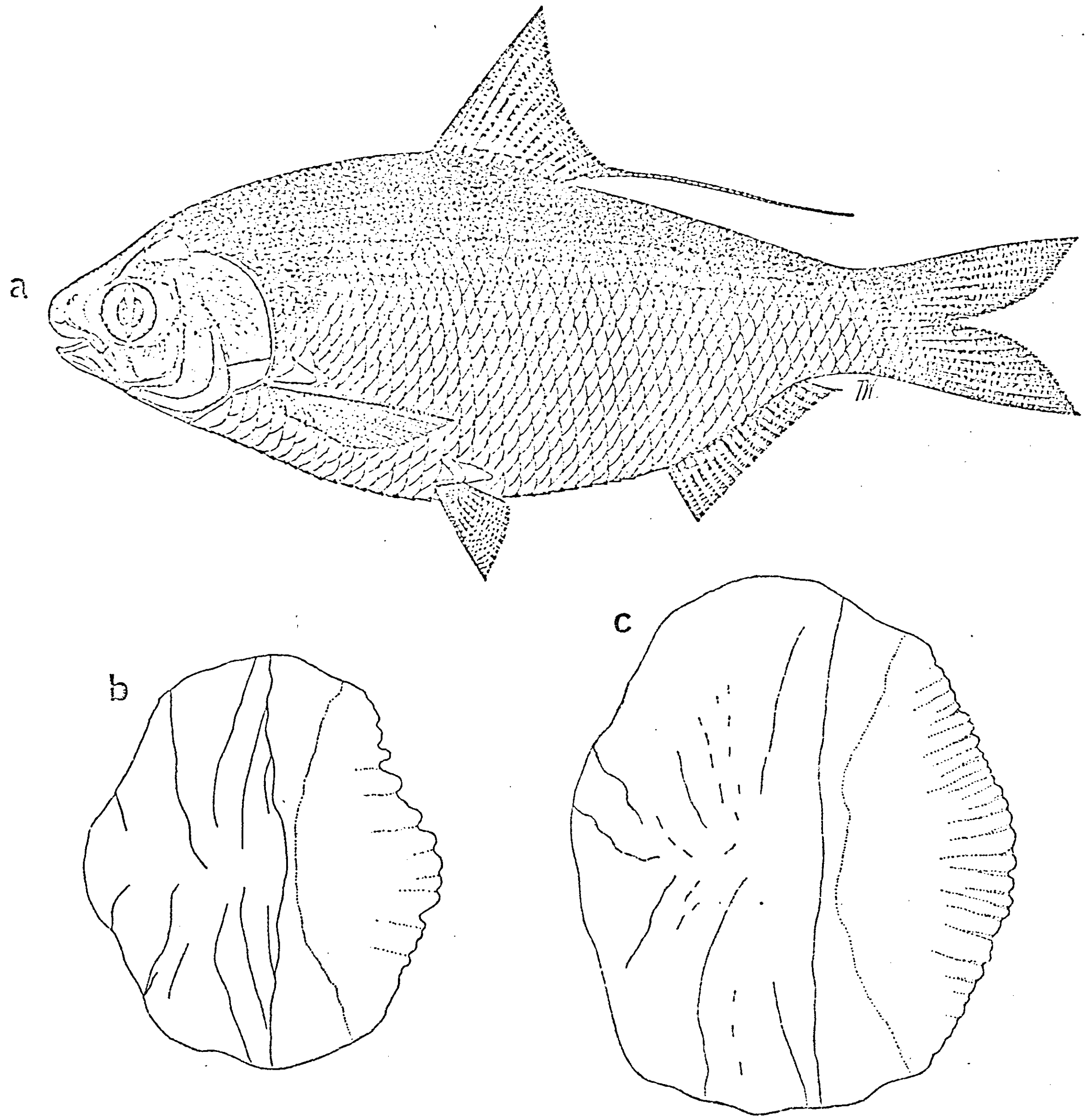


Plate 135. Nematalosa vlaminghi:- a, adult; b, c, scales (a, c, from AMS. IB. 1836-1837, paratypes, 150.0 mm S.L. for a and 183.0 mm S.L. for c; d, from WAM. P. 12832, 149.0 mm S.L.).

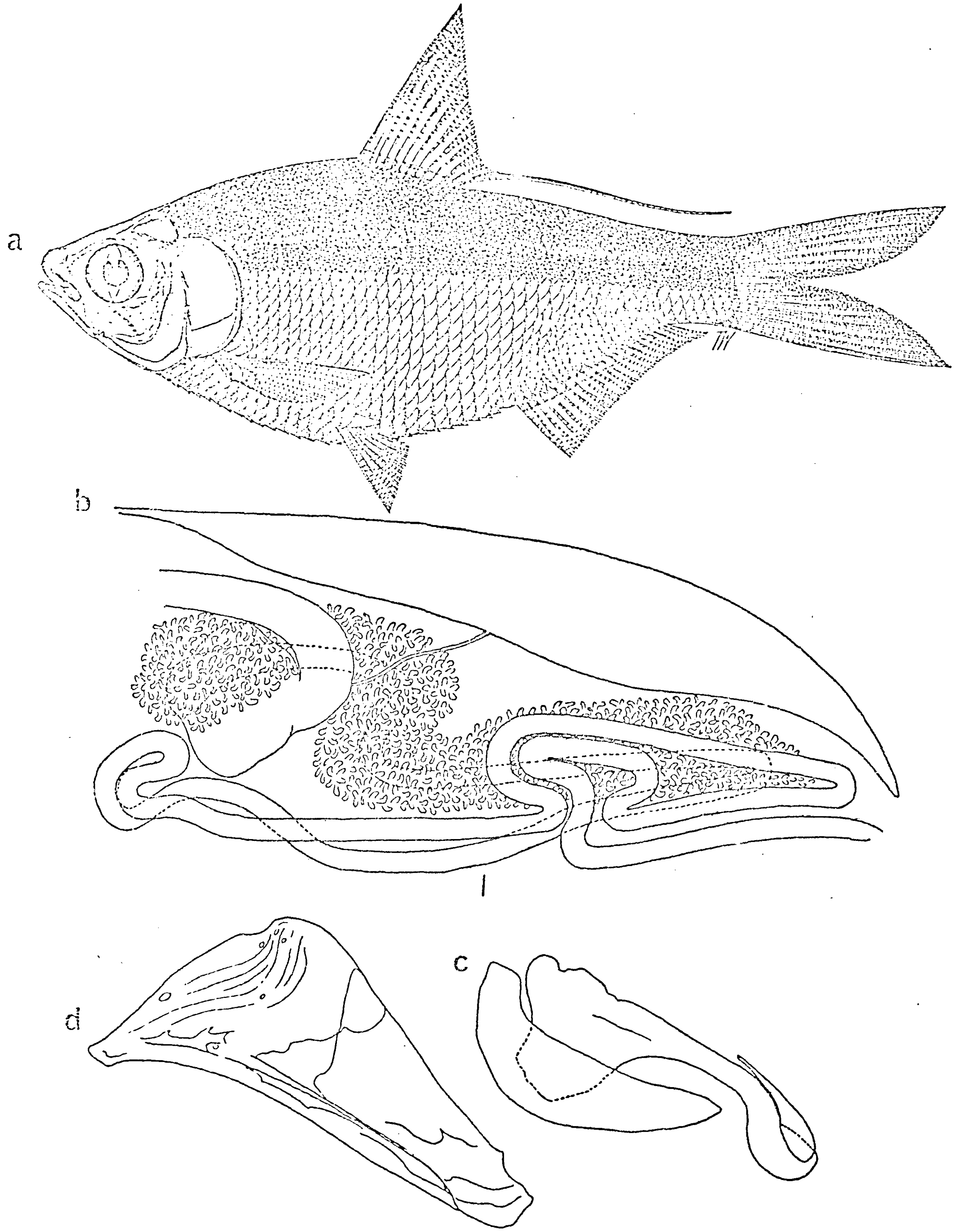


Plate 136. Nematalosa papuensis:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1977.11.17.38-40, 77.0 mm S.L.; others from USNM. 217022a, 154.0 mm S.L.).

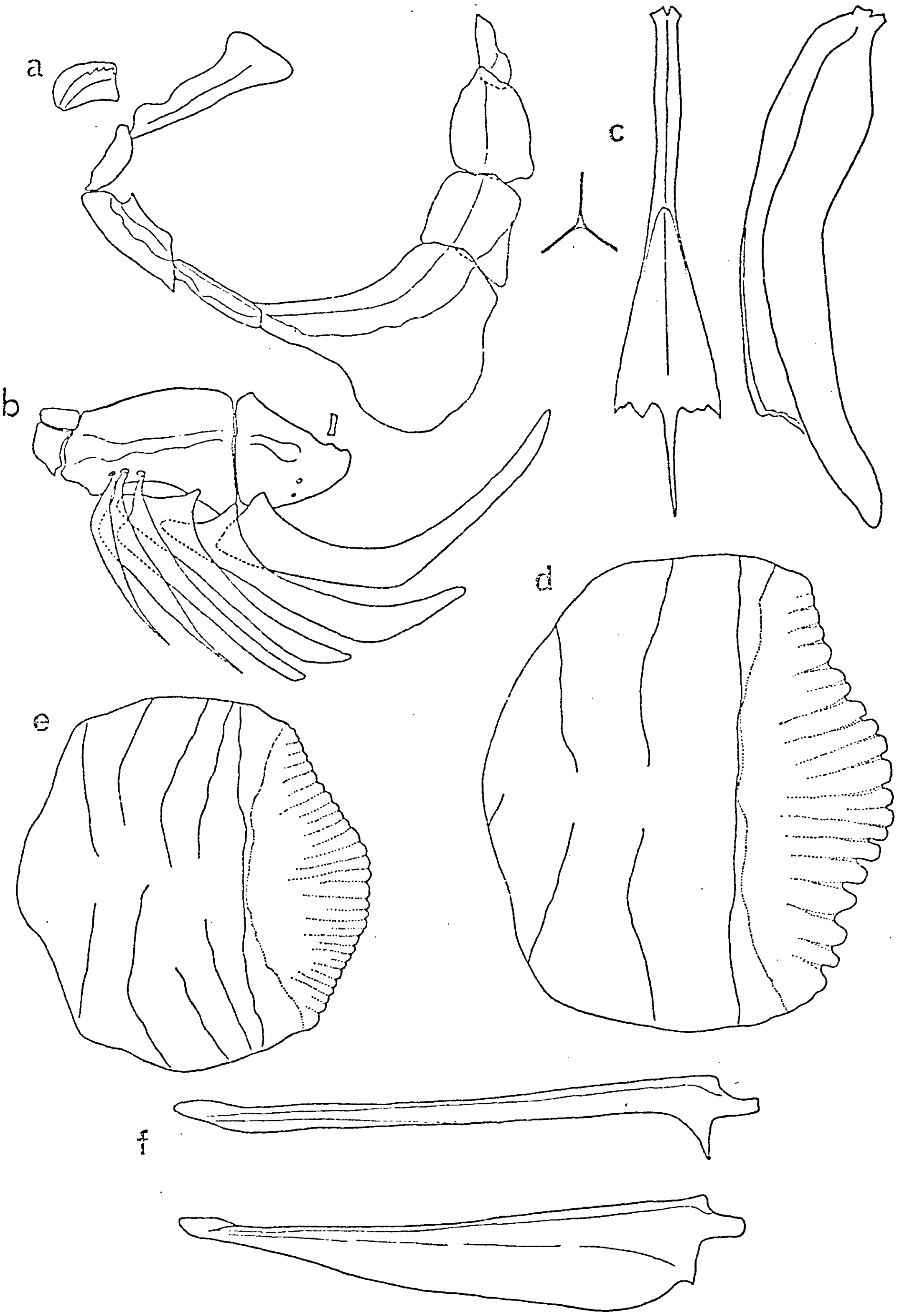


Plate 137. Nematalosa papuensis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, scales; f, slender and broader types of gillraker (a, b, c, e, f from USNM. 217022a, 154.0 mm S.L.; d, from BMNH. 1977.11.17.38-40, 77.0 mm S.L.).

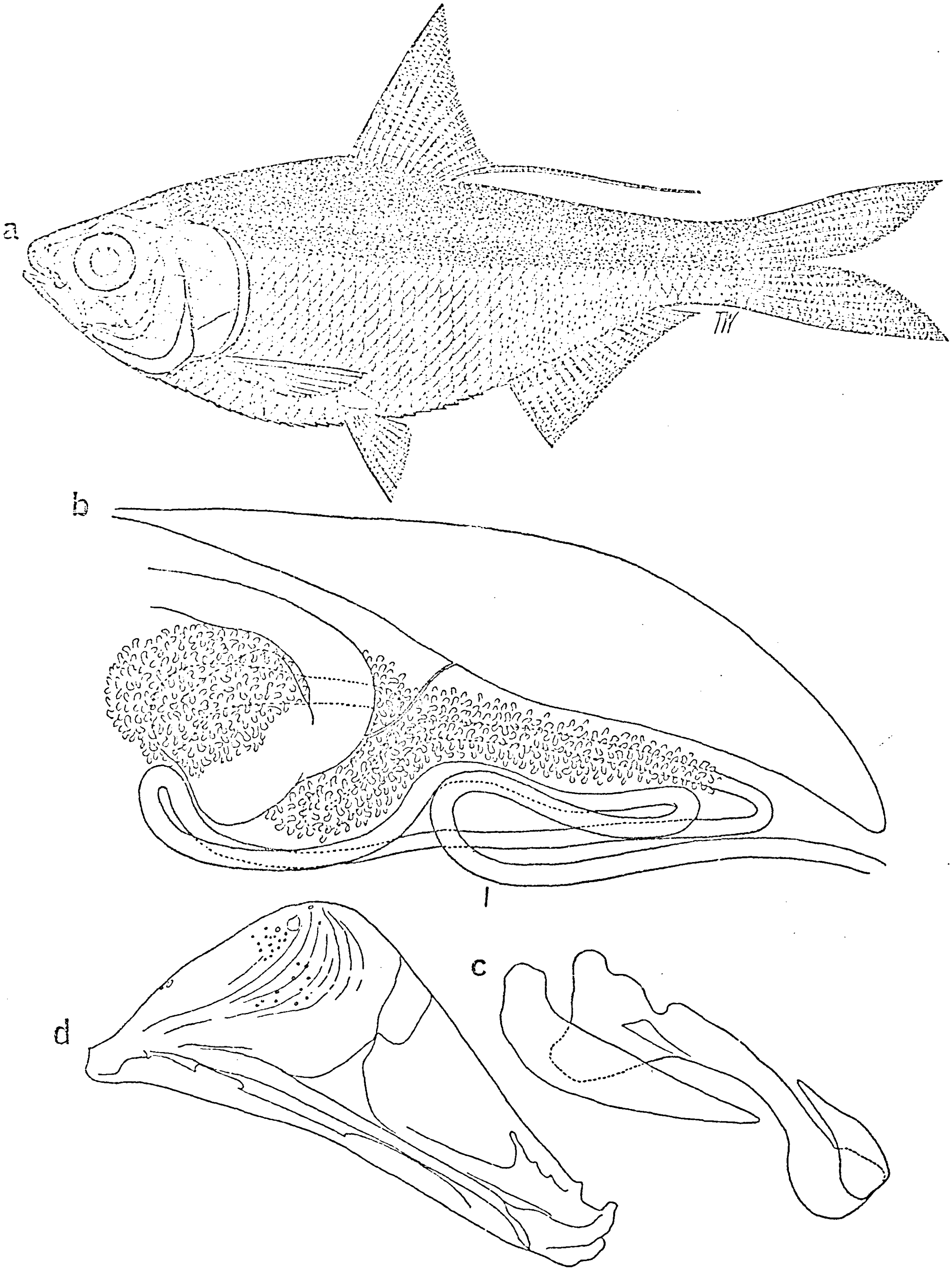


Plate 138. *Nematalosa flyensis*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1979.8.17.1, 76.0 mm S.L. holotype; b, c, d from USNM. 217022b, 162.0 mm S.L.).

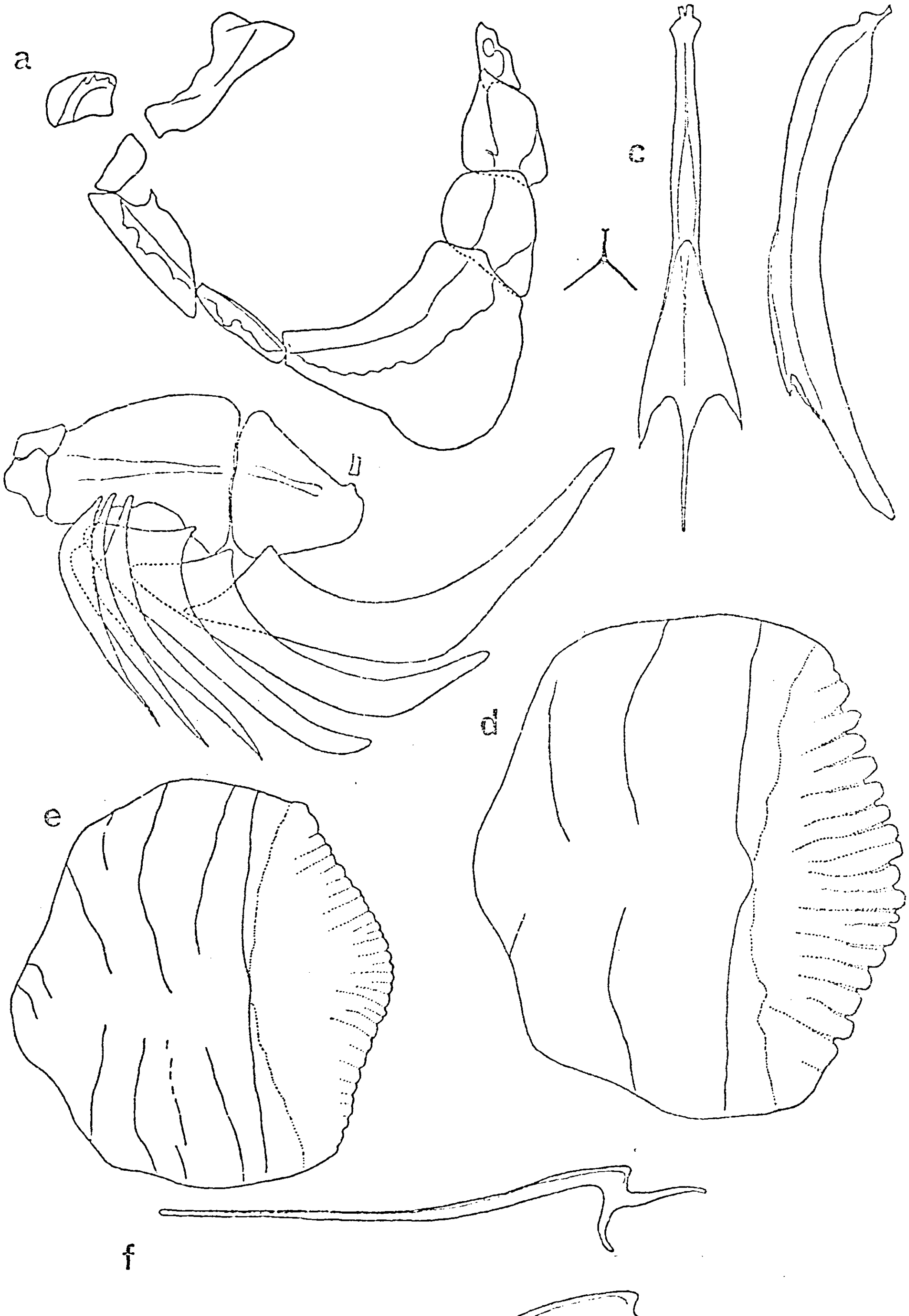


Plate 139. Nematalosa flyensis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, scales; f, slender and broader types of gillraker (a, b, c, e, f, g from USNM. 217022b, 162.0 mm S.L. for a, b, c, f, g and 180.0 mm S.L. for e; d from BMNH. 1979.8.17.1, 76.0 mm S.L.; holotype).

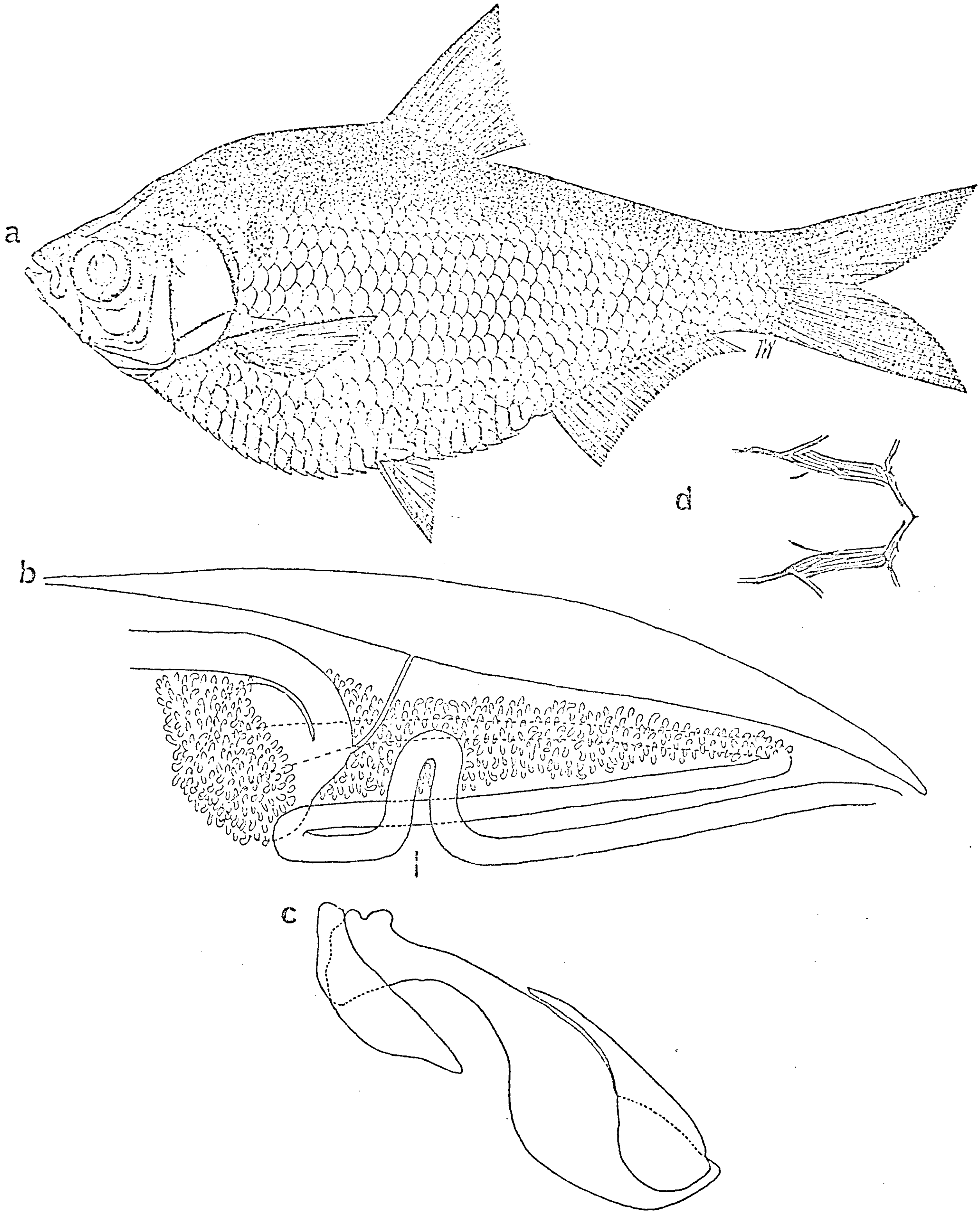


Plate 140. Gonialosa whiteheadi:- a, adult; b, gas bladder and digestive tract; c, upper jaw in situ; d, frontoparietal striae (all from BMNH. 1893. 2.16.75, 68.5 mm S.L., holotype).

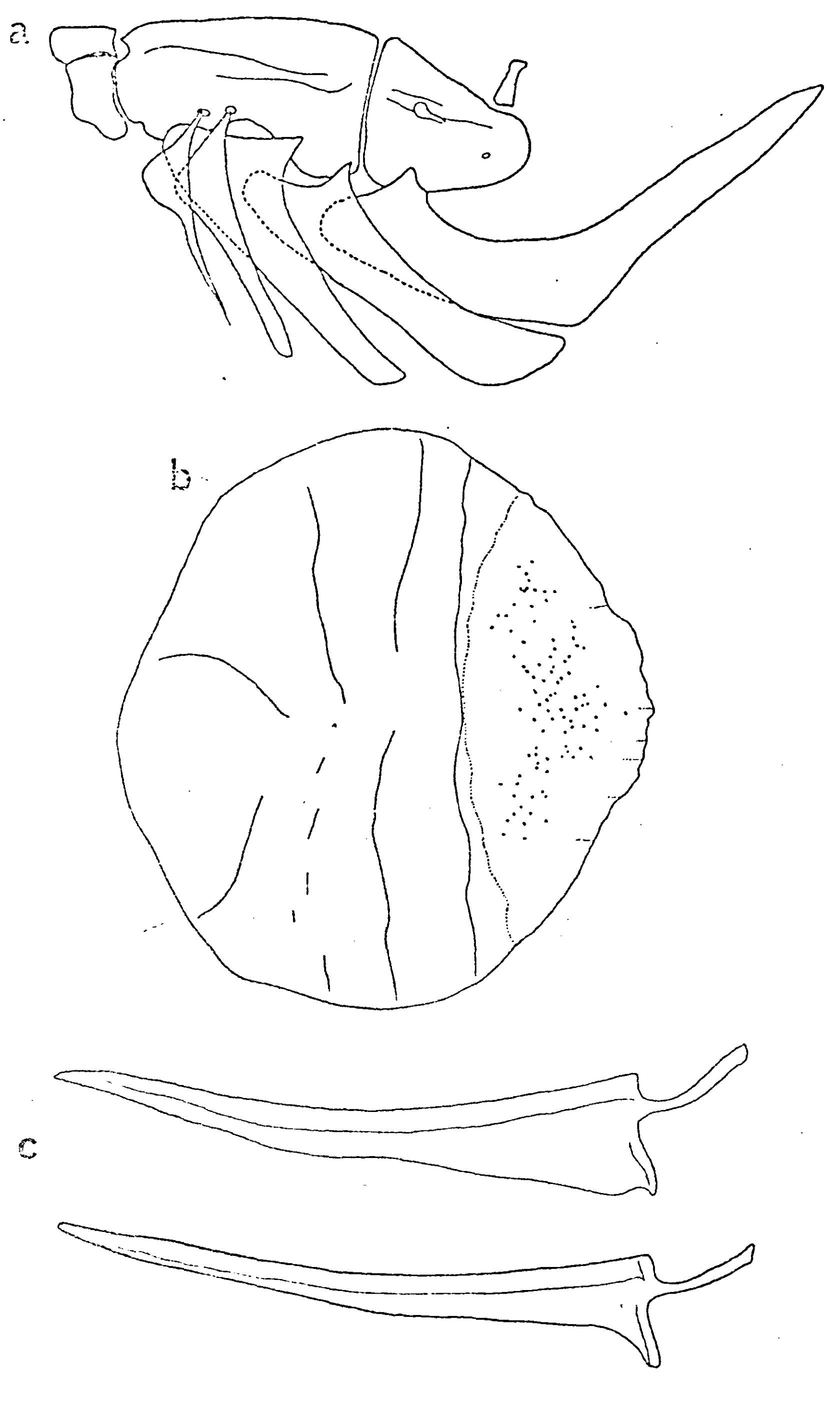


Plate 141. Gonialosa whiteheadi:- a, hyoid arch; b, scale; c, broader and slender types of gillraker (all from BMNH. 1893.2.16.75, 68.5 mm S.L., holotype)

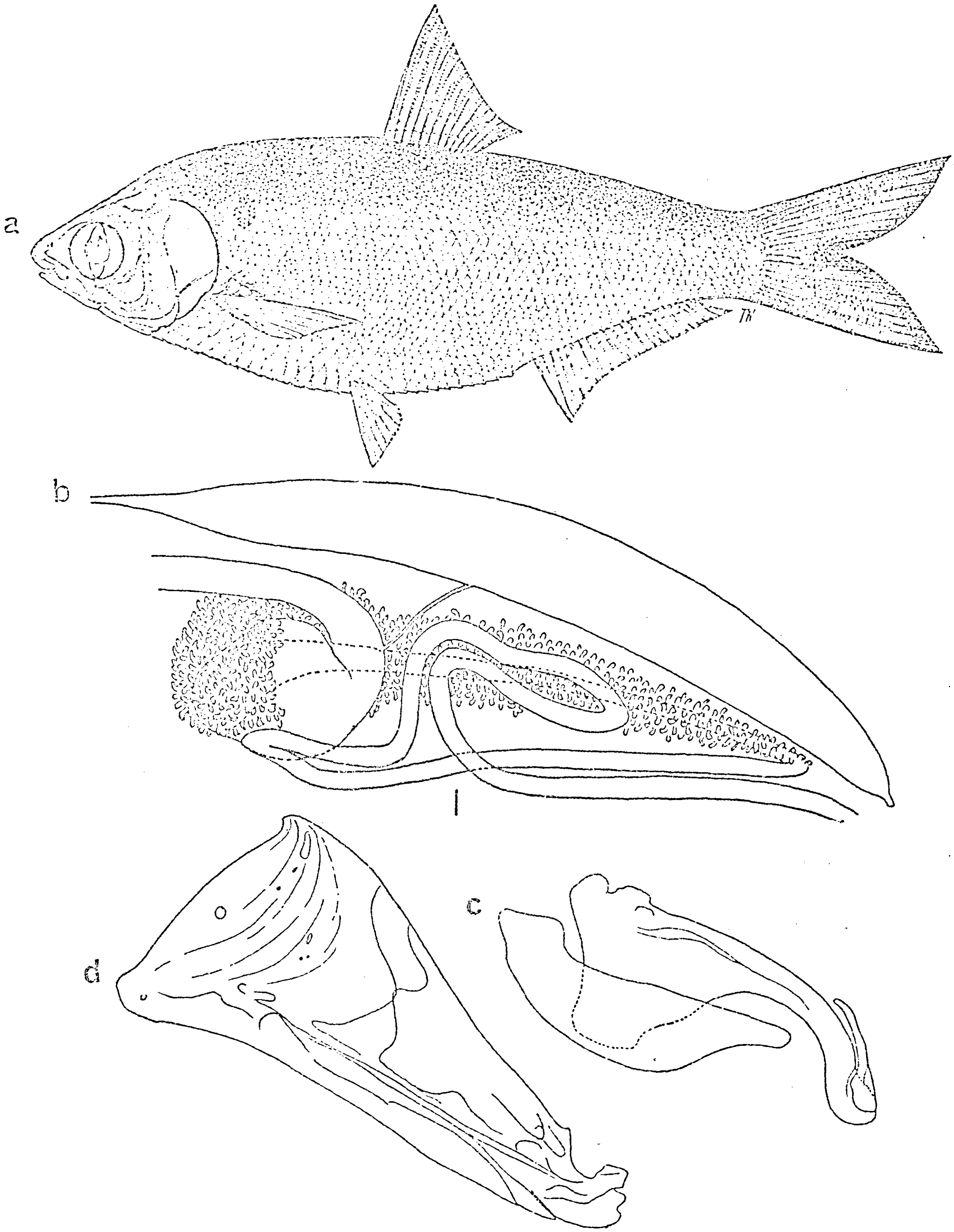


Plate 142. *Gonialosa manmina*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1889.21.1.1864, 102.0 mm S.L.; others from BMNH. 1872.4.17.40, 94.0 mm S.L.).

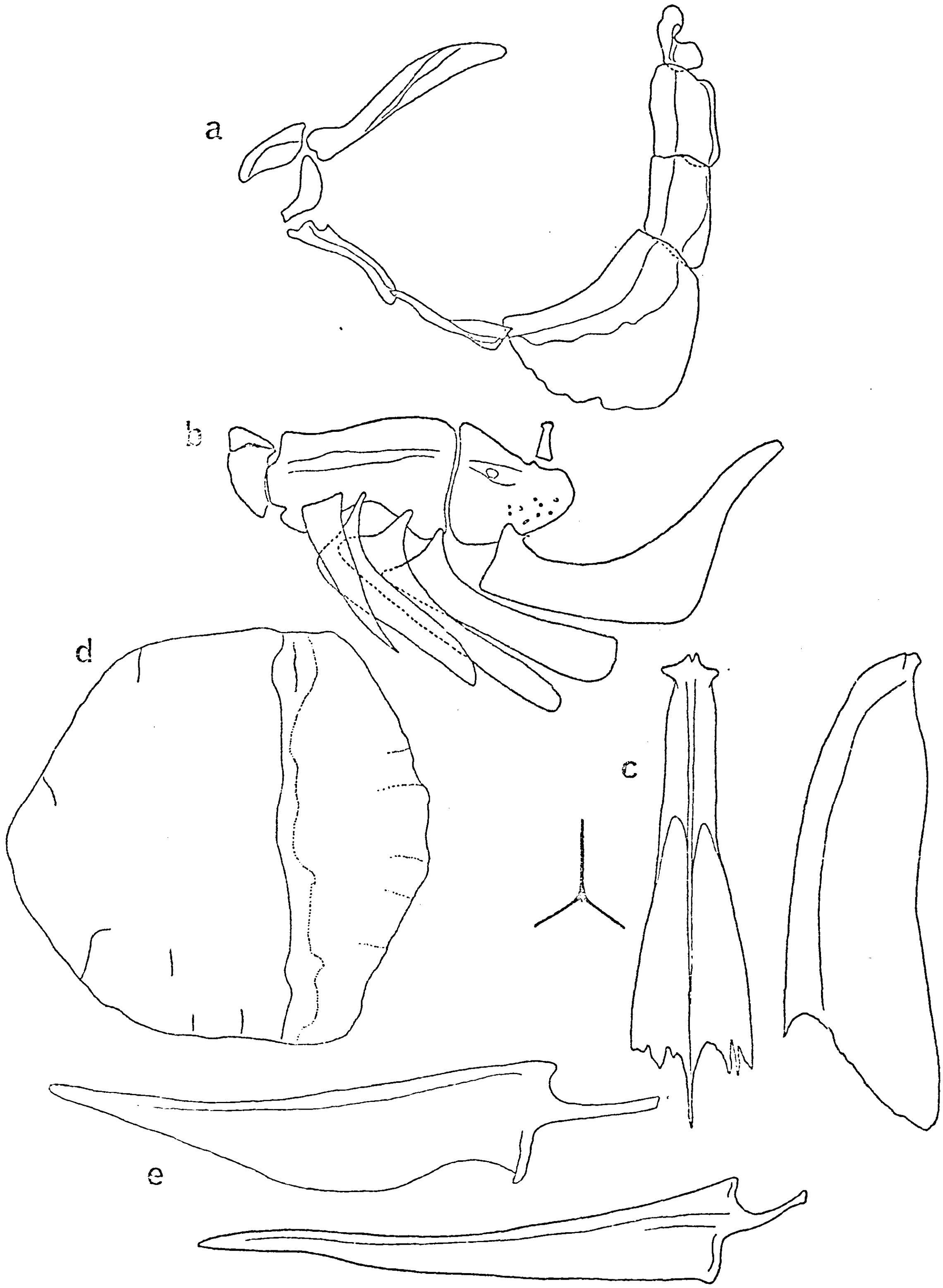


Plate 143. Gonialosa manmina:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, broader and slender types of gillraker (all from BMNH. 1872.4.17.40, 94.0 mm S.L. for a, b, c and 90.0 mm S.L. for d and 115.0 mm S.L. for e).

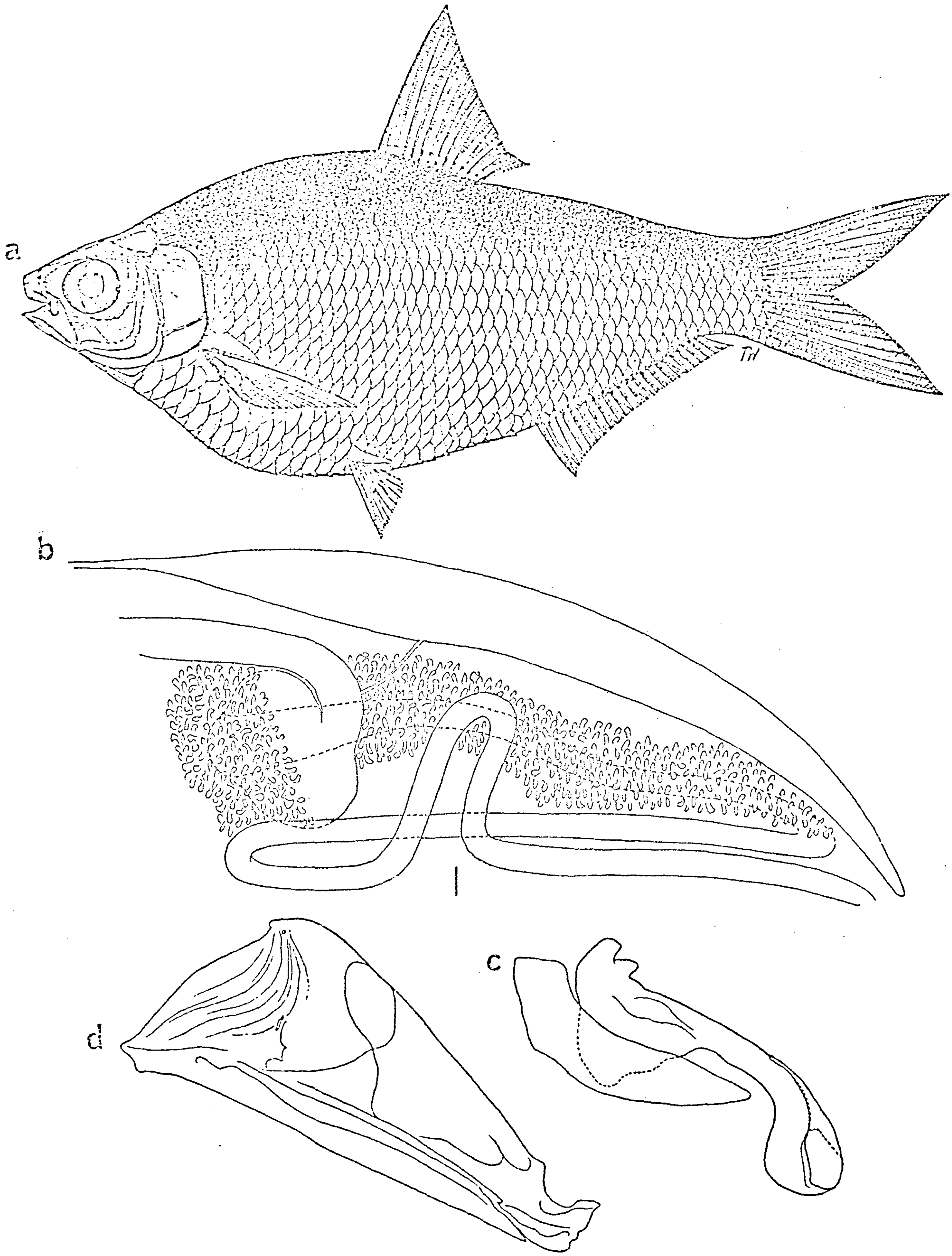


Plate 14. Gonialosa modesta:- a, lateral view; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1891.11.30.391-395, 79.0 mm S.L. for a and 68.5 mm S.L. for others).

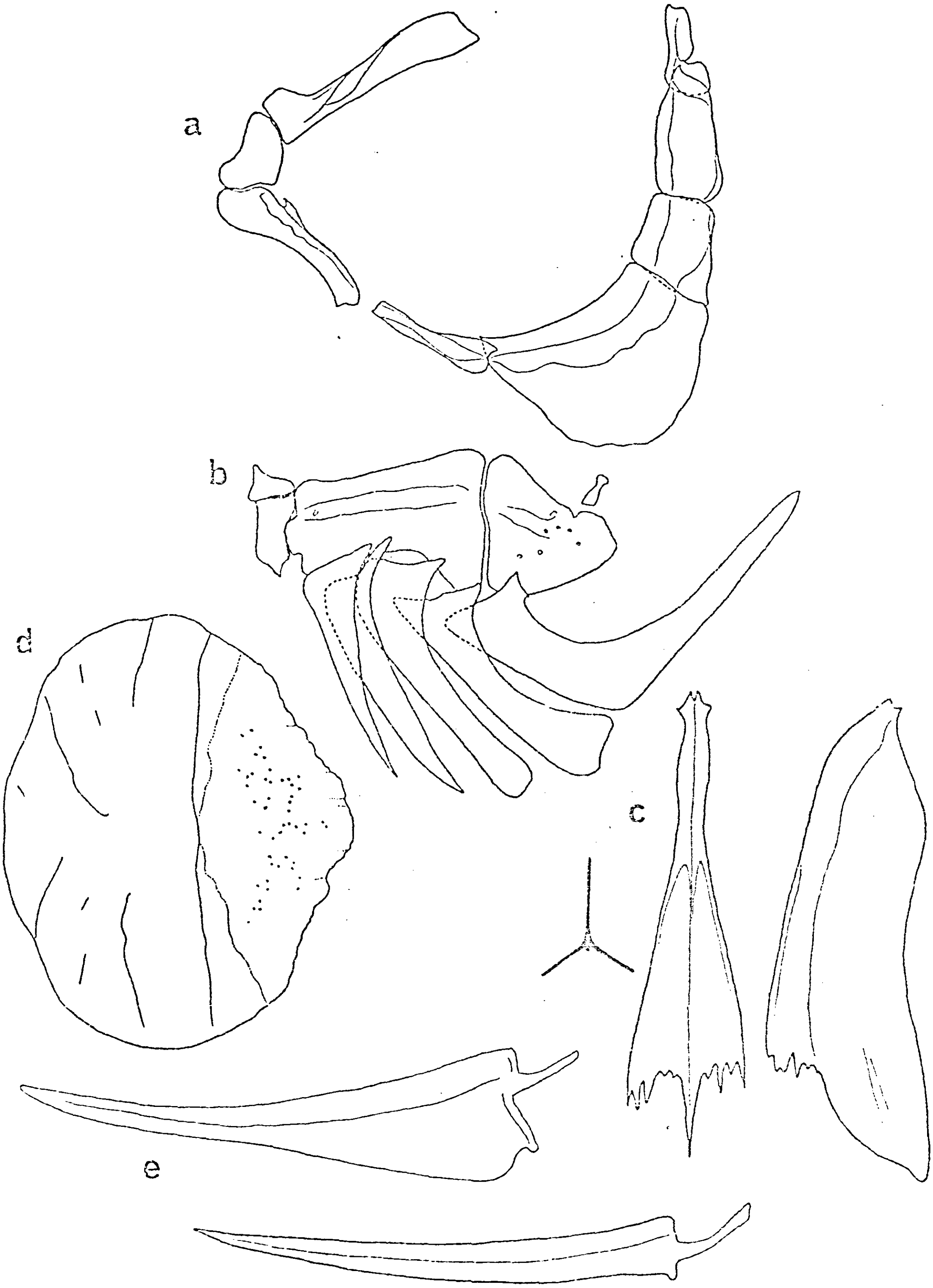


Plate 145. Gonialosa modesta:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, broader and slender types of gillraker (all from BMNH. 1891.11.30.391-395, 68.5 mm S.L.).

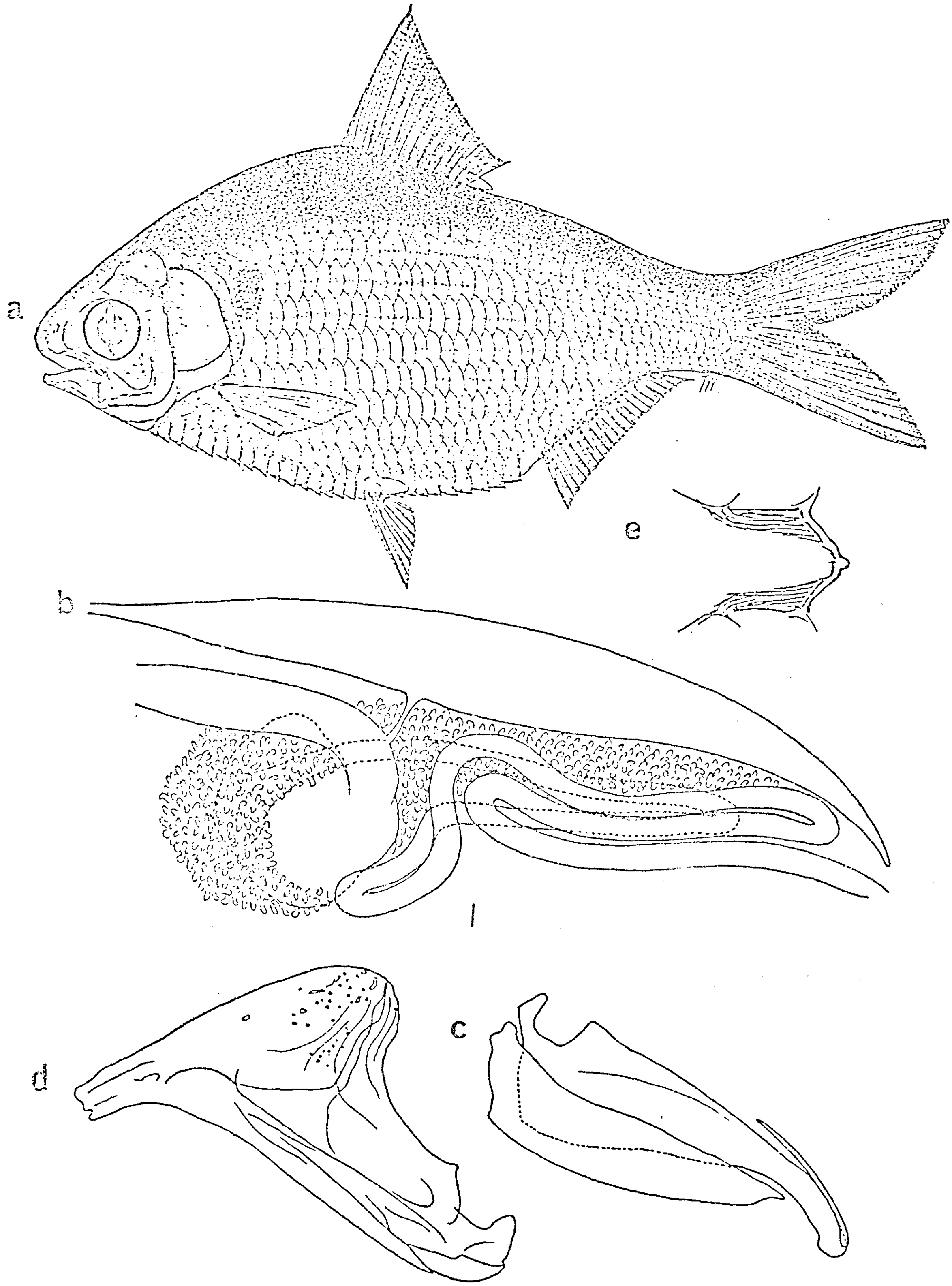


Plate 146. *Anodontostoma chacunda*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, frontoparietal striae (a, e from BMNH. 1898.4.2.251-252, 110.0 mm S.L.; b, c, d from BMNH. 1979.8.16.51-53, 118.0 mm S.L.).

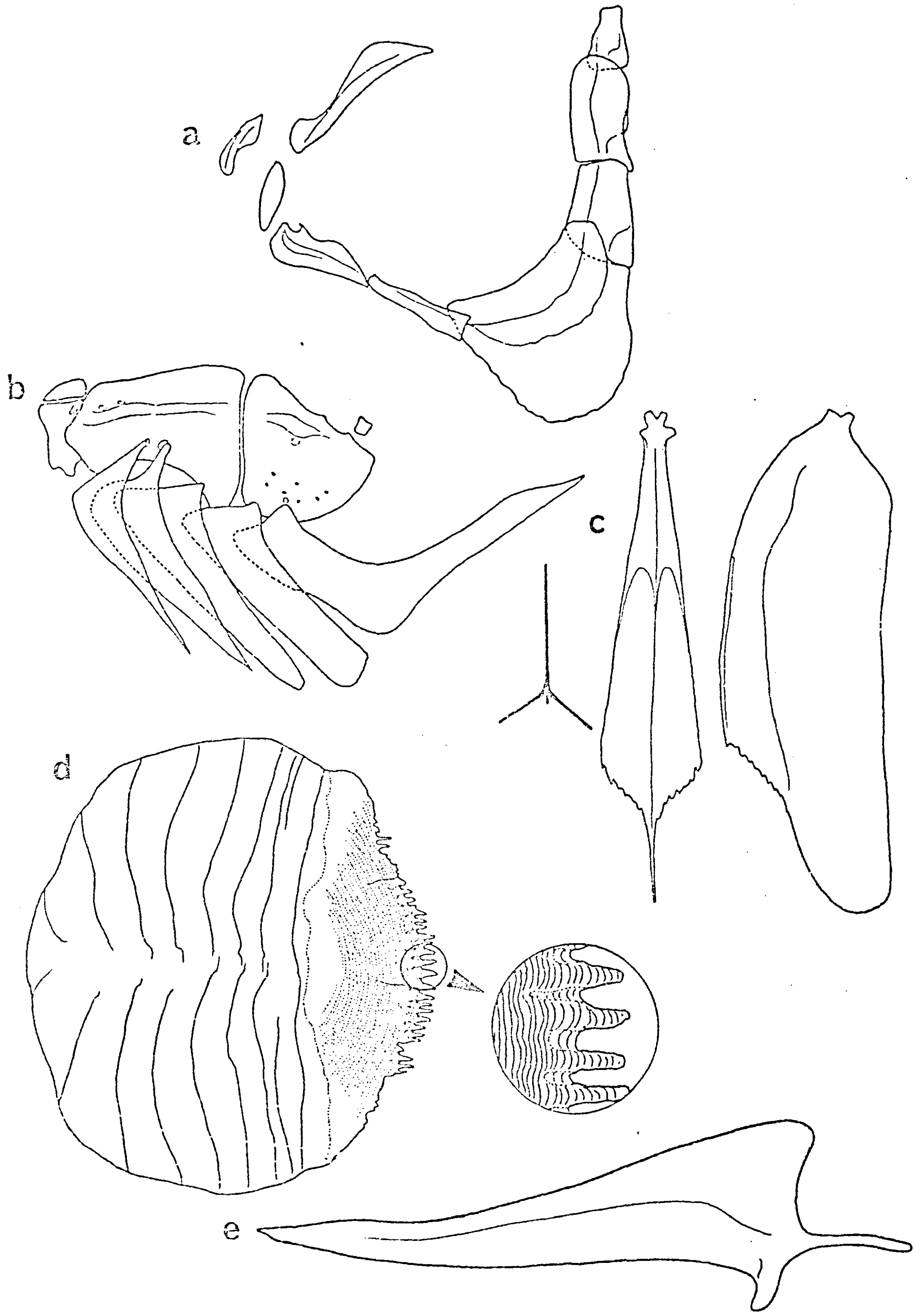


Plate 147. Anodontostoma chaunda:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale and enlargement of its posterior margin; e, gillraker (all from BMNH. 1979.8.16.51-53, 118.0 mm S.L.).

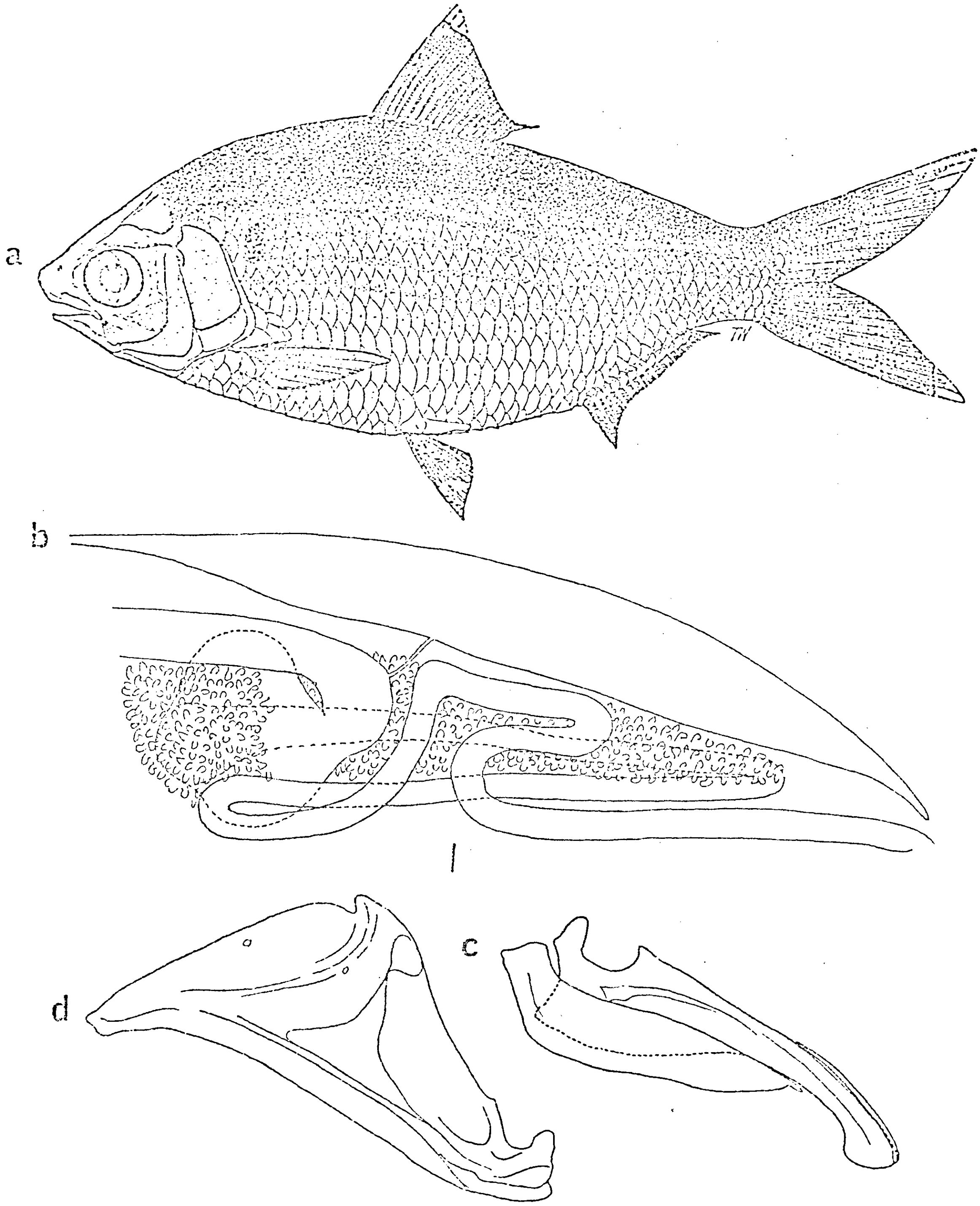


Plate 148. Anodontostoma selangkat:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1867.11.28.64, 119.0 mm S.L.; b from BMNH. 27765, 102.0 mm S.L.; c, d from BMNH. 1889.2.1.1863, 90.5 mm S.L.).

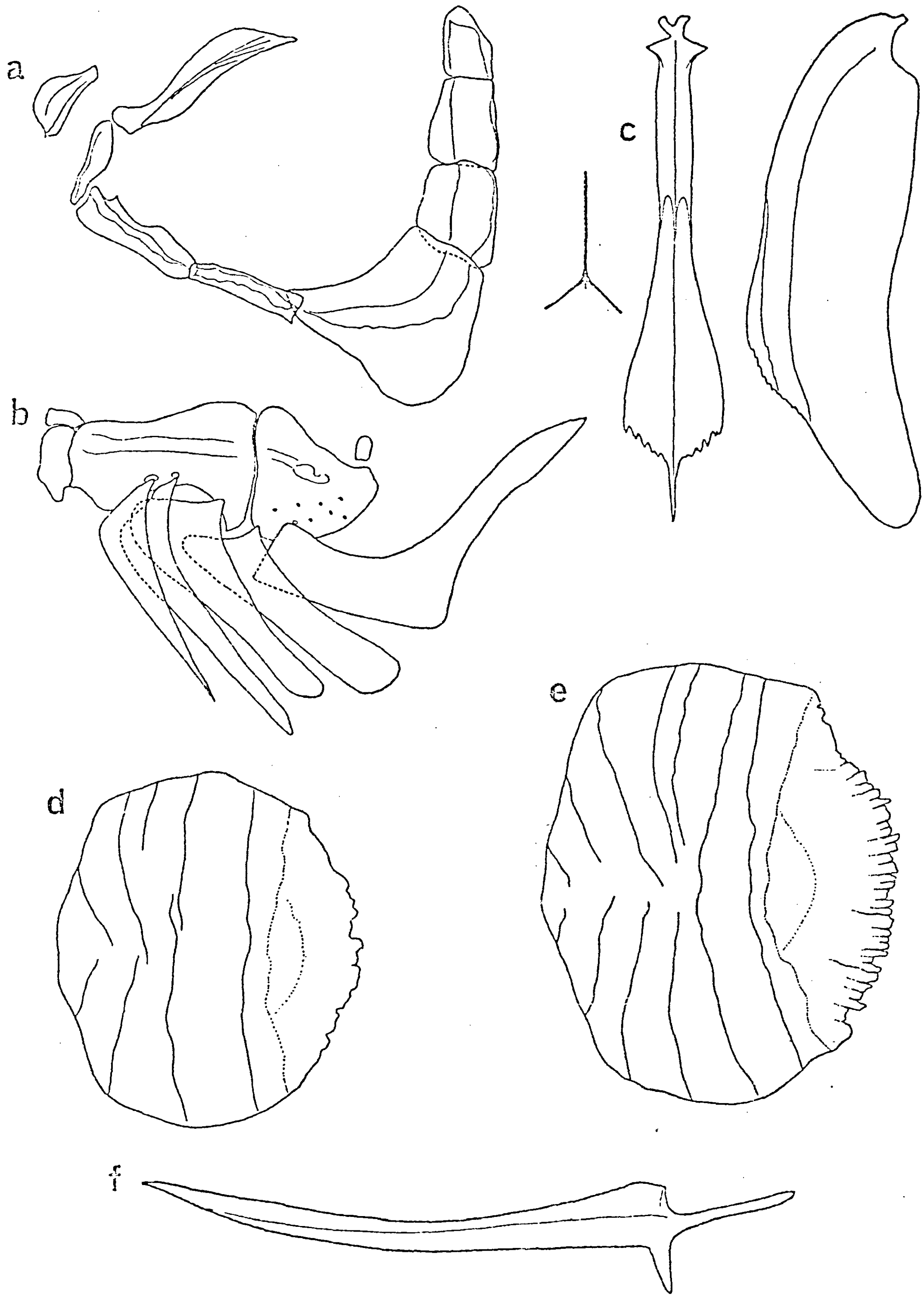


Plate 149. Anodontostoma selangkat:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, scales; f, gillraker (a, b, c, d, f from BMNH. 1889.2.1. 1863, 90.5 mm S.L.; e from FMNH. 72259, 170.0 mm S.L.).

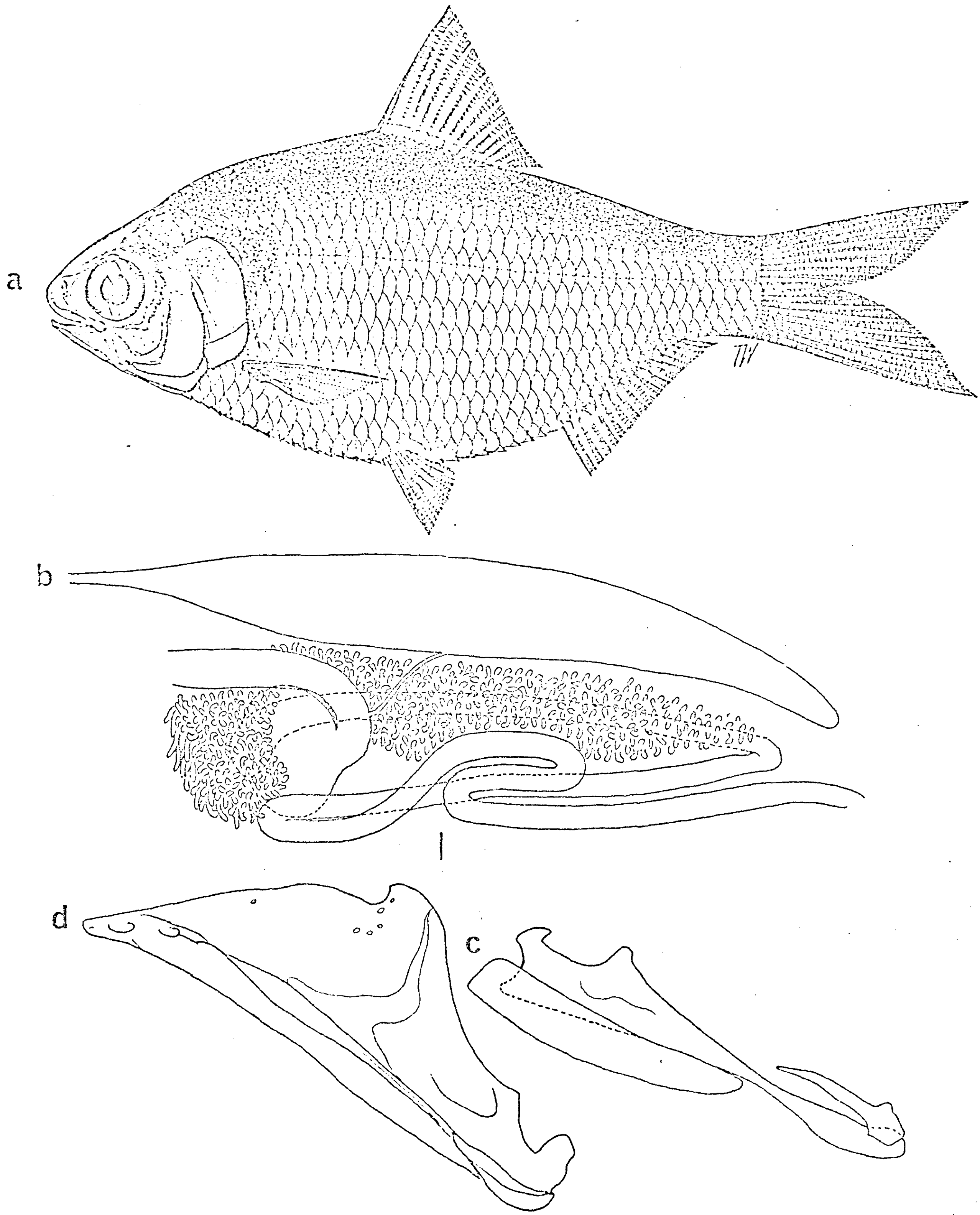


Plate 150. *Anodontostoma thailandiae*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from MFLB. uncat., 99.0 mm S.L., holotype; b, from MFLB. uncat., 118.0 mm S.L.; c, d from BMNH. 1973.6.4.30-36, 135.0 mm S.L.).

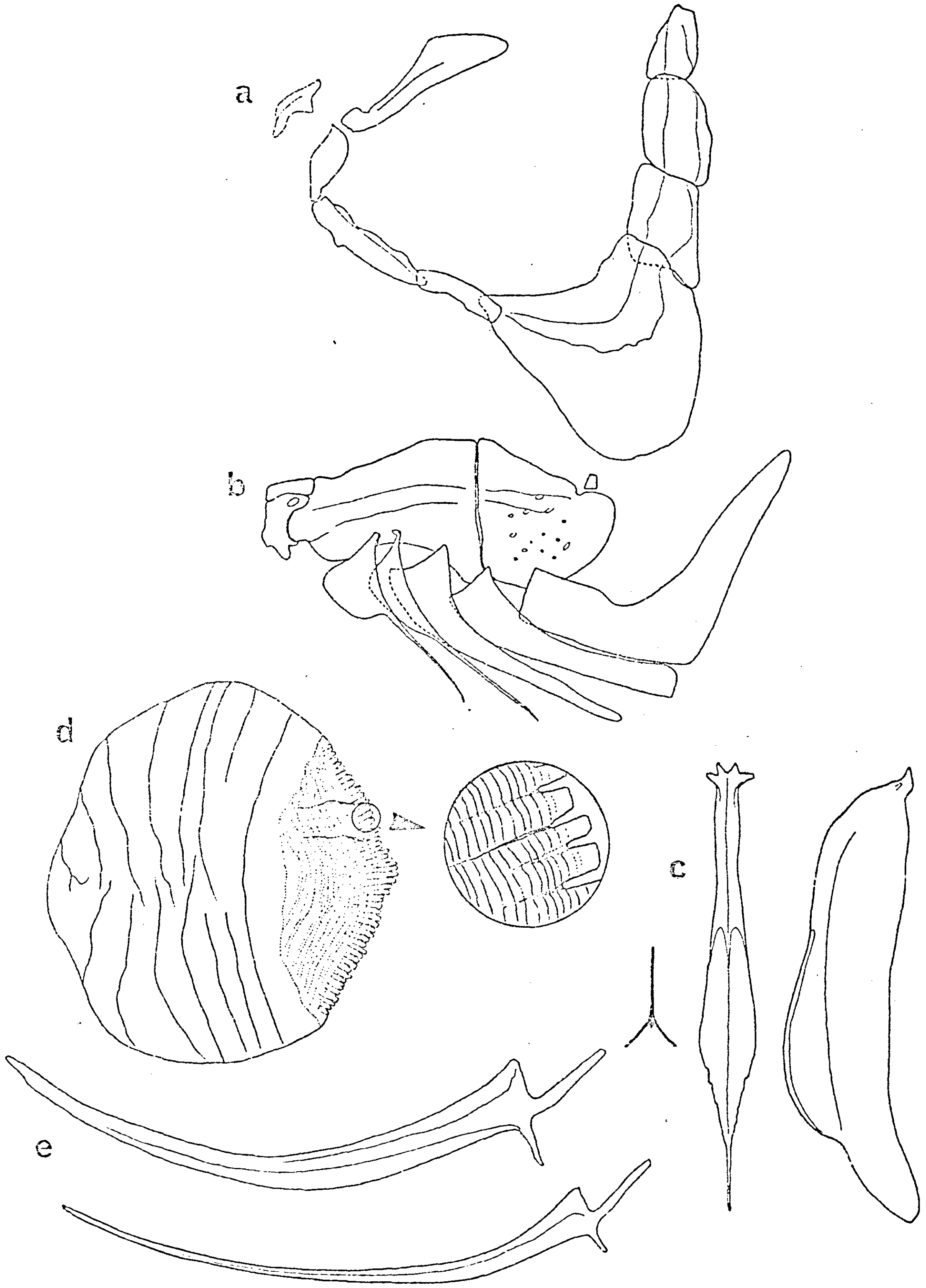


Plate 151. Anodontostoma thailandiae:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale and enlargement of its posterior margin; e, broader and slender types of gillraker (a, b, c, d from BMNH. 1973.6.4.30-36, 135.0 mm S.L. for a, b, c and 120.0 mm S.L. for d; e from MFLB. uncat., 118.0 mm S.L.).

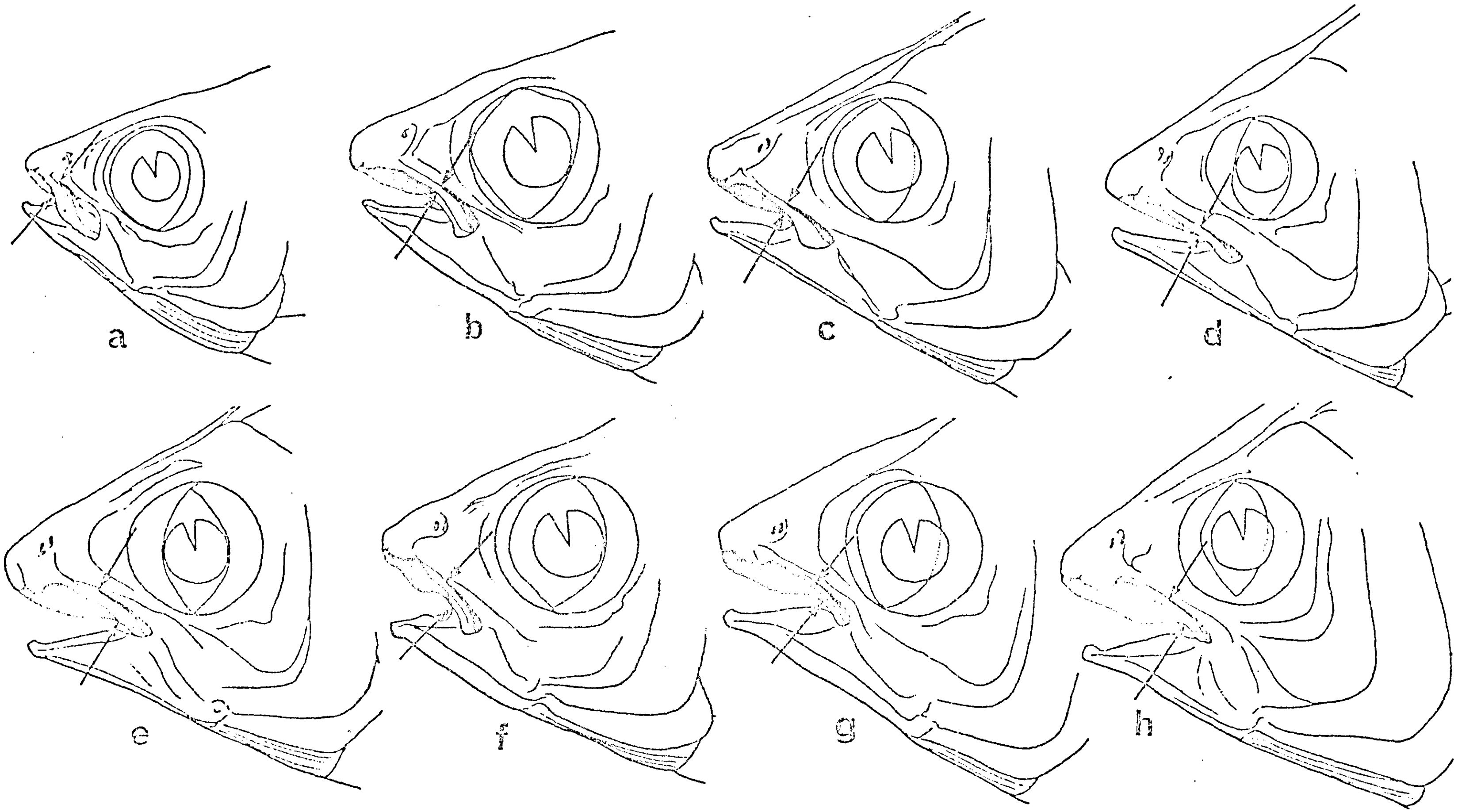


Plate 152. Diagrammatic representation of head of three species of Anodontostoma showing degree of overlapping of premaxilla and 2nd supramaxilla in relation to their ontogenetic changes. a, to d, *Anodontostoma thailandiae*, 42.0, 45.0, 68.5, 108.0 mm S.L. respectively; e, *A. selangkat*, 89.5 mm S.L.; f, to h, *A. chacunda*, 48.0, 72.0, 110.0 mm S.L. respectively. Arrows indicate position of the corresponding tip of the bones.

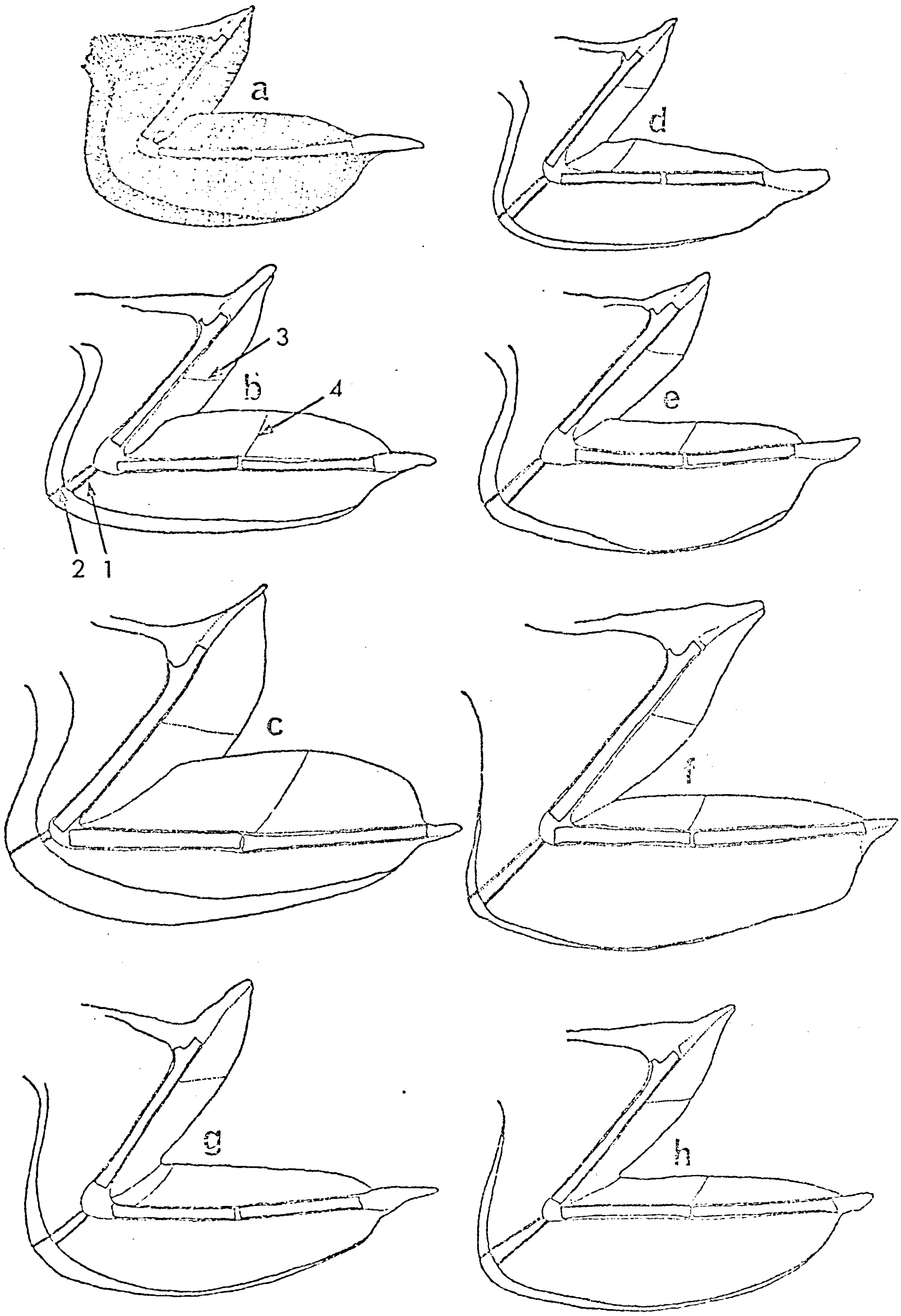


Plate 153. Diagrammatic representation of 1st gillarch (right side) of three species of Anodontostoma arrow showing relative length of outer (1) and inner (2) hemibranches, length and position of longest gillraker on upper (3) and lower (4) gillarches. a, to c, Anodontostoma thailandiae, 45.0, 90.0 and 136.5 mm S.L. respectively; d, to f, A. chacunda, 48.0, 90.0 and 136.0 mm S.L.; g, to h, A. selangkat, 89.5 and 119.5 mm S.L. respectively.

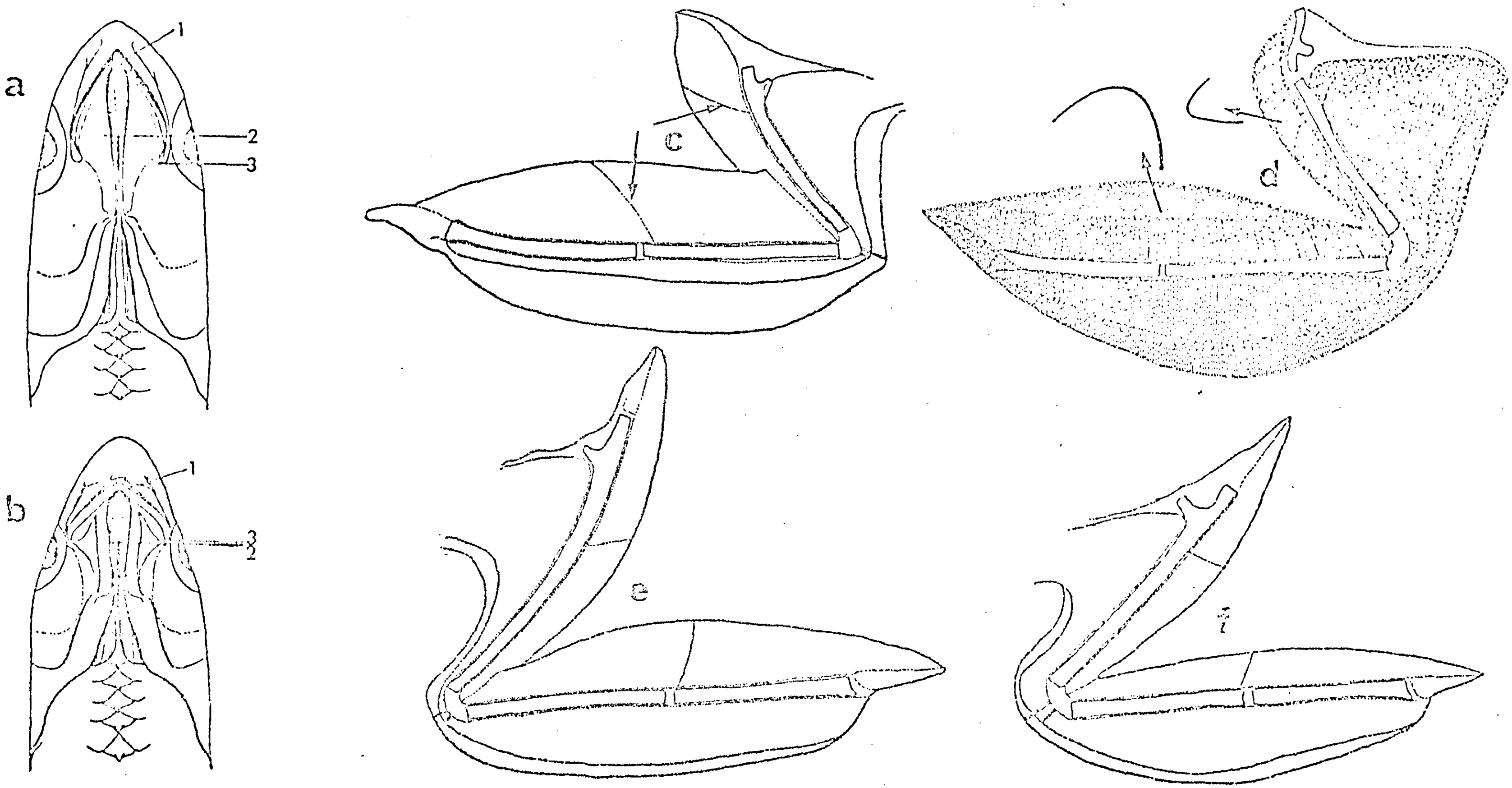


Plate 154. Diagrammatic representation of : a, longer and narrower jaws of Anodontostoma thailandiae, 118.0 mm S.L.; b, short and wide jaws of A. chacunda, 112.0 mm S.L.; 1, gape of mouth, 2, conjunction of right and left musculatures of branchiostegal membranes, 3, posterior extremity of upper jaw. c, first and d, second gill arches of Hilsa kelee, 128.0 mm S.L., arrows indicate position and nature of gillrakers on both arches. e, and f, first gill arch of Nematalosa flyensis, 162.0 mm S.L., and N. papuensis, 154.0 mm S.L., showing relative length of gillrakers and gill filaments.

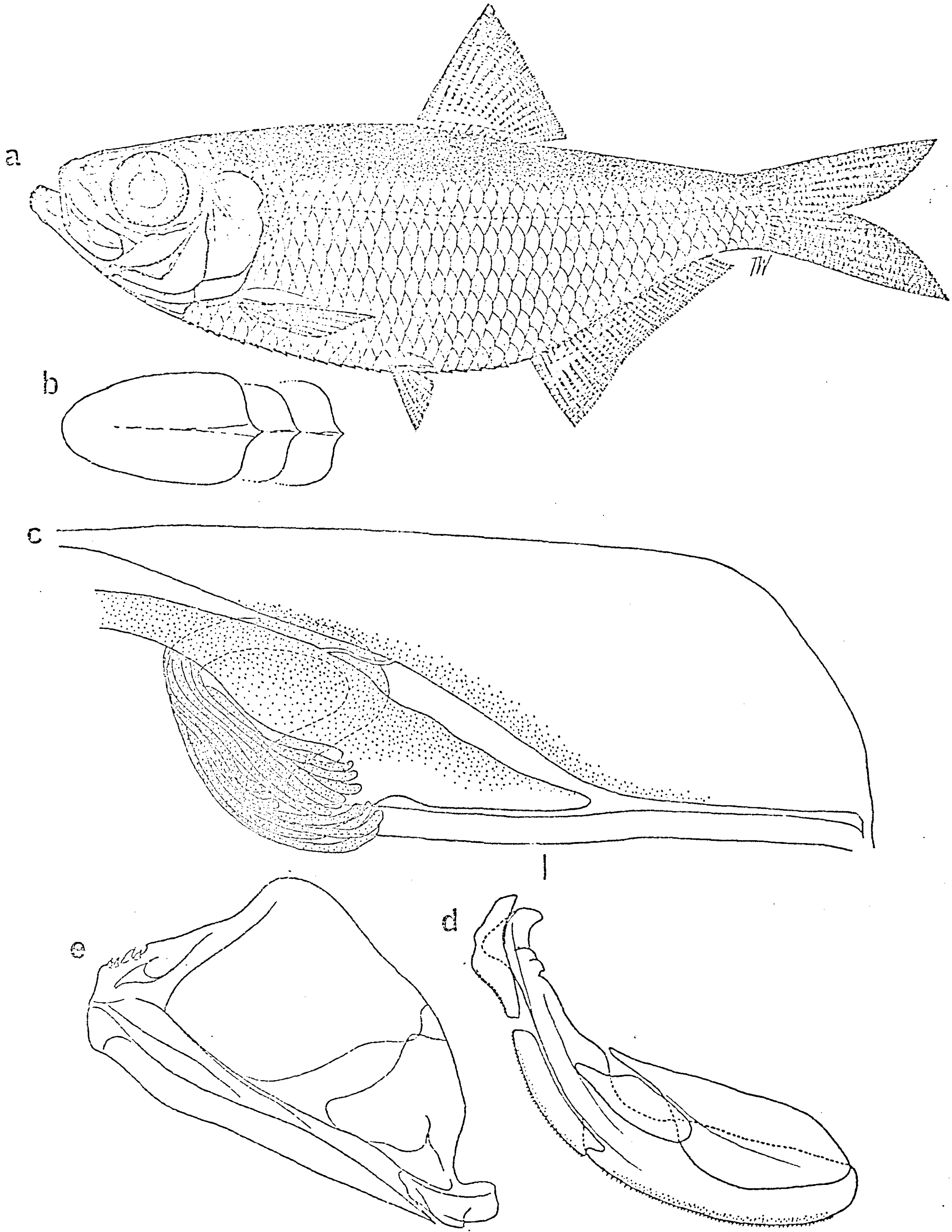


Plate 155. Pellona ditchela:- a, adult; b, enlargement of three anterior most prepelvic scutes; c, gas bladder and digestive tract; d, e, upper and lower jaws (a, b from BMNH. 1858.4.21.288, 137.0 mm S.L.; c from BMNH. 1966. 11.16.312-318, 57.0 mm S.L.; d, e from BMNH. 1964.12.14.226-260, 69.0 mm S.L.).

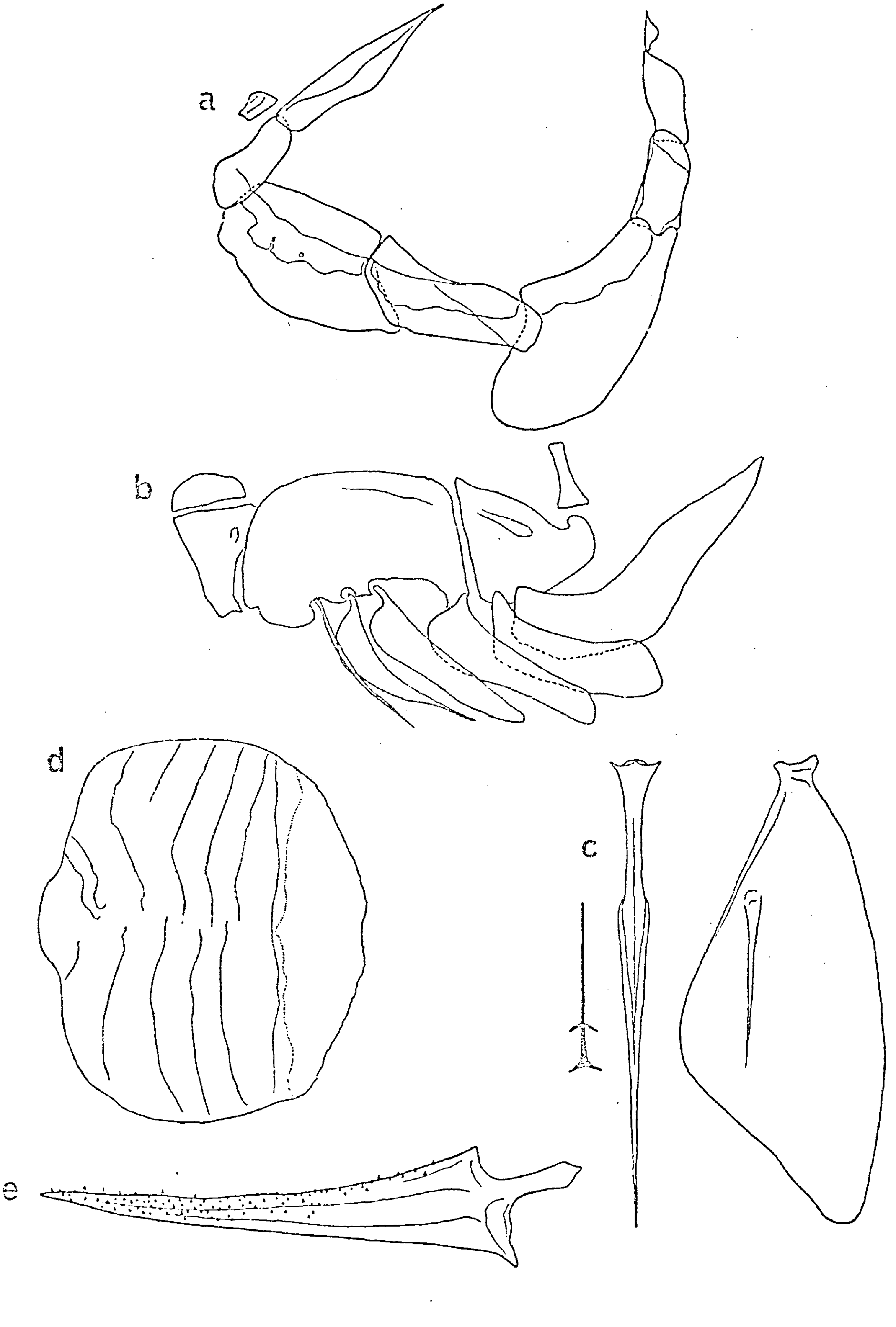


Plate 156. Pellona ditchela:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c from BMNH. 1964.12.14.226-260 69.0 mm S.L.; d from WAM. 13385, 110.0 mm S.L.; e from BMNH. 1966.11.16. 312-318, 57.0 mm S.L.).

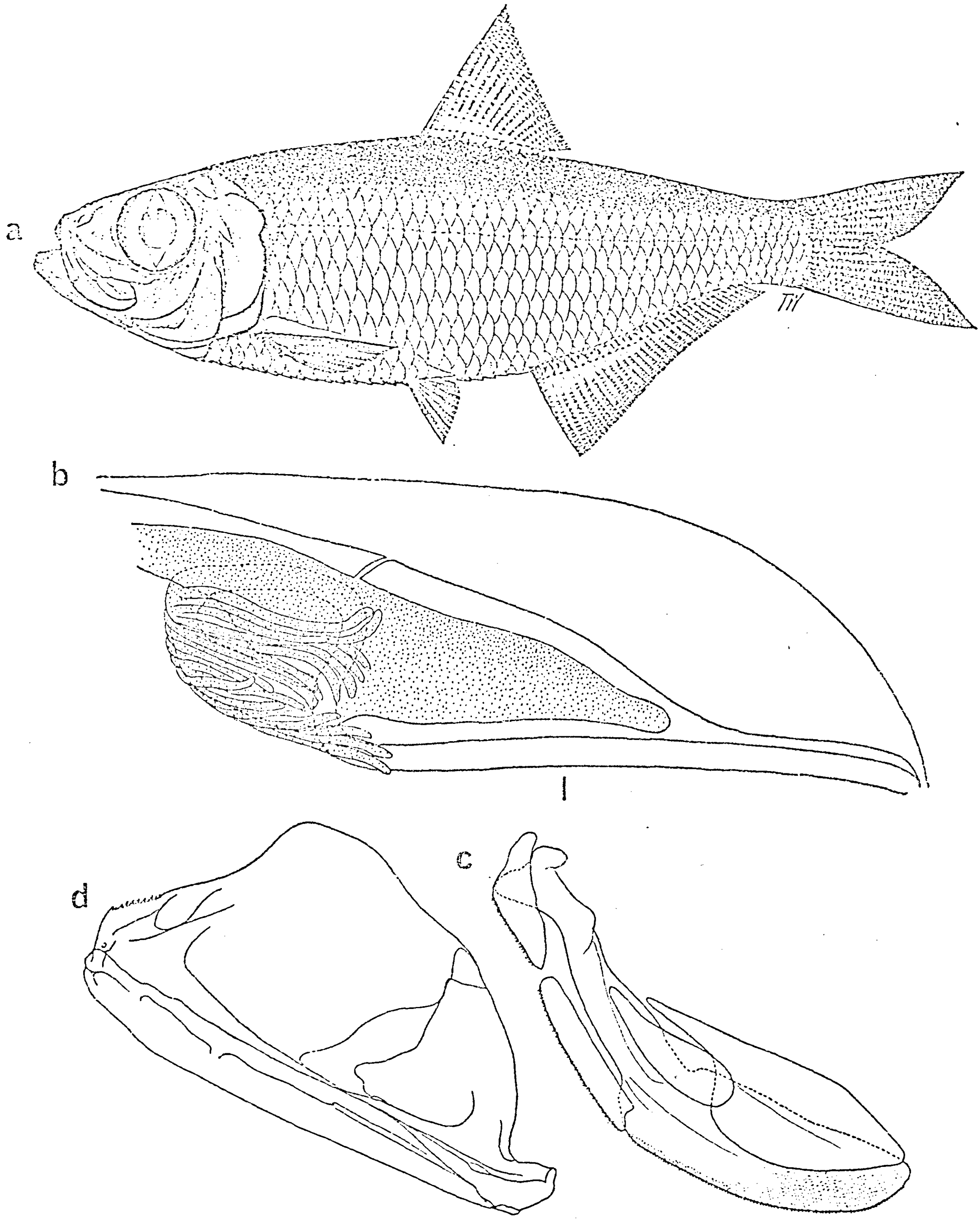


Plate 157. *Pellona dayi*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a, from BMNH. 1969.11.6.17, 117.0 mm S.L., holotype; others from BMNH. 1969.11.16.15-16, 135.0 mm S.L.; paratype).

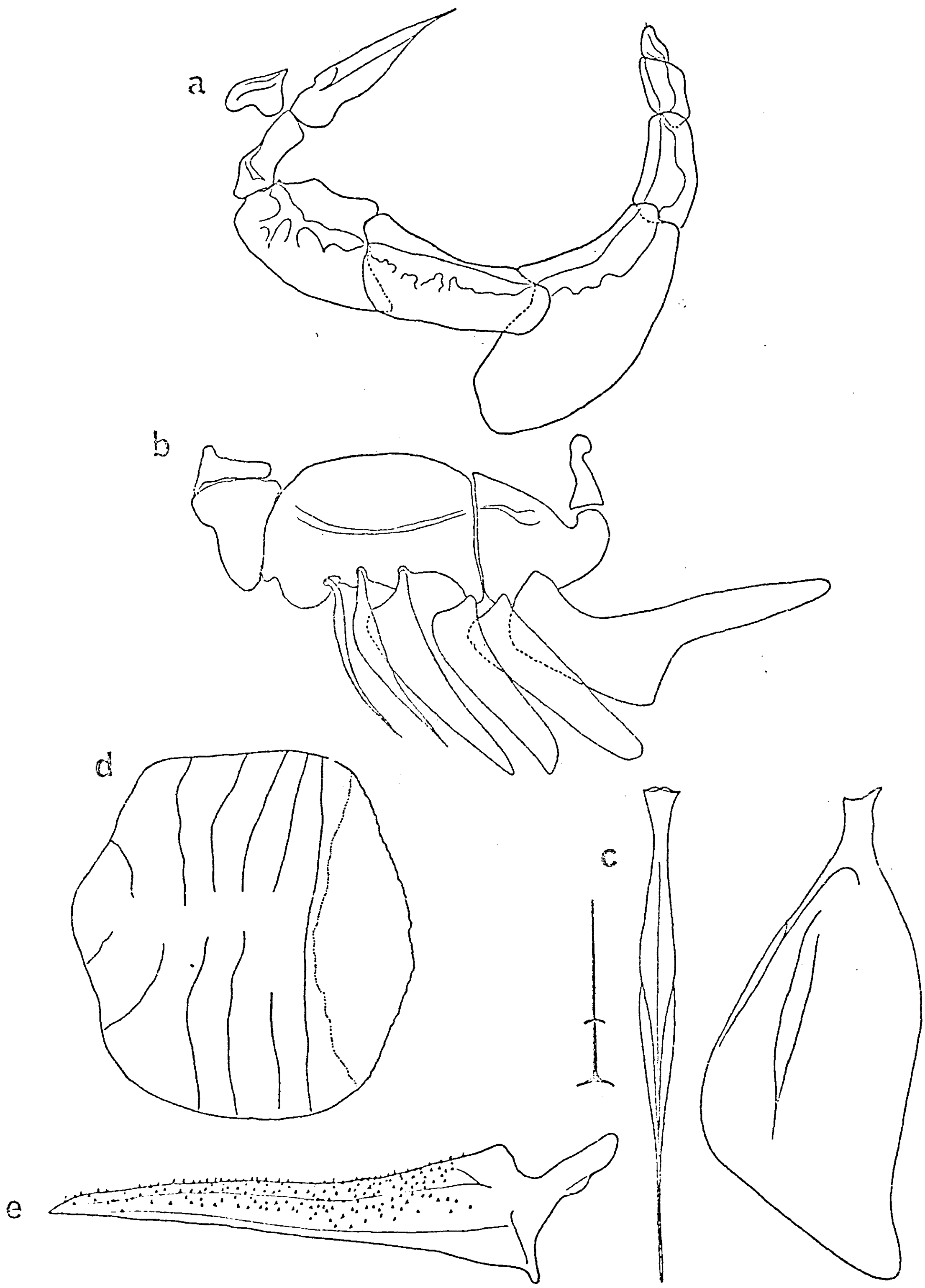


Plate 158. Pellona dayi:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1969.11.6.15-16, 135.0 mm S.L. paratype; d from BMNH. 1889.2.1.2002-2006, 93.0 mm S.L., paratype).

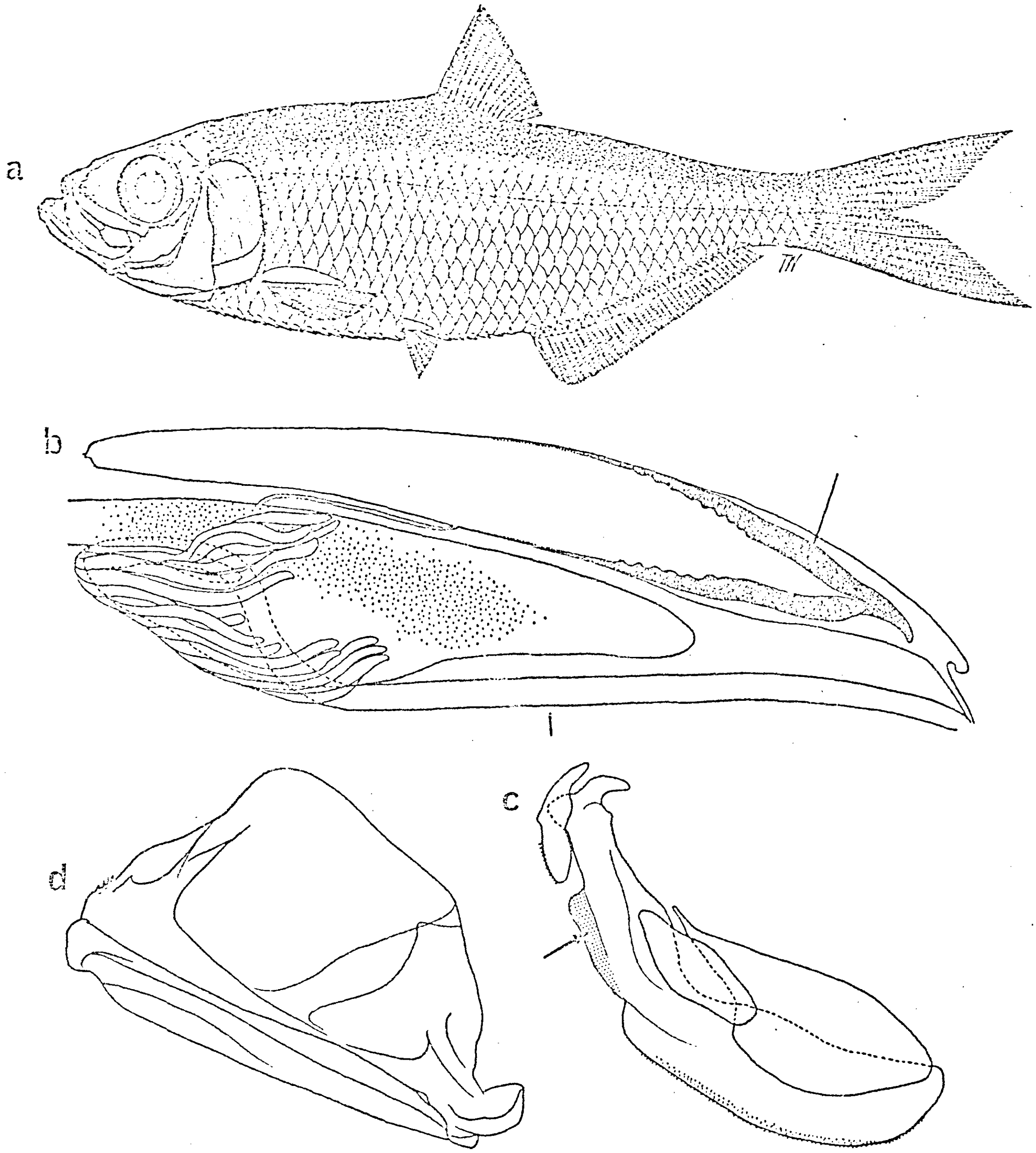


Plate 159. Ilisha sirishai:- a, adult; b, gas bladder and digestive tract; arrow indicates inner capsule of gas bladder (tunica interna according to Dehadrai, 1960); c, d upper and lower jaws, arrow indicates out growth of bone (stippled) on upper jaw (a from BMNH. 1979.7.5.13, 120.0 mm S.L.; b, c, d from BMNH. 1975.3.20.823-826, 160.0 mm S.L.).

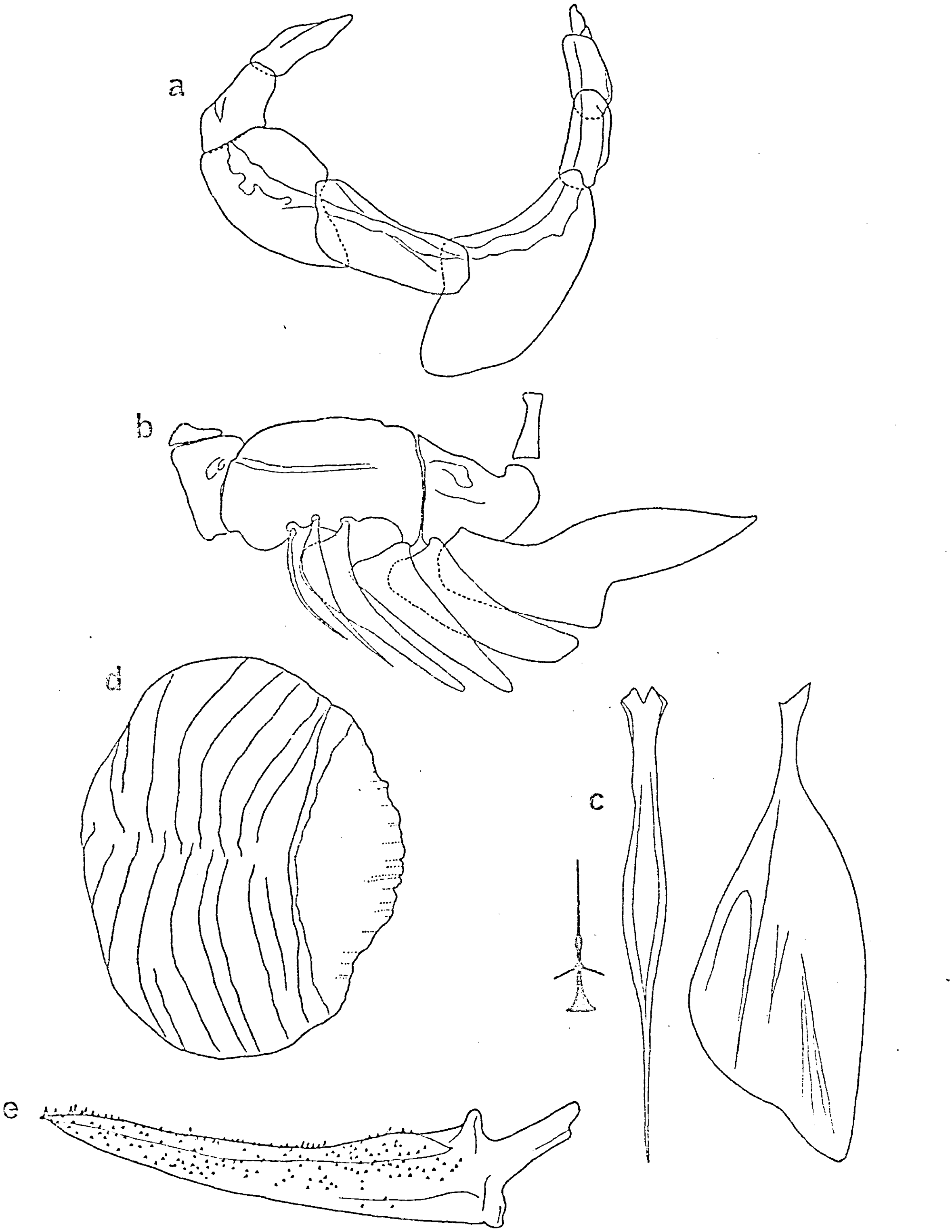


Plate 160. Ilisha sirishai:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1975.3.20.823-826, a, b, c, e from 160.0 mm S.L. and d from 172.0 mm S.L.).

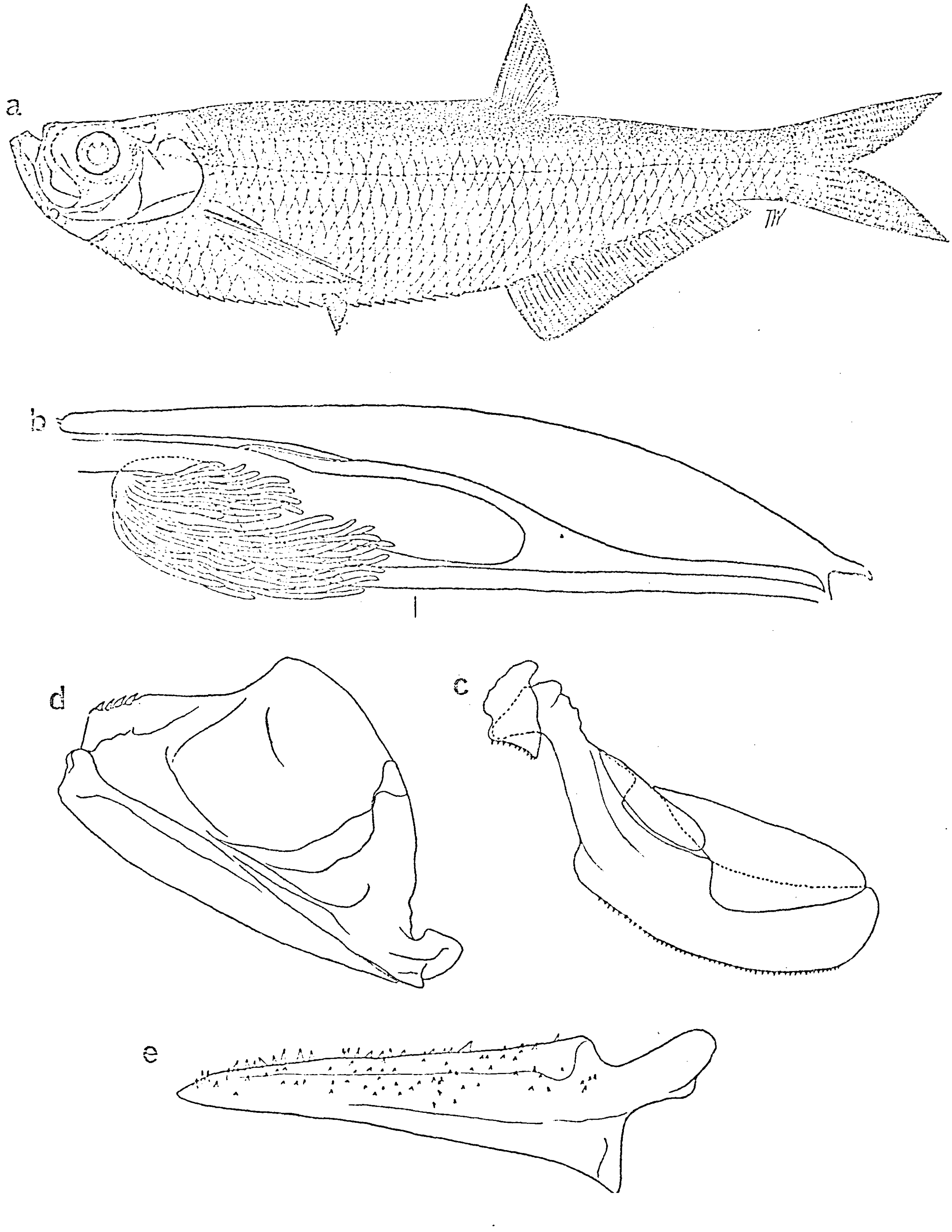


Plate 161. Ilisha novacula:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, gillraker (a from BMNH. 1870.6.14.36, 209.0 mm S.L.; others from BMNH. 1891.11.30.402-403, 206.0 mm S.L.).

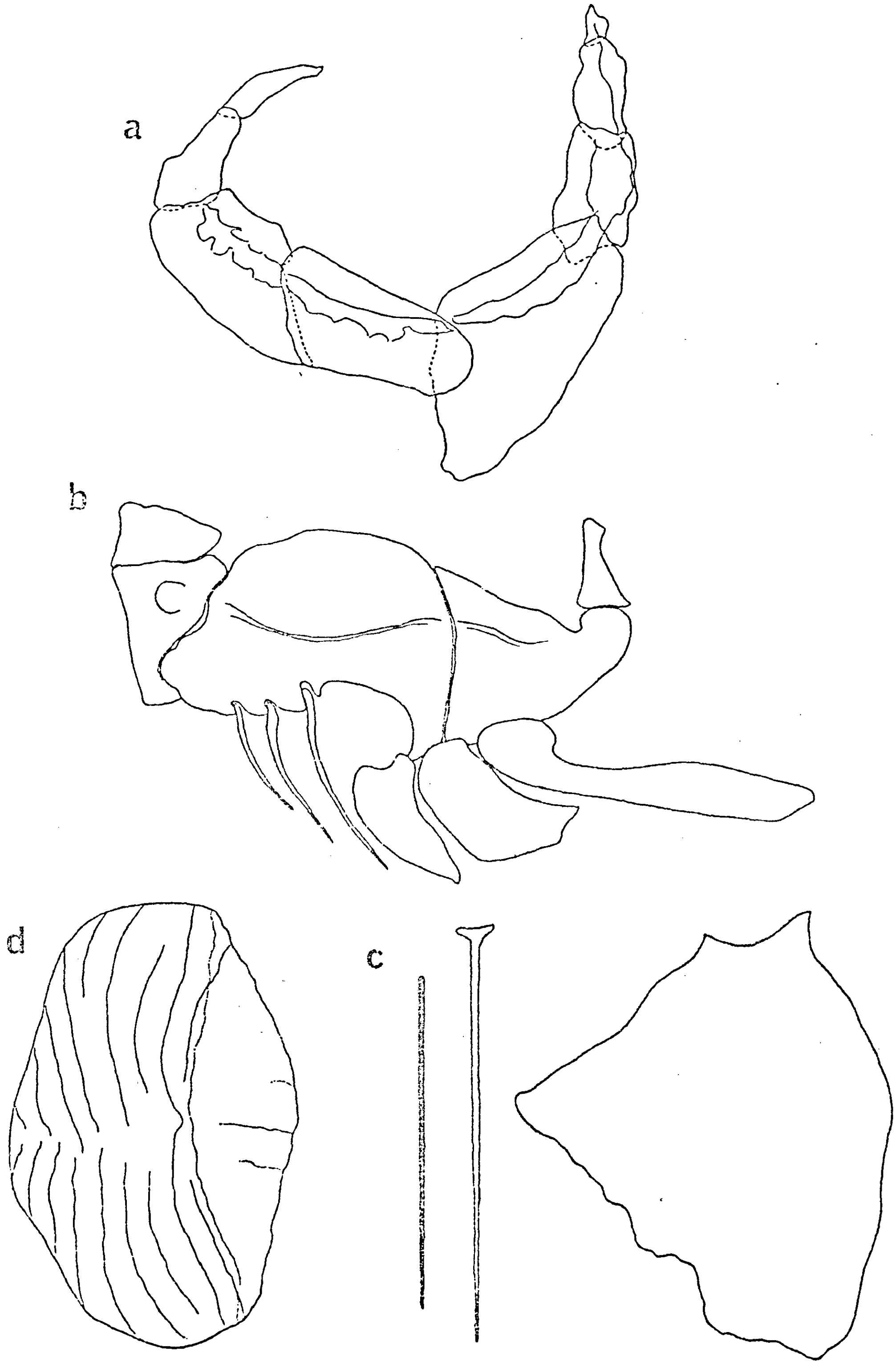


Plate 162. Ilisha novacula:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale (all from BMNH. 1891.11.30.402-403, 206.0 mm S.L.).

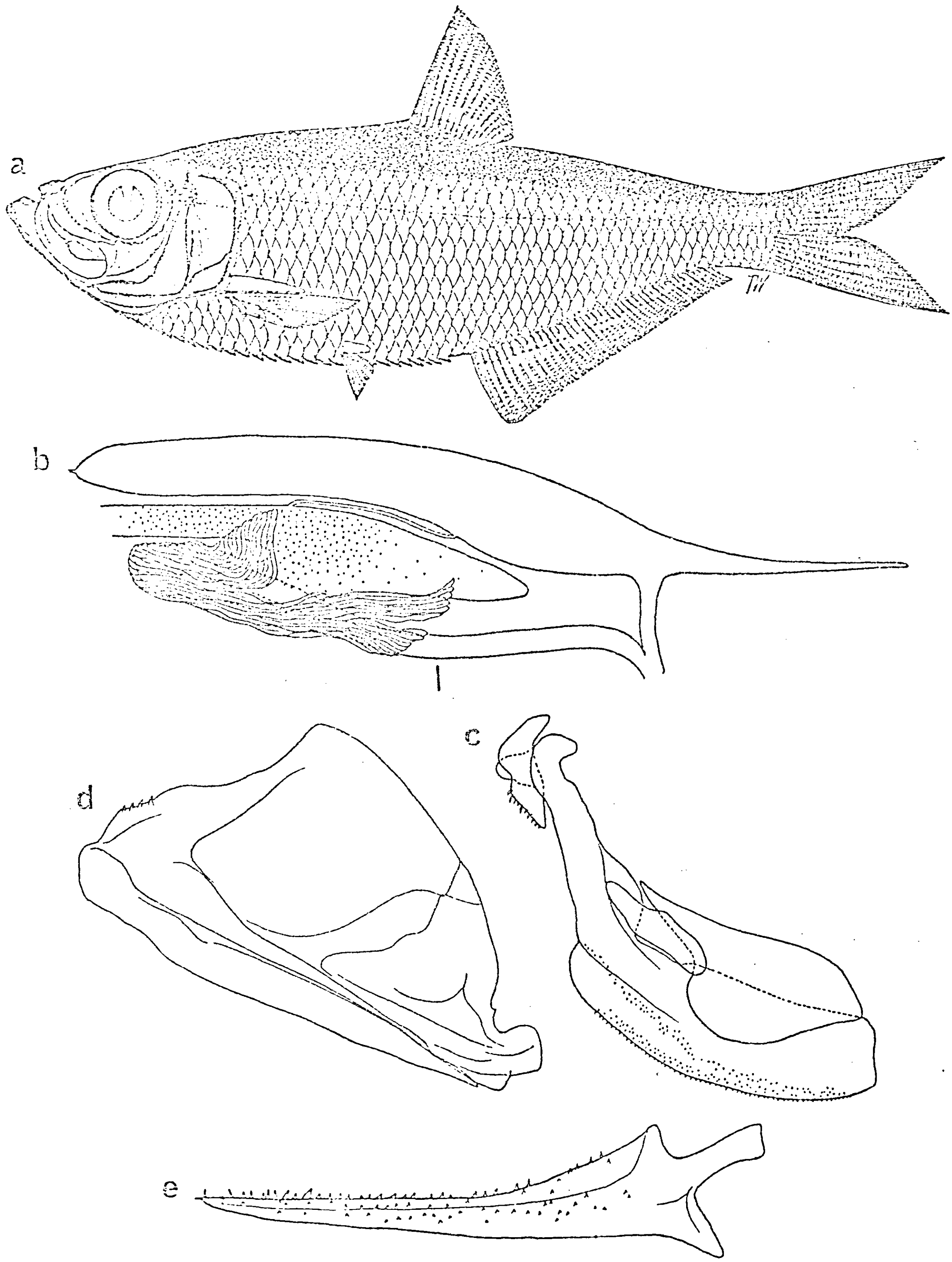


Plate 163. Ilisha megaloptera:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, gillraker (a from BMNH. 1979.7.5.15-16, 130.0 mm S.L.; others from BMNH. 1979.8.17.22, 106.0 mm S.L.).

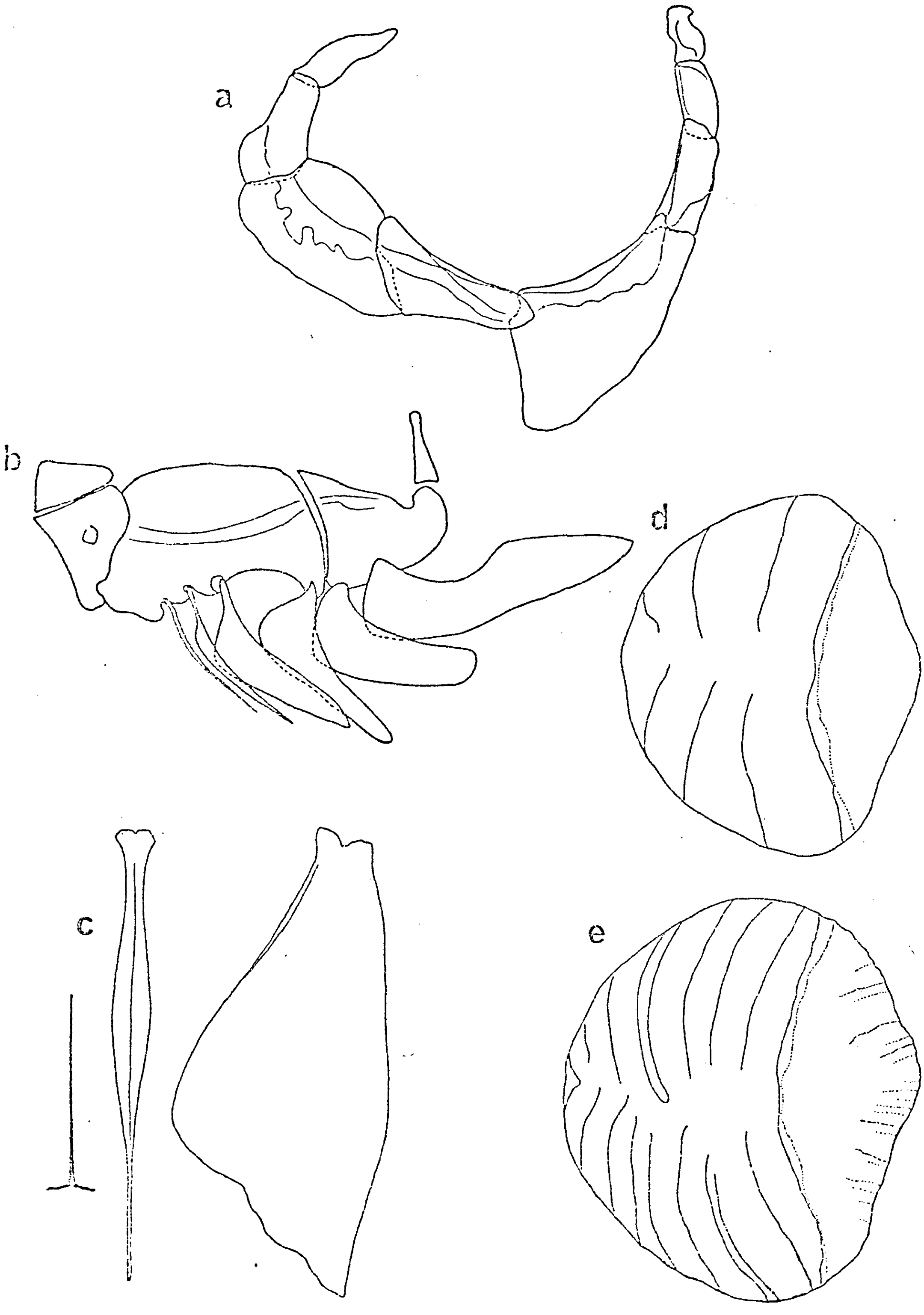


Plate 164. Ilisha megaloptera:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, scales; (a, b, c from BMNH. 1979.8.17.22, 106.0 mm S.L. for a, b, c and d from BMNH. 1967.11.13.58-61, 89.0 mm S.L.; e from BMNH. 1867.11.28. 13, 165.0 mm S.L., lectotype of Pellona russellii).

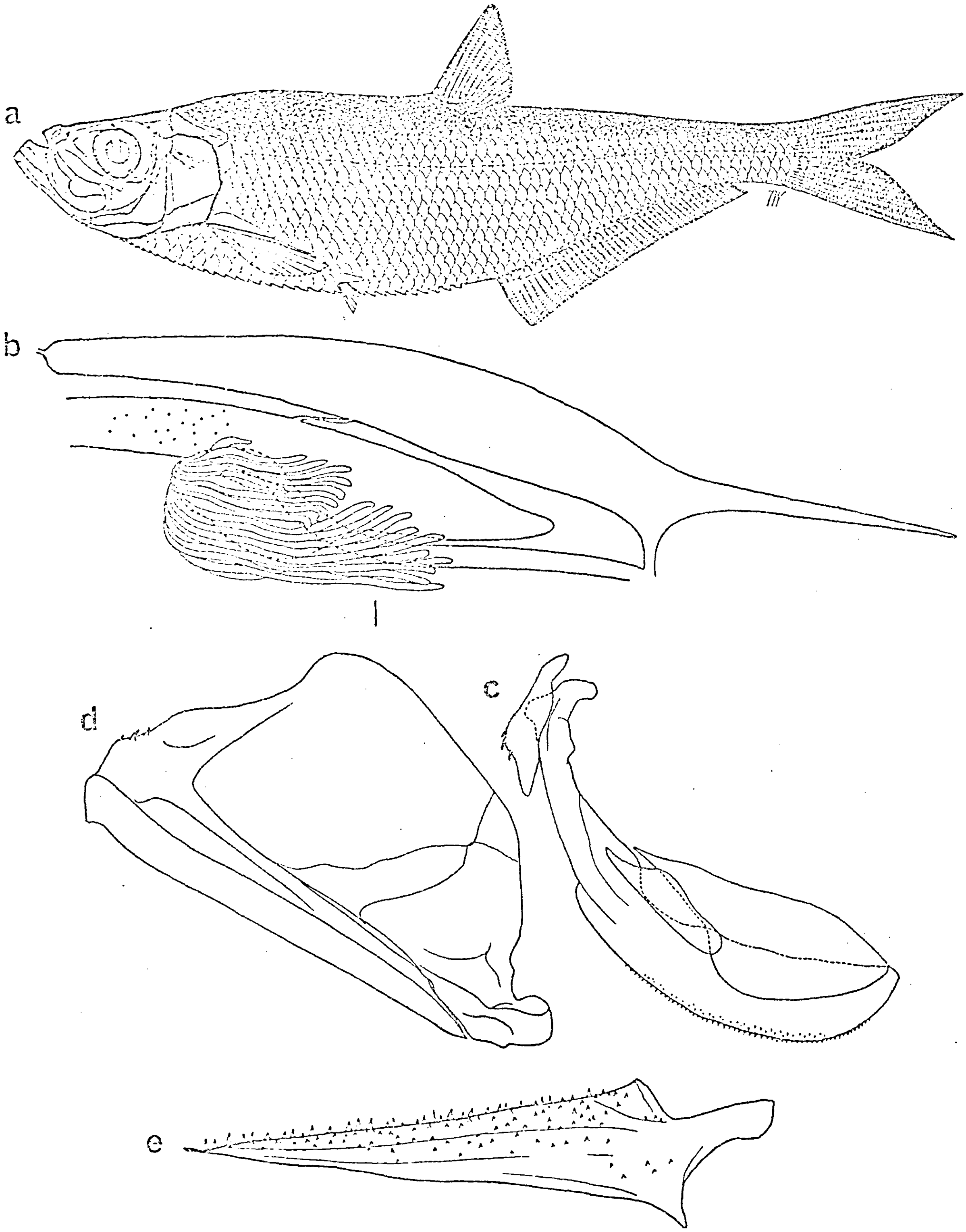


Plate 165. Ilisha elongata:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, gillraker (a from BMNH. 1867.11.28.11, 259.0 mm S.L.; b from BMNH. 1868.11.17.38, 180.0 mm S.L.; c, d, e from BMNH. 1868. 11.17.38, 180.0 mm S.L.).

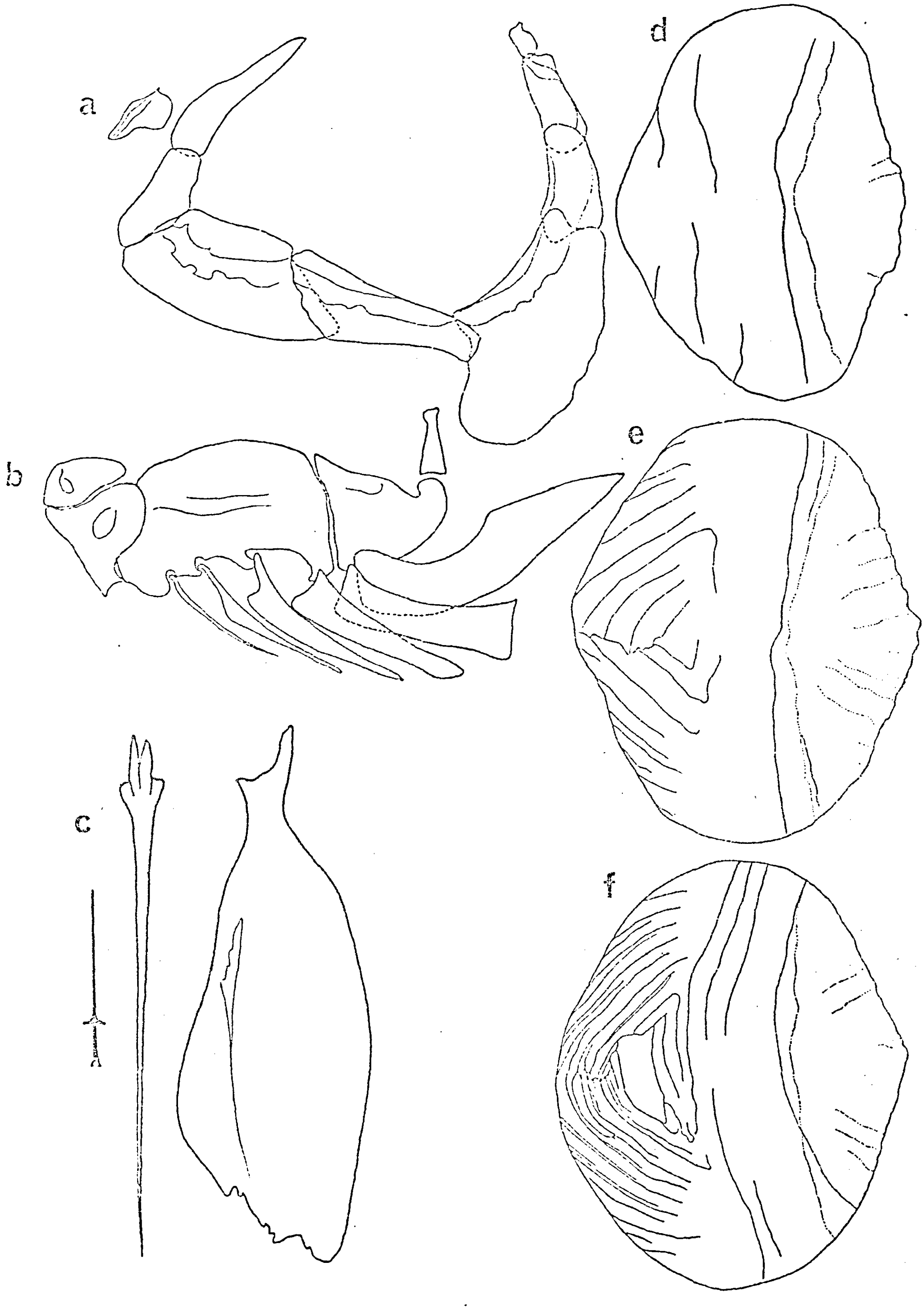


Plate 166. Ilisha elongata:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, f, scales (a, b, c from BMNH. 1868.11.17.38, 180.0 mm S.L.; d from BMNH. 1933.3.11.840, 115.0 mm S.L.; e from BMNH. 1867.11.28.25, 224.0 mm S.L.; f from BMNH. 1852.9.13.107, 311.0 mm S.L., holotype of Alosa elongata).

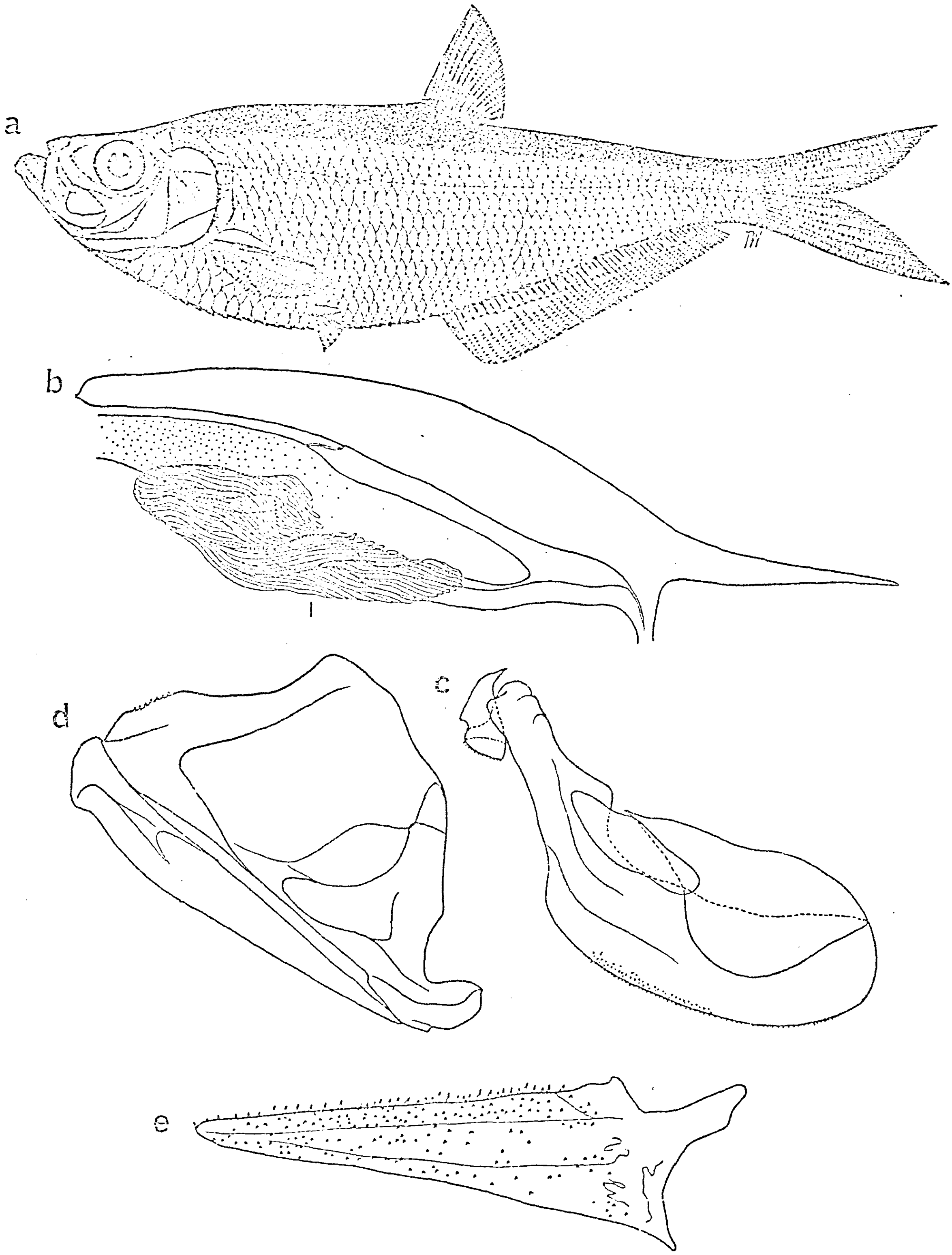


Plate 167. *Ilisha filigera*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, gillraker (a from BMNH. 1979.8.17.6, 189.0 mm S.L.; b, c, d, e from BMNH. 1969.11.6.3, 179.0 mm S.L.).

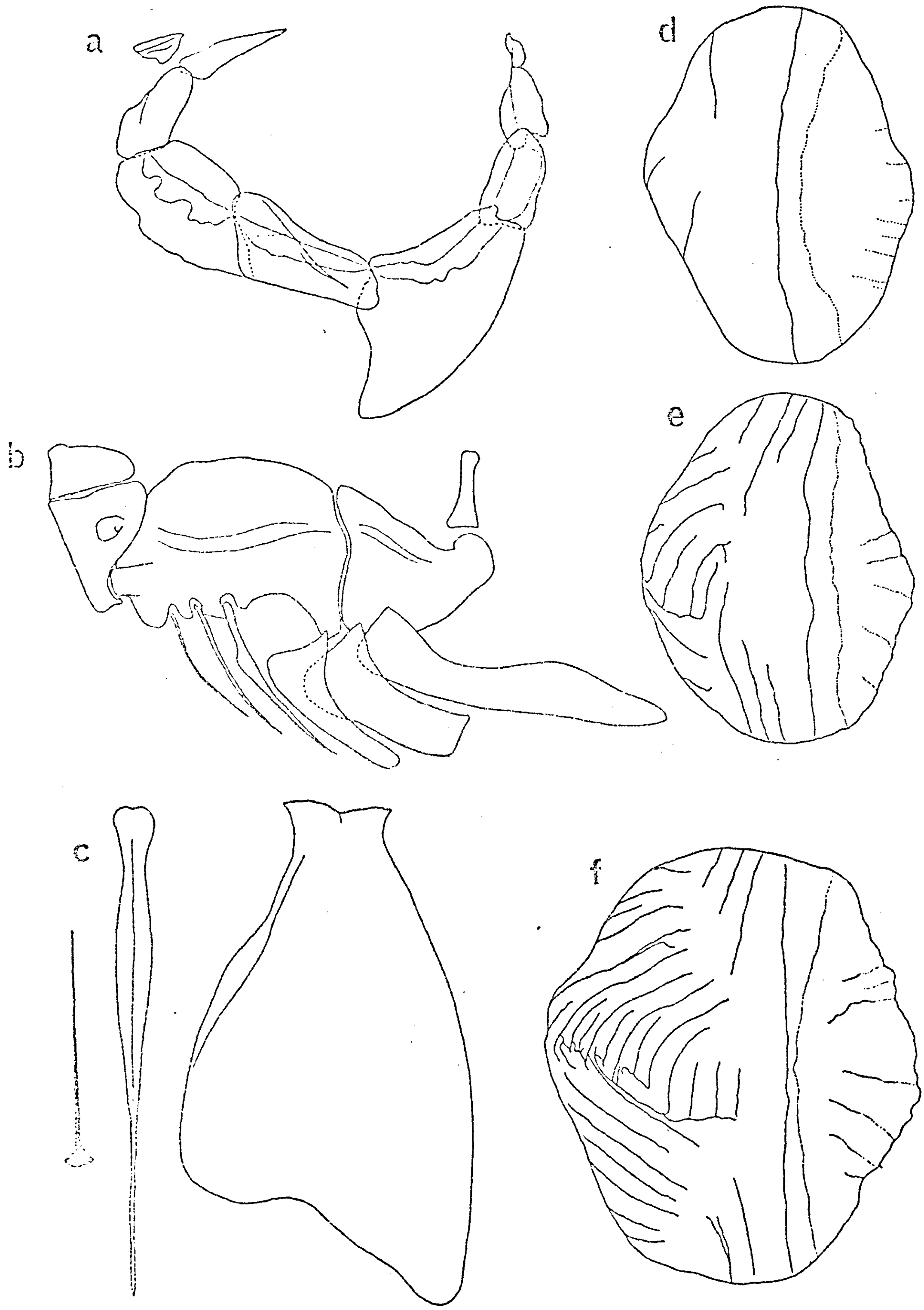


Plate 168. <u>Ilisha</u> <u>filigera</u>:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, f, scales (a, b, c, e from BMNH. 1969.11.6.3, 179.0 mm S.L. for a, b, c and 142.0 mm S.L. for e; d from BMNH. 1895.2.28.70, 106.0 mm S.L.; f from BMNH. 1979.8.17.6, 189.0 mm S.L.).

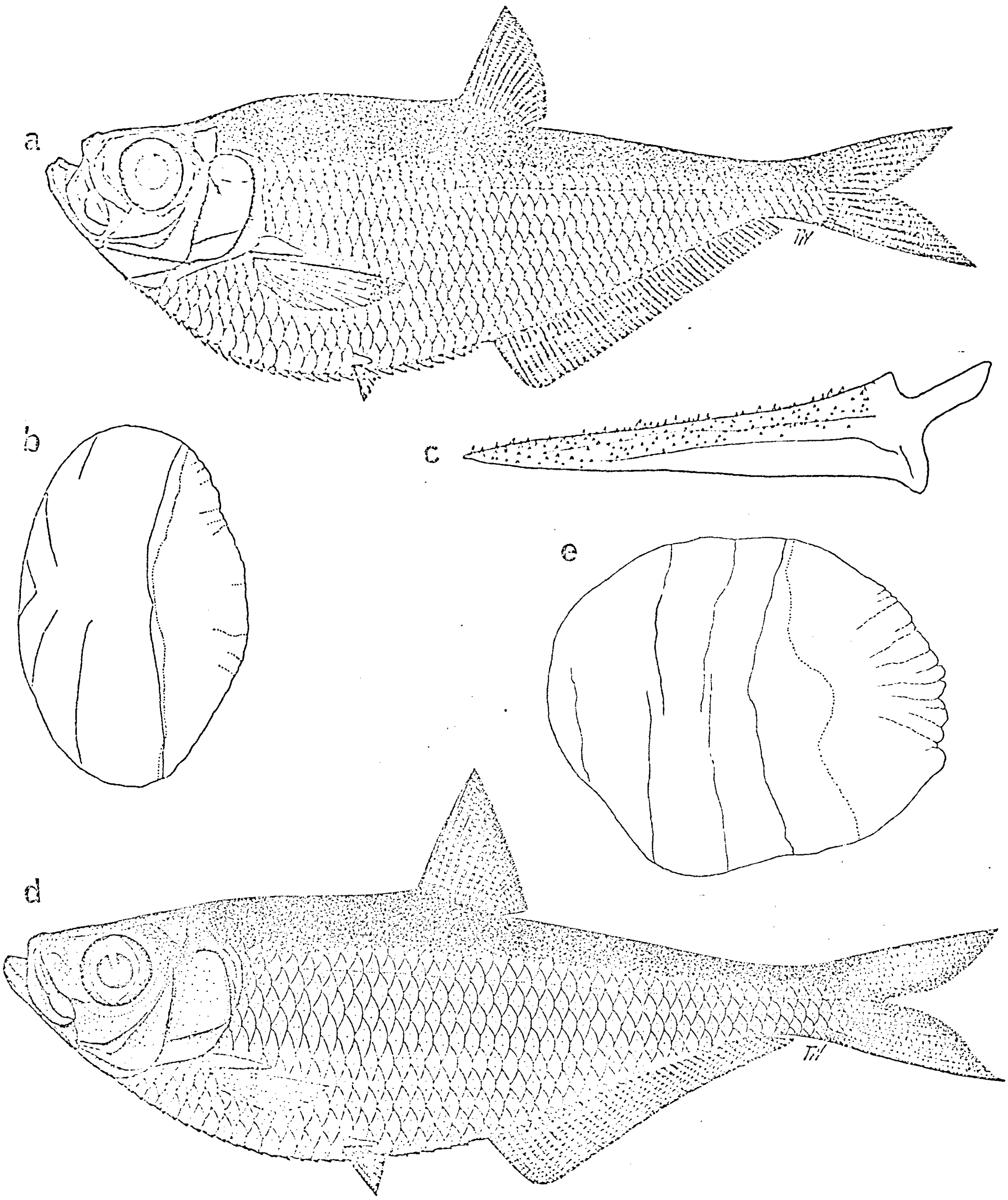


Plate 169. Ilisha macrogaster:- a, adult; b, scale; c, gillraker (a, b from BMNH. 1867.11.28.20, 117.0 mm S.L., holotype of Ilisha macrogaster; c from BMNH. 1894.1.19.80, 111.5 mm S.L.

Ilisha obfuscata:- d, adult; e, scale (all from MNHN.B.2879, 74.0 mm S.L., holotype).

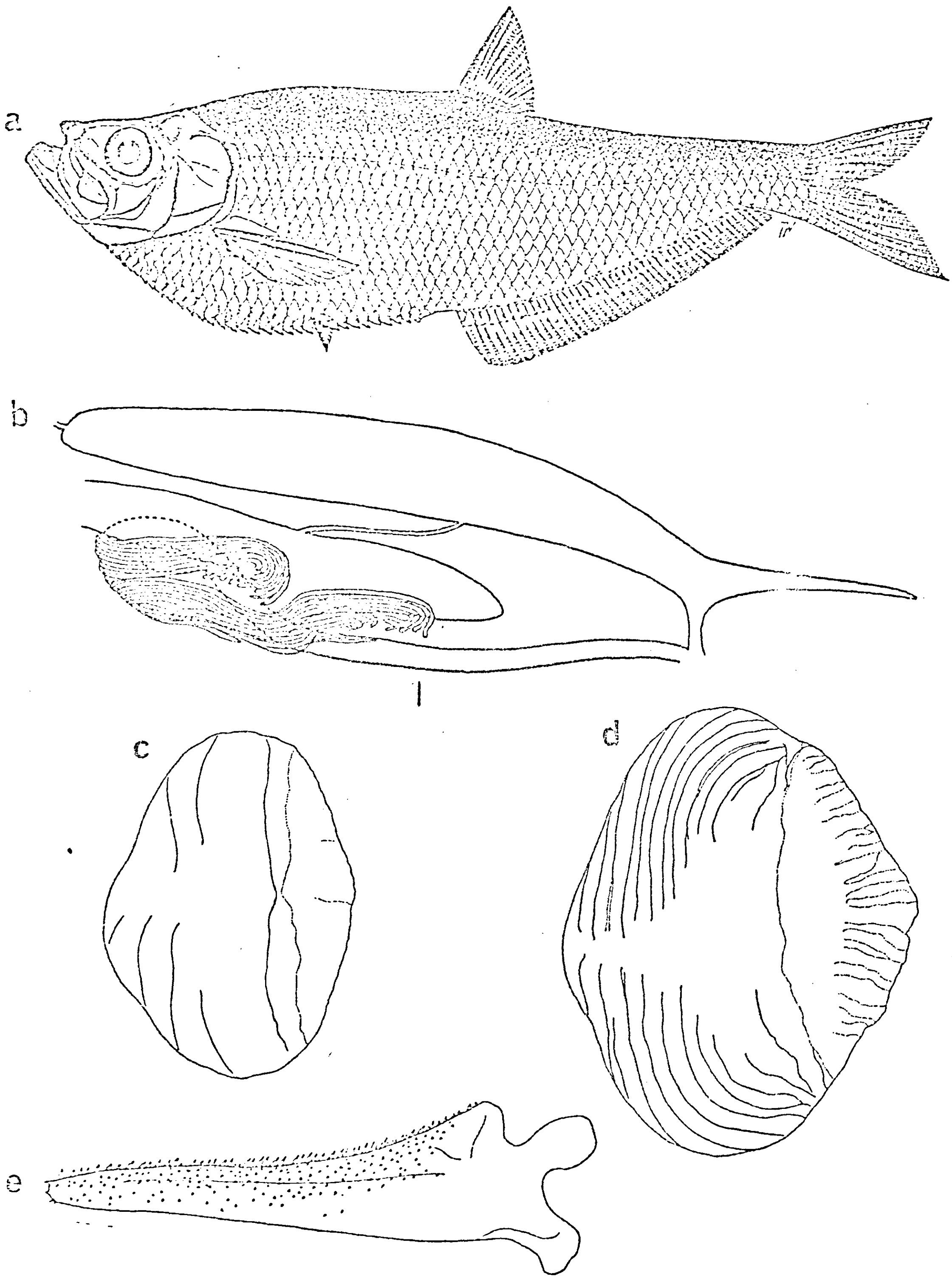


Plate 170. Ilisha pristigastroides:- a, adult; b, gas bladder and digestive tract; c, d, scales; e, gillraker (a, c from BMNH. 1867.11.28.12, 145.0 mm S.L., holotype of Pellona pristigastroides; b, d, e from BMNH. 1867.11.28.9, 295.0 mm S.L.).

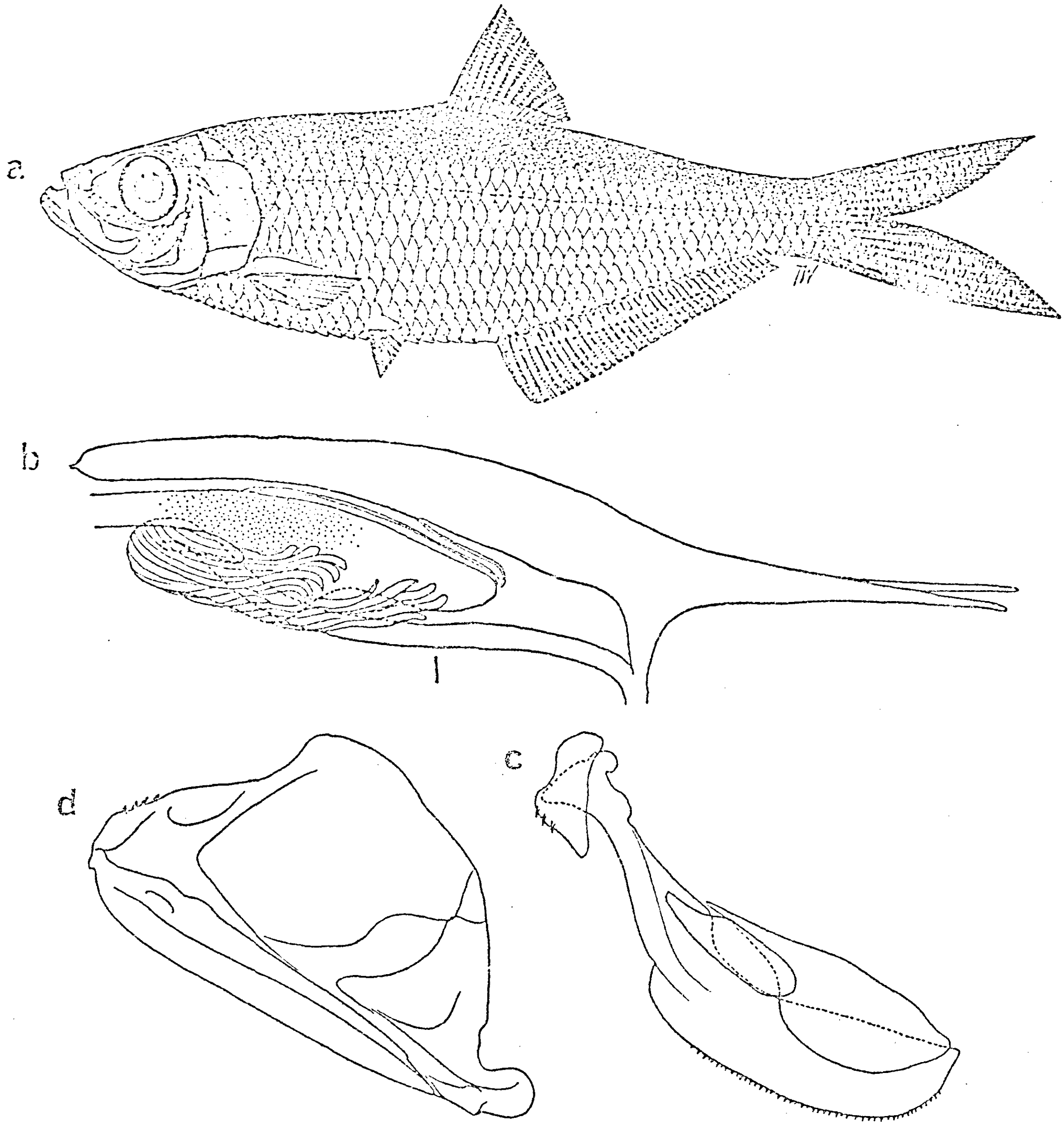


Plate 171. Ilisha kampeni:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1975.9.24.36, 144.0 mm S.L., holotype of Ilisha whiteheadi; b, c, d from BMNH. 1975.6.4.56-59, 100.0 mm S.L.).

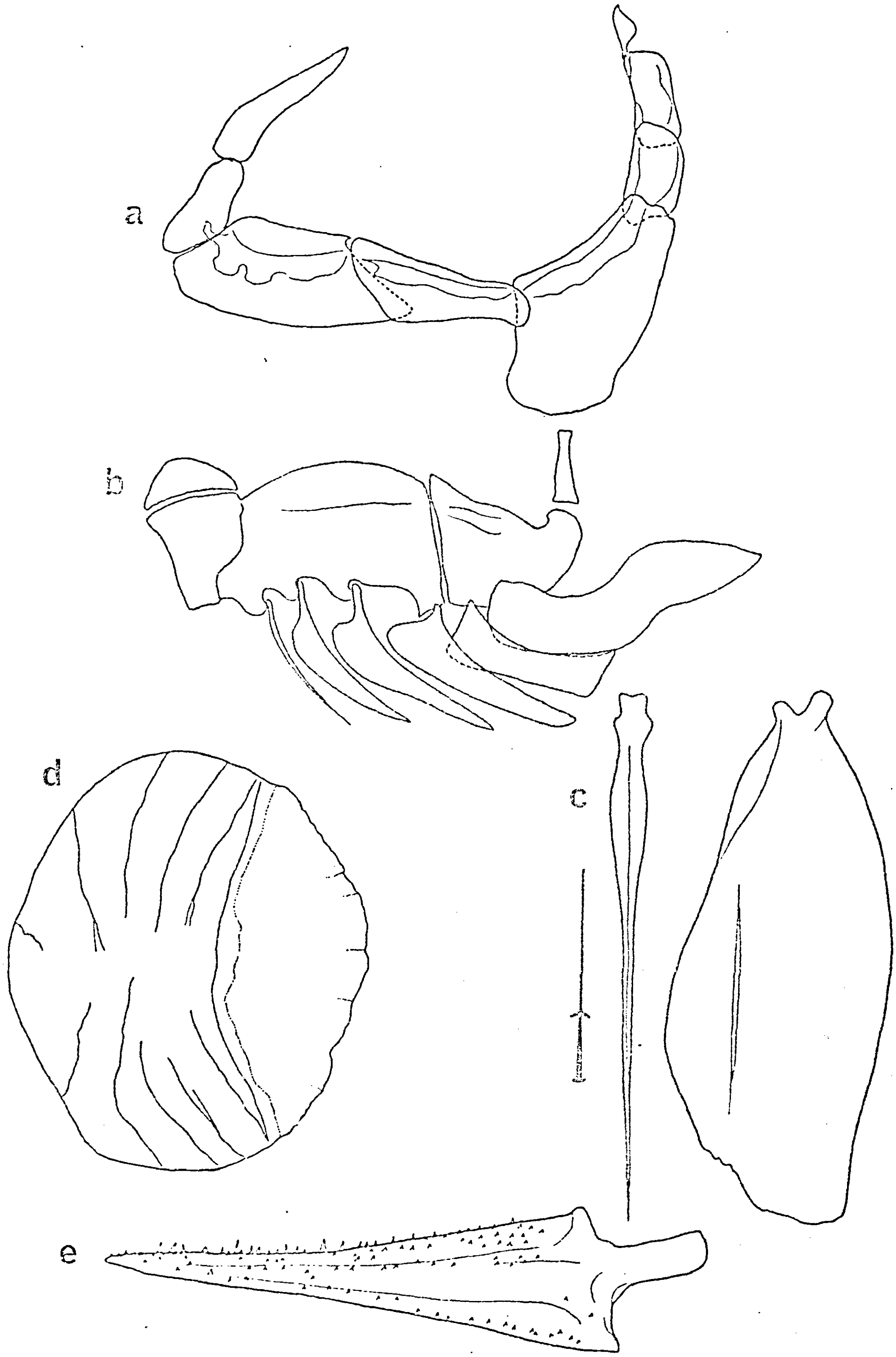


Plate 172. Ilisha kampeni:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1973.6.4.56-59, 100.0 mm S.L.; d from BMNH. 1975.9.24.37-47, 146.0 mm S.L., paratype of Ilisha whiteheadi).

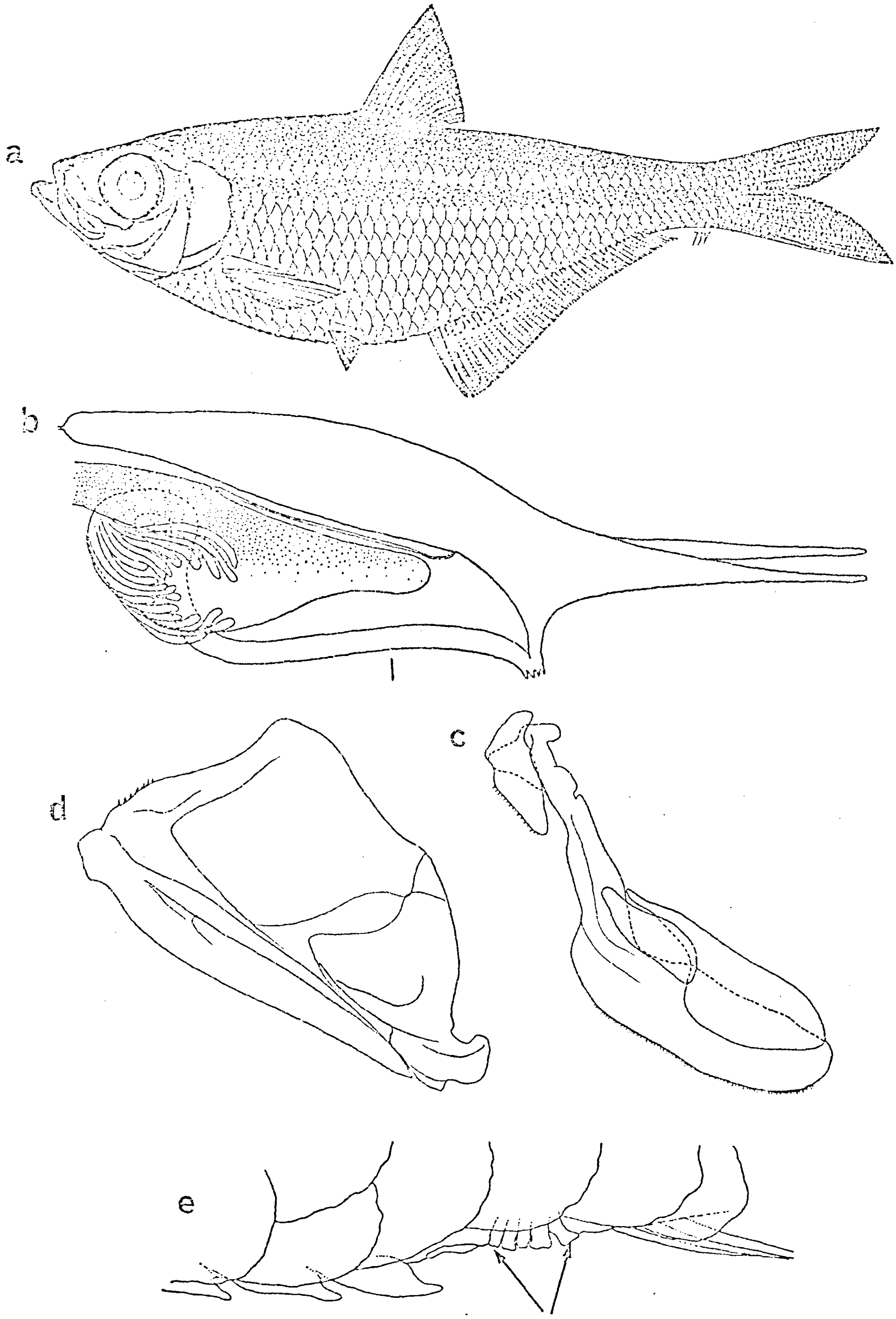


Plate 173. <u>Ilisha</u> <u>striatula</u>:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, enlargement of preanal region to show genital papillae between two arrows (a from BMNH. 1979.3.20.700-709, 114.0 mm S.L., paratype; others from BMNH. 1970.10.21.18-27, 111.0 mm S.L.).

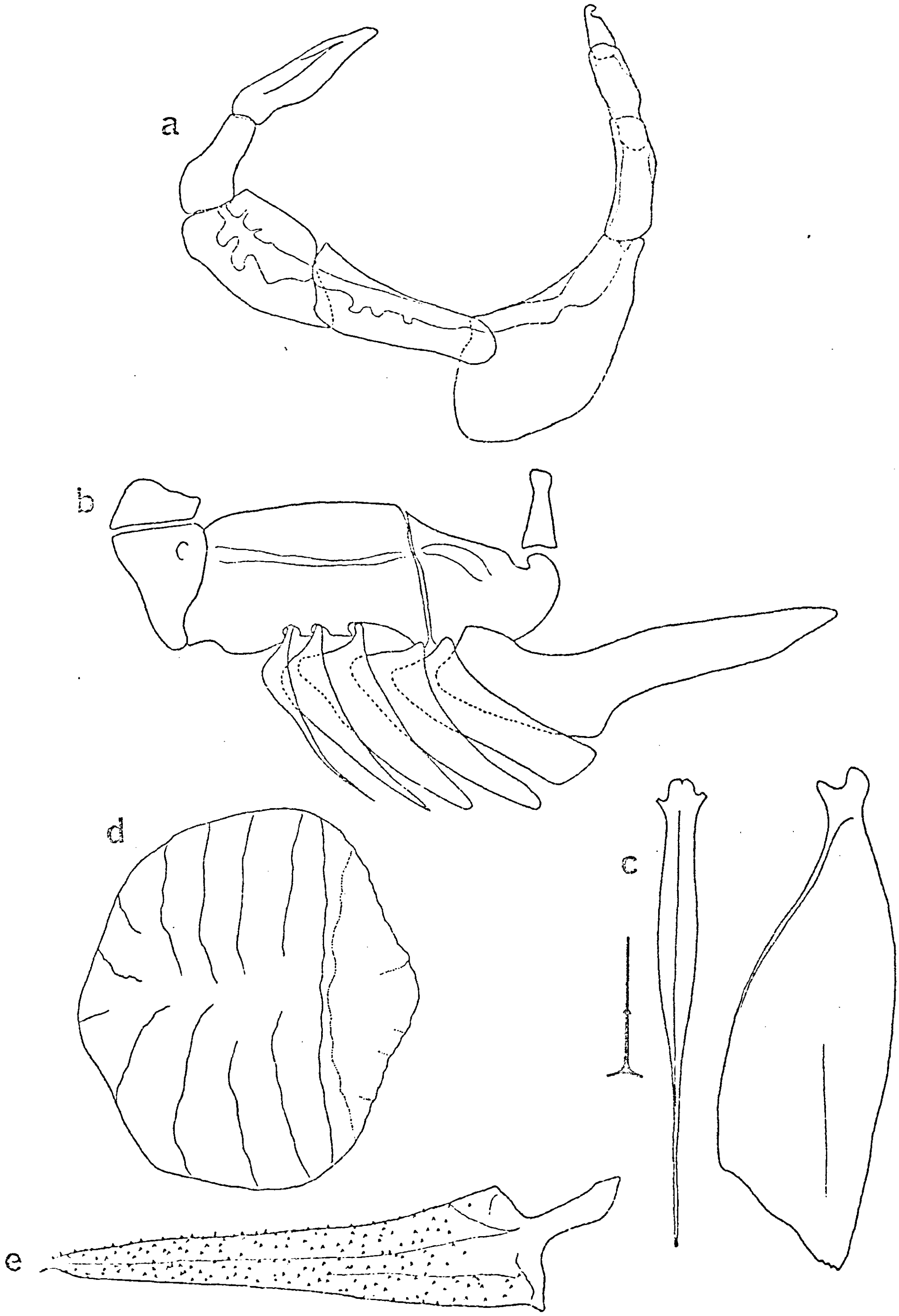


Plate 174. Ilisha striatula:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1970.10.21.18-27, 111.0 mm S.L. for a, b, c, e and 116.0 mm S.L. for d).

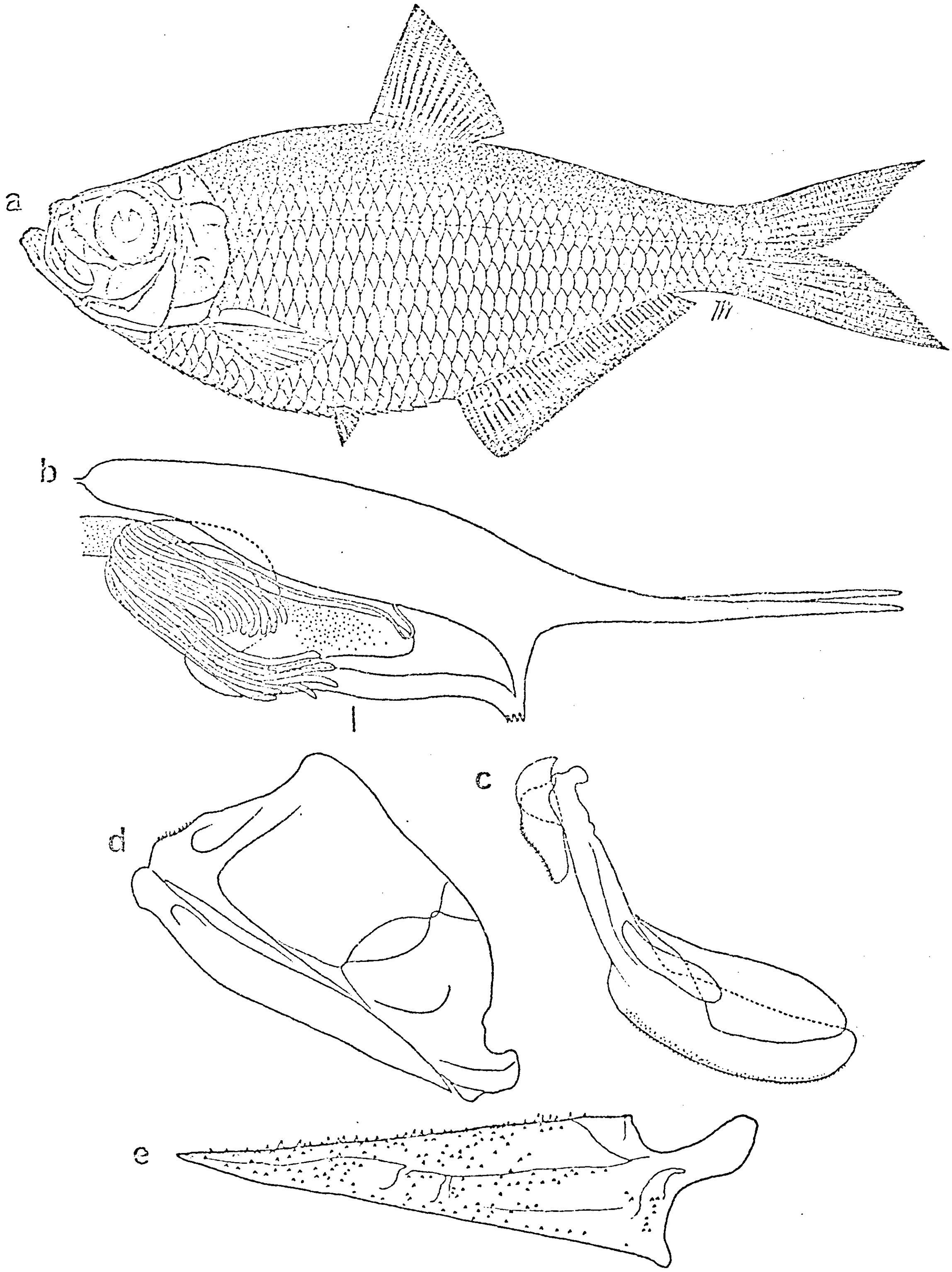


Plate 175. Ilisha melastoma:- a, adult (deeper body specimen); b, gas bladder and digestive tract; c, d, upper and lower jaws; e, gillraker (a from BMNH. 1966.2.28.27-28, 144.0 mm S.L.; others from BMNH. 1970.10.21.34-43, 115.0 mm S.L.).

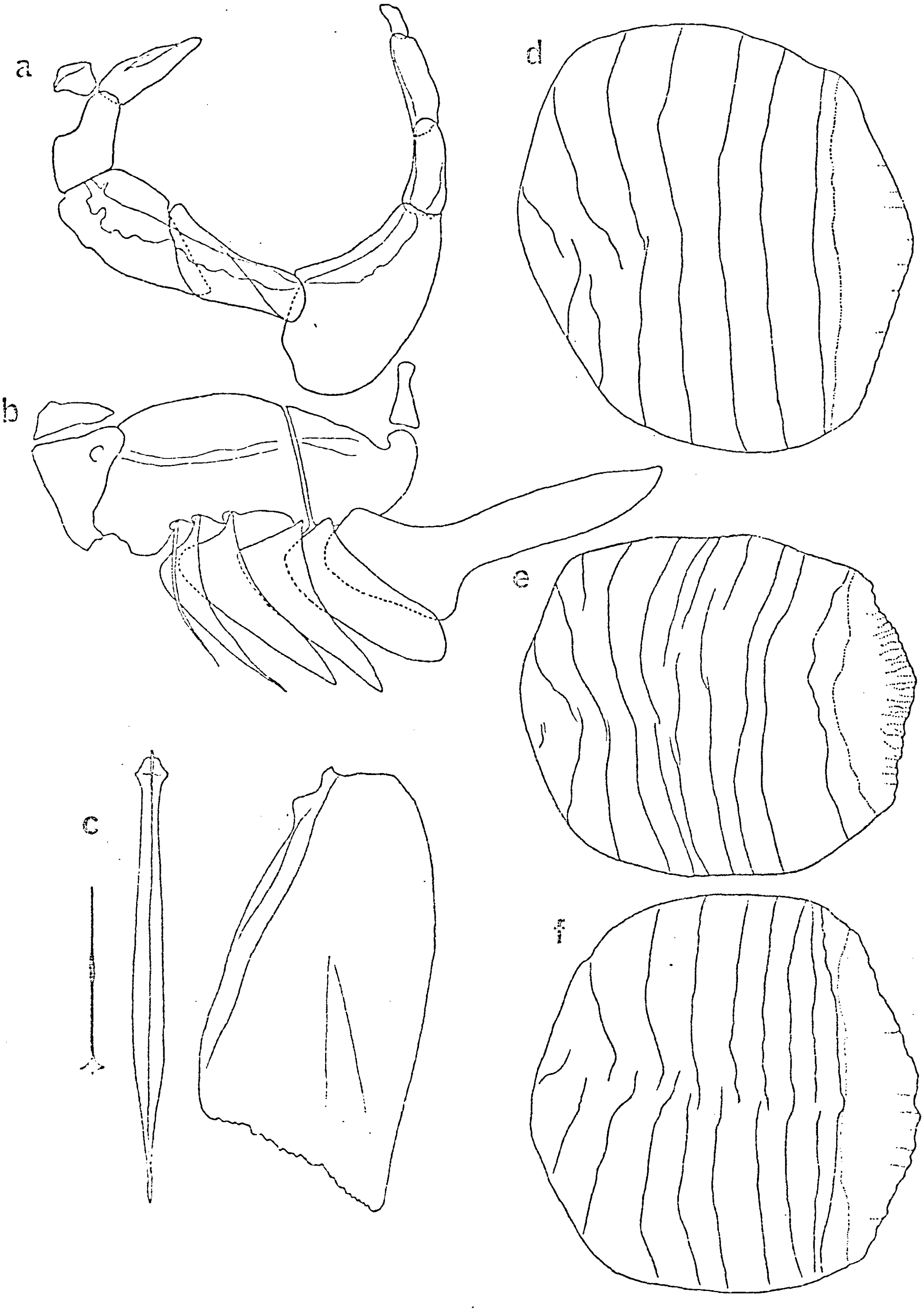


Plate 176. Ilisha melastoma:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, f, scales (a, b, c, f from BMNH. 1970.10.21.34-43, 115.0 mm S.L.; d from BMNH. 1889.2.1.1994-1997, 86.0 mm S.L.; e from holotype of Clupea melastoma, ZMB.3842, 120.0 mm S.L.).

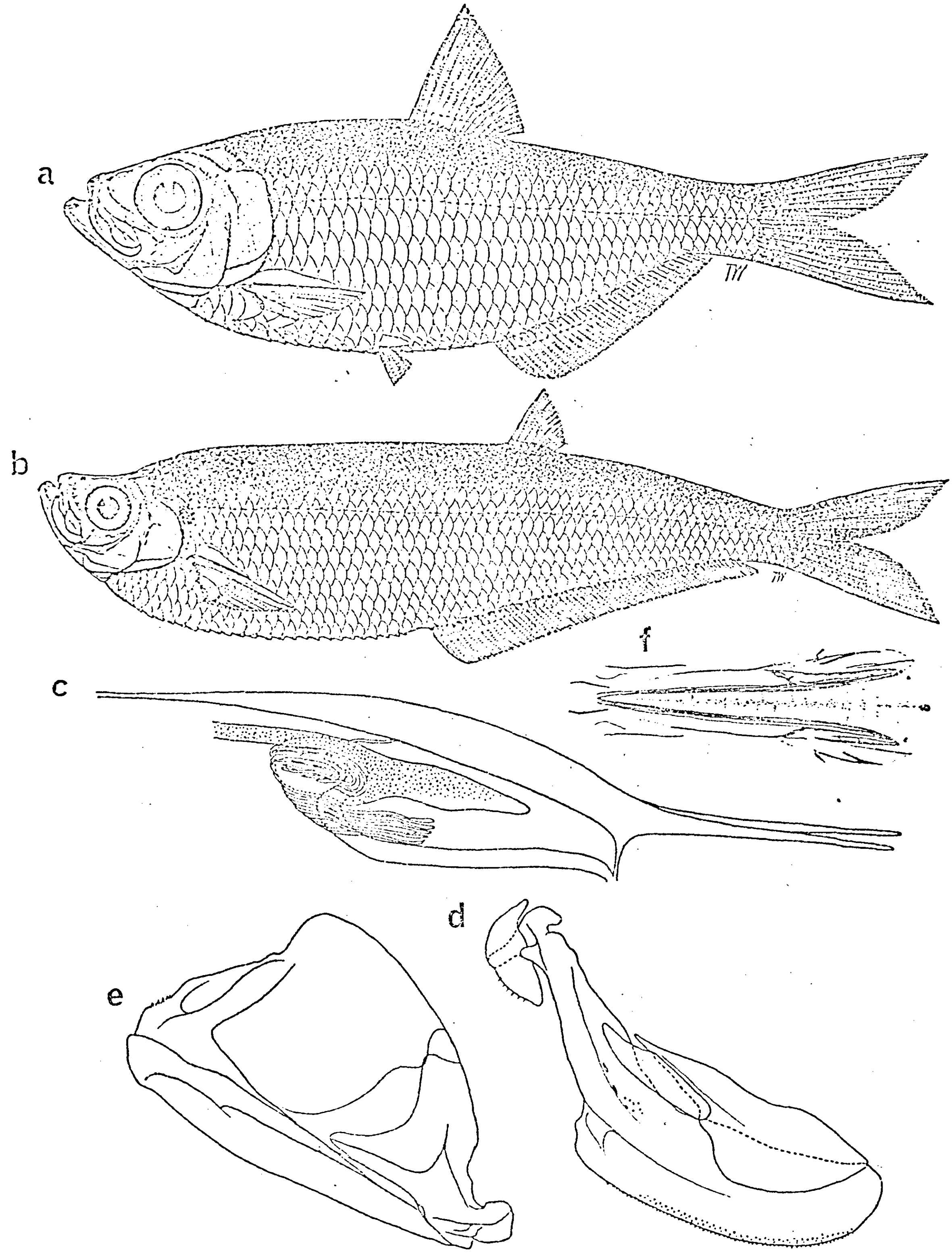


Plate 177. Ilisha melastoma:- a, adult (shallower body specimen) (from BMNH. 1966.2.28.27-28, 114.0 mm S.L.).

Opisthopterus valenciennesi:- b, adult; c, gas bladder and digestive tract; d, e, upper and lower jaws; f, frontoparietal striae (b, f from BMNH. 1867. 11.28.8, 173.0 mm S.L., paralectotype of Opisthopterus valenciennesi; c, d, e from BMNH. 1965.7.5.48, 145.0 mm S.L.).

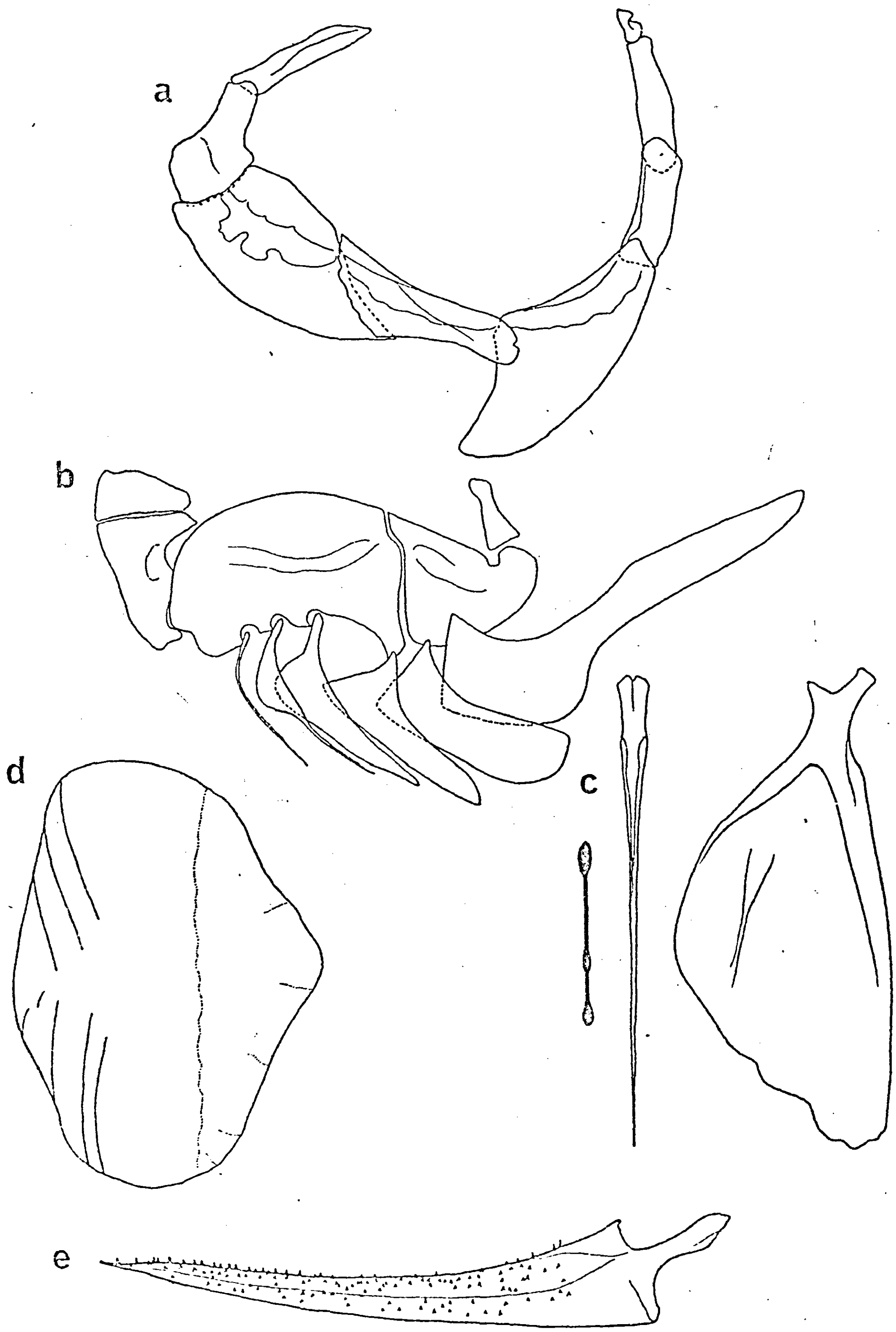


Plate 178. *Opisthopterus valenciennesi*:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1965.7.5. 48, 145.0 mm S.L.; d from BMNH. 1965.9.24.1, 170.0 mm S.L., lectotype of *Opisthopterus valenciennesi*).

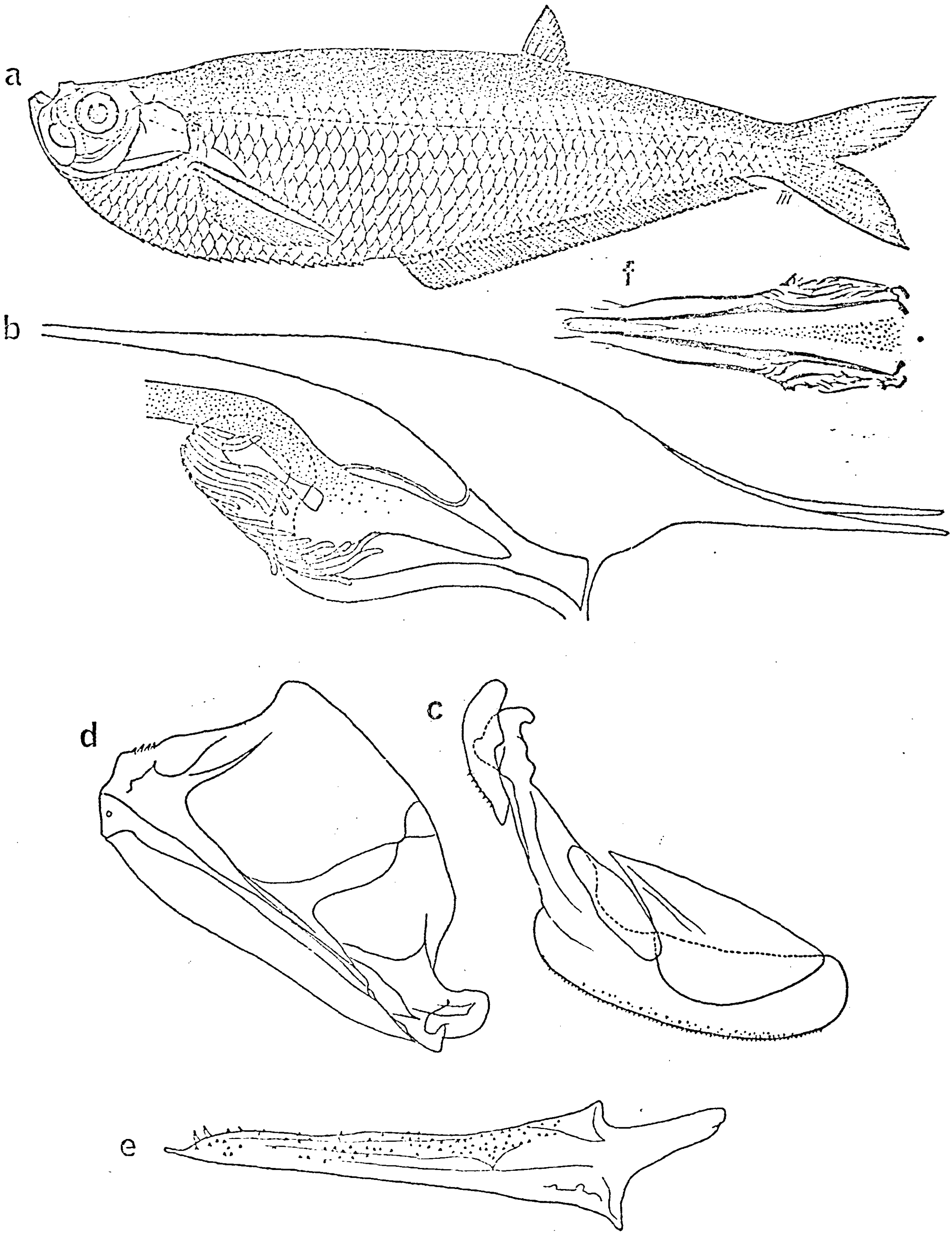


Plate 179. Opisthopterus tardoore:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, gillraker; f, frontoparietal striae (a, f from BMNH. 1867.11.28.7, 166.0 mm S.L.; b, e from BMNH. 1889.2.1. 2024-2025, 159.0 mm S.L.; c, d from BMNH. 1979.8.17.1-2, 84.0 mm S.L.).

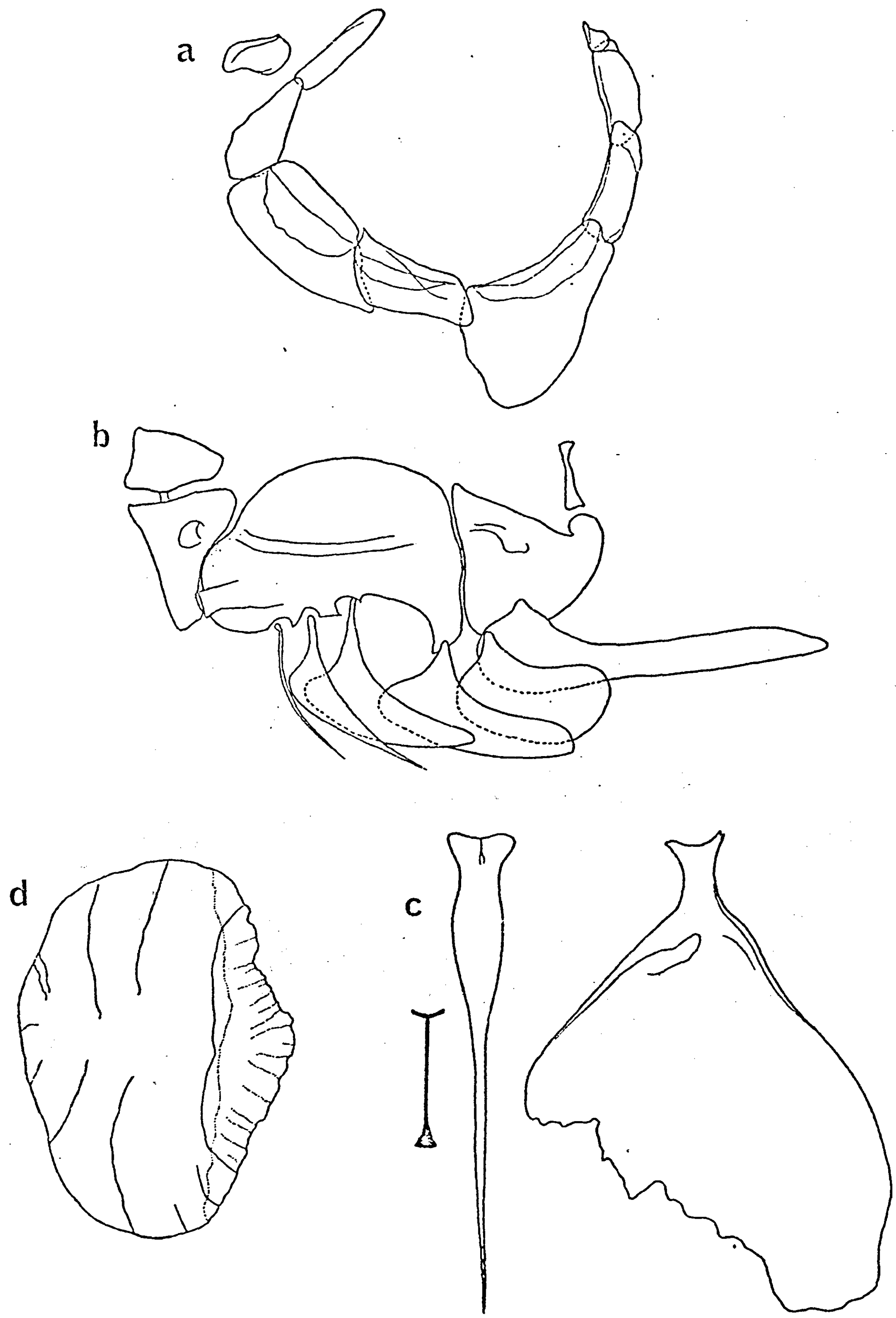


Plate 180. Opisthopterus tardoore:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale (a, b, c from BMNH. 1979.8.17.1-2, 84.0 mm S.L.; d from BMNH. 1968.10.27.28, 163.0 mm S.L.).

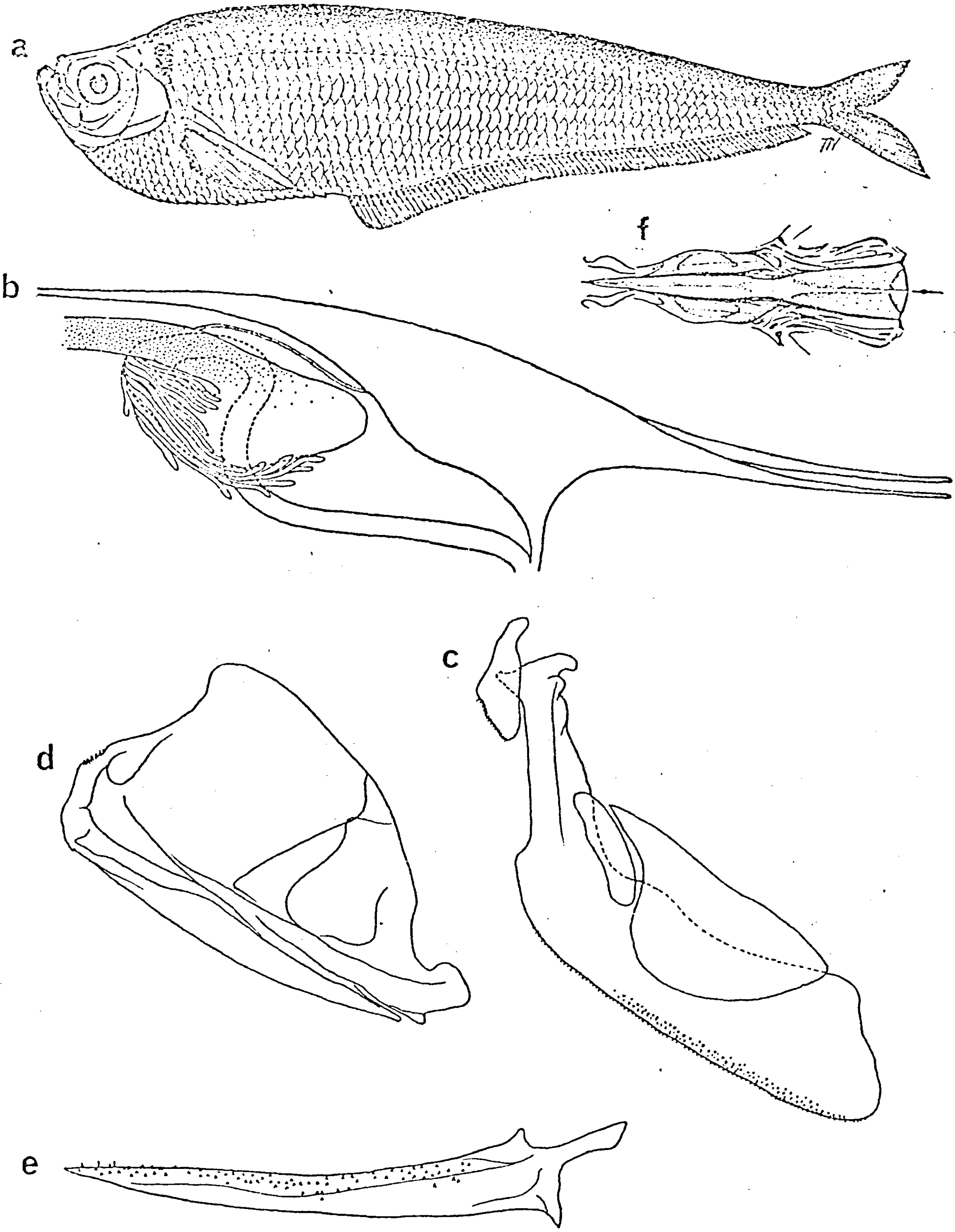


Plate 181. Raconda russeliana:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws; e, gillraker; f, frontoparietal striae (all from BMNH. 1973.6.4.60-71, 151.0 mm S.L. for a, f, 162.0 mm S.L. for b and 123.0 mm S.L. for others).

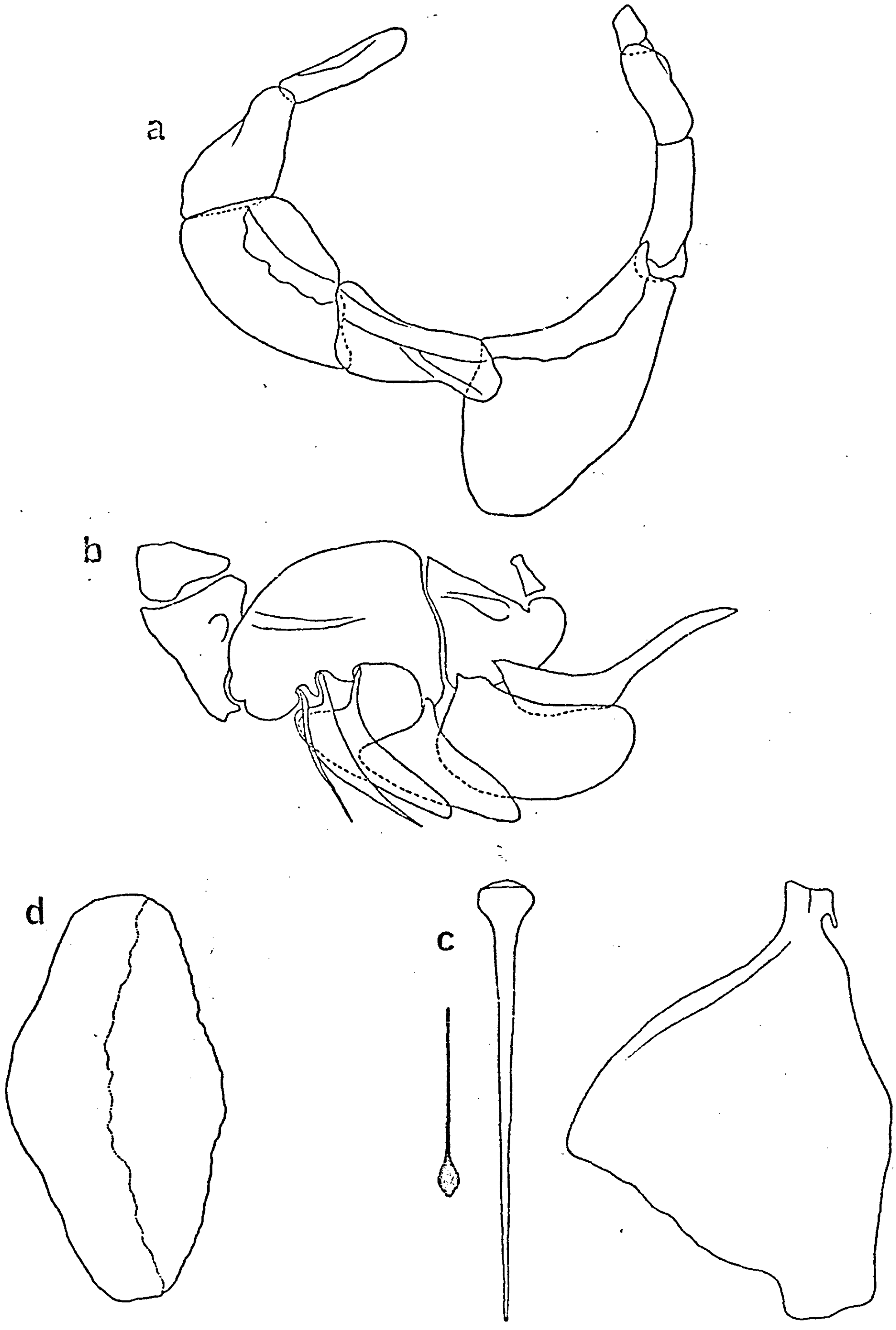


Plate 182. *Raconda russeliana*:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale (a, b, c from BMNH. 1973.6.4.60-71, 123.0 mm S.L.; d from BMNH. 1858.8.15.123, 176.0 mm S.L.).

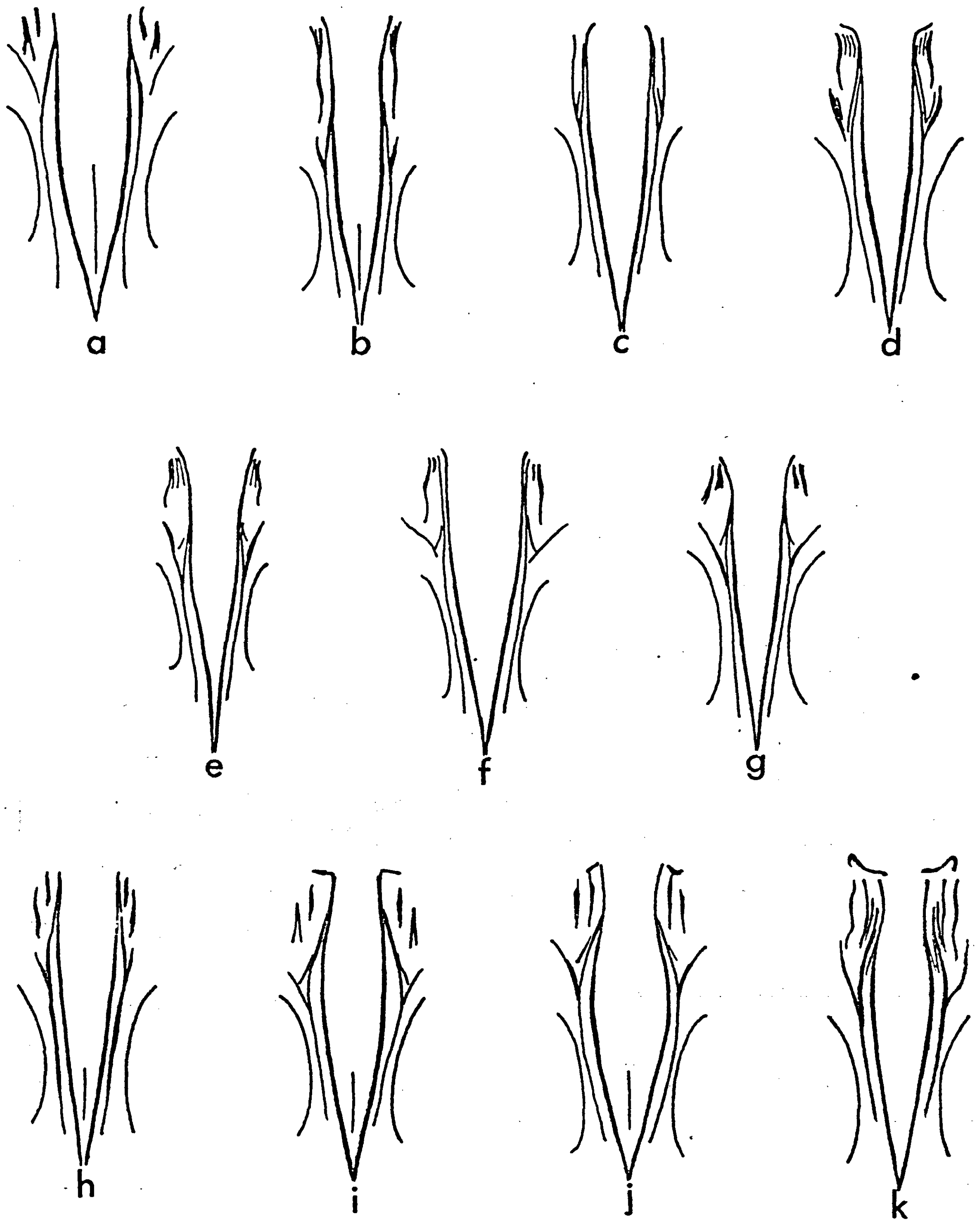


Plate 183. Outlines of the striae on the frontoparietal and occipital region in *Ilisha* : a, *I. sirishai*; b, *I. novacula*; c, *I. megaloptera*; d, *I. filigera*; e, *I. pristigastroides*; f, *I. macrogaster*; g, *I. elongata*; h, *I. kampeni*; i, *I. striatula*; j, *I. melastoma*; k, *I. obfuscata*. (Top is posterior).

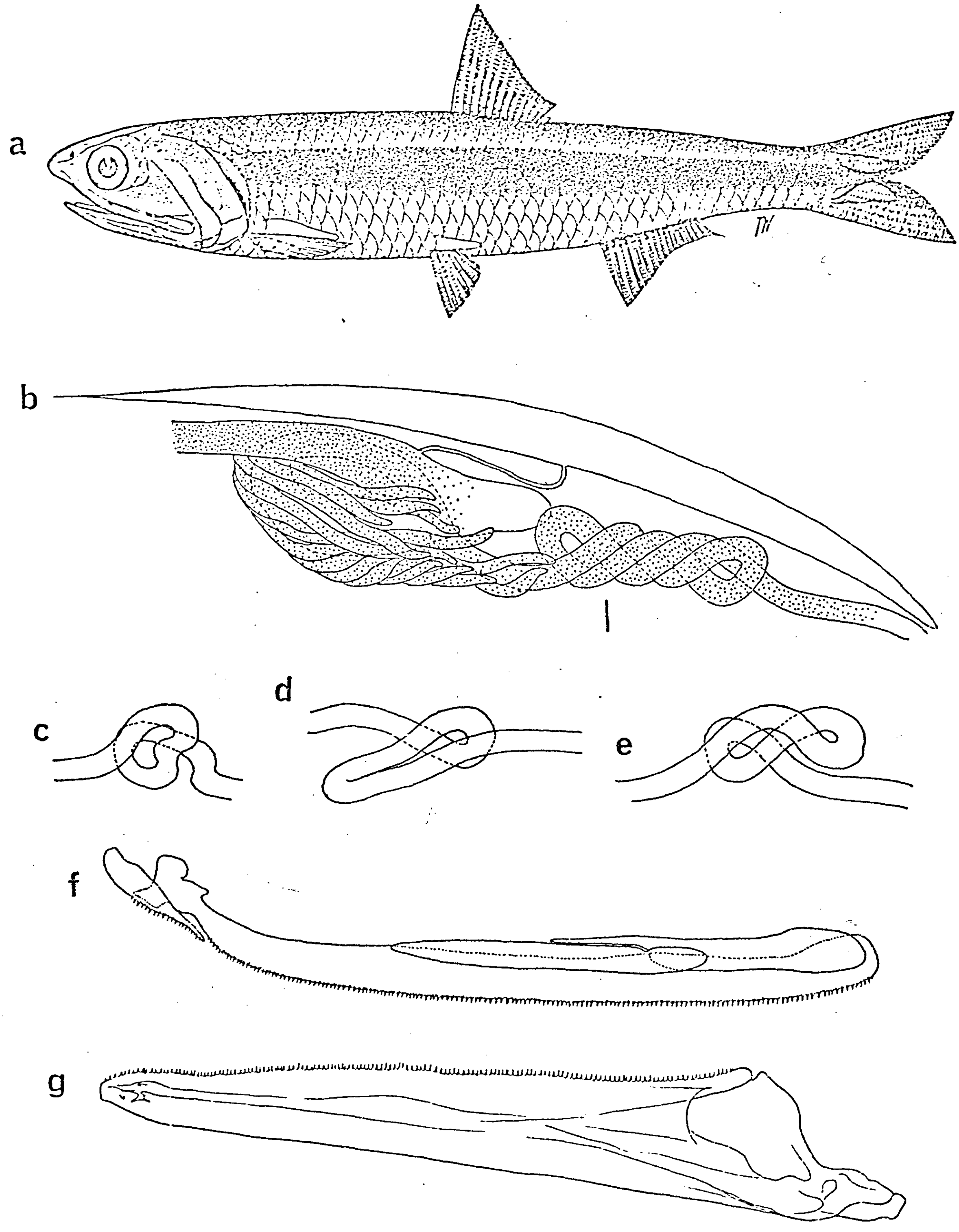


Plate 184. Engraulis japonicus:- a, adult; b, gas bladder and digestive tract; c, d, e, some patterns of coiling of intestine; f, g, upper and lower jaws (a from BMNH. 1969.4.22.1678-1687, 96.0 mm S.L.; b, f, g from BMNH. 1979.8.16.24-35, 109.0 mm S.L.; c, d, e from BMNH. 1969.4.22.1708-1717, 60.0, 61.0 and 84.0 mm S.L. respectively).

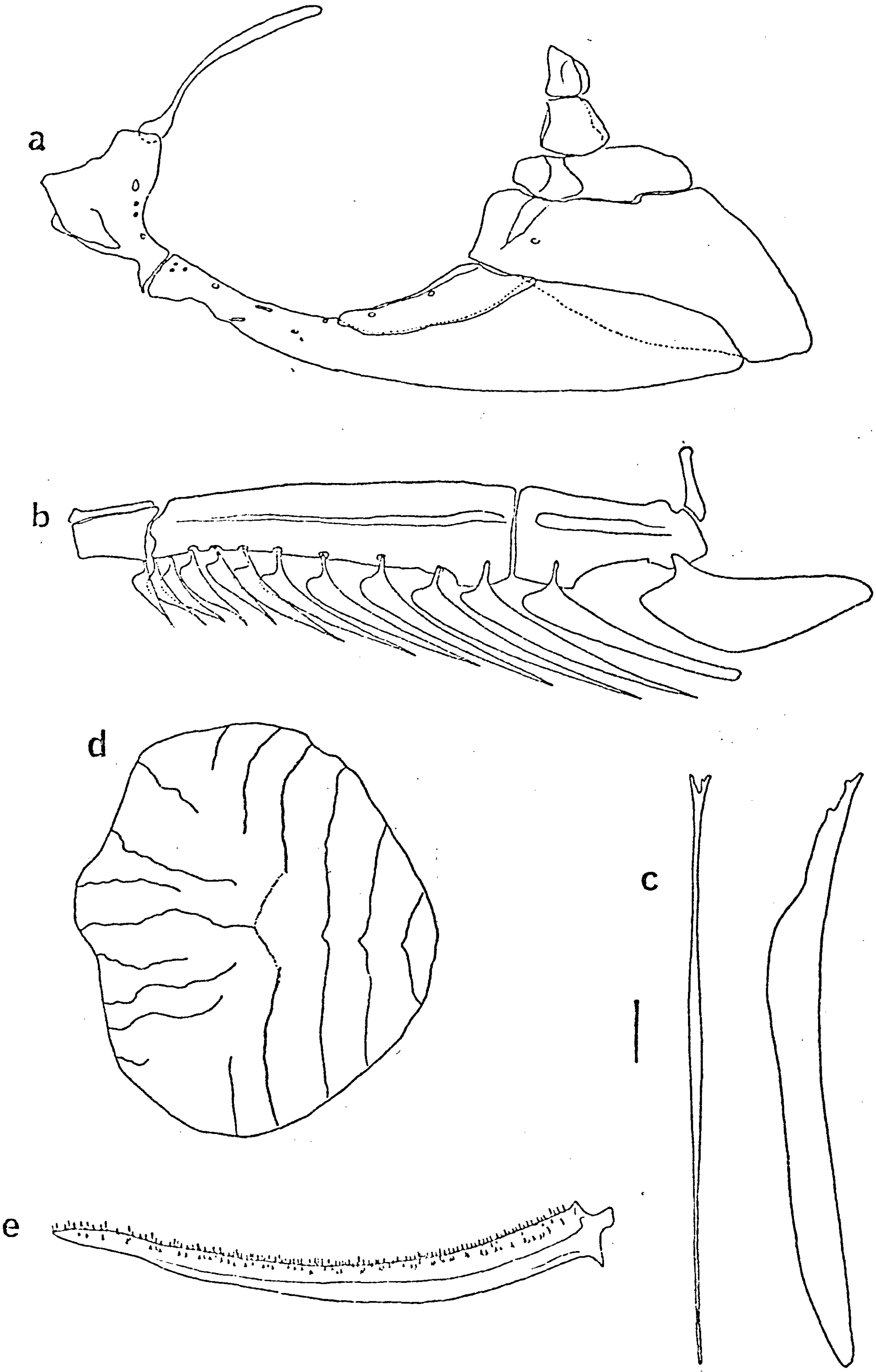


Plate 185. Engraulis japonicus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1979.8.16.24-35, 109.0 mm S.L.; d from BMNH. 1969.4.22.1718-1722, 74.0 mm S.L.).

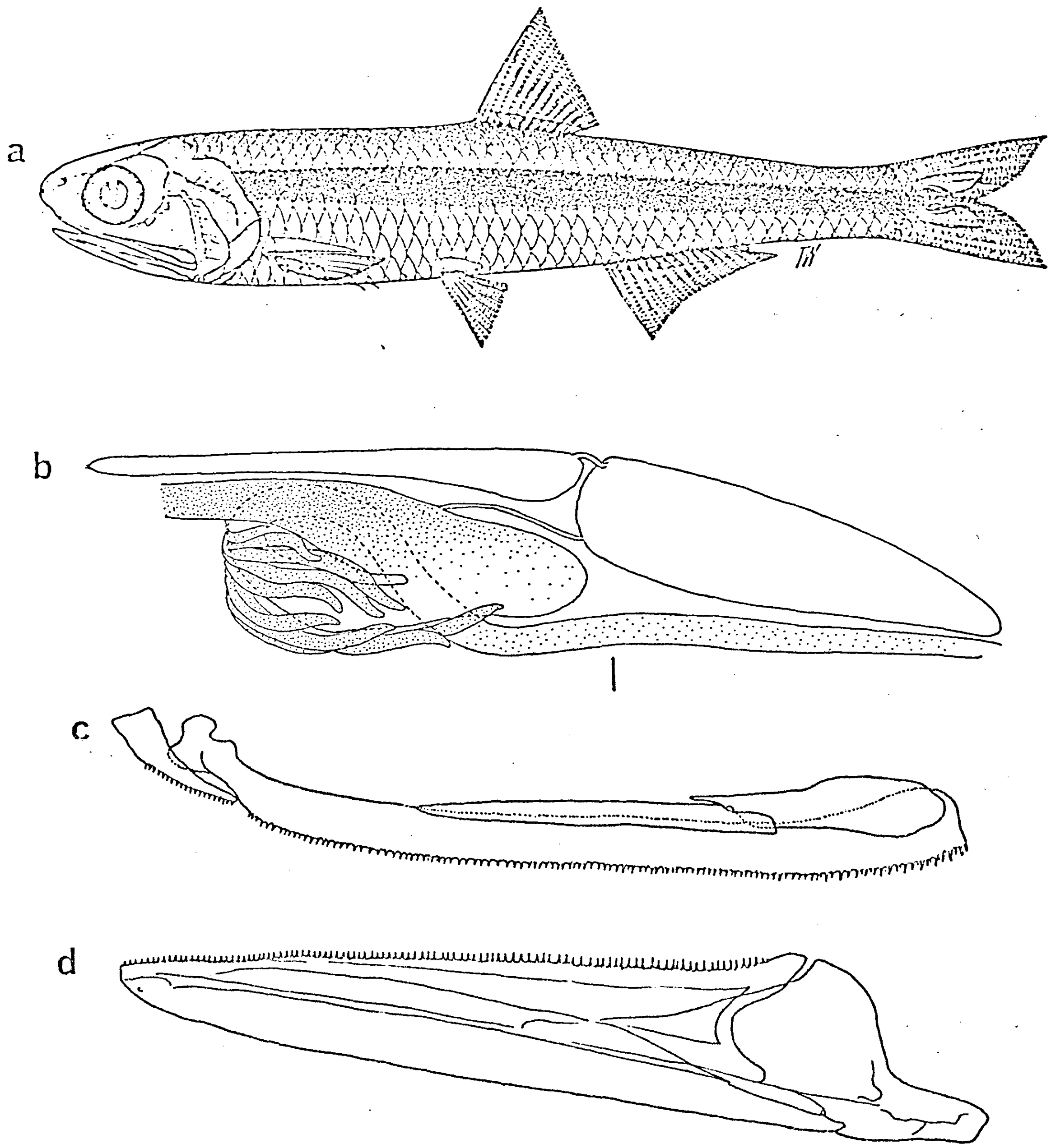


Plate 186. Stolephorus purpureus:- a, adult; b, gas bladder and digestive tract; e, d, upper and lower jaws (all from BMNH. 1979.8.16.587-694, 59.0 mm S.L. for a and 60.0 mm S.L. for others).

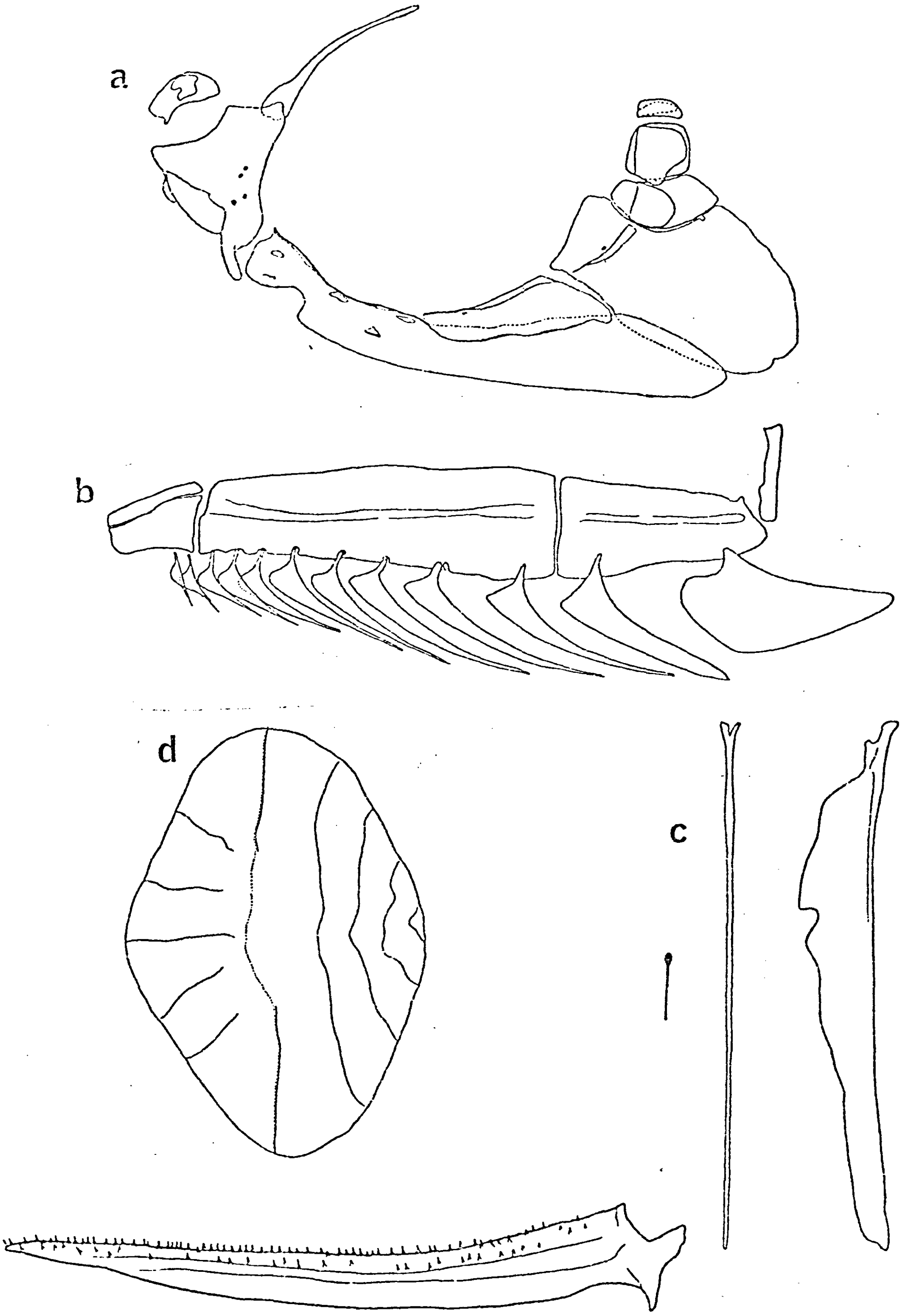


Plate 187. Stolephorus purpureus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1979.8.16.587-694, 60.0 mm S.L.).

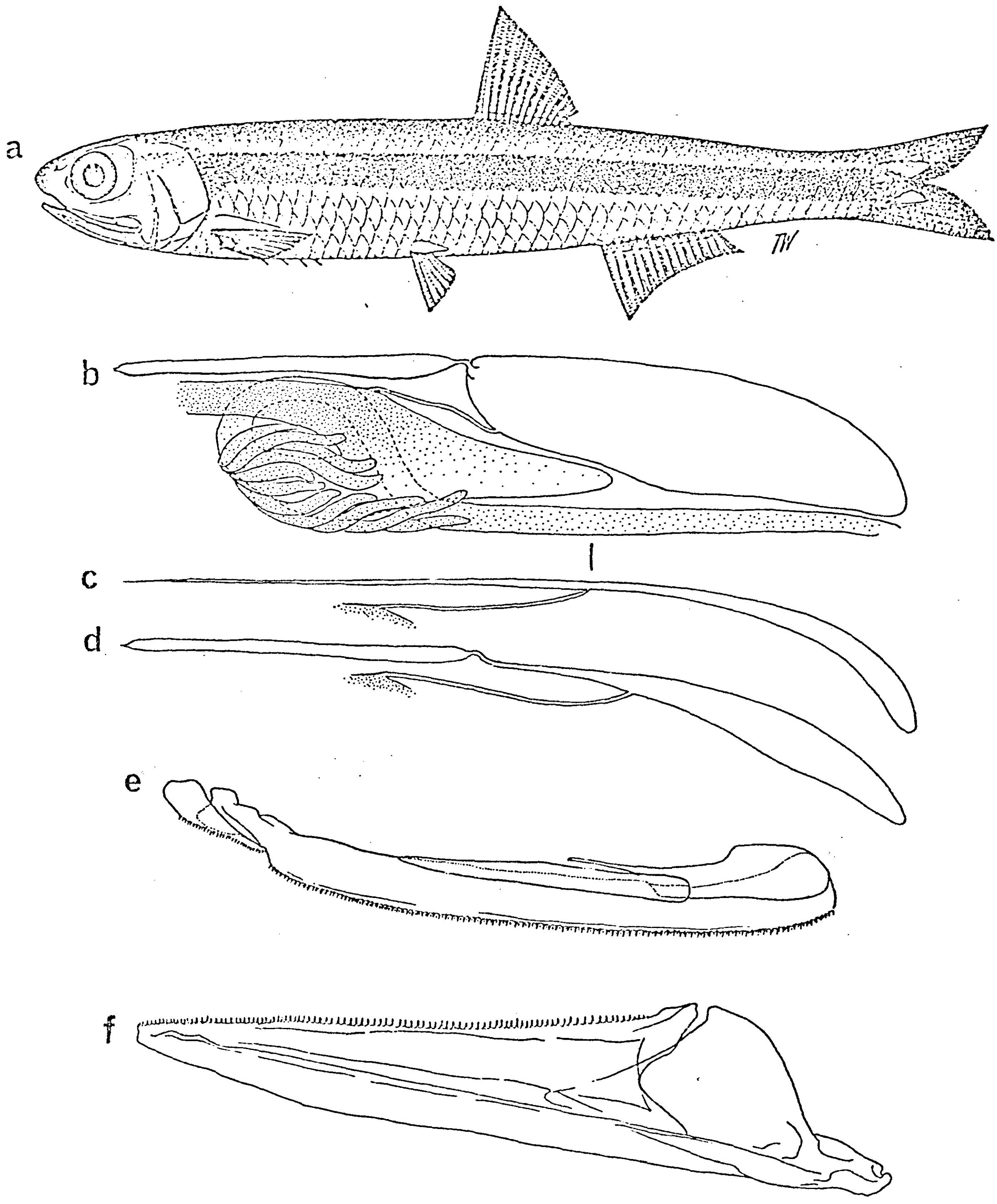


Plate 188. Stolephorus buccaneeri:- a, adult; b, gas bladder and digestive tract; c, d, flattened gas bladders; e, f, upper and lower jaws (a from BMNH. 1969.4.22.1123-1126, 83.0 mm S.L.; b, e, f from BMNH. 1969.4.22.1355-1358, 67.0 mm S.L.; c from BMNH. 1970.6.2.8-32, 64.0 mm S.L.; d from BMNH. 1969.4.22.1266-1275, 76.0 mm S.L.).

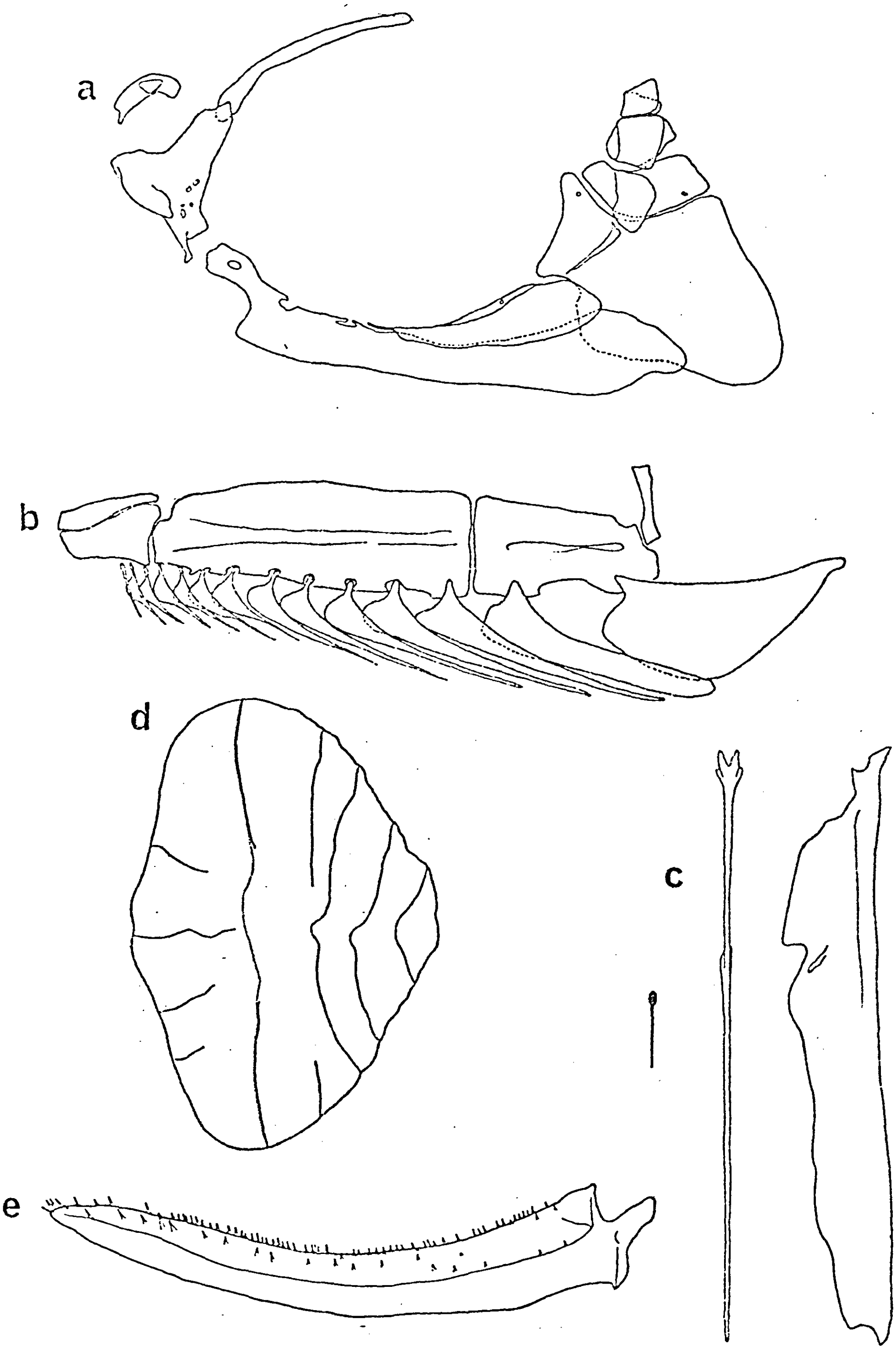


Plate 189. Stolephorus buccaneeri:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1969.4.22.1355-1358, 67.0 mm S.L.; d from BMNH. 1970.6.2.8-32, 64.0 mm S.L.).

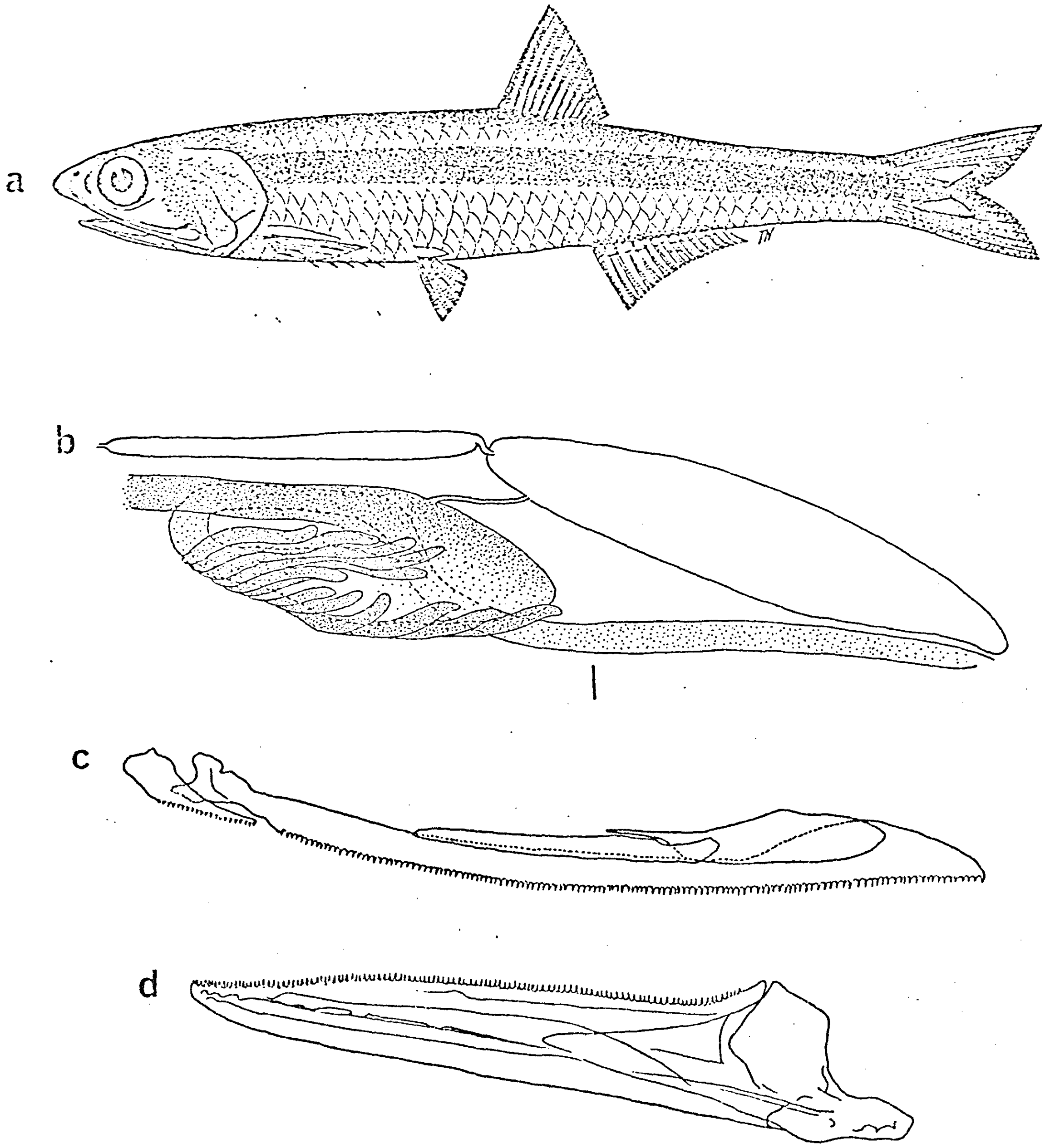


Plate 190. *Stolephorus hererolobus*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1967.11.13.310-318, 64.0 mm S.L.; b, c, d from BMNH. 1977.11.30.77-86, 67.0 mm S.L.).

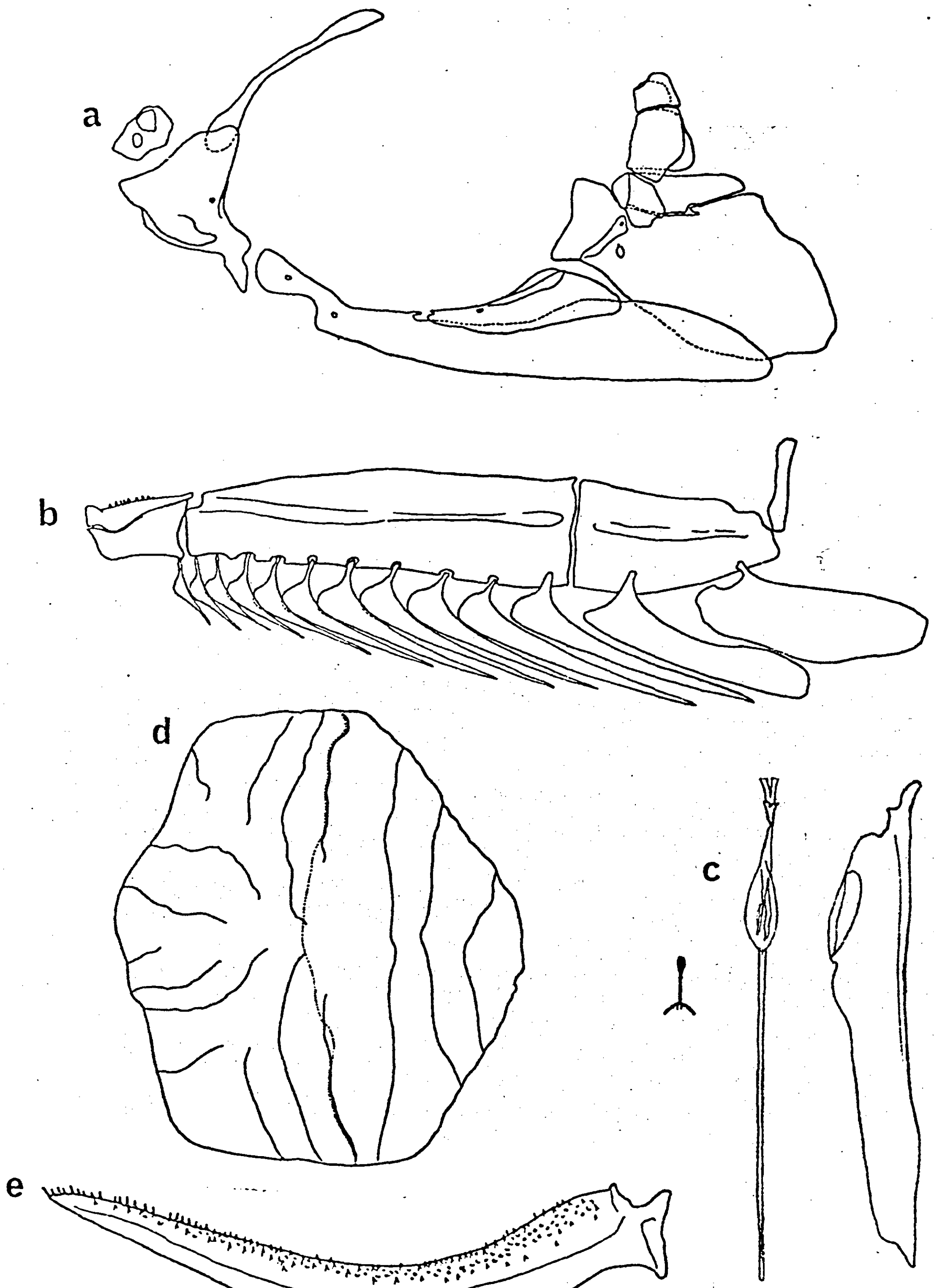


Plate 191. Stolephorus heterolobus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1977.11.30.77-86, 67.0 mm S.L.; d from BMNH. 1967.11.13.238-309, 52.0 mm S.L.).

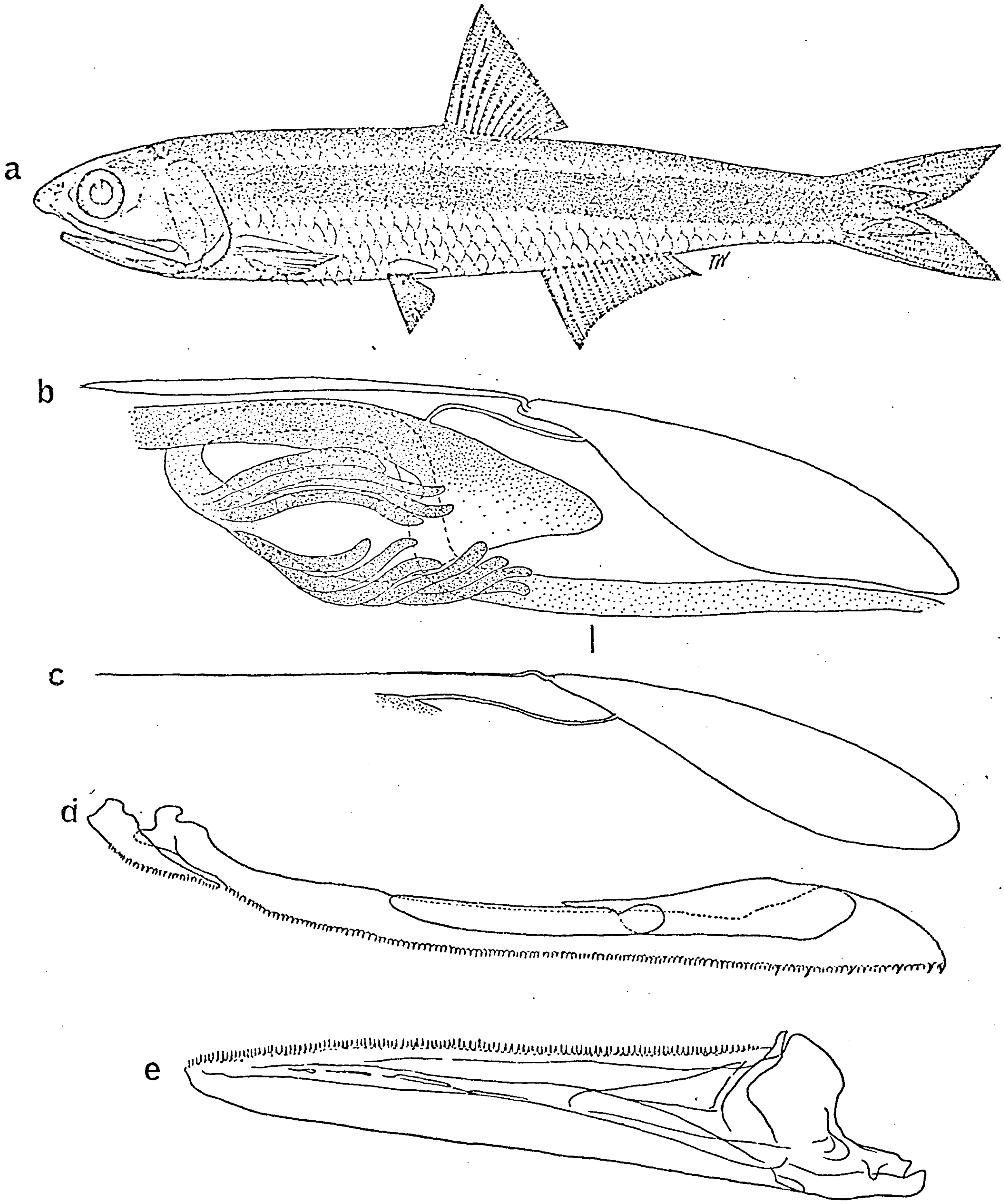


Plate 192. Stolephorus devisi:- a, adult; b, gas bladder and digestive tract; c, slightly flattened gas bladder; d, e, upper and lower jaws (a from BMNH. 1979.8.16.744, 72.0 mm S.L.; others from BMNH. 1969.4.22.470-478, 71.0 mm S.L.)

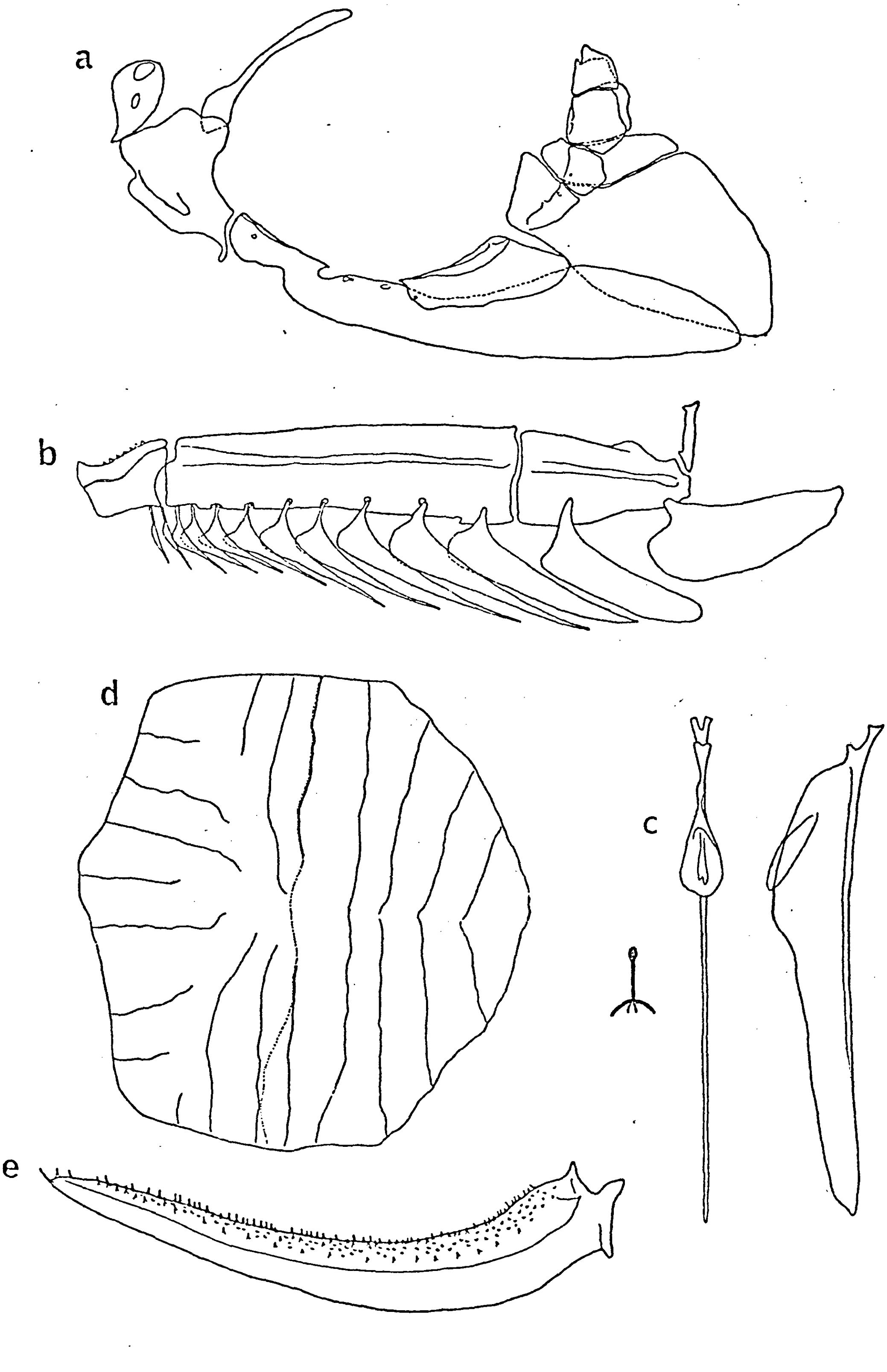


Plate 193. Stolephorus devisi:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1969.4.22.470-478, 71.0 mm S.L.).

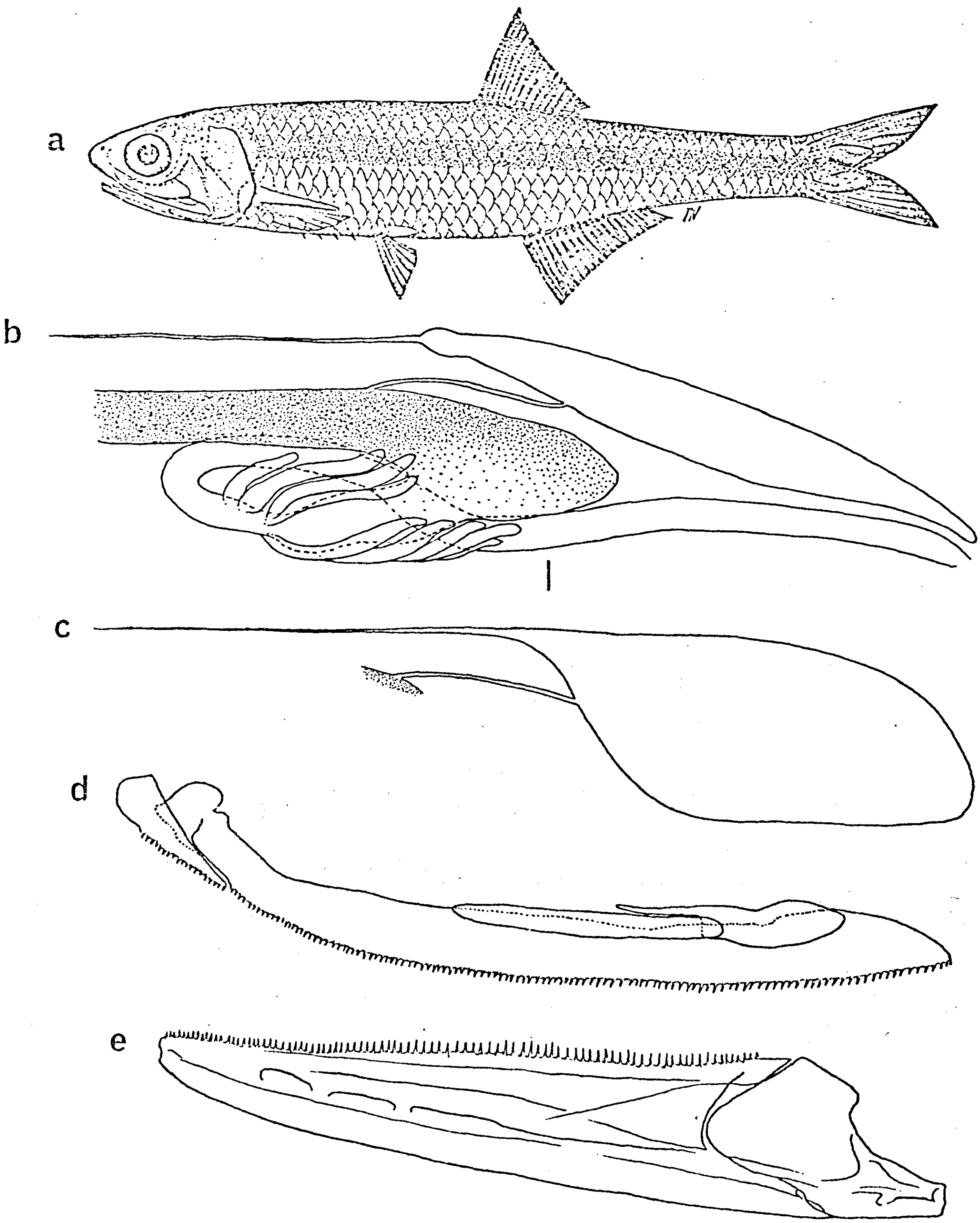


Plate 194. Stolephorus indicus:- a, adult; b, gas bladder and digestive tract; c, inflattened gas bladder; d, e, upper and lower jaws (all from BMNH. 1979. 8.17.23-24, 125.0 mm S.L.).

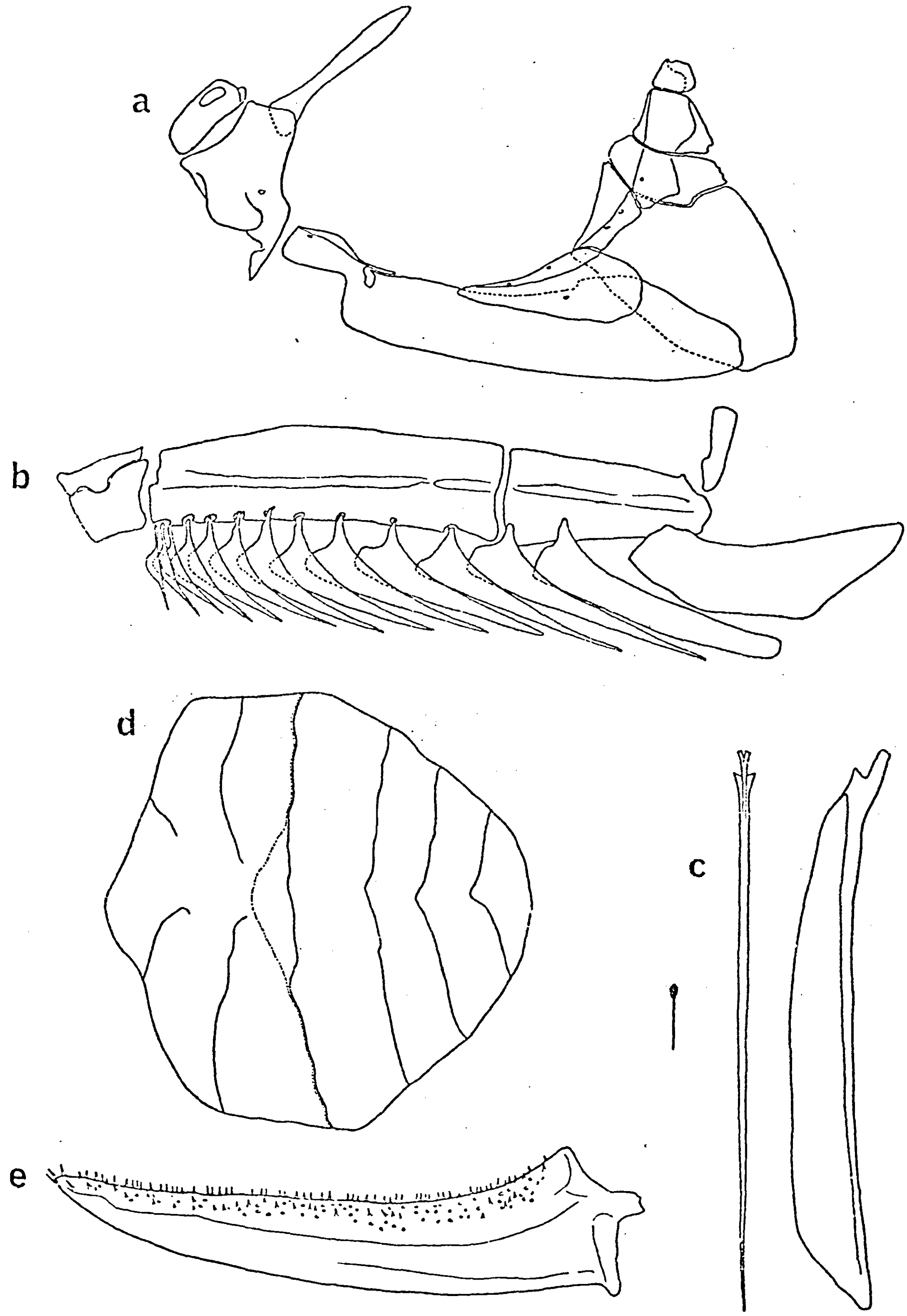


Plate 195. Stolephorus indicus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1979.8.17.23-24, 125.0 mm S.L.; d from BMNH. 1889.2.1.1817-1822, 51.0 mm S.L.).

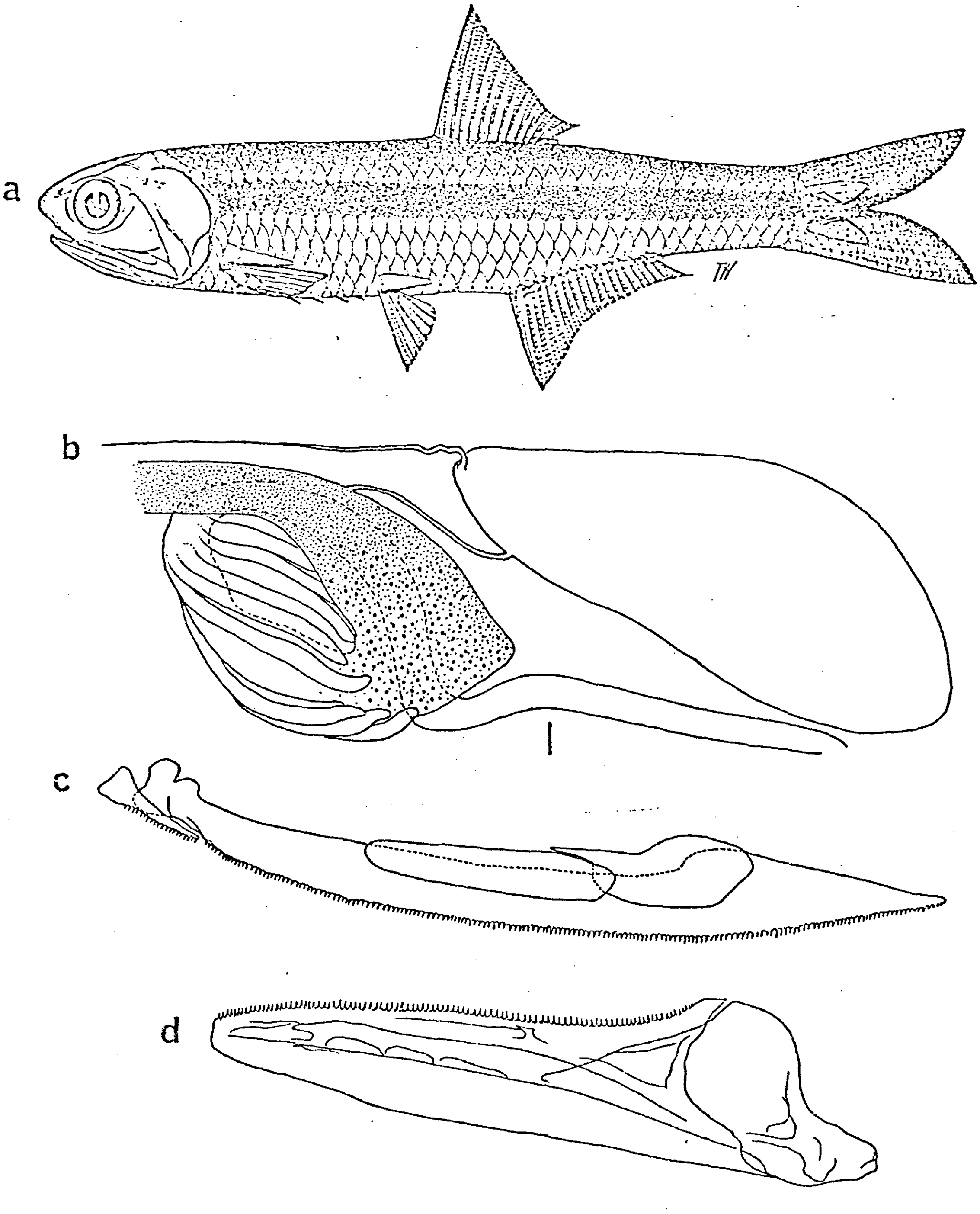


Plate 196. Stolephorus commersonii:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1969.4.22.272, 74.0 mm S.L.; others from BMNH. 1977.11.30.22-24, 59.0 mm S.L.).

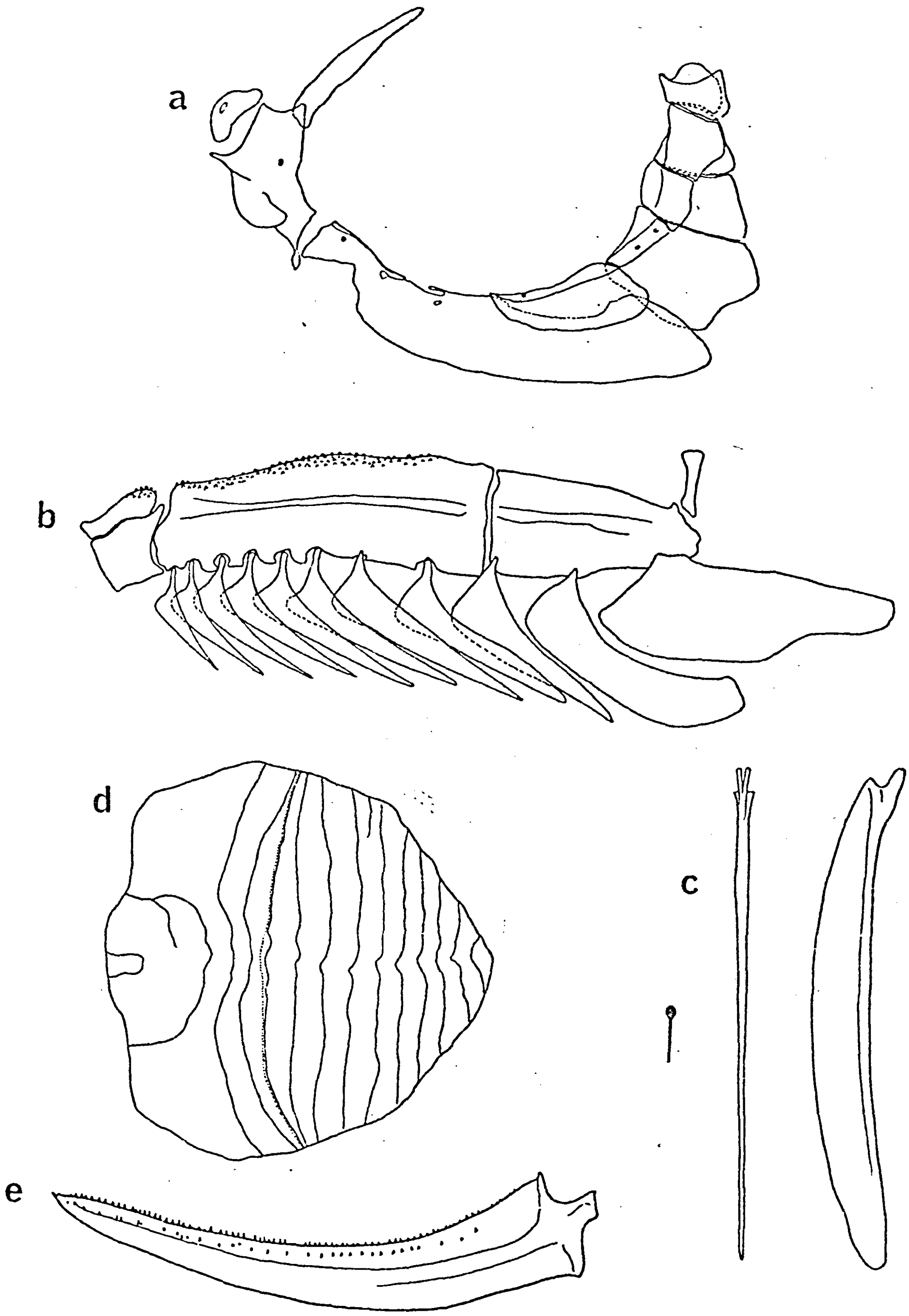


Plate 197. Stolephorus commersonii:- a, circumorbital bones; b. hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1977.11.30.22-24, 59.0 mm S.L.; d from BMNH. 1933.3.11.838, 93.0 mm S.L.).

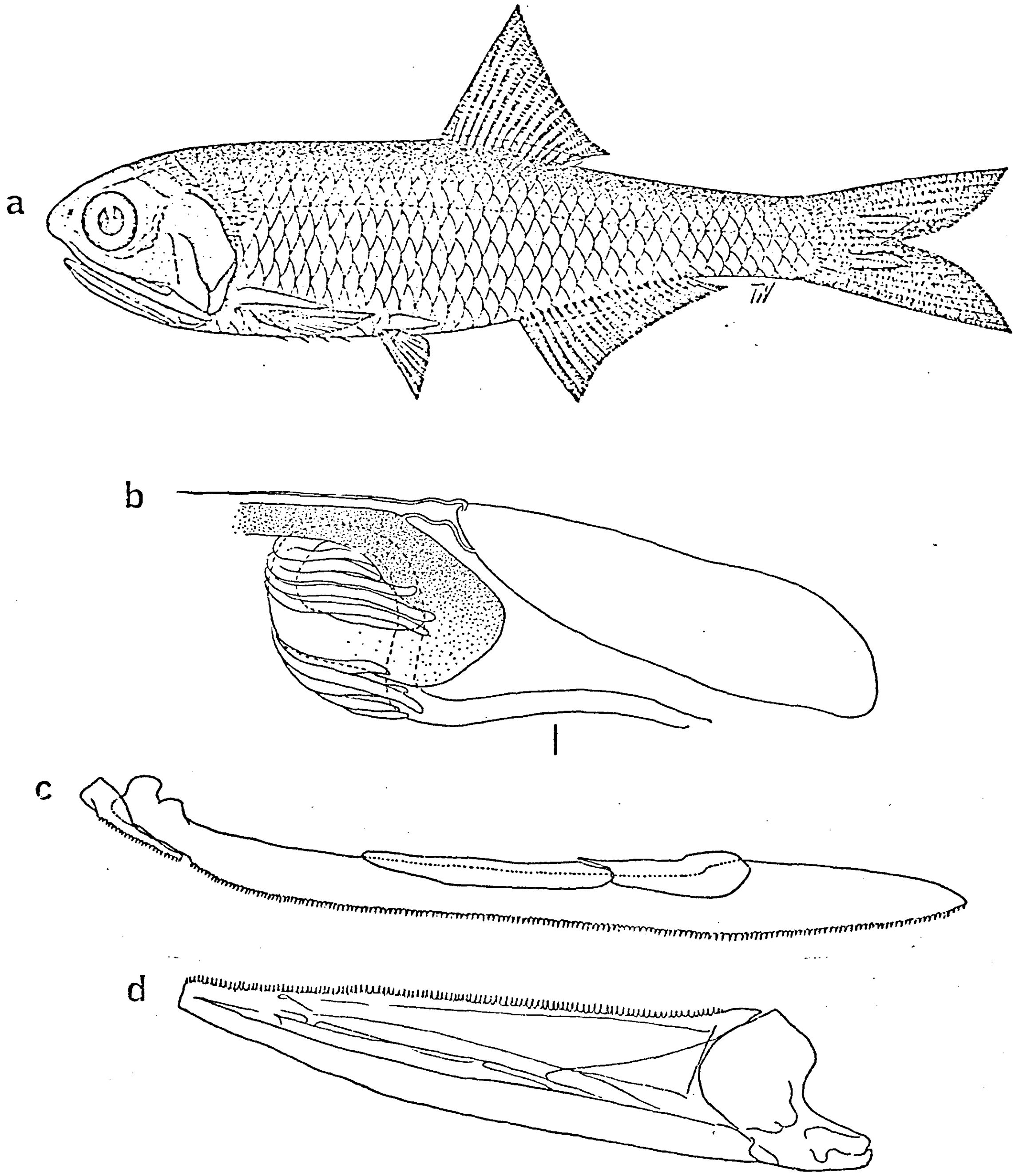


Plate 198. Stolephorus brachycephalus:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1979.3.21.447, 42.0 mm S.L., holotype; others from BMNH. 1979.8.16.828, 37.0 mm S.L.).

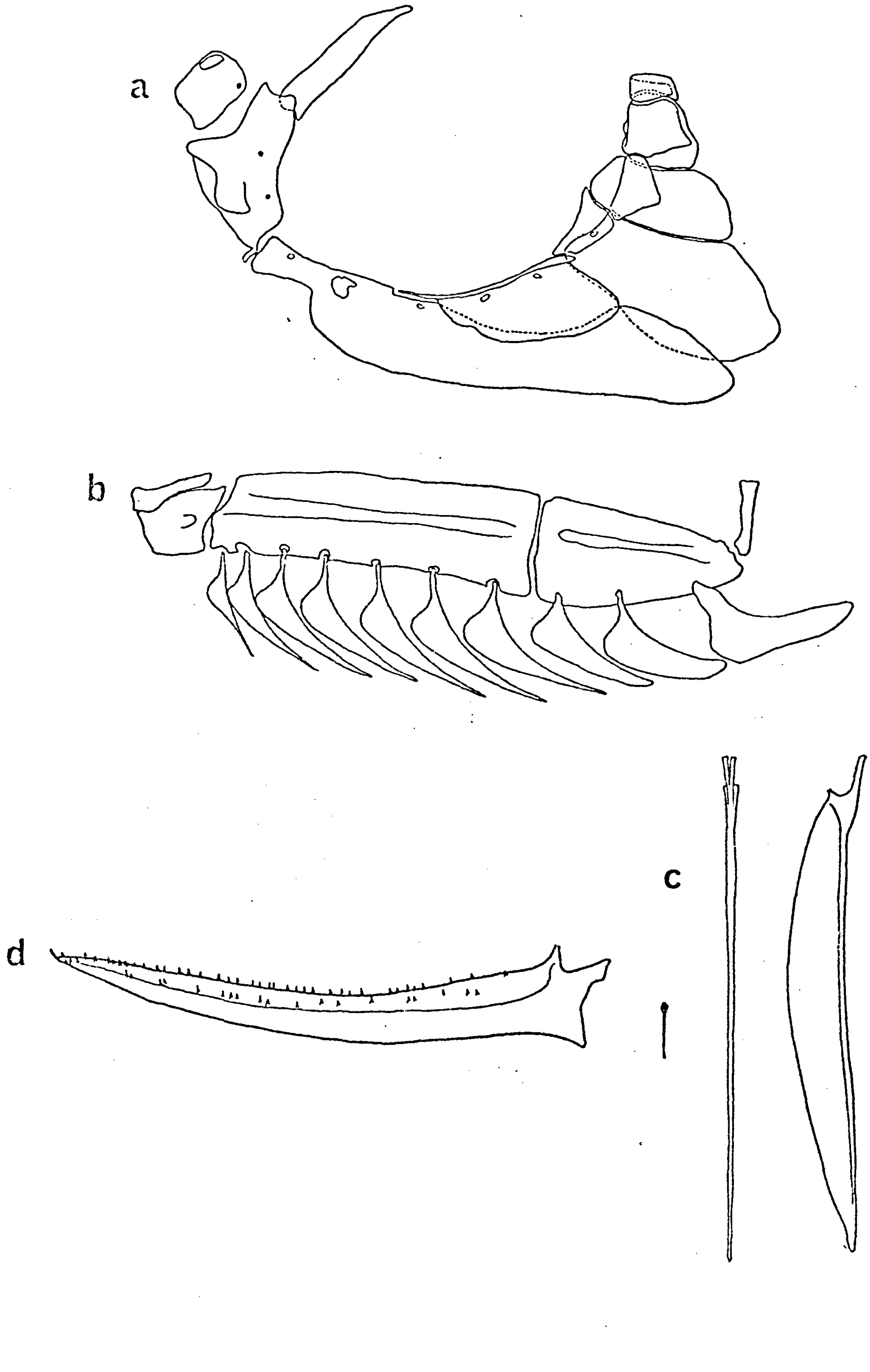


Plate 199. Stolephorus brachycephalus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, gillraker (all from BMNH. 1979.8.16.828, 37.0 mm S.L.).

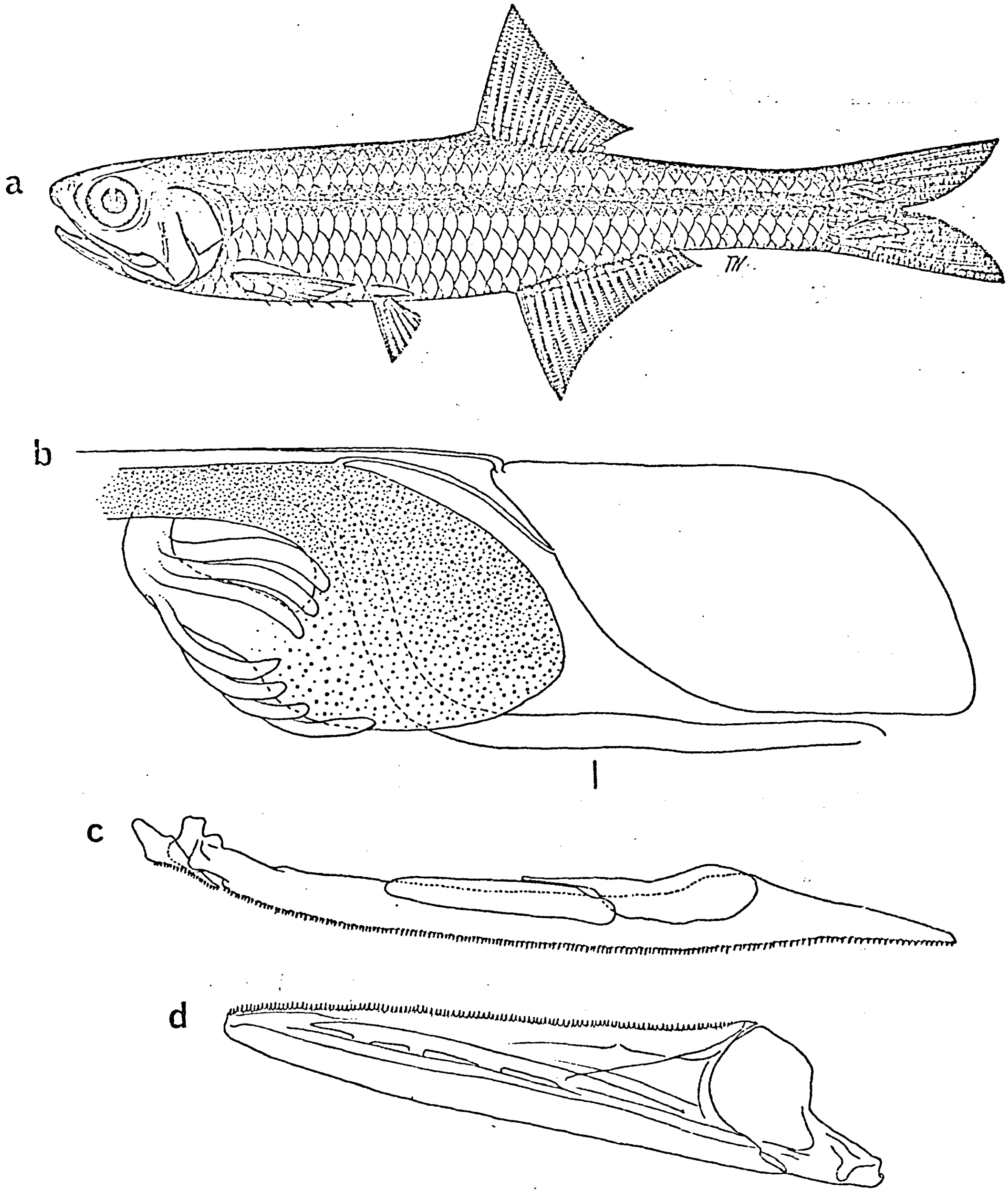


Plate 200. <u>Stolephorus</u> <u>chinensis</u>:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1966.11.20.6, 62.0 mm S.L.; others from BMNH. 1969.5.30.89-92, 59.0 mm S.L.).

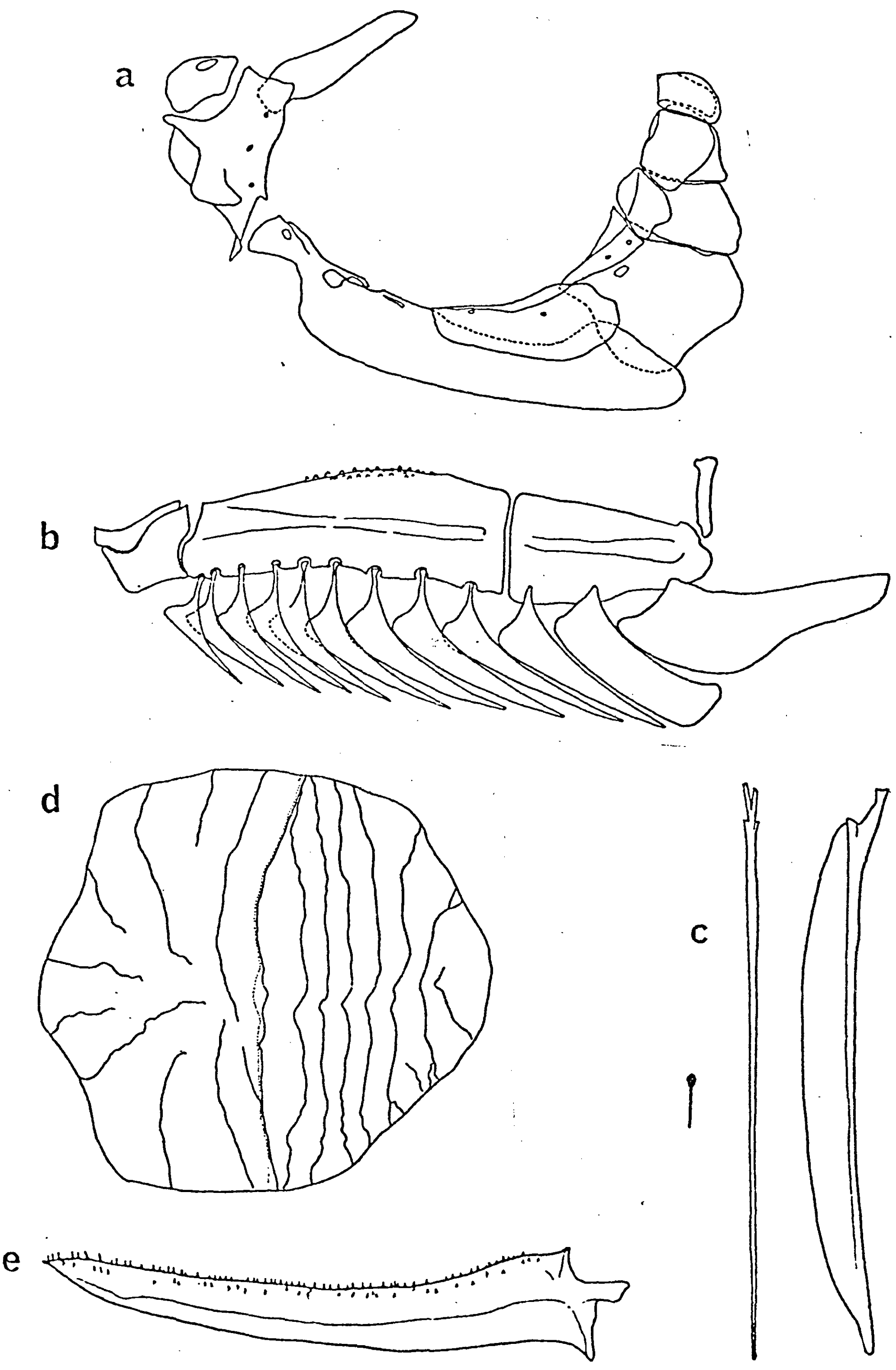


Plate 201. Stolephorus chinensis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1969.5.30.89-92, 59.0 mm S.L.; d from BMNH. 1860.7.20.103-106, 84.0 mm S.L., lectotype of Engraulis chinensis).

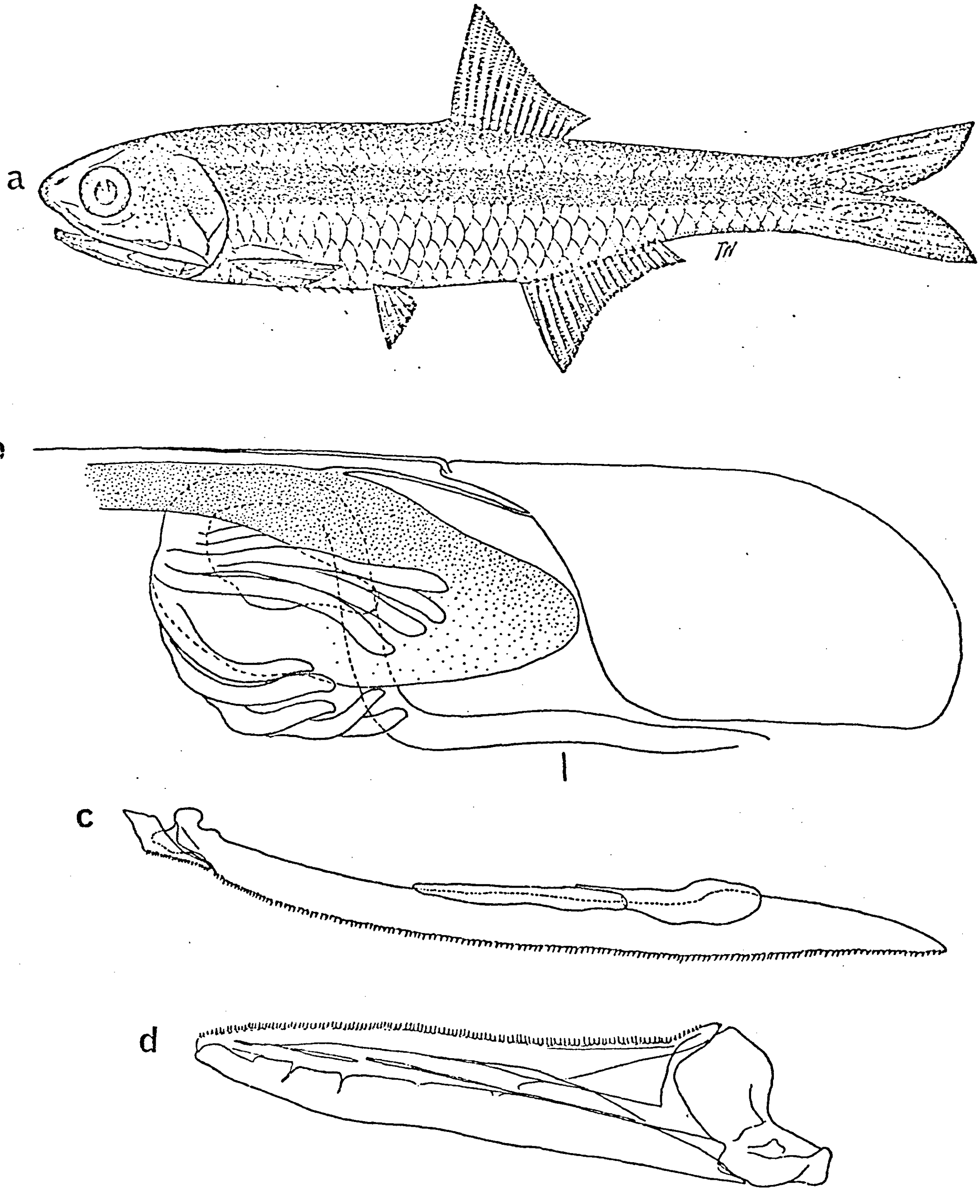


Plate 202. Stolephorus waitei:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1969.4.22.961-973, 75.0 mm S.L. for a, 65.0 mm S.L. for others).

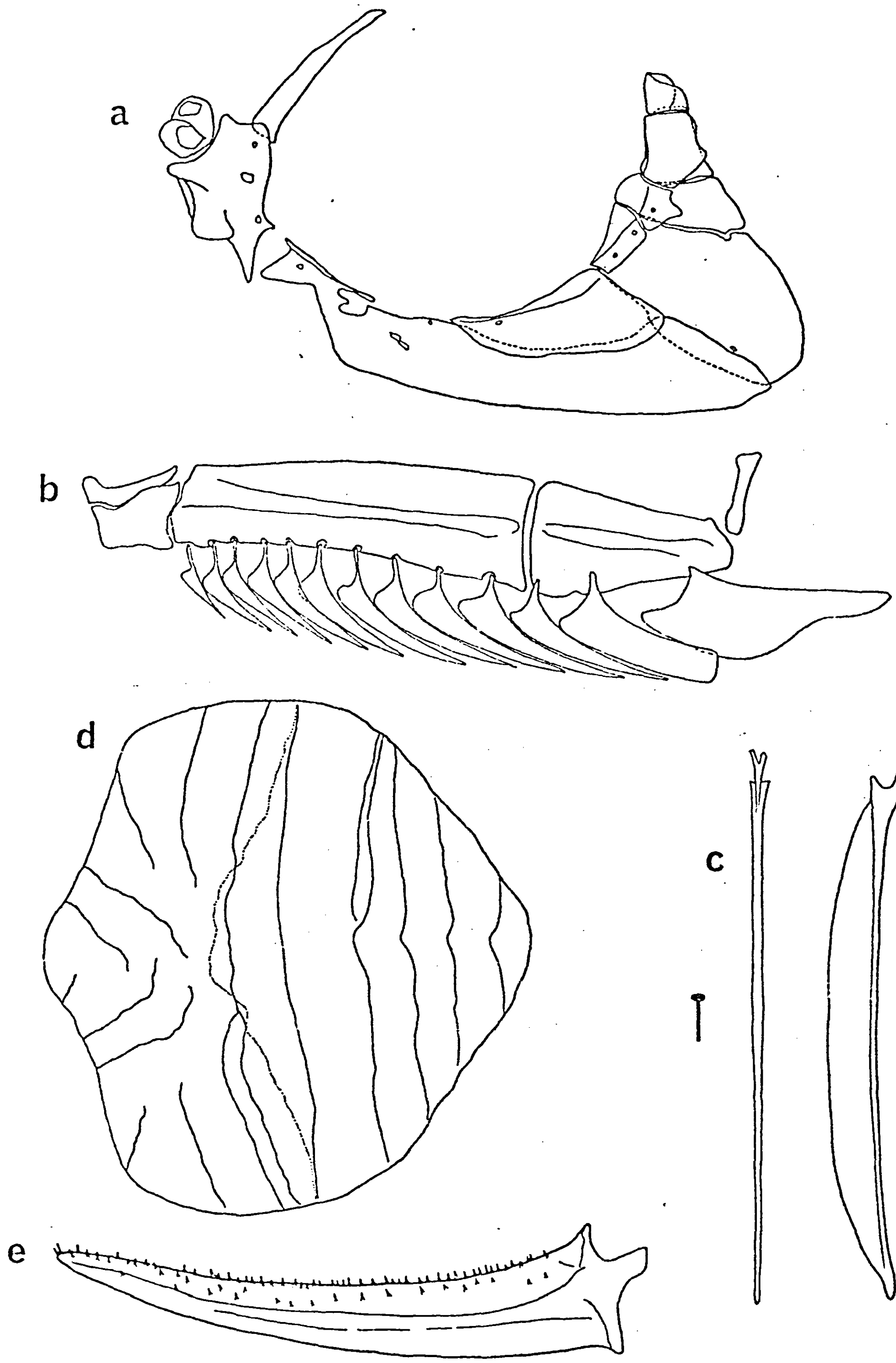


Plate 203. Stolephorus waitei:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1969.4.22.961-973, 65.0 mm S.L., except for d, 40.0 mm S.L.).

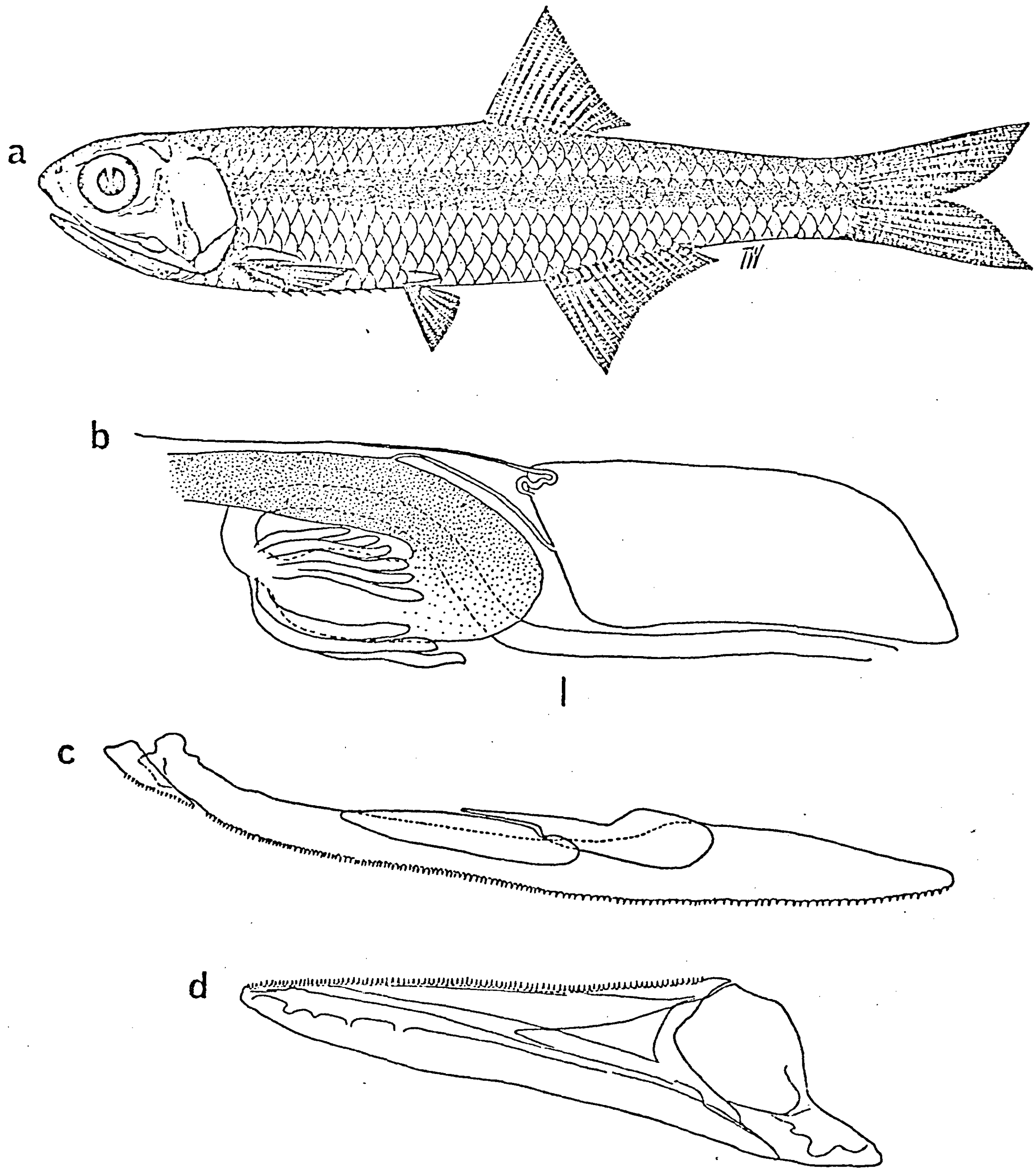


Plate 204. Stolephorus holodon:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1969.2.27.4-5, 65.0 mm S.L.; others from BMNH. 1979.8.17.8-13, 50.0 mm S.L.).

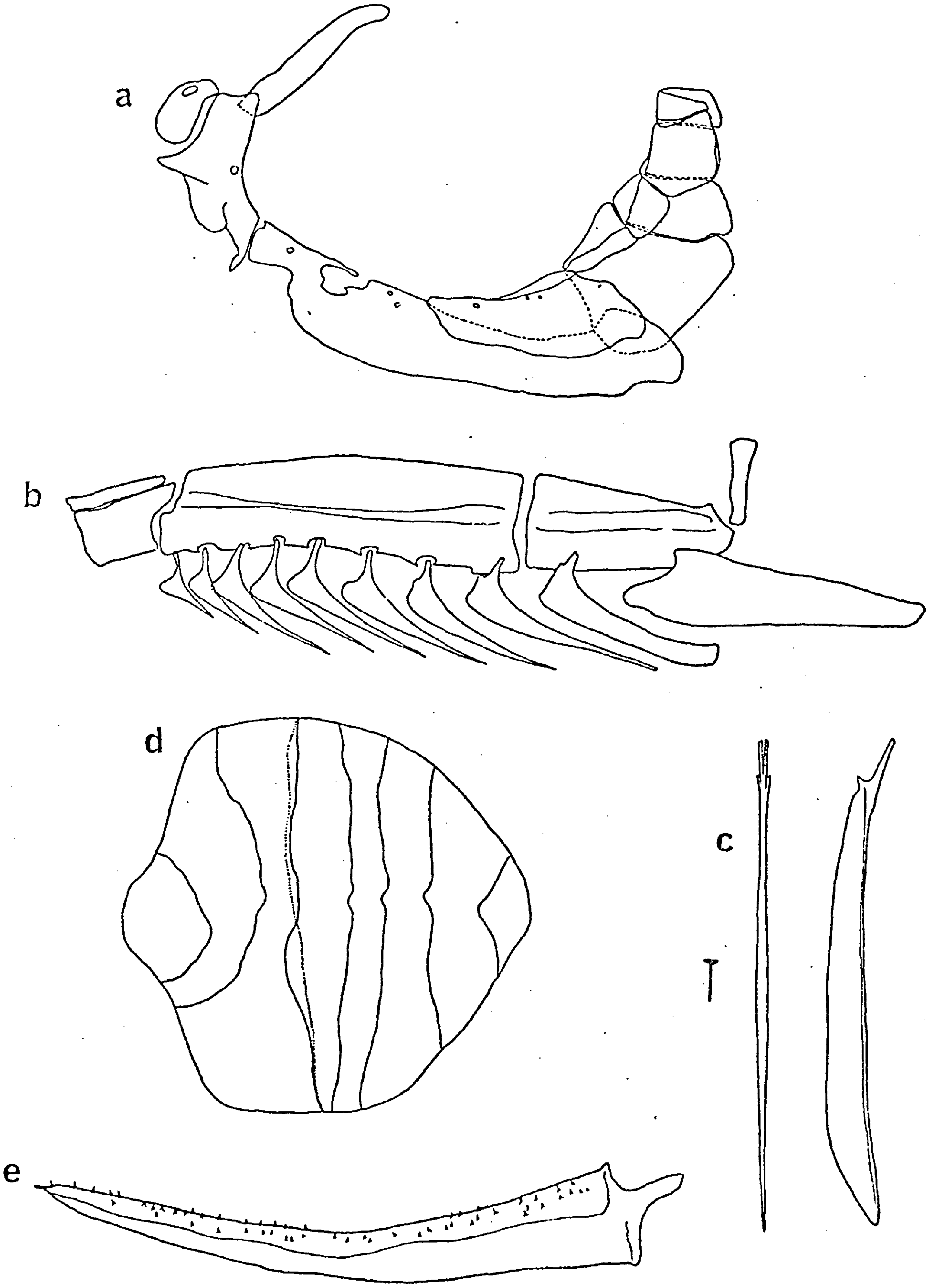
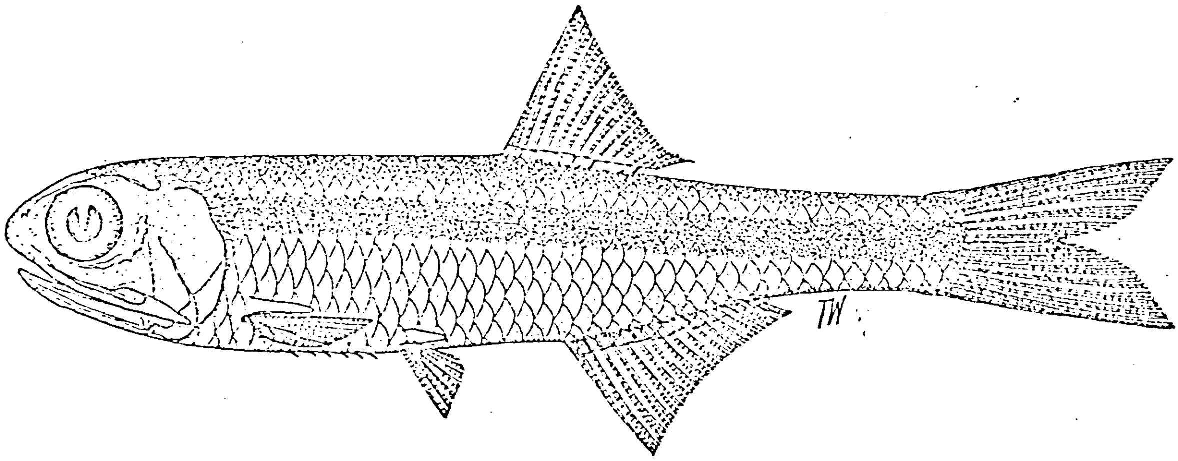
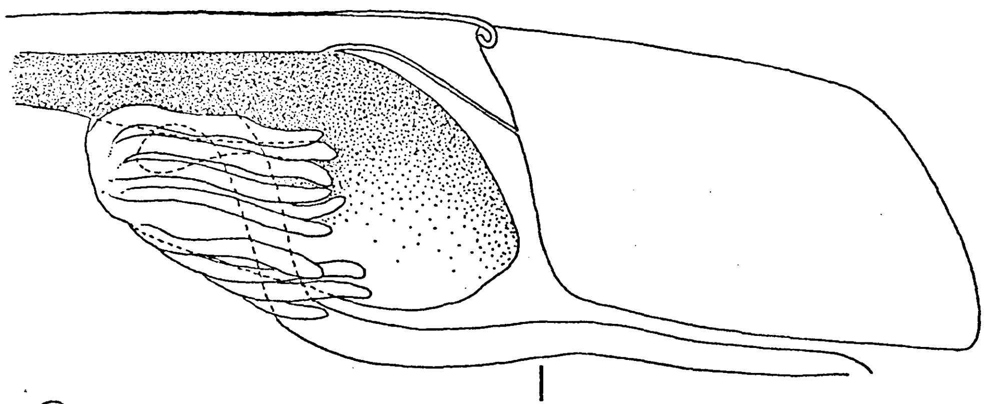


Plate 205. Stolephorus holodon:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1979.8.17.8-13, 50.0 mm S.L.; d from BMNH. 1919.9.12.7, 65.0 mm S.L.).

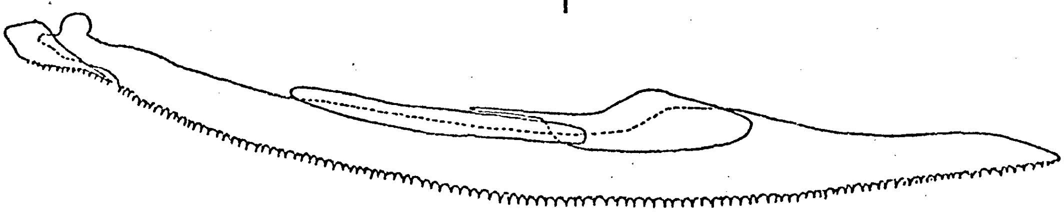
a



b



c



d

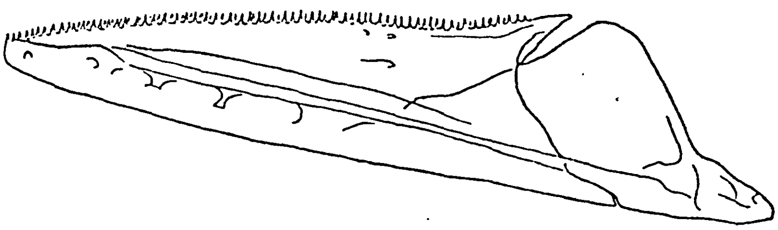


Plate 206. Stolephorus andhraensis:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1969. 4.22.904-908, 36.0 mm S.L. for a, 37.0 mm S.L. for others).

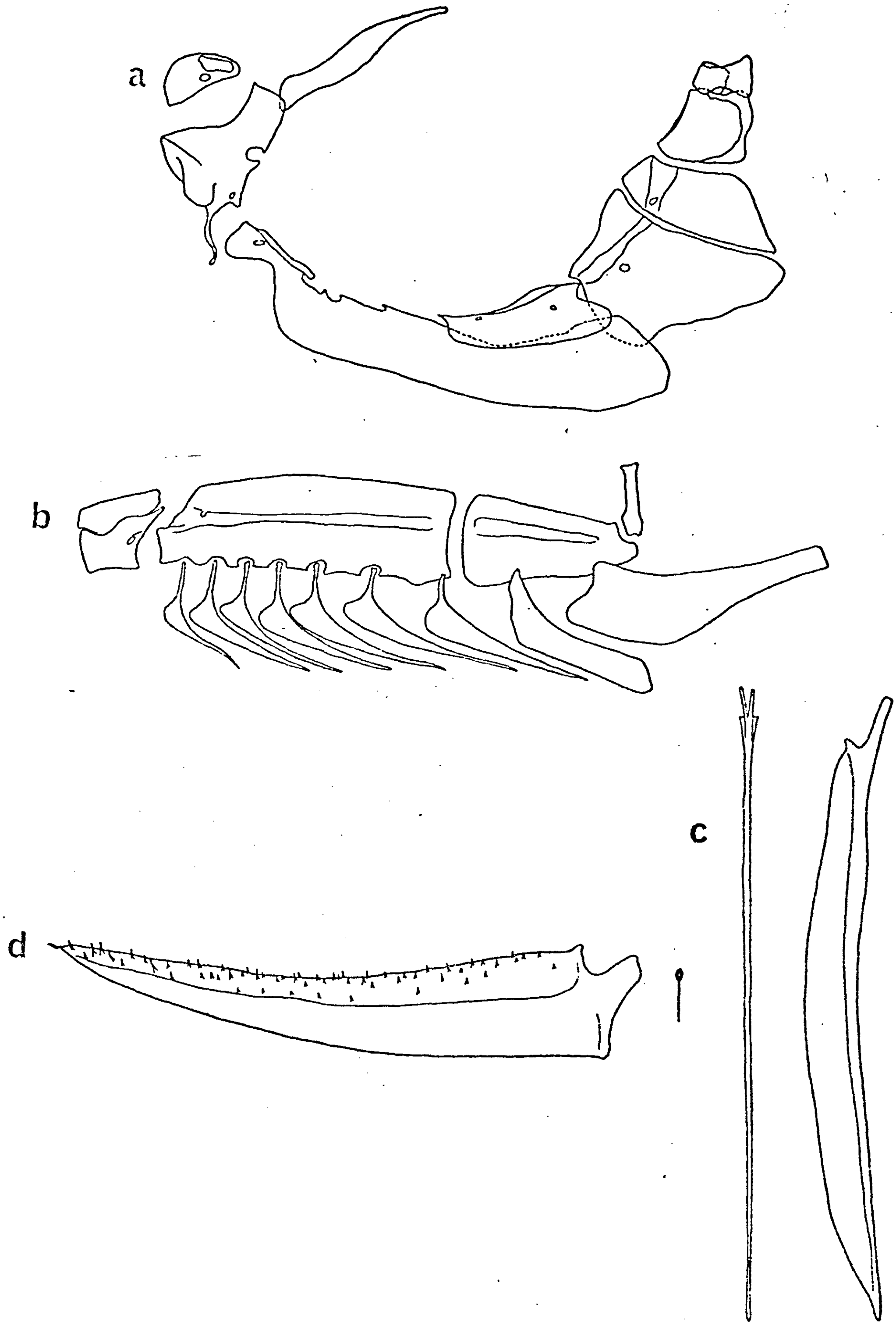


Plate 207. Stolephorus andhraensis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, gillraker (all from BMNH. 1969.4.22.904-908, 37.0 mm S.L.).

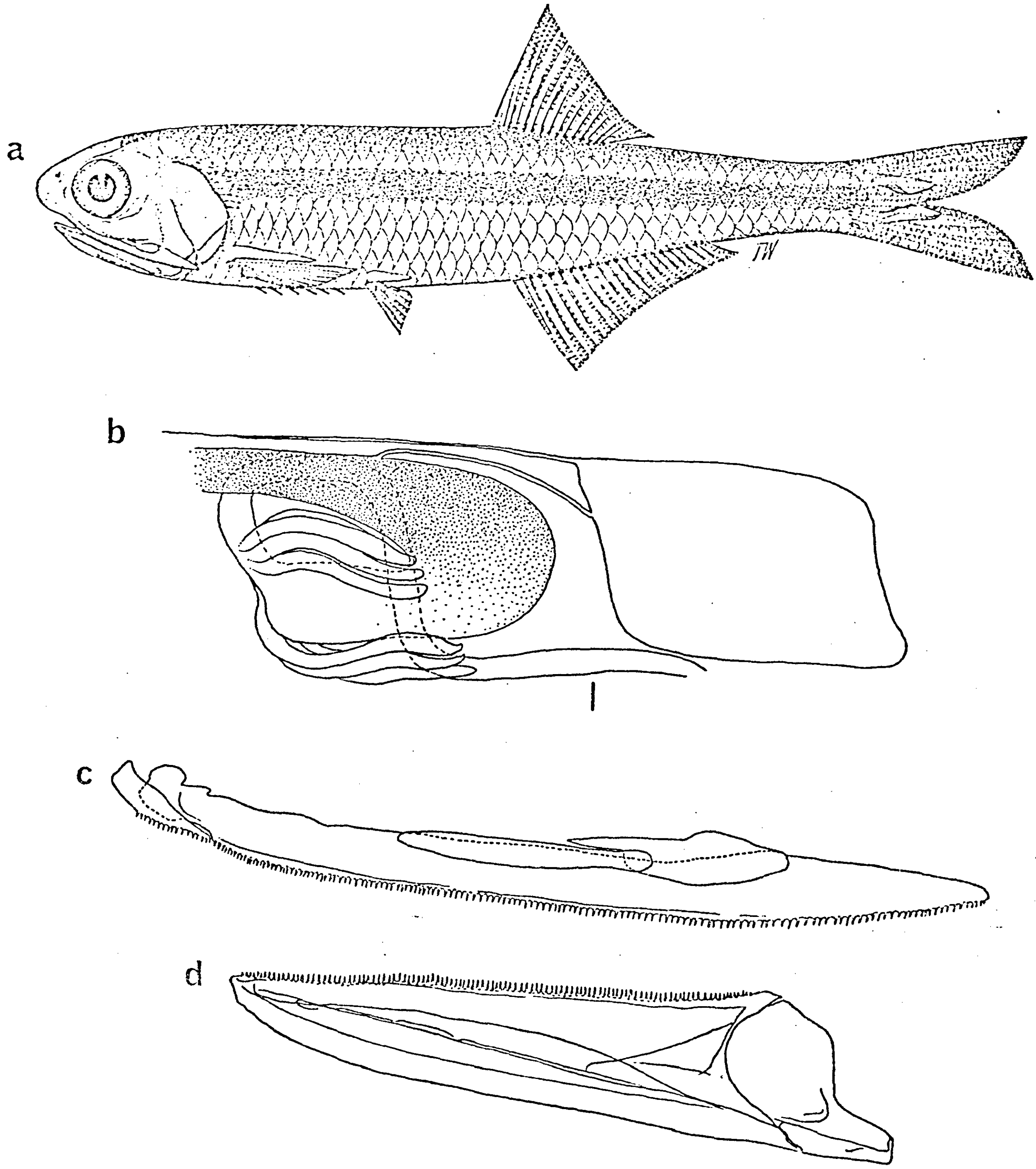


Plate 208. Stolephorus tysoni:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1979.3.21.493, 46.8 mm S.L., holotype; others from BMNH. 1979.3.21.502-505, 47.4 mm S.L. paratype).

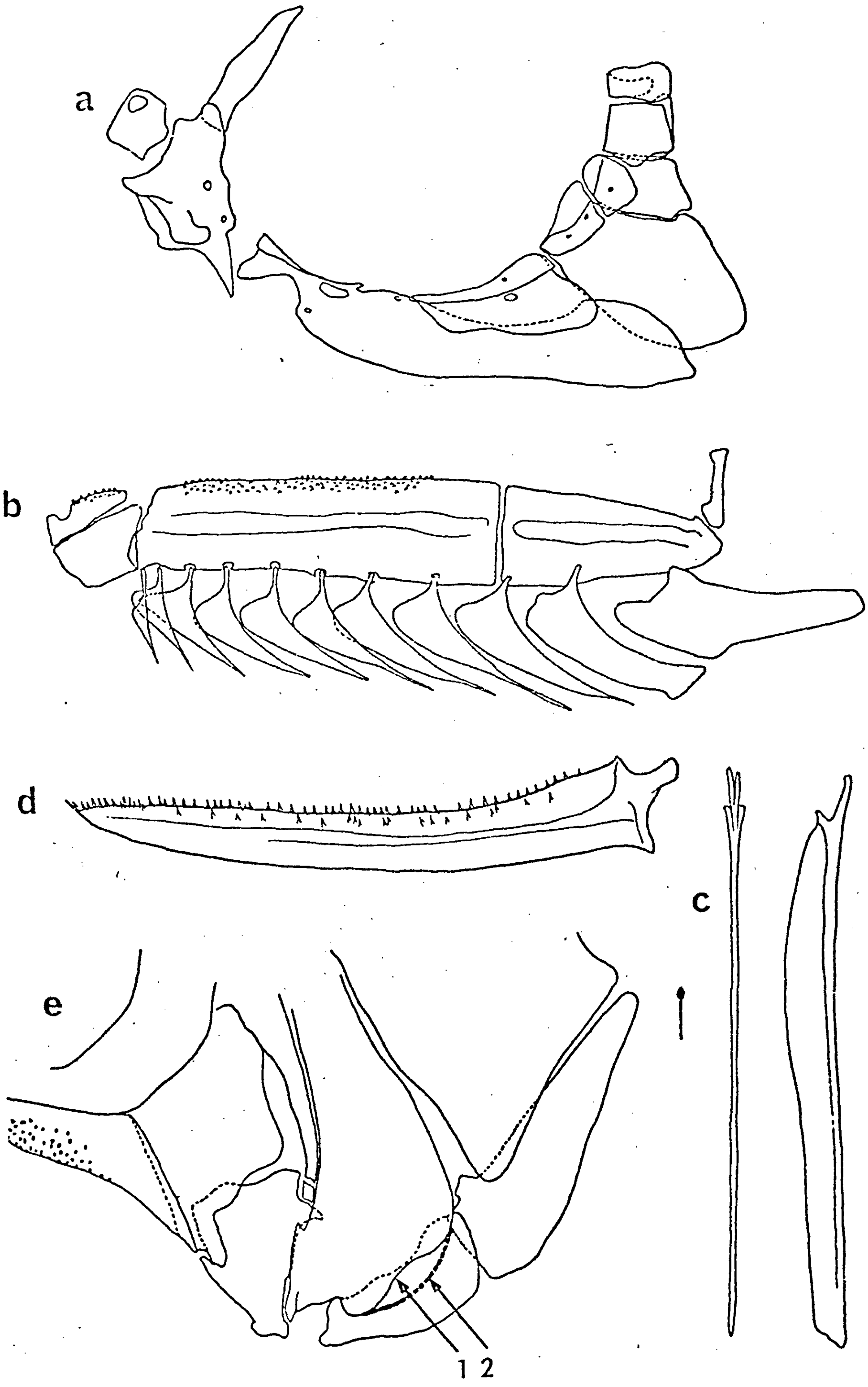


Plate 209. Stolephorus tysoni:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, gillraker; e, opercular bones: arrow 1 indicates indented preoperculum of this species, arrow 2 indicates normally rounded preoperculum of most species (all from BMNH. 1979.3.21.502-505, 47.4 mm S.L., paratype).

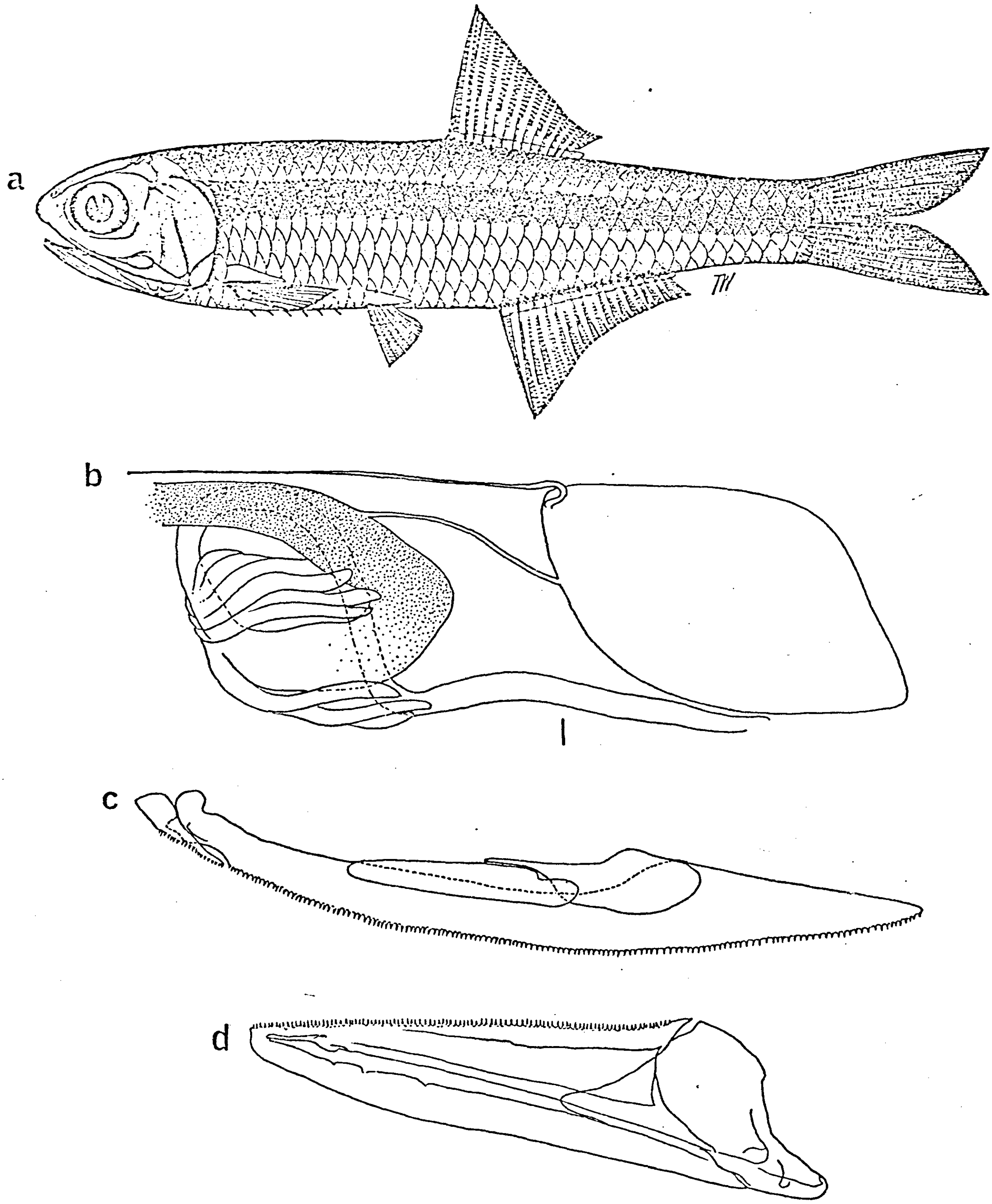


Plate 210. Stolephorus ronquilloi:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1969.5.30.88, 48.7 mm S.L., holotype; others from BMNH. 1969.5.30.79-87, 48.5 mm S.L., paratype).

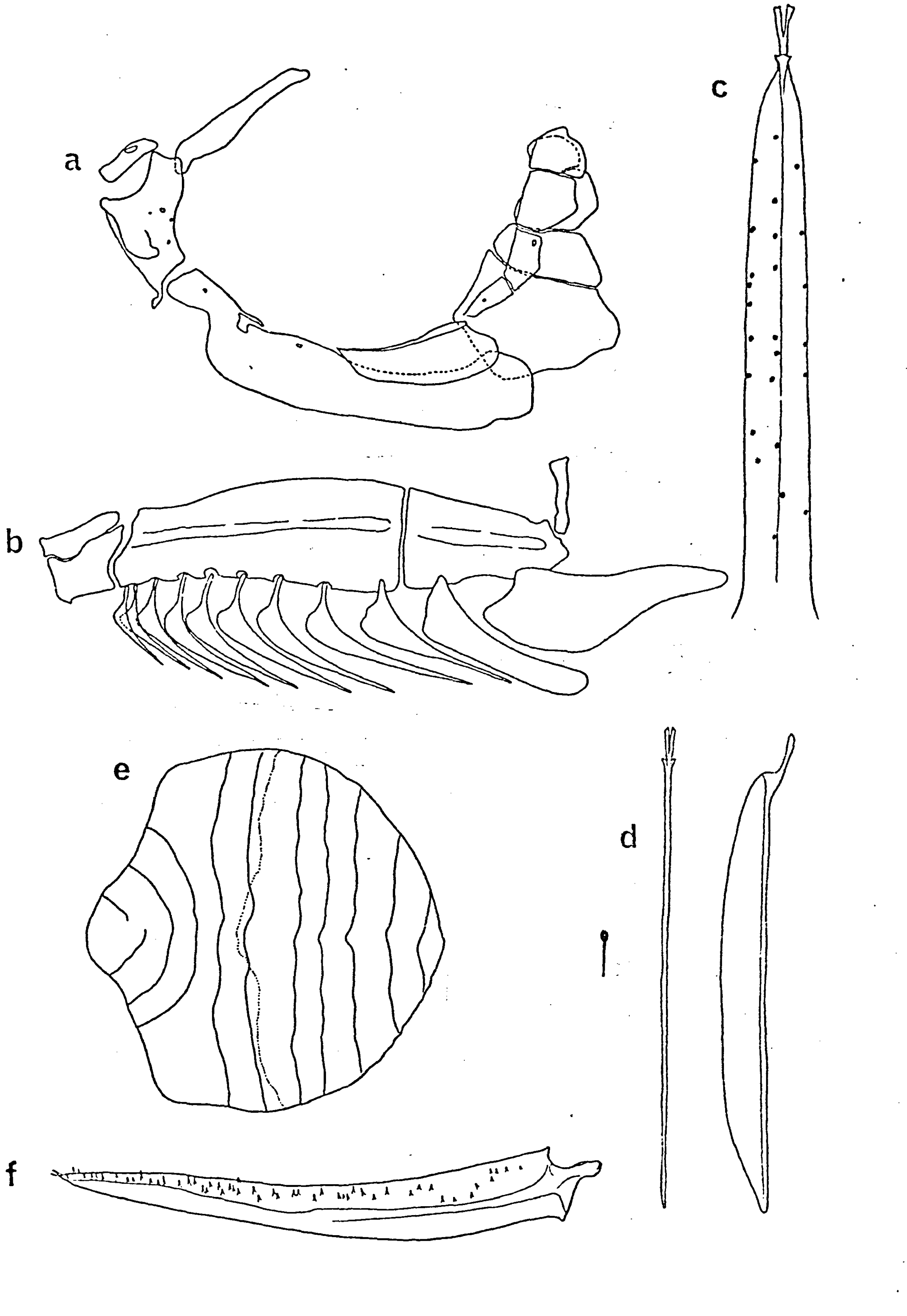


Plate 211. Stolephorus ronquilloi:- a, circumorbital bones; b, hyoid arch; c, arrangement of dark dots on isthmus; d, urohyal; e, scale; f, gillraker (a, b, c, d, f from BMNH. 1969.5.30.79-87, 48.5 mm S.L., paratype; d from BMNH. 1960.4.7.103-115, 45.0 mm S.L., paratype).

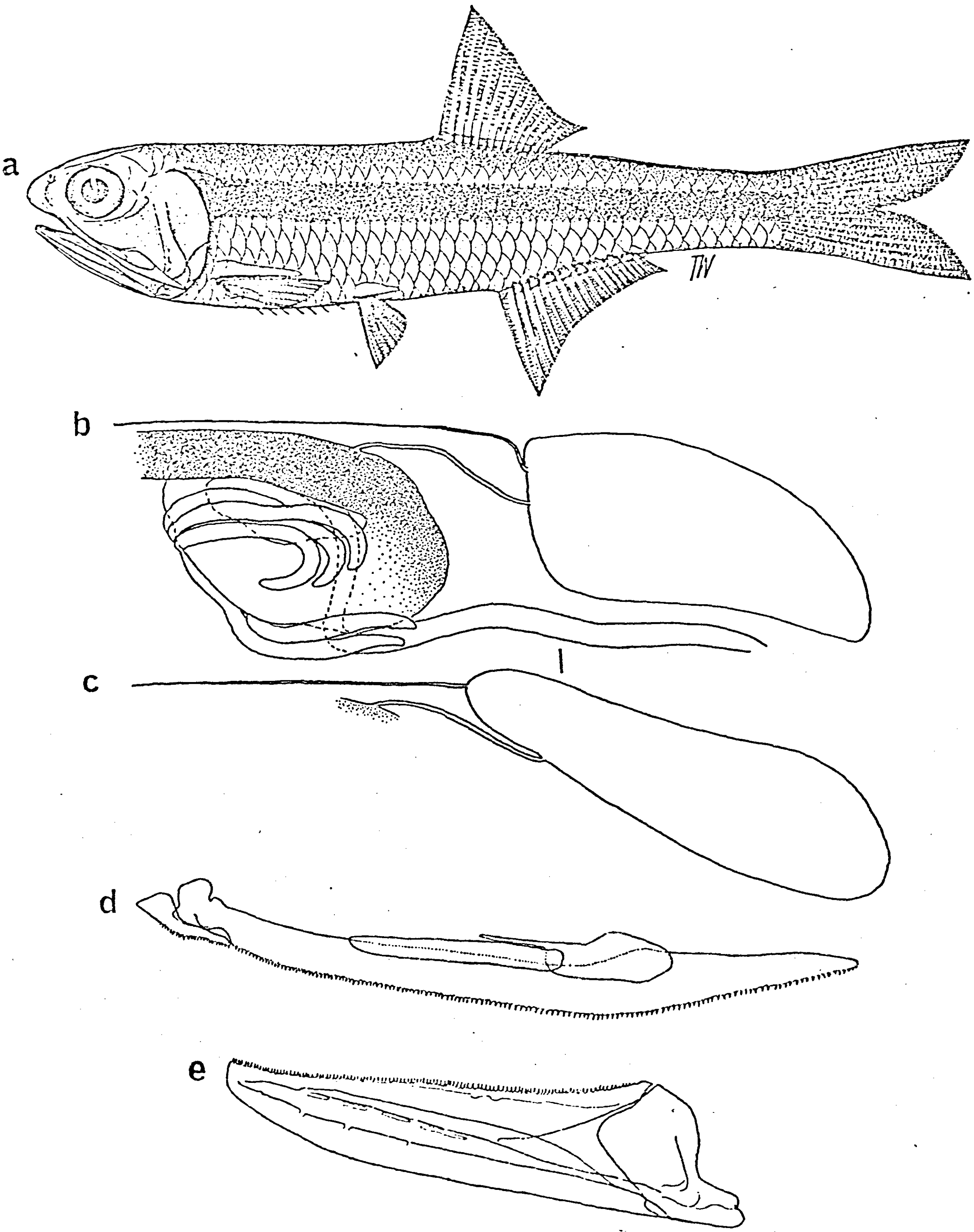


Plate 212. <u>Stolephorus</u> <u>insularis</u>:- a, adult; b, gas bladder and digestive tract; c, slightly flattened gas bladder; d, e, upper and lower jaws (a from BMNH. 1969.4.22.368-369, 50.0 mm S.L.; others from BMNH. 1977.11.30.158-161, 51.0 mm S.L.).

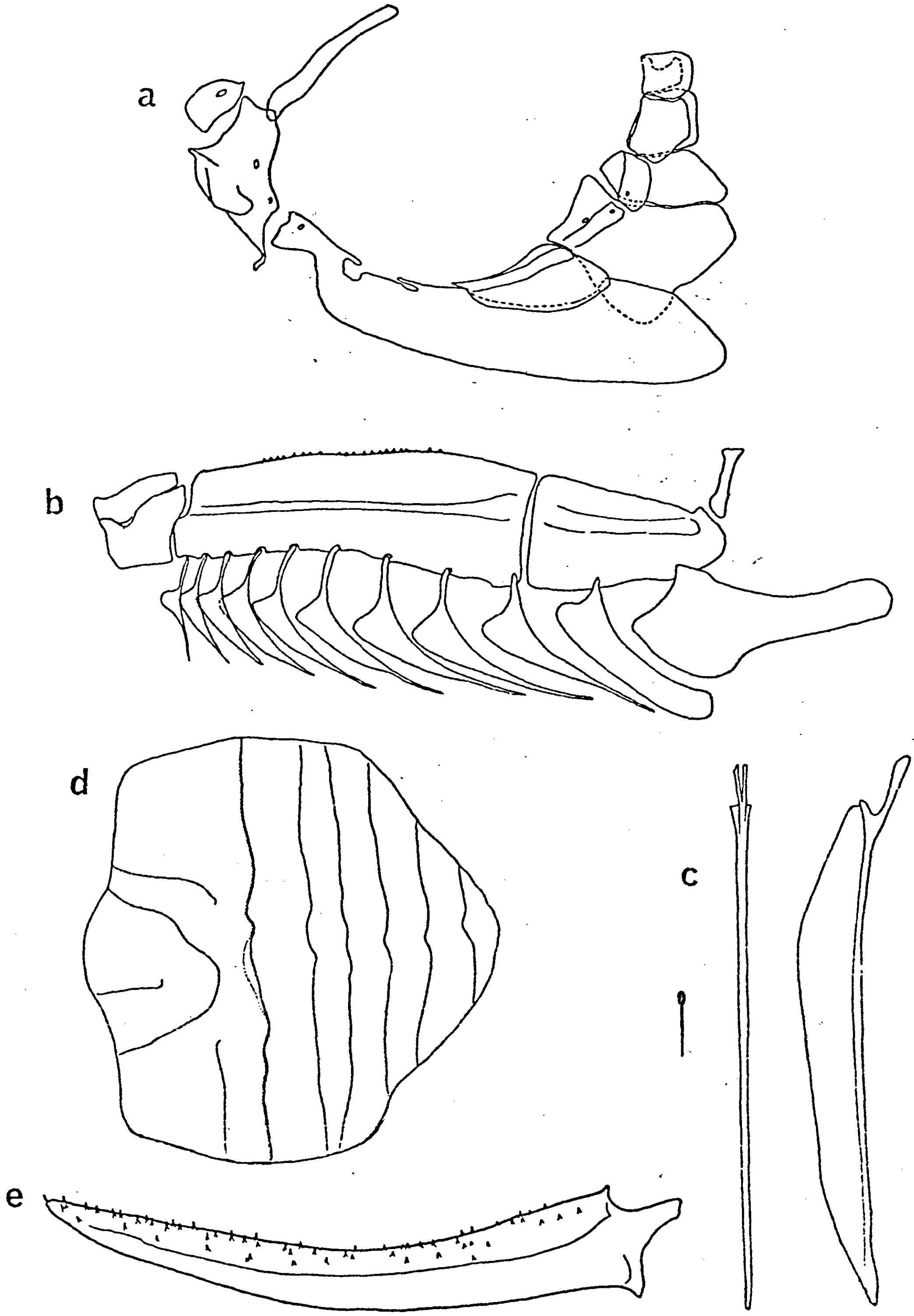


Plate 213. Stolephorus insularis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1977.11.30.158-161, 51.0 mm S.L.; d from BMNH. 1977.11.30.145-150, 45.0 mm S.L.).

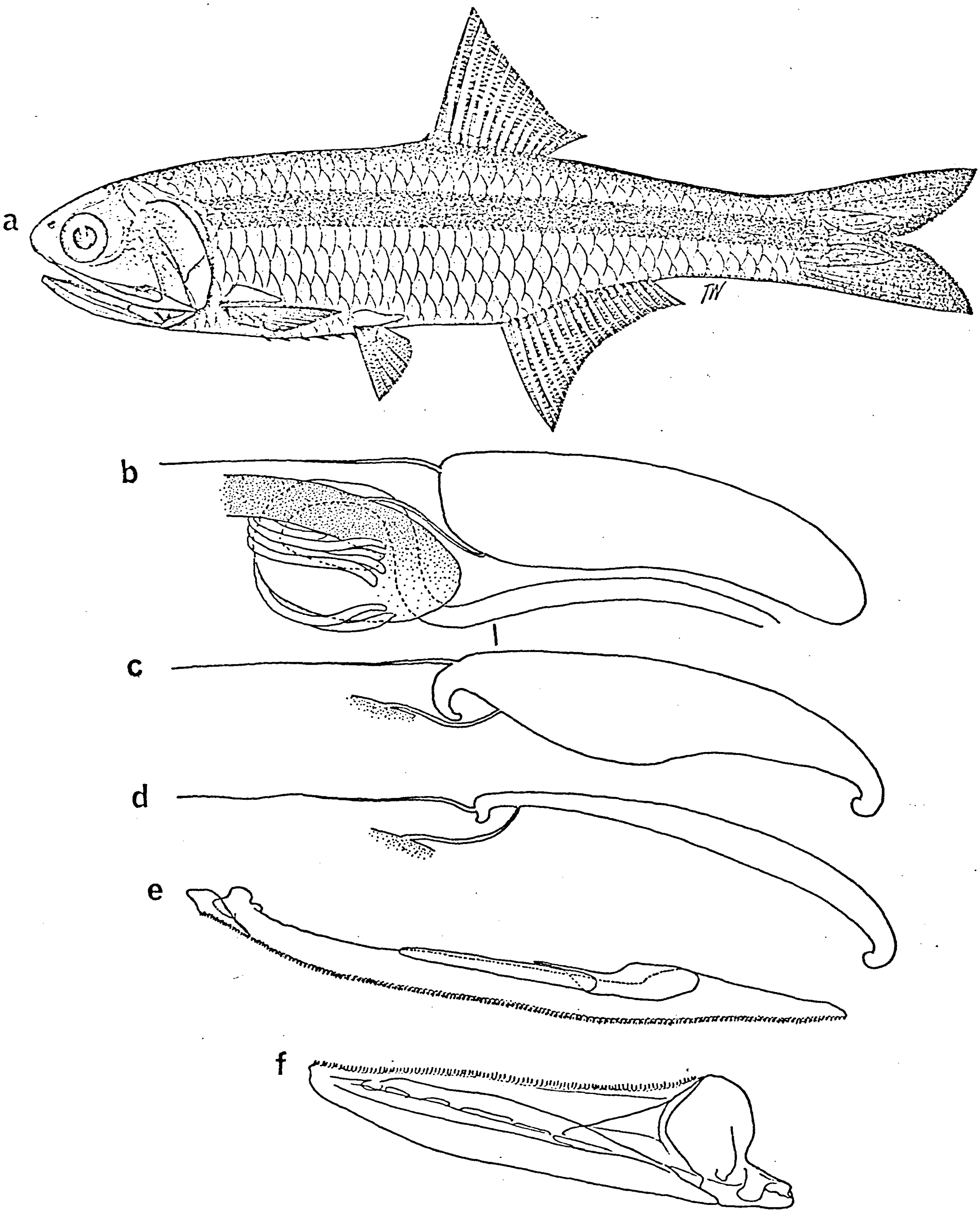


Plate 214. Stolephorus dubiosus:- a, adult; b, gas bladder and digestive tract; c, slightly flattened gas bladder; d, flattened gas bladder; e, f, upper and lower jaws (a from BMNH. 1969.4.22.1826, 69.0 mm S.L., holotype; others from BMNH. 1969.4.22.1813-1822, 64.0 mm S.L.).

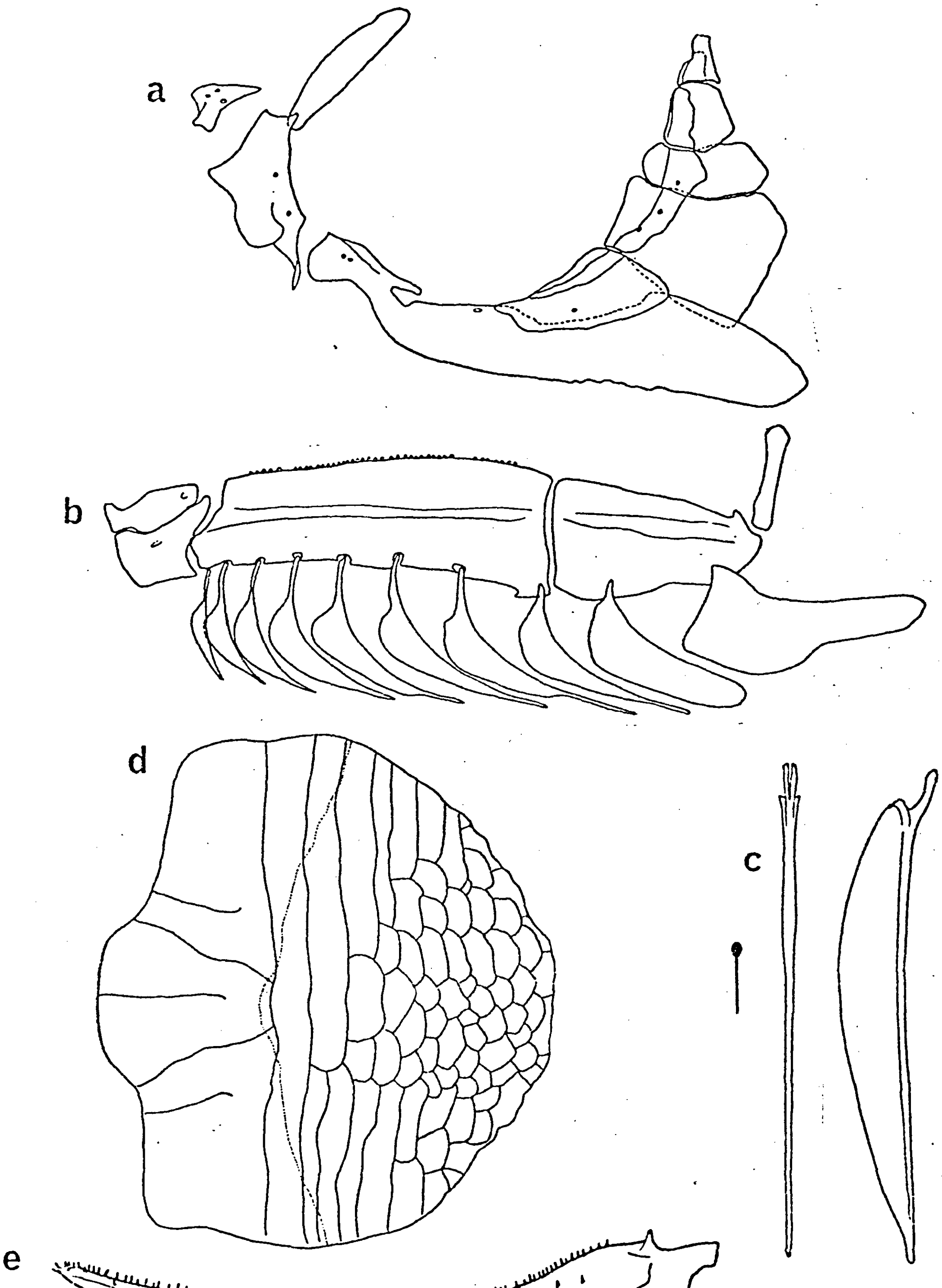


Plate 215. Stolephorus dubiosus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1969.4.22.1813-1822, 64.0 mm S.L.).

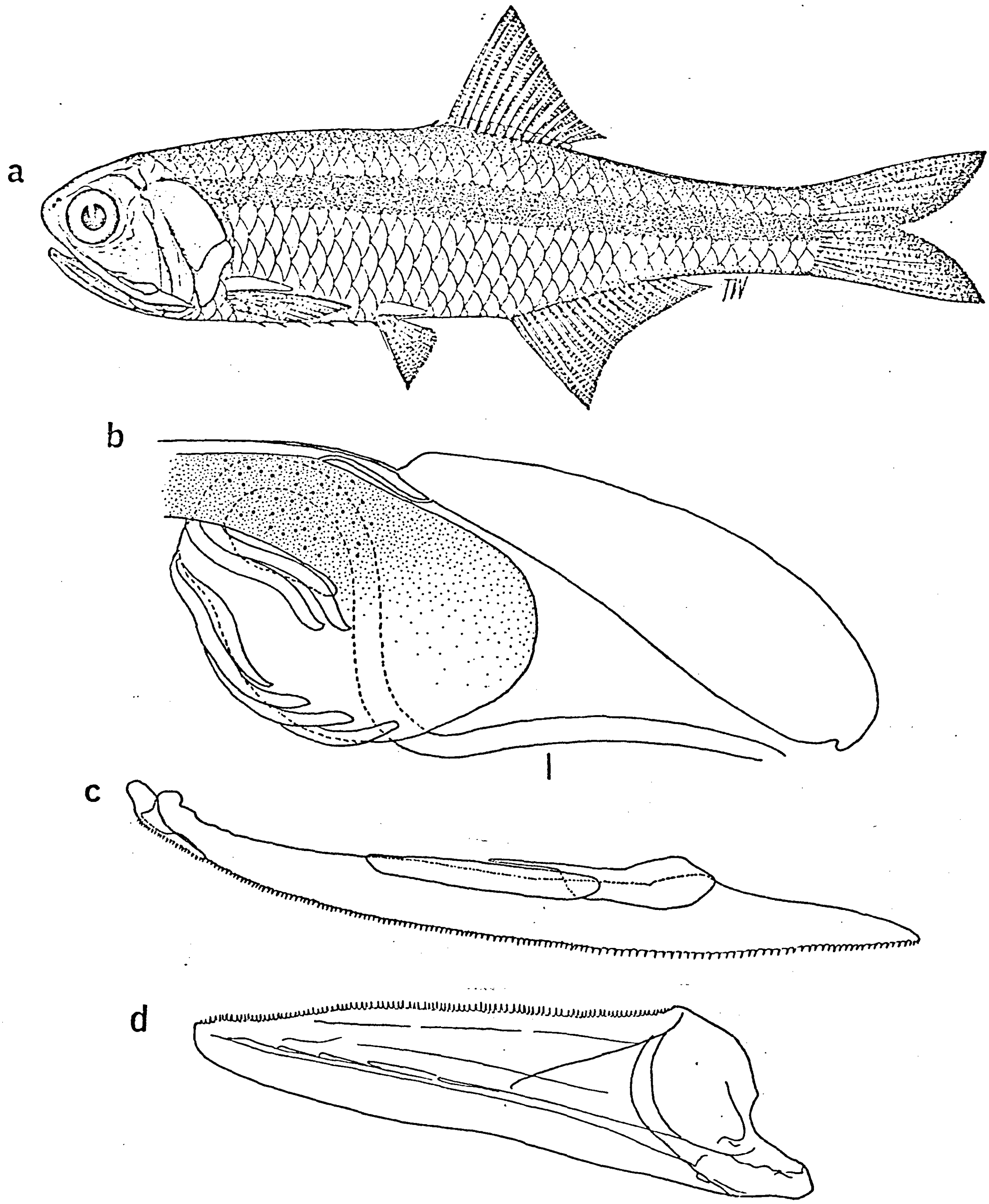


Plate 216. Stolephorus baganensis:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1967.11.13.526, 68.0 mm S.L.; others from BMNH. 1979.8.16.805-827, 51.0 mm S.L.).

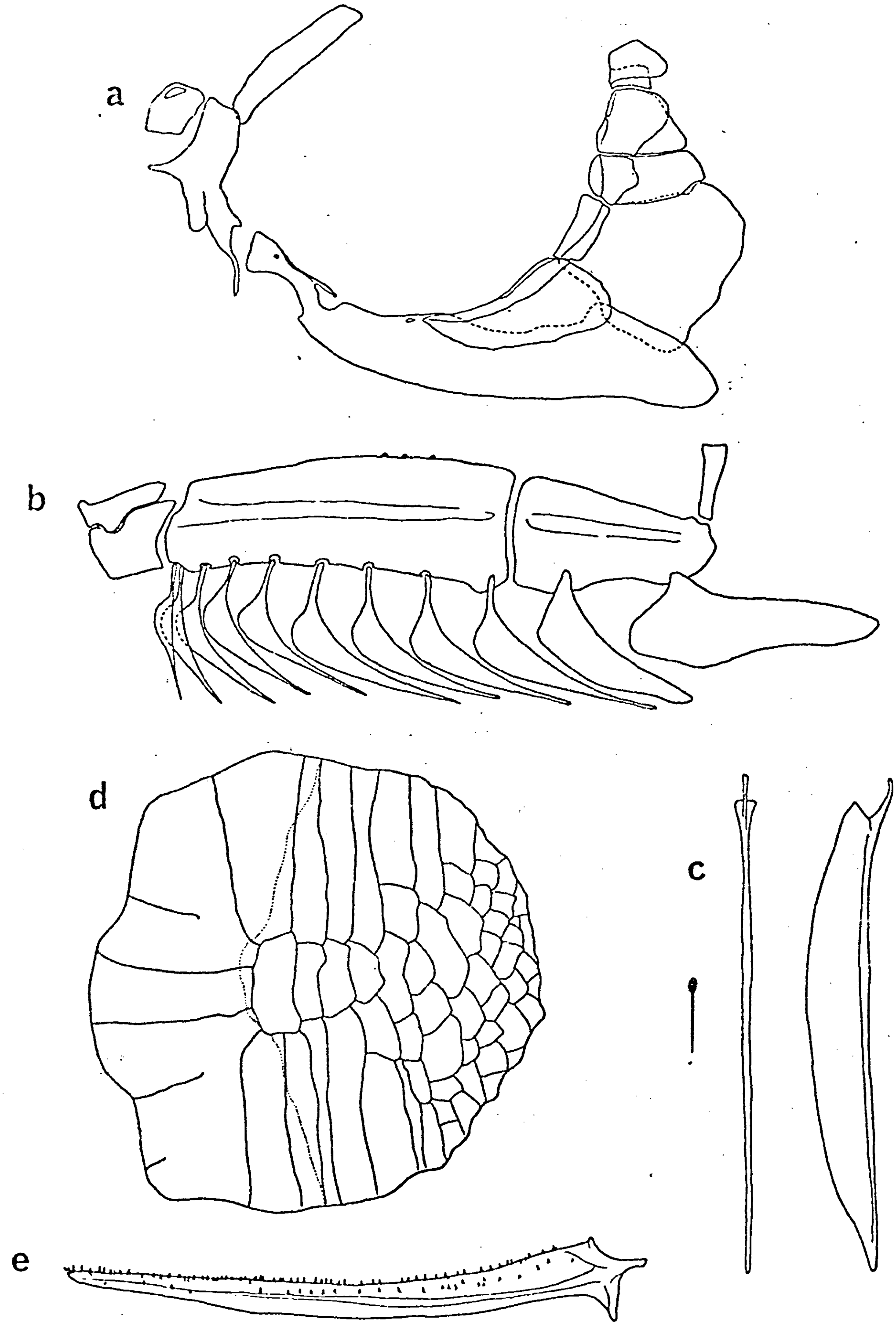


Plate 217. Stolephorus baganensis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1979.8.16.805-827, 51.0 mm S.L. for a, b, c, e and 56.0 mm S.L. for d).

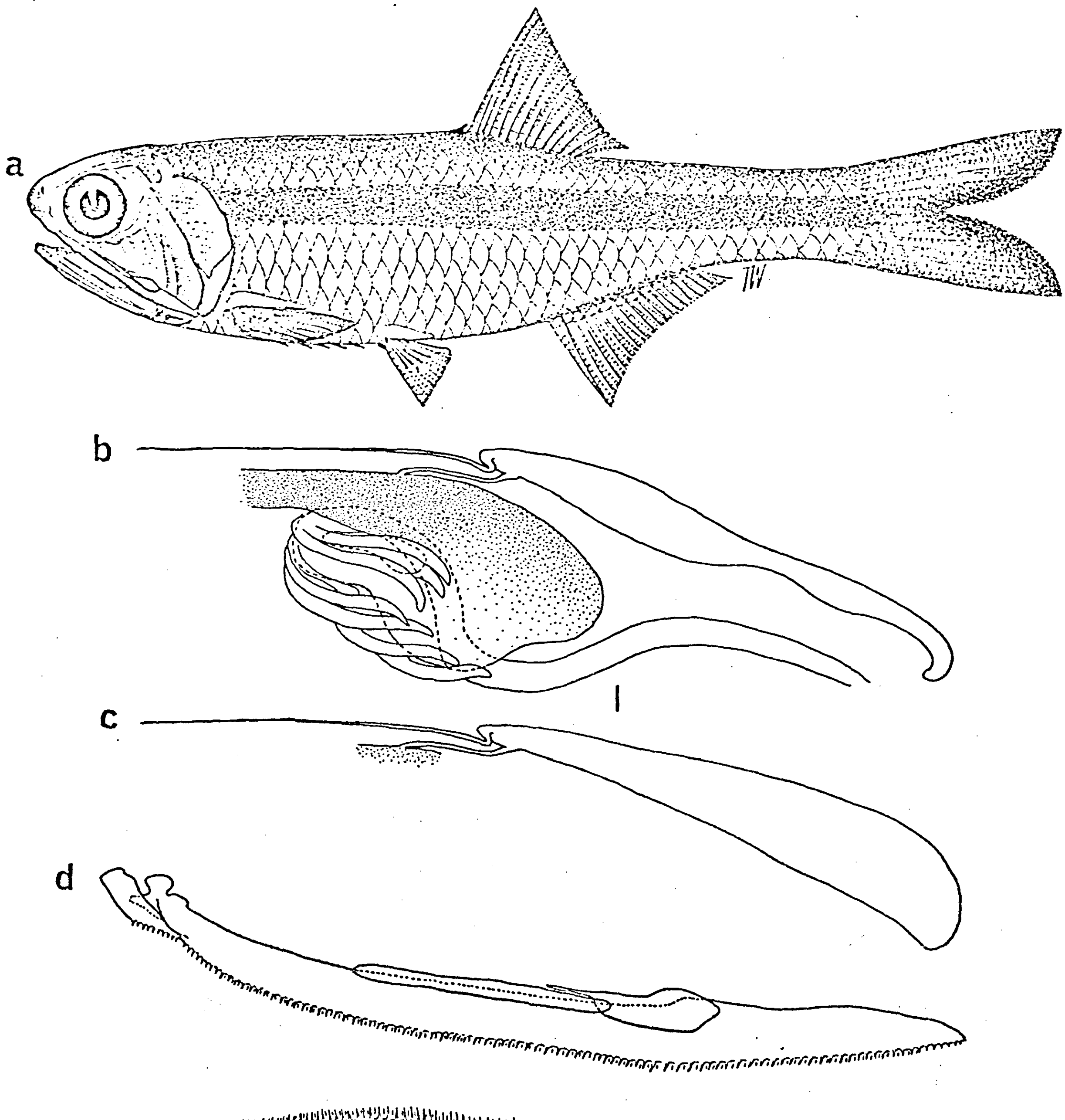


Plate 218. Stolephorus tri:- a, adult; b, flattened gas bladder and digestive tract; c, slightly flattened gas bladder; d, e, upper and lower jaws (all from BMNH. 1977.9.8.73-95, 68.0 mm S.L. for a and 75.5 mm S.L. for others).

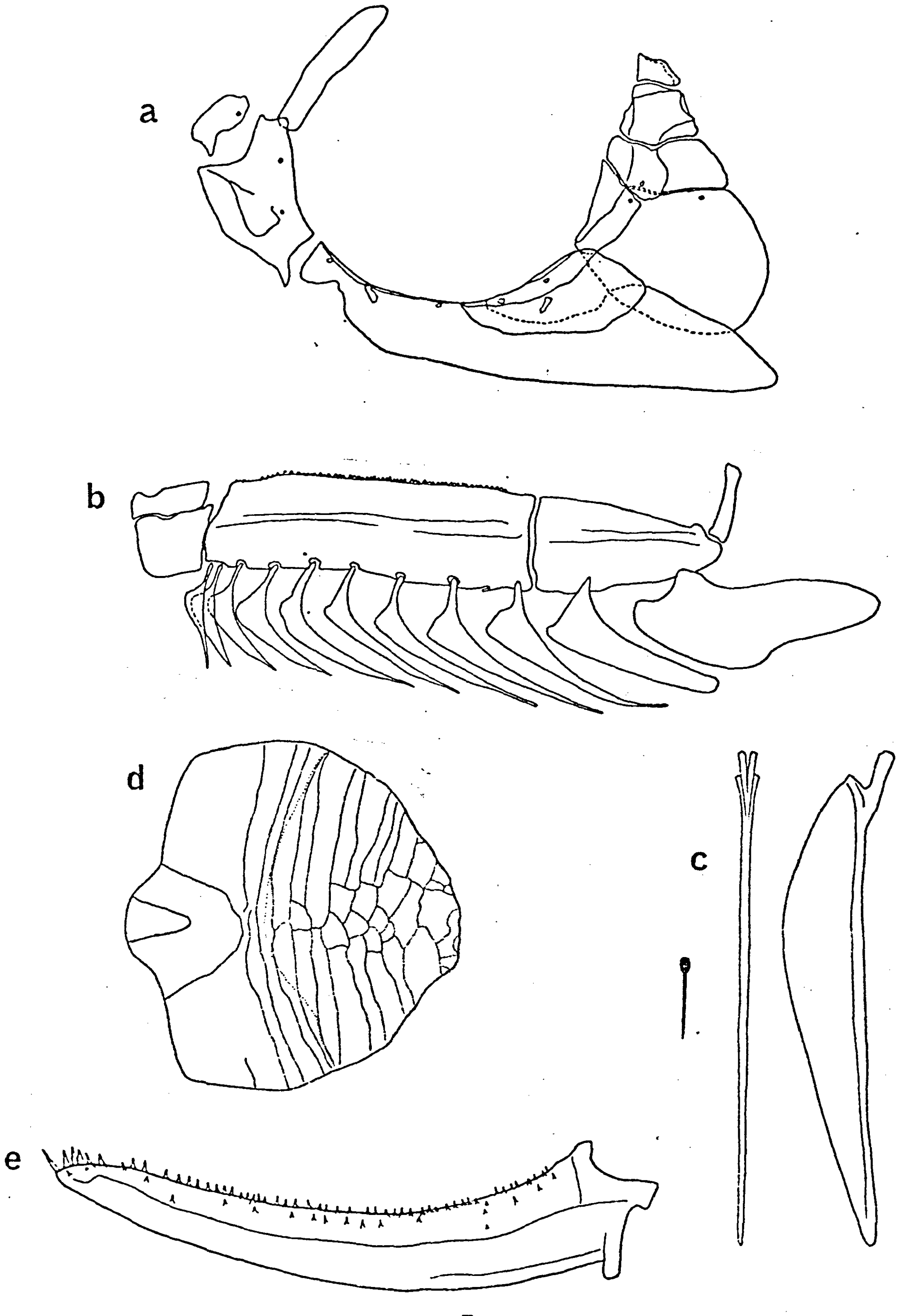


Plate 219. *Stolephorus tri*:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1977.9.8.73-95, 75.5 mm S.L.; d from BMNH. 1977.11.30.163-166, 91.0 mm S.L.).

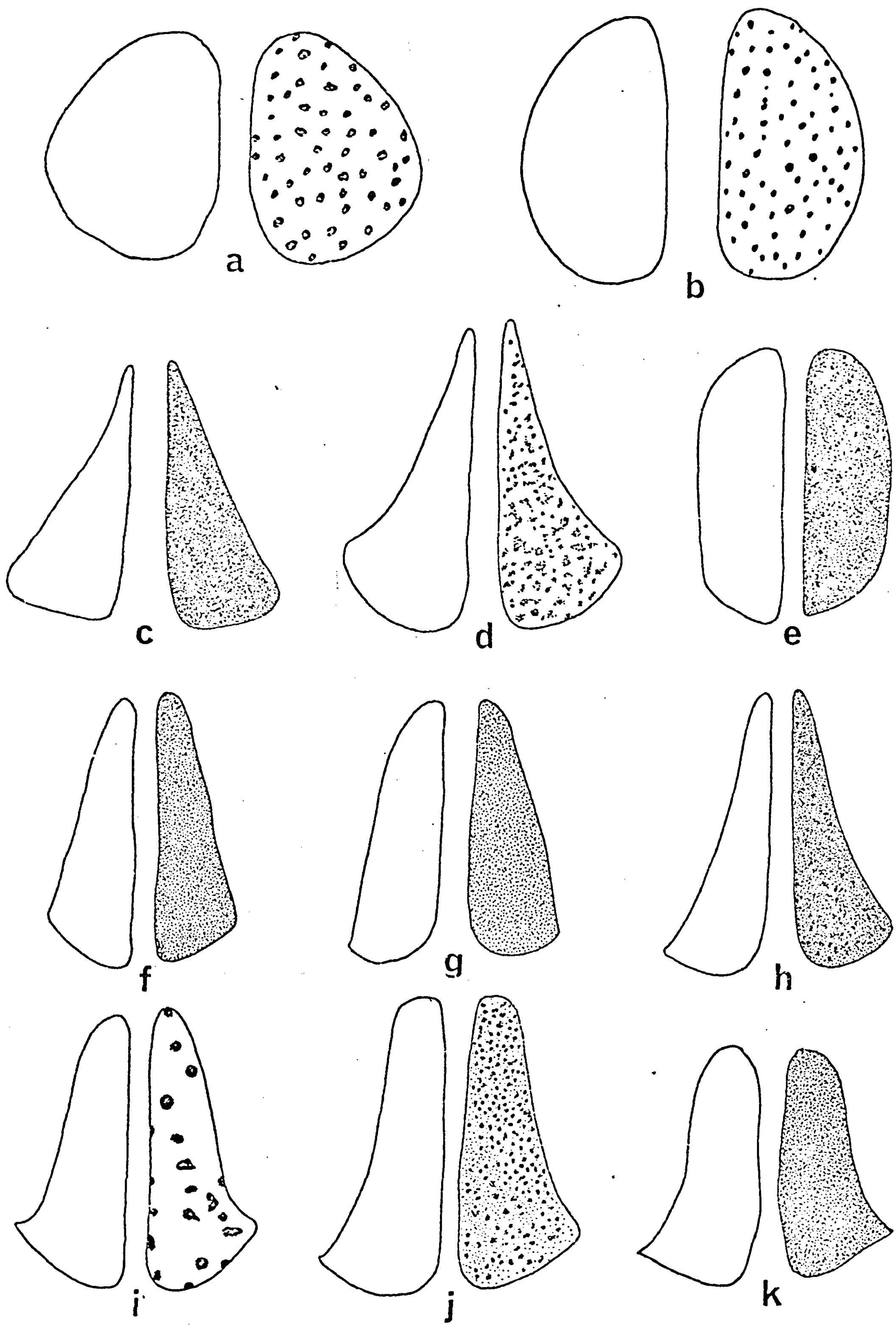


Plate 220. Posterior frontal fontanelles of Stolephorus: a, S. purpureus, 61.0 mm S.L.; b, S. buccaneeri, 73.0 mm S.L.; c, S. heterolobus, 71.0 mm S.L.; d, S. devisi, 77.0 mm S.L.; e to h, S. indicus, 29.0, 41.0, 90.0 and 123.0 mm S.L. respectively; i to k, S. commersonii, 49.0, 76.0 and 89.0 mm S.L. respectively. (Top is anterior).

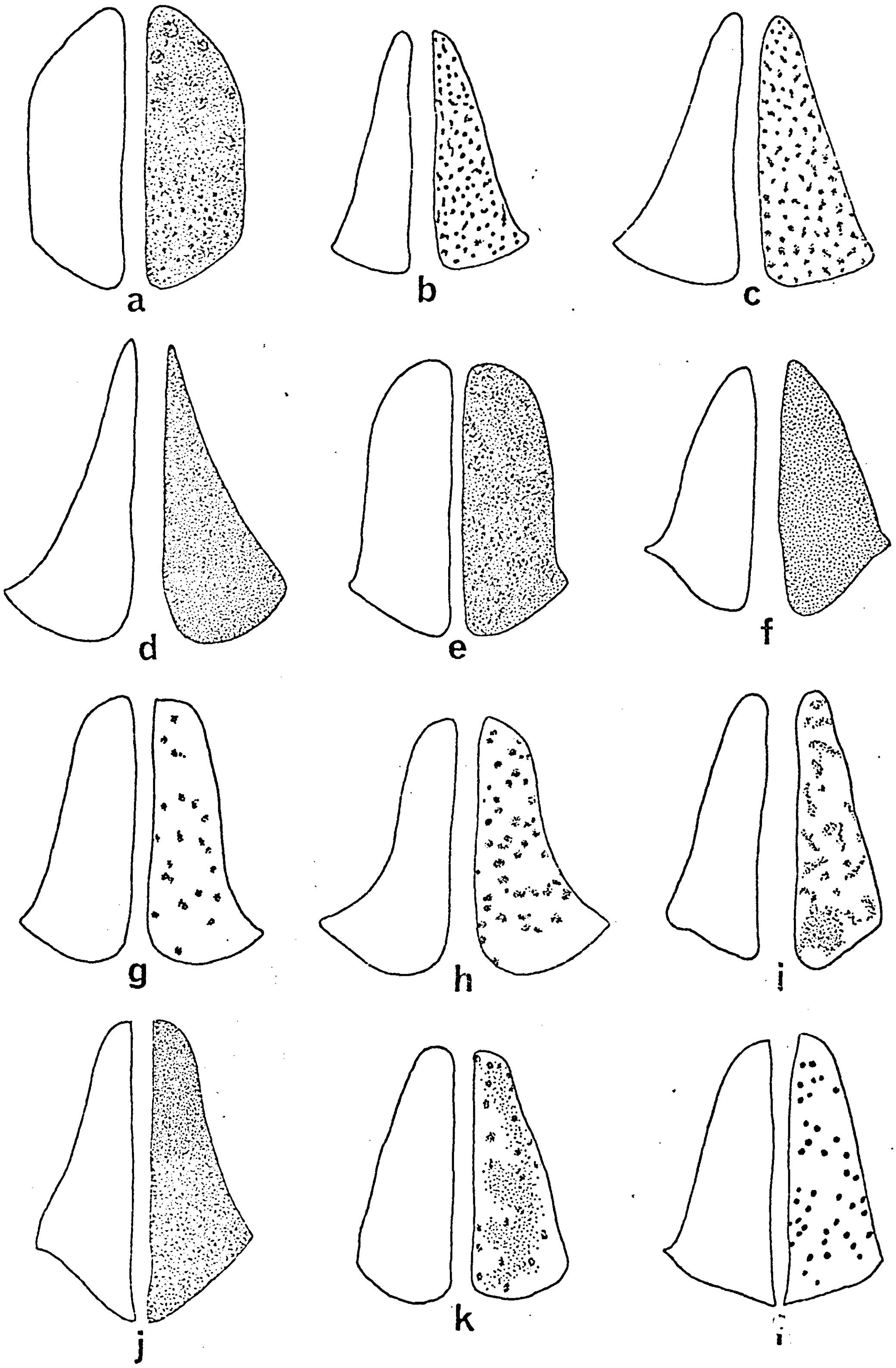


Plate 221. Posterior frontal fontanelles of Stolephorus: a to d, S. waitei, 25.0, 48.0, 65.0 and 67.0 mm S.L. respectively; e and f, S. brachycephalus, 27.5 and 42.5 mm S.L. respectively; g to i, S. chinensis, 47.0, 64.0 and 76.0 mm S.L. respectively; j, S. tysoni, 47.5 mm S.L.; k and l, S. ronquilloi, 36.0 and 48.5 mm S.L. respectively. (Top is anterior).

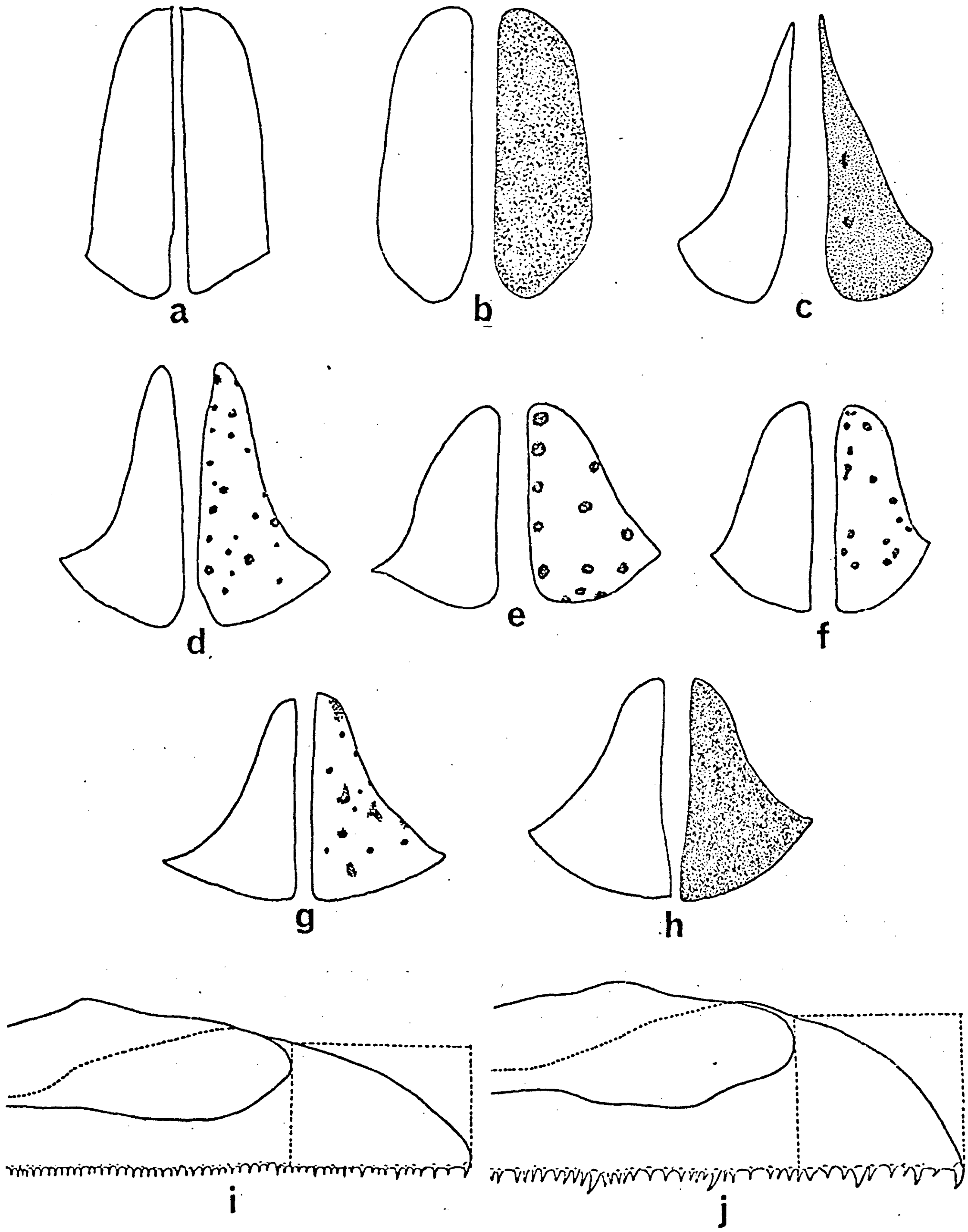


Plate 222. Posterior frontal fontanelles of *Stolephorus*: a, *S. andhraensis*, 37.0 mm S.L.; b and c, *S. holodon*, 32.0 and 64.0 mm S.L. respectively; d, *S. insularis*, 49.0 mm S.L.; e and f, *S. dubiosus*, 42.0 and 64.0 mm S.L. respectively; g, *S. baganensis*, 51.0 mm S.L.; h, *S. tri*, 75.5 mm S.L..

Comparisons of posterior extremity of upper jaw (left side) and dentition in: i, *Stolephorus heterolobus*, 75.0 mm S.L.; and j, *S. devisi*, 71.5 mm S.L.

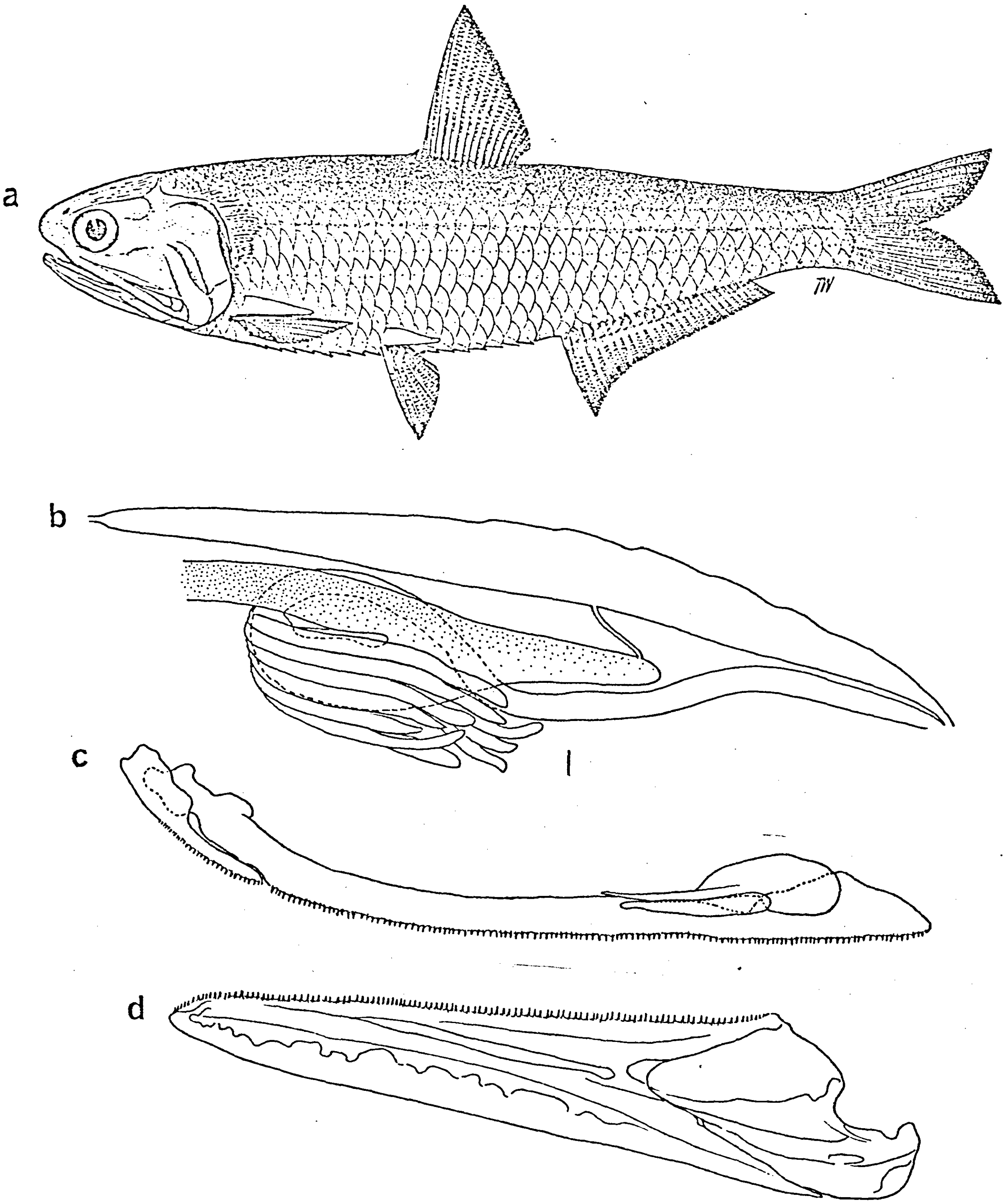


Plate 223. *Thryssa* (*Thrissina*) *baelama*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1867.11.28.50, 106.5 mm S.L.; others from BMNH. 1967.11.20.107-156, 106.0 mm S.L.).

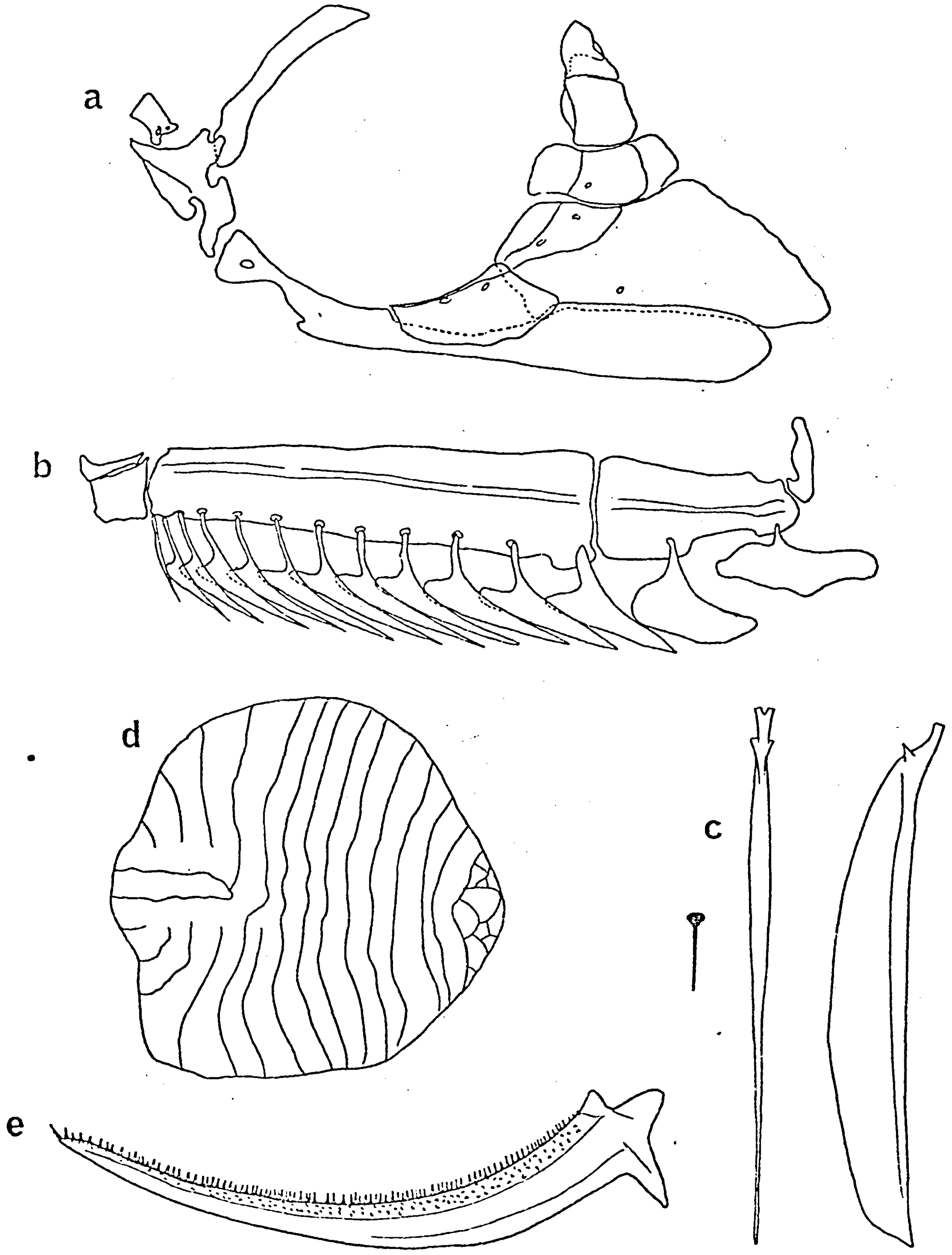


Plate 224. Thryssa (Thrissina) baelama:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1967.11.20.107-156, 106.0 mm S.L.; d from BMNH. 1870.8.31.127-128, 90.0 mm S.L.).

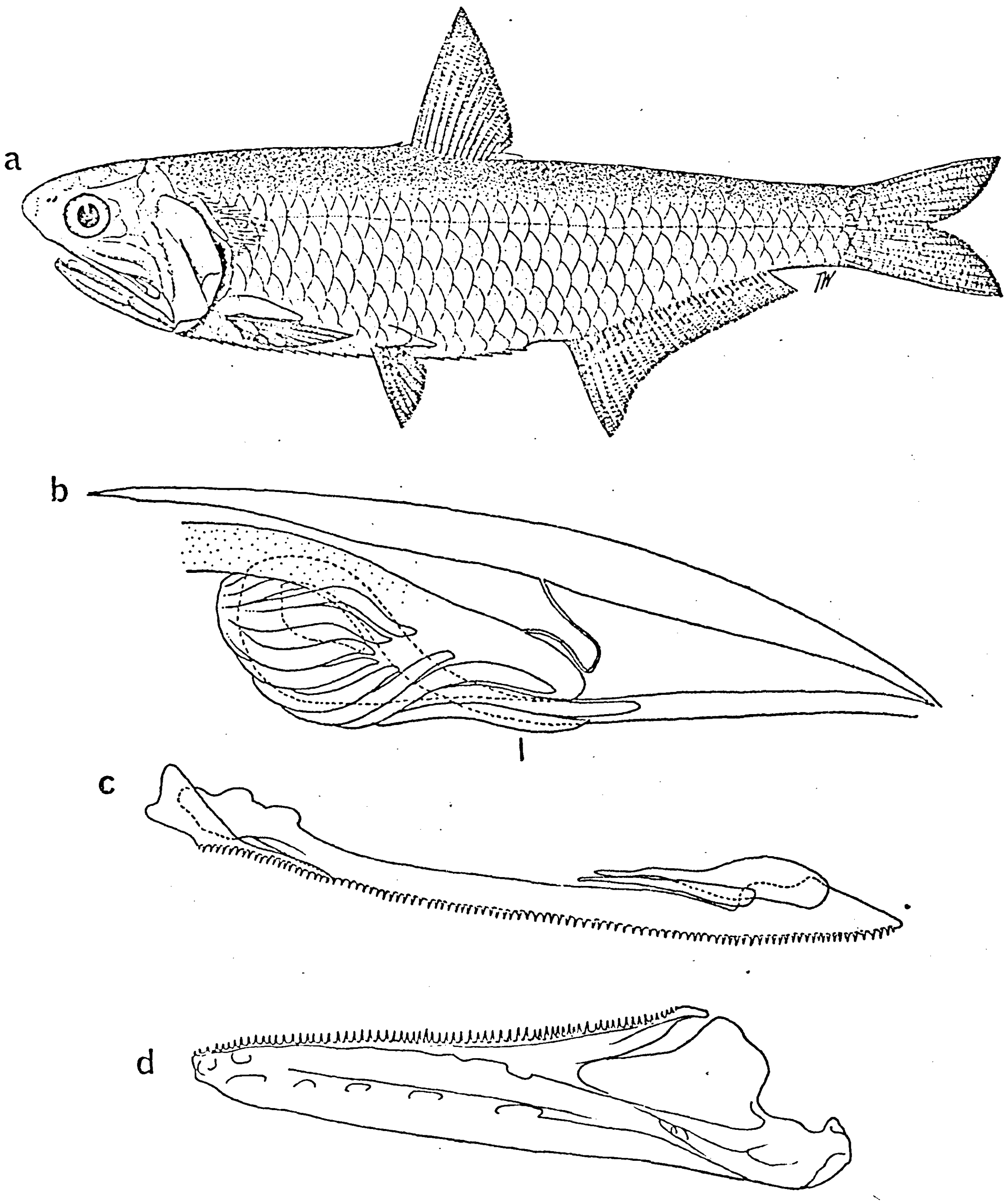


Plate 225. Thryssa (Scutengraulis) chefuensis:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1874.1.16.54, 107.0 mm S.L., type of Engraulis chefuensis; others from BMNH. 1928.6.22.4, 95.0 mm S.L.).

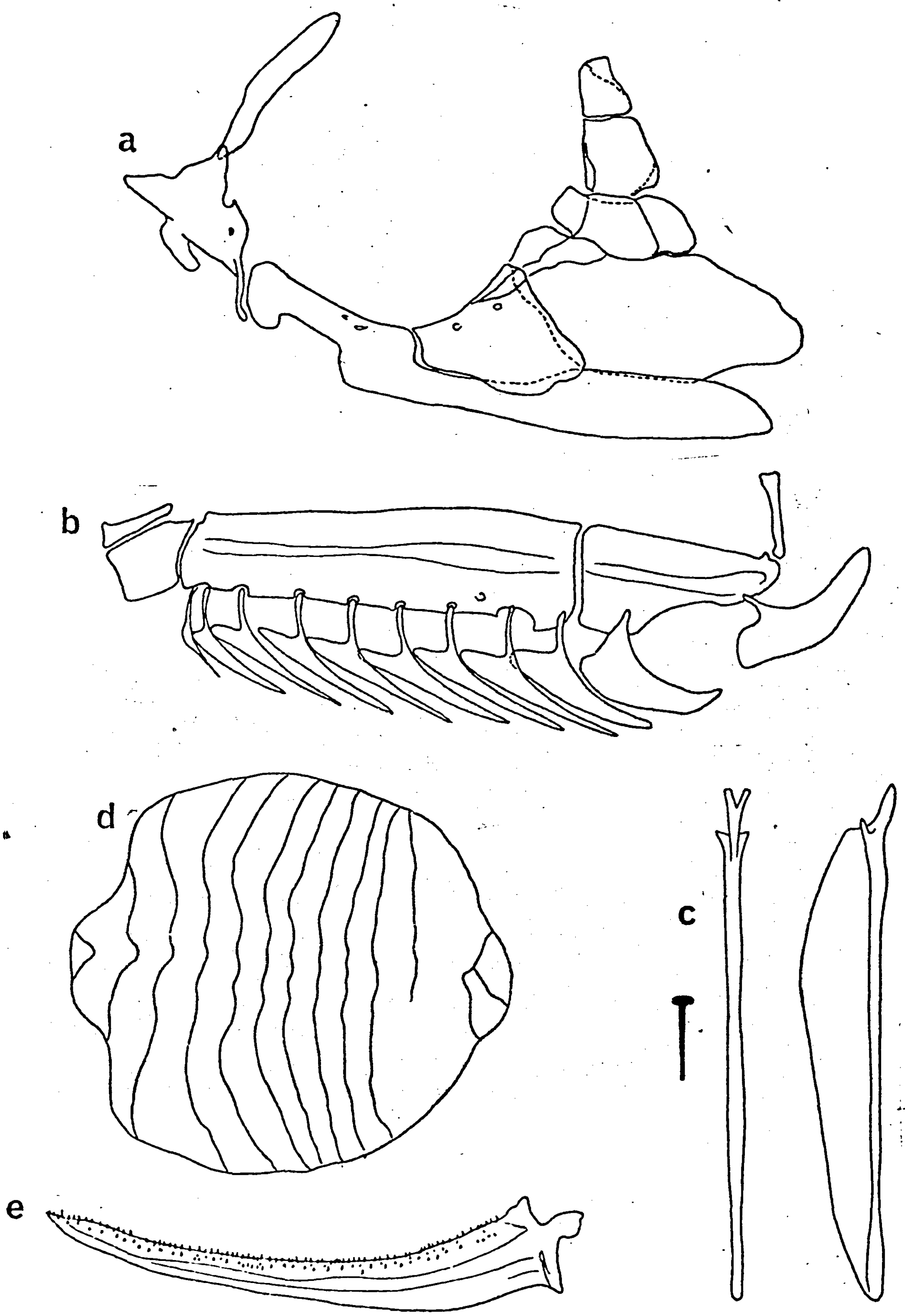


Plate 226. Thryssa (Scutengraulis) chefuensis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1928.6.22.4, 95.0 mm S.L.).

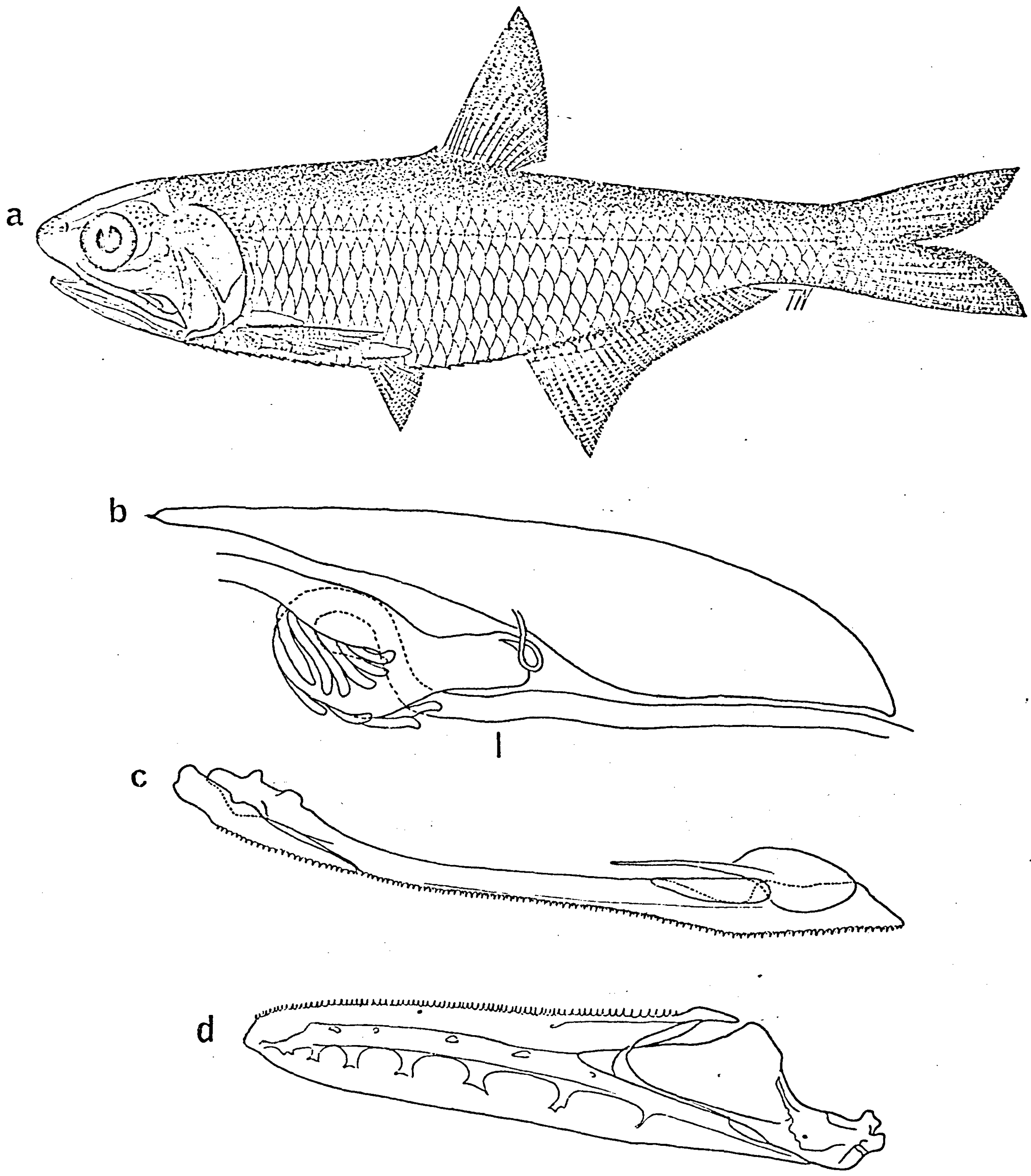


Plate 227. Thryssa (Scutengraulis) rastrosa:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1977.11.17.33-36, paratypes of Thryssa rastrosa, 68.0 mm S.L. for a, 54.5 mm S.L. for others).

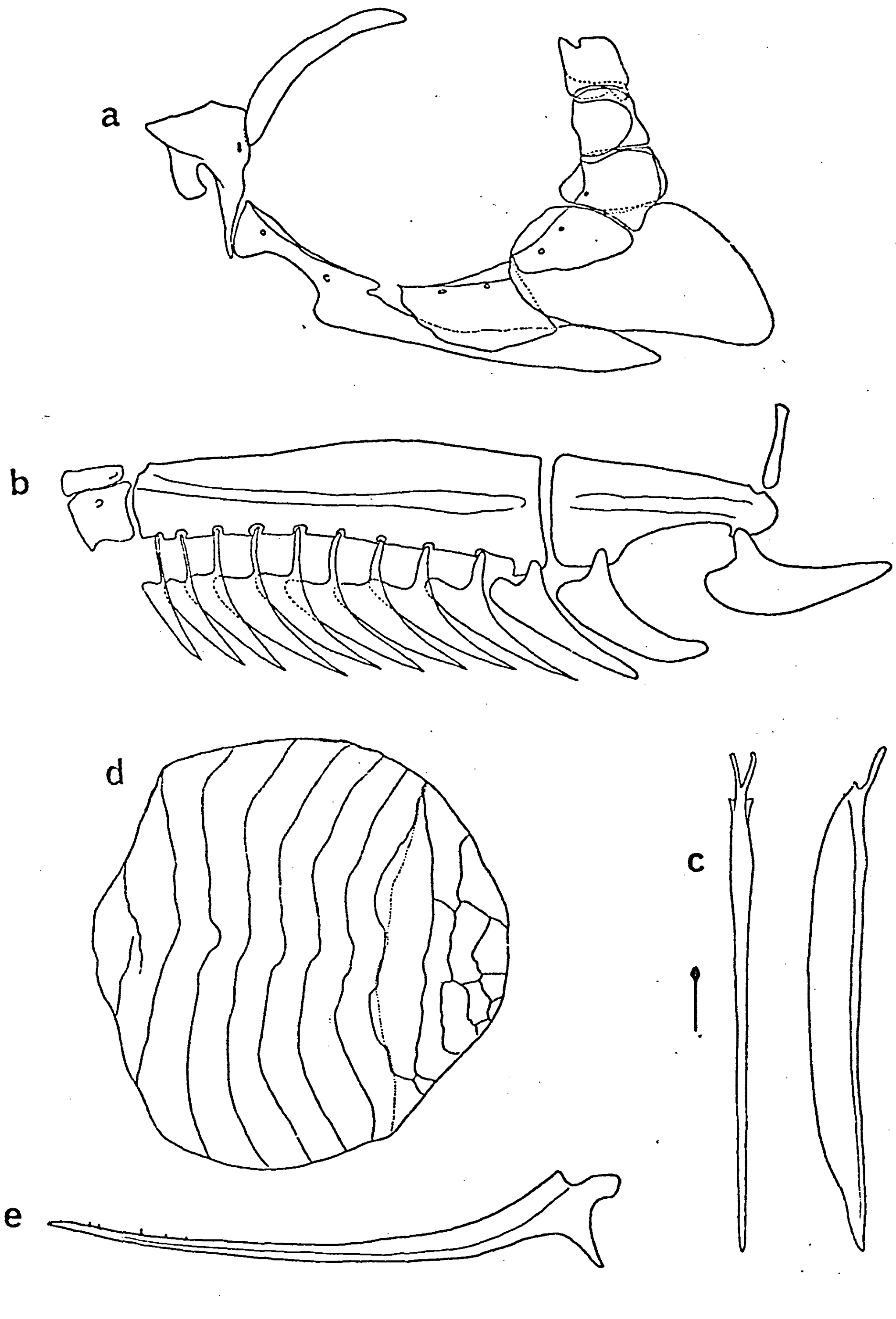


Plate 228. Thryssa (Scutengraulis) rastrosa:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1977.11.17.26-30, paratypes of Thryssa rastrosa, 54.5 mm S.L.).

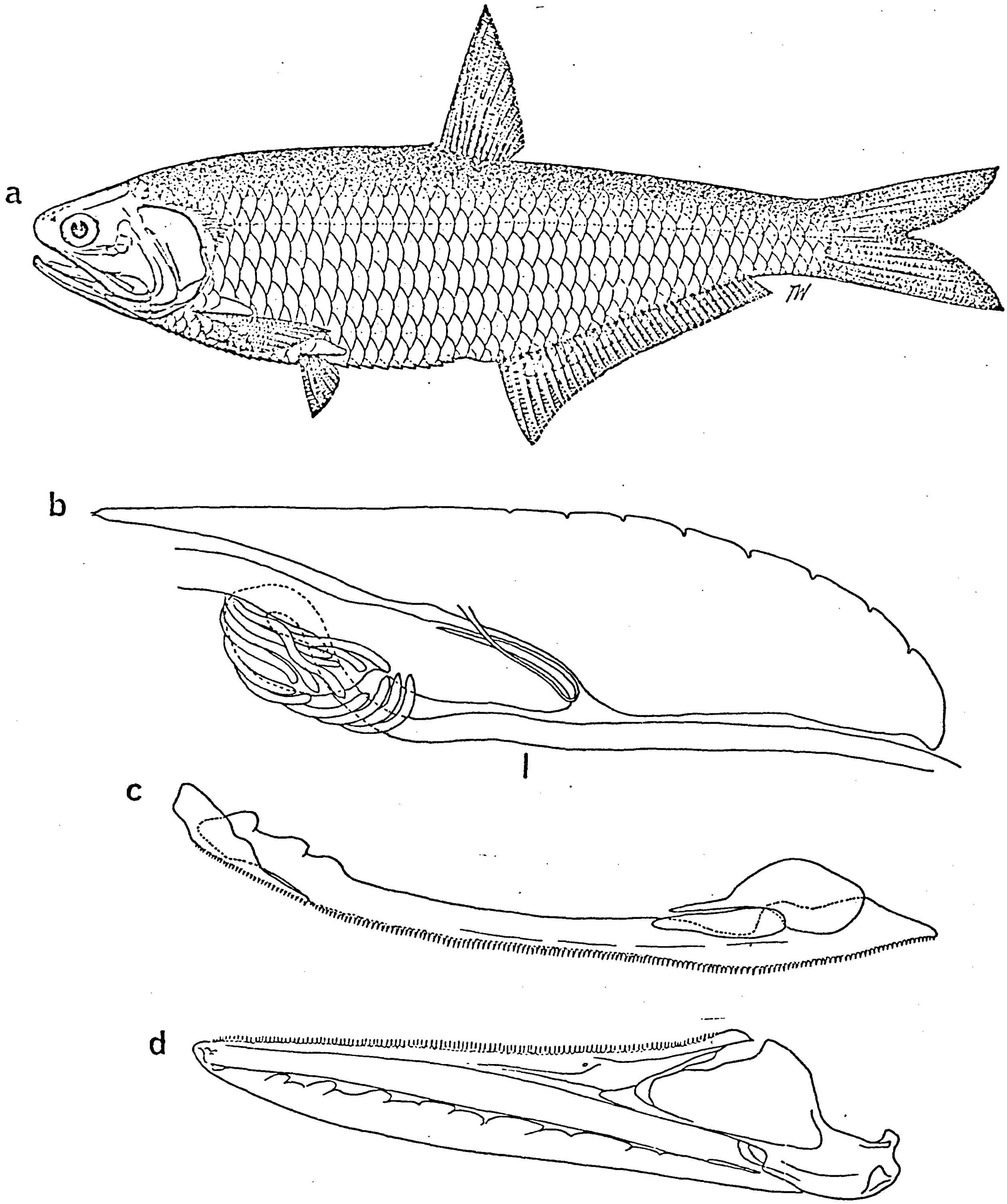


Plate 229. *Thryssa* (*Scutengraulis*) *seratchleyi*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1913.12.15.2, 305.0 mm S.L.; others from BMNH. 1977.11.17.37, 95.0 mm S.L.).

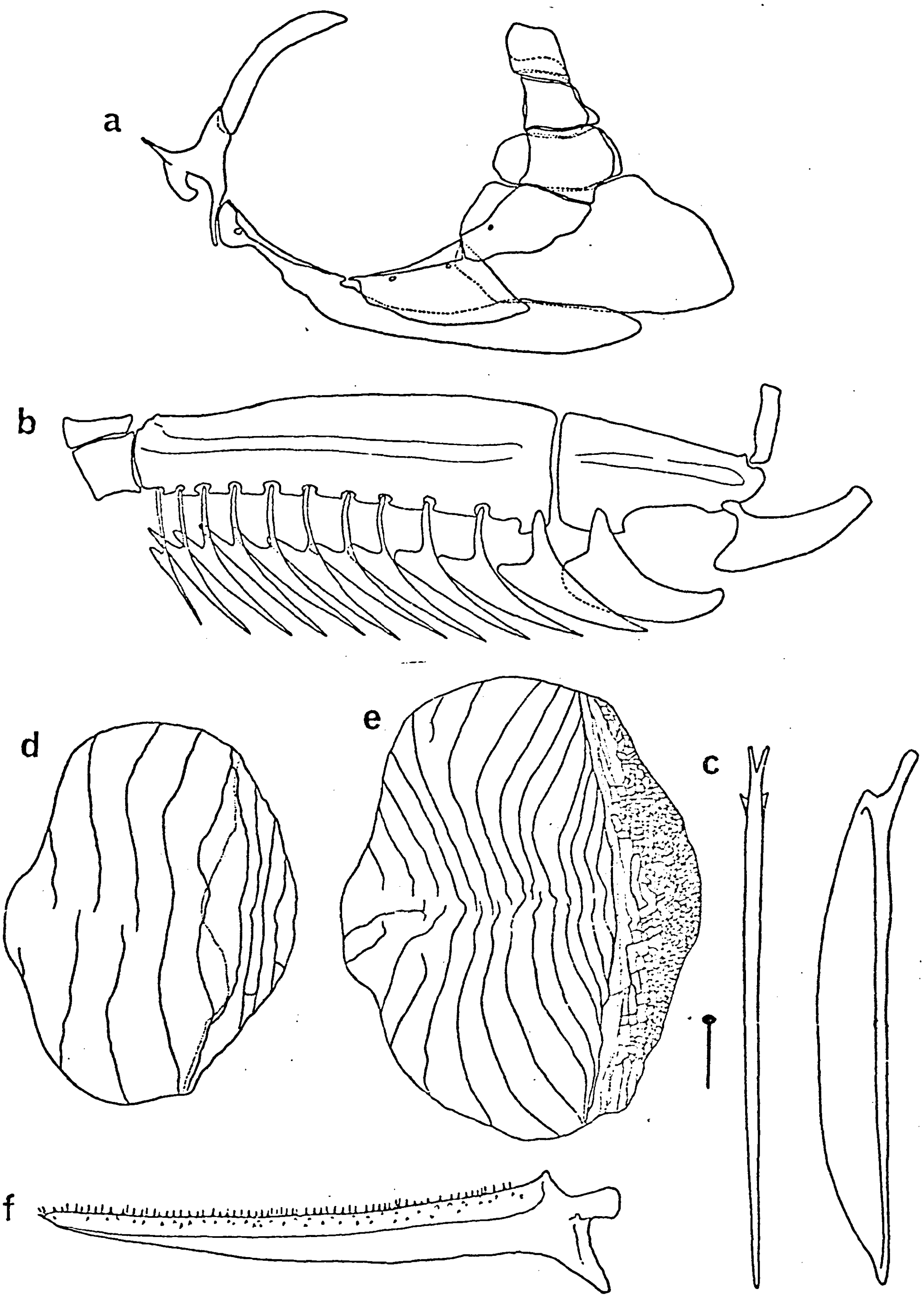


Plate 230. Thryssa (Scutengraulis) seratchleyi:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, scales; f, gillraker (a, b, c, d, f from BMNH. 1977.11.17.37, 95.0 mm S.L.; e from BMNH. 1913.12.15.2, 305.0 mm S.L.).

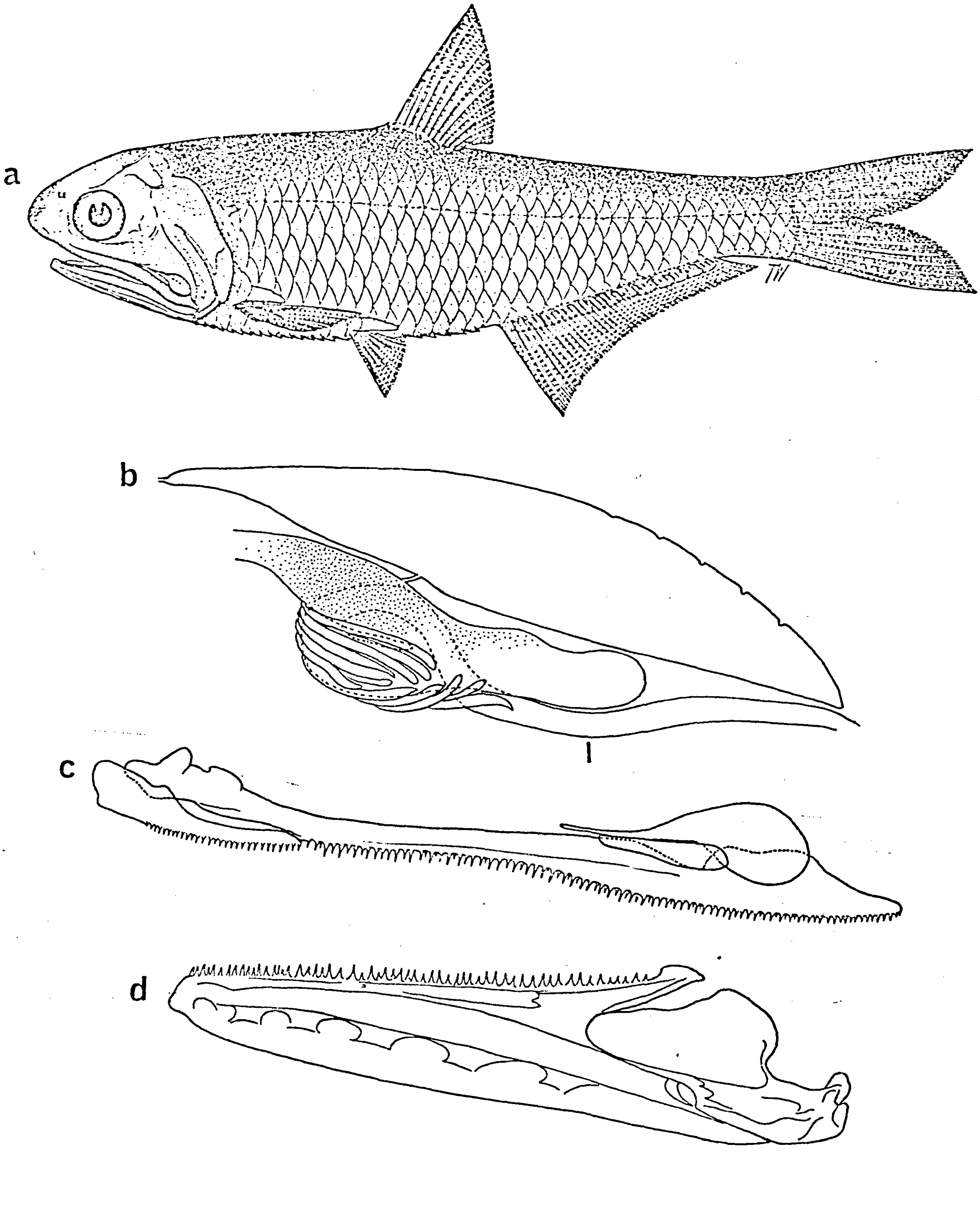


Plate 231. Thryssa (Scutengraulis) aestuaria:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1977.11.17.26-30, paratypes of Thryssa brevicauda, 50.5 mm S.L. for a, 48.0 mm S.L. for others).

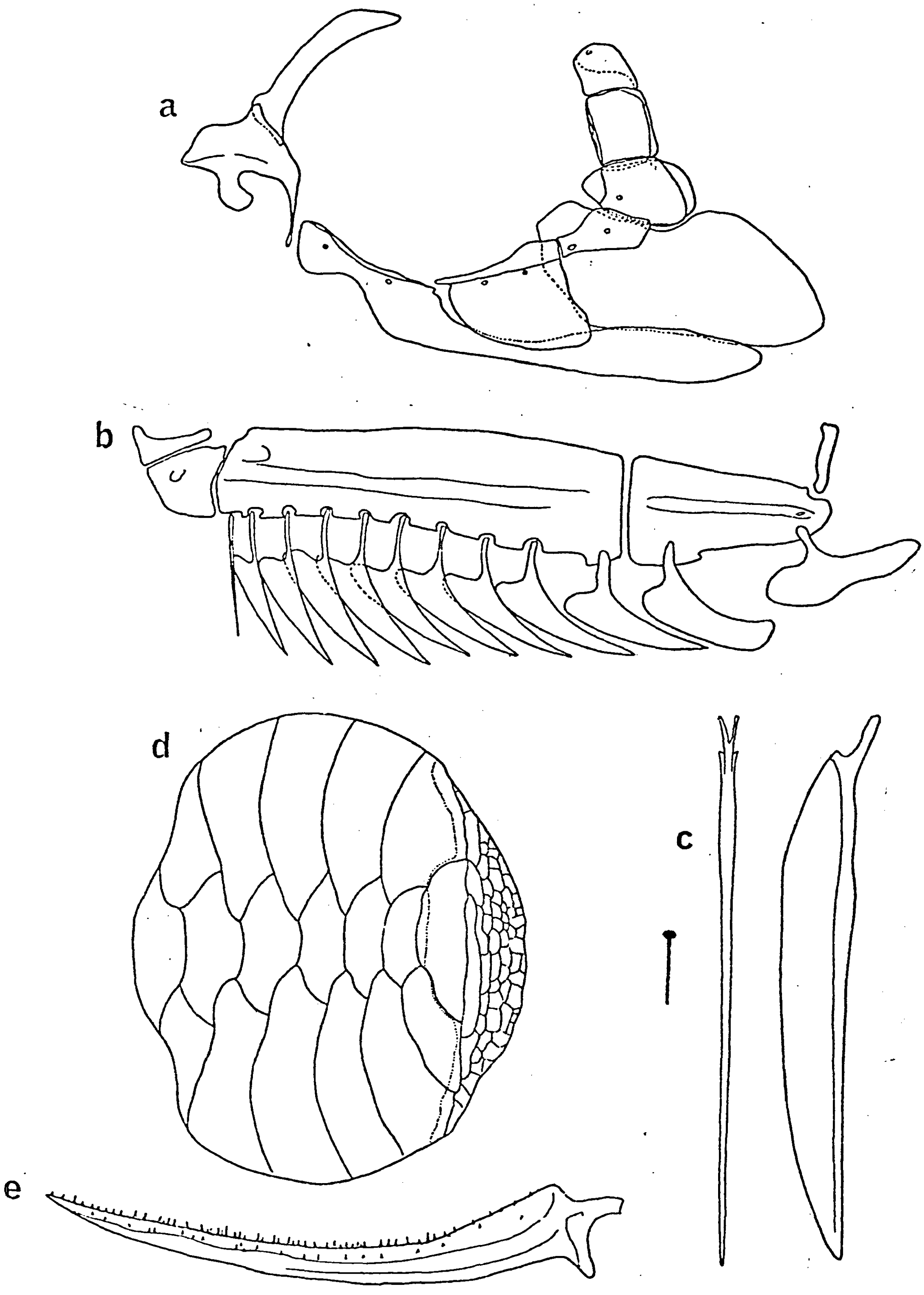


Plate 232. Thryssa (Scutengraulis) aesturia:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1977.11.17. 26-30, paratypes of Thryssa brevicauda, 48.0 mm S.L. for a, b, c, e; 48.5 mm S.L. for d).

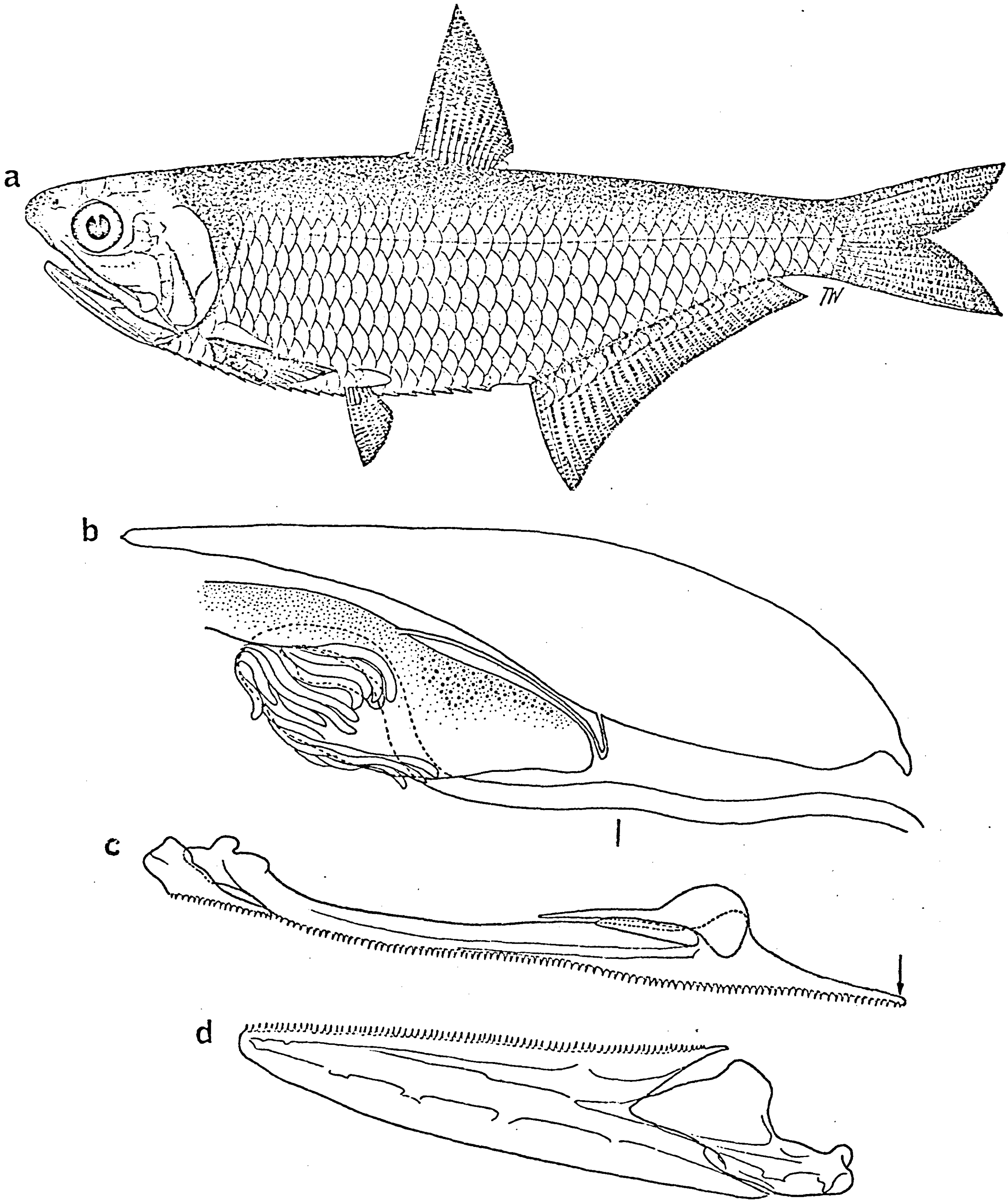


Plate 233. Thryssa (Scutengraulis) kammalensis:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from BMNH. 1967.11.13.650-653, 73.0 mm S.L.; others from BMNH. 1979.8.16.505-512, 72.0 mm S.L.).

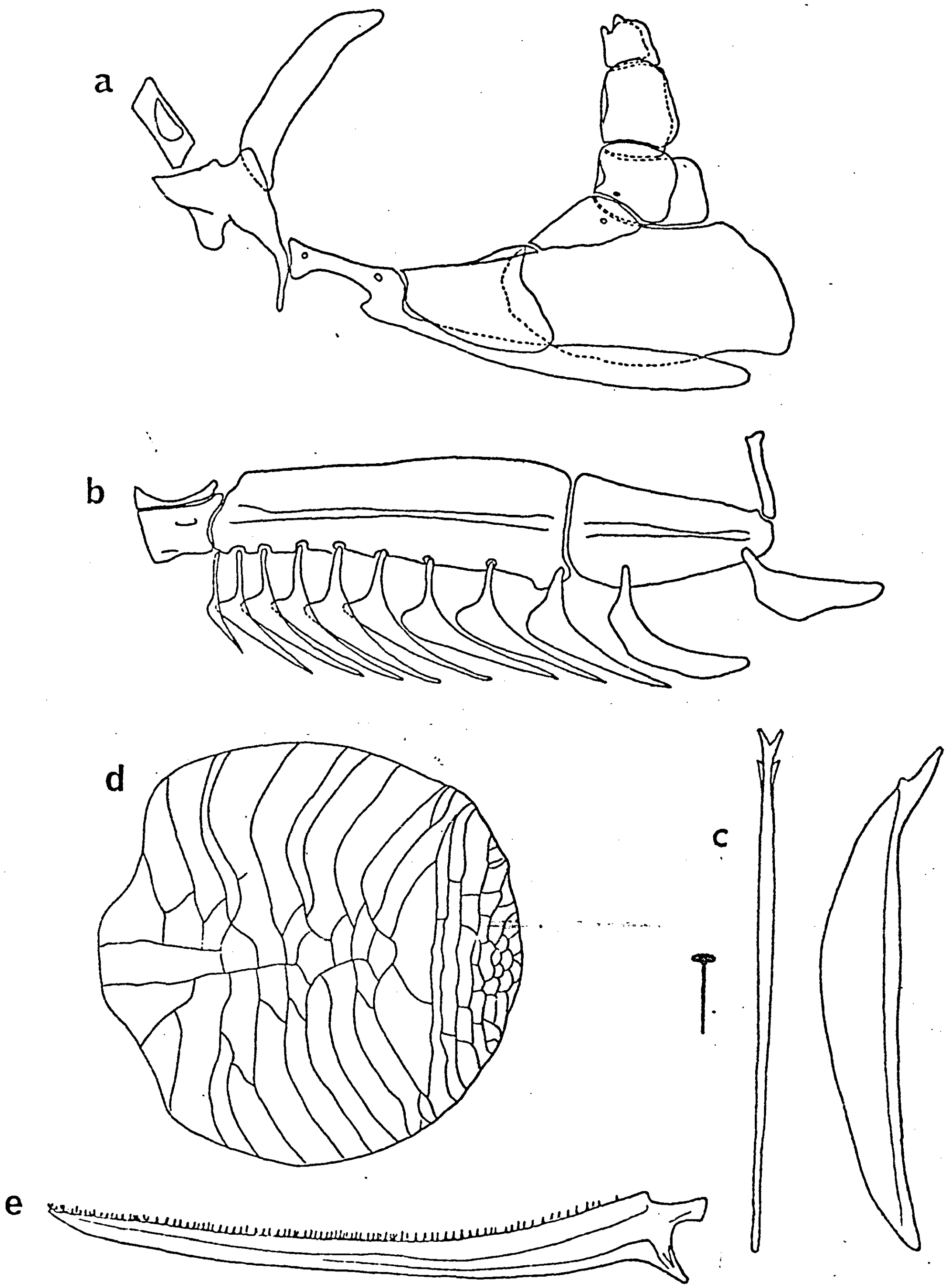


Plate 234. Thryssa (Scutengraulis) kammalensis:- a, circumorbital bones; b, hyoid arch; e, urohyal; d, scales; e, gillraker (all from BMNH. 1979. 8.16.505-512, 72.0 mm S.L. for a, b, c, d; 68.0 mm S.L. for e).

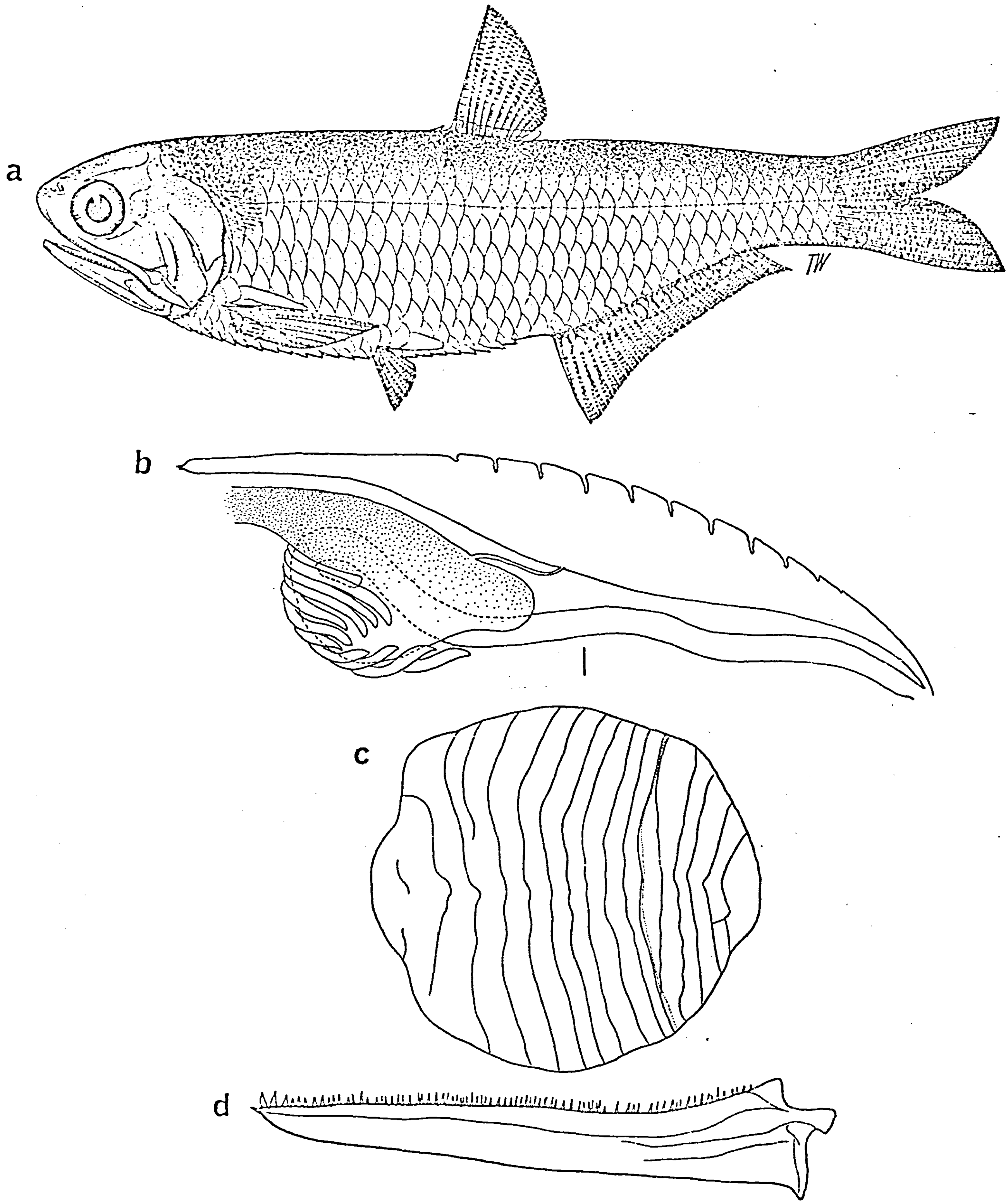


Plate 235. Thryssa (Scutengraulis) kammalensoides:- a, adult; b, gas bladder and digestive tract; c, scale; d, gillraker (a, c from BMNH. 1965.7.12.248, 112.0 mm S.L. holotype; b, d from BMNH. 1965.7.12.247, 108.0 mm S.L., paratype).

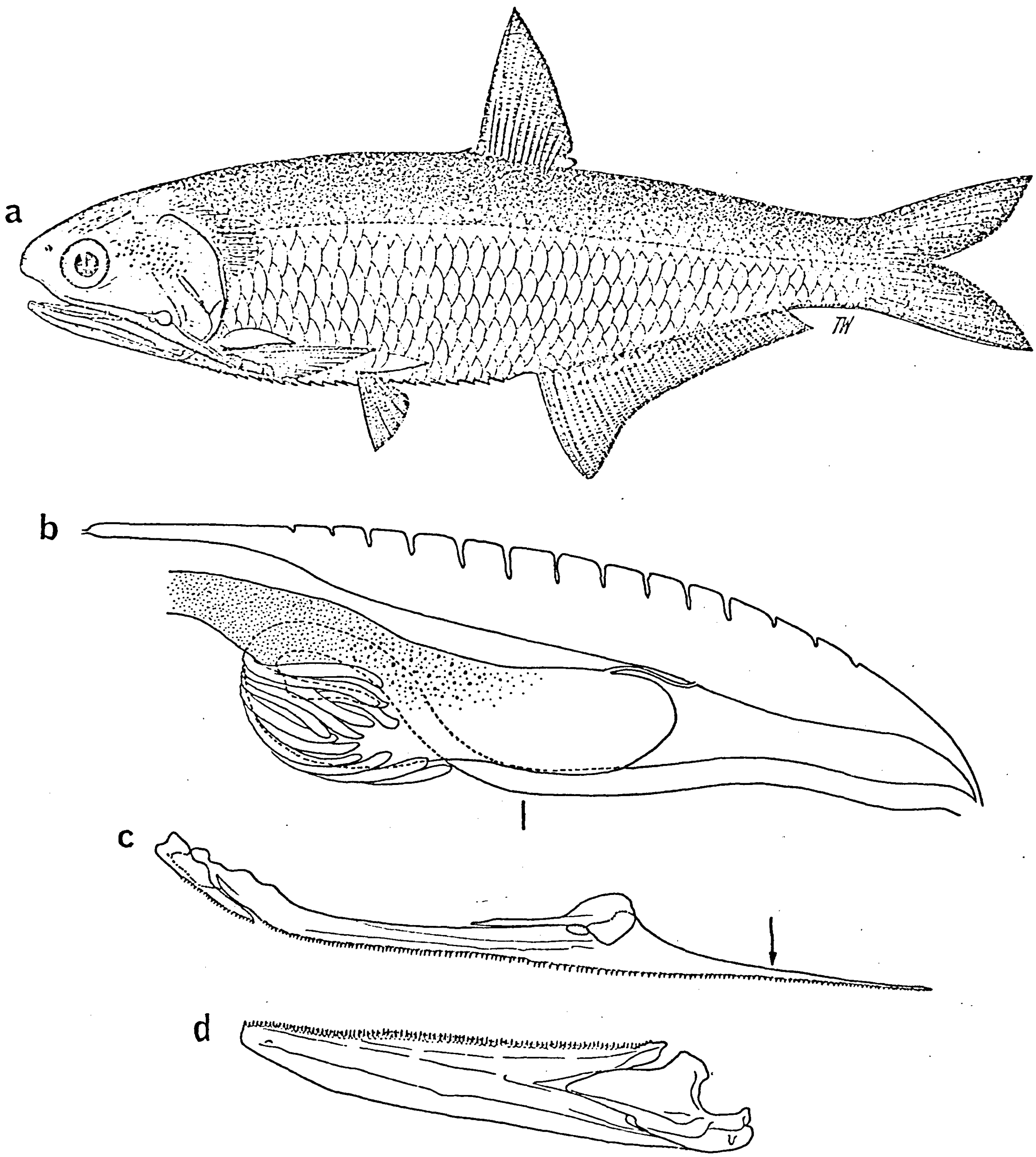


Plate 236. Thryssa (Scutengraulis) vitrirostris:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from BMNH. 1965.7.12.258-259, 109.0 mm S.L.; others from BMNH. 1970.10.22.76-87, 112.0 mm S.L.).

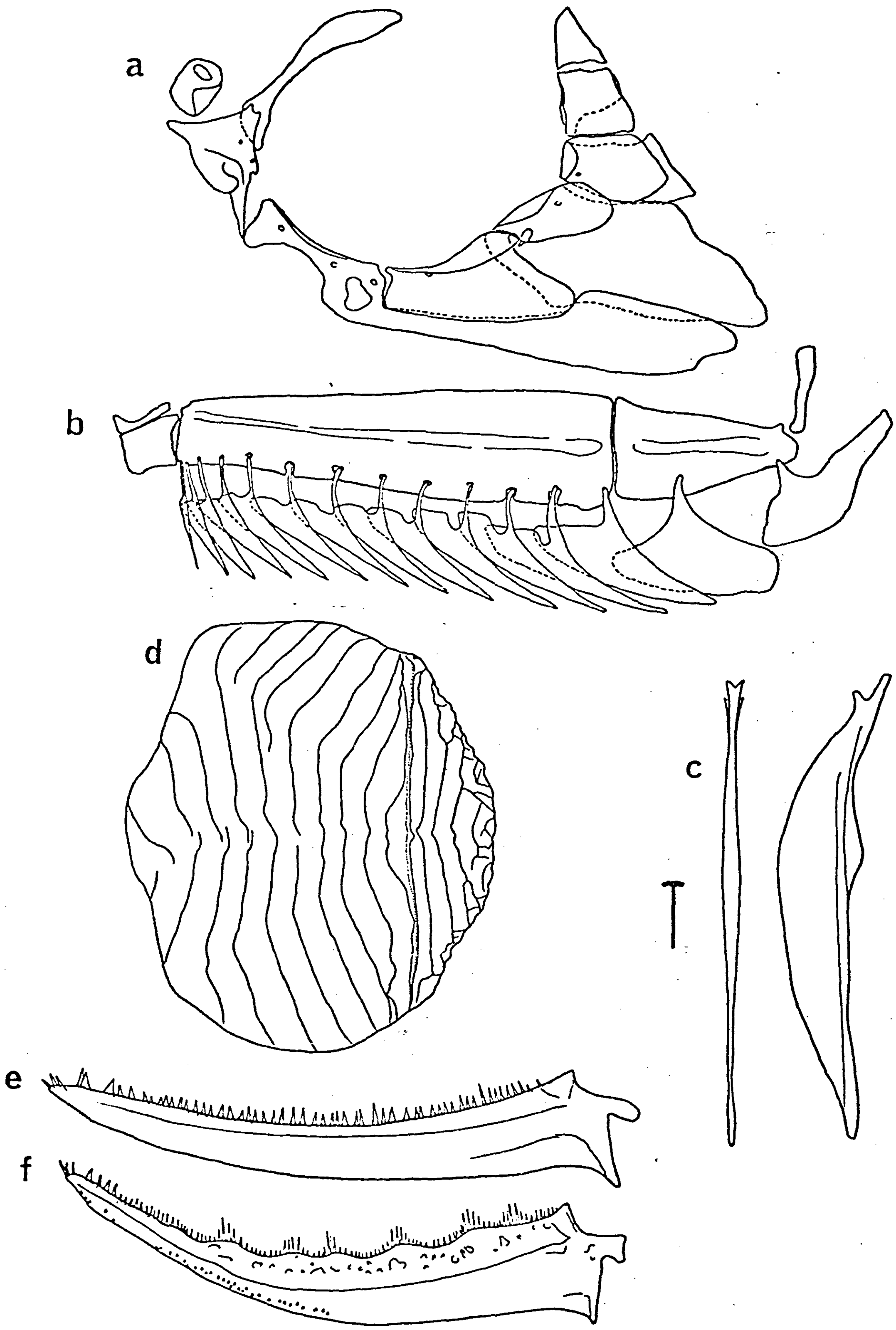


Plate 237. Thryssa (Scutengraulis) vitrirostris:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, f, gillrakers (a, b, c, d, f from BMNH. 1970.10.22.76-87, 112.0 mm S.L. for a, b, c, f and 115.0 mm S.L. for d; e from BMNH. 1970.10.22.52-63, 62.0 mm S.L.).

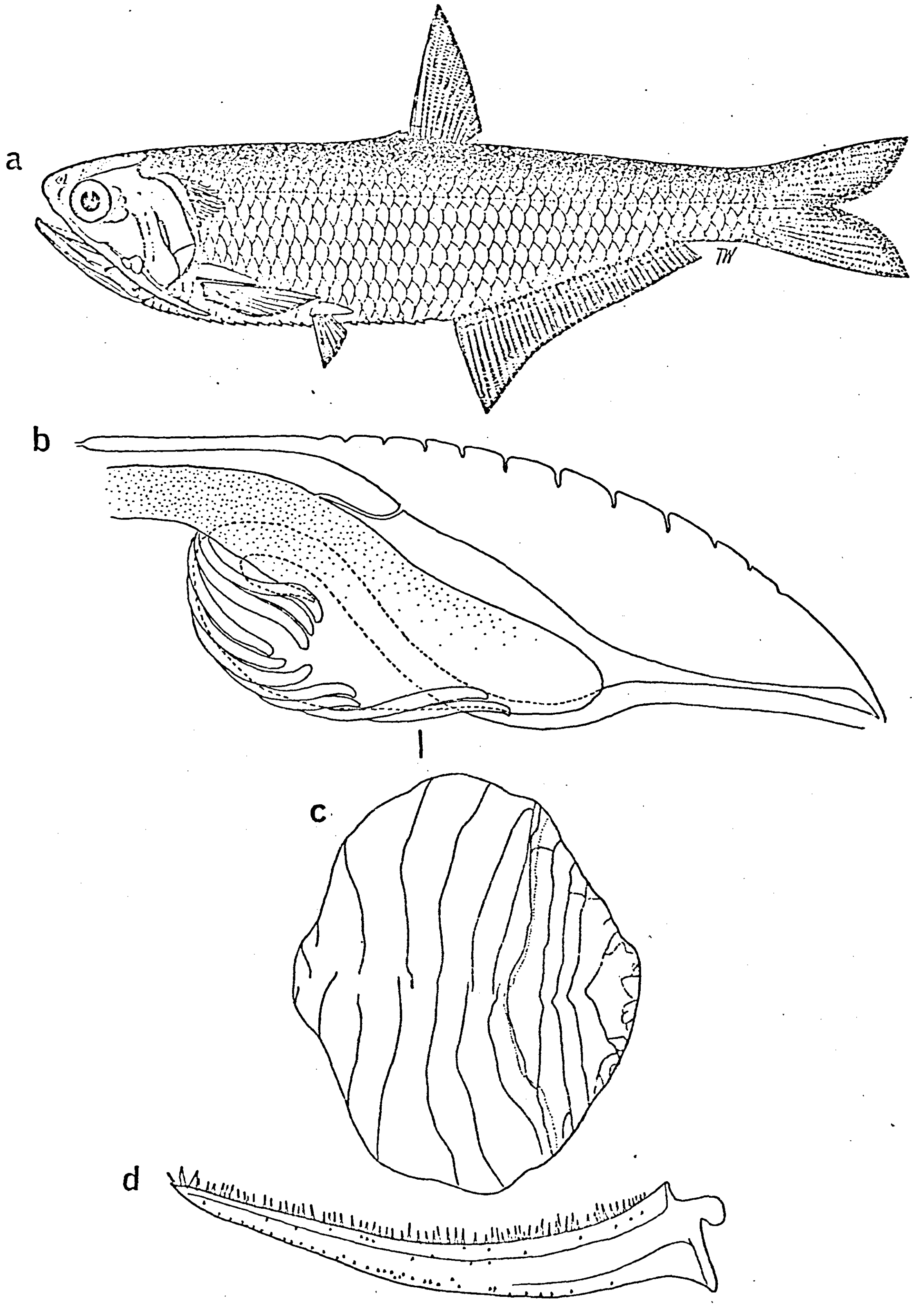


Plate 238. Thryssa (Scutengraulis) adelae:- a, adult; b, gas bladder and digestive tract; c, scale; d, gillraker (a, c from BMNH. 1860.7.20.34, 110.0 mm S.L.; b, d from BMNH. 1851.12.27.199, 88.0 mm S.L.).

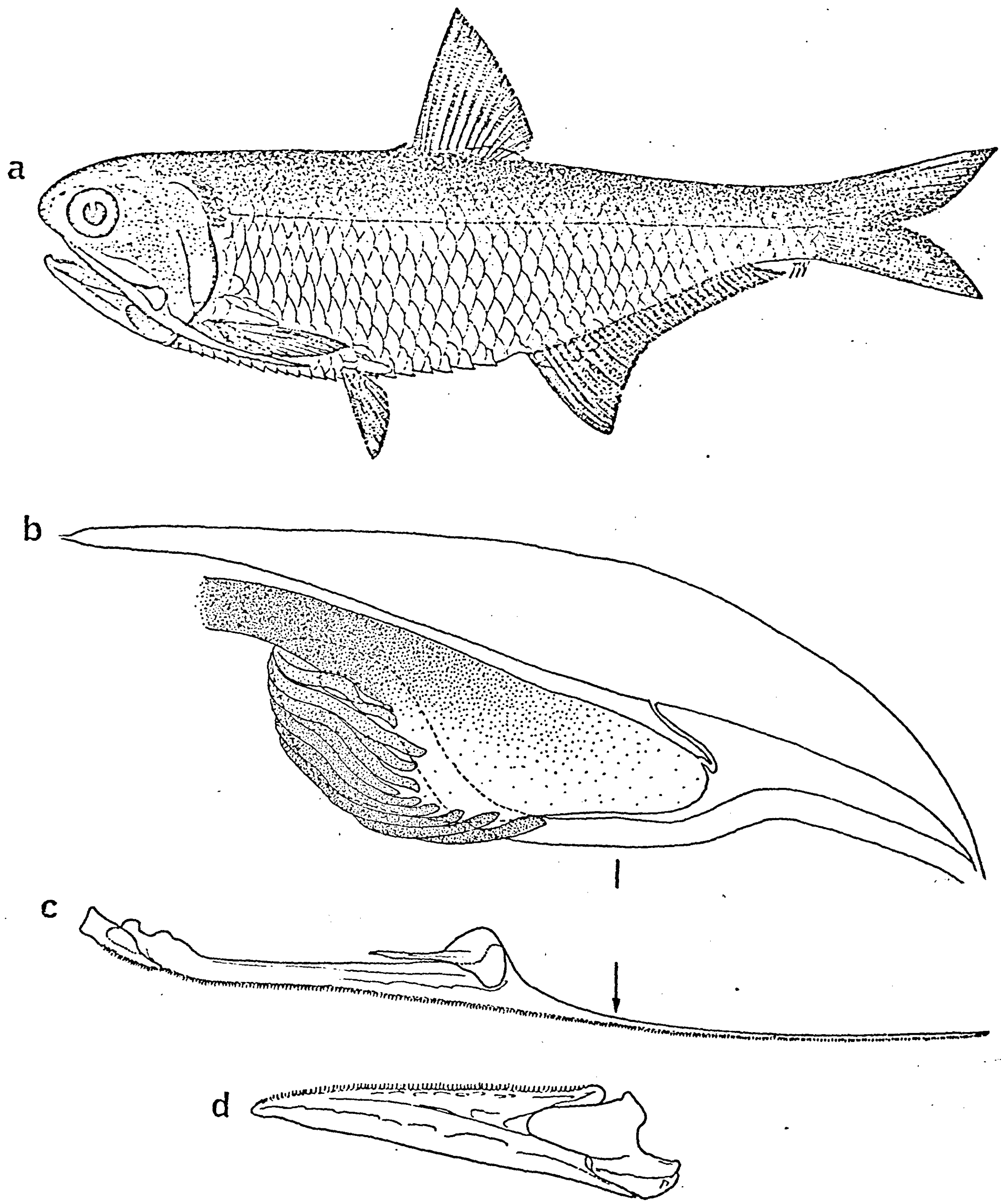


Plate 239. Thryssa (Scutengraulis) dussumieri:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from BMNH. 1979.8.15.29-30, 93.9 mm S.L.; others from BMNH. 1967.11.20.163-304, 88.0 mm S.L.).

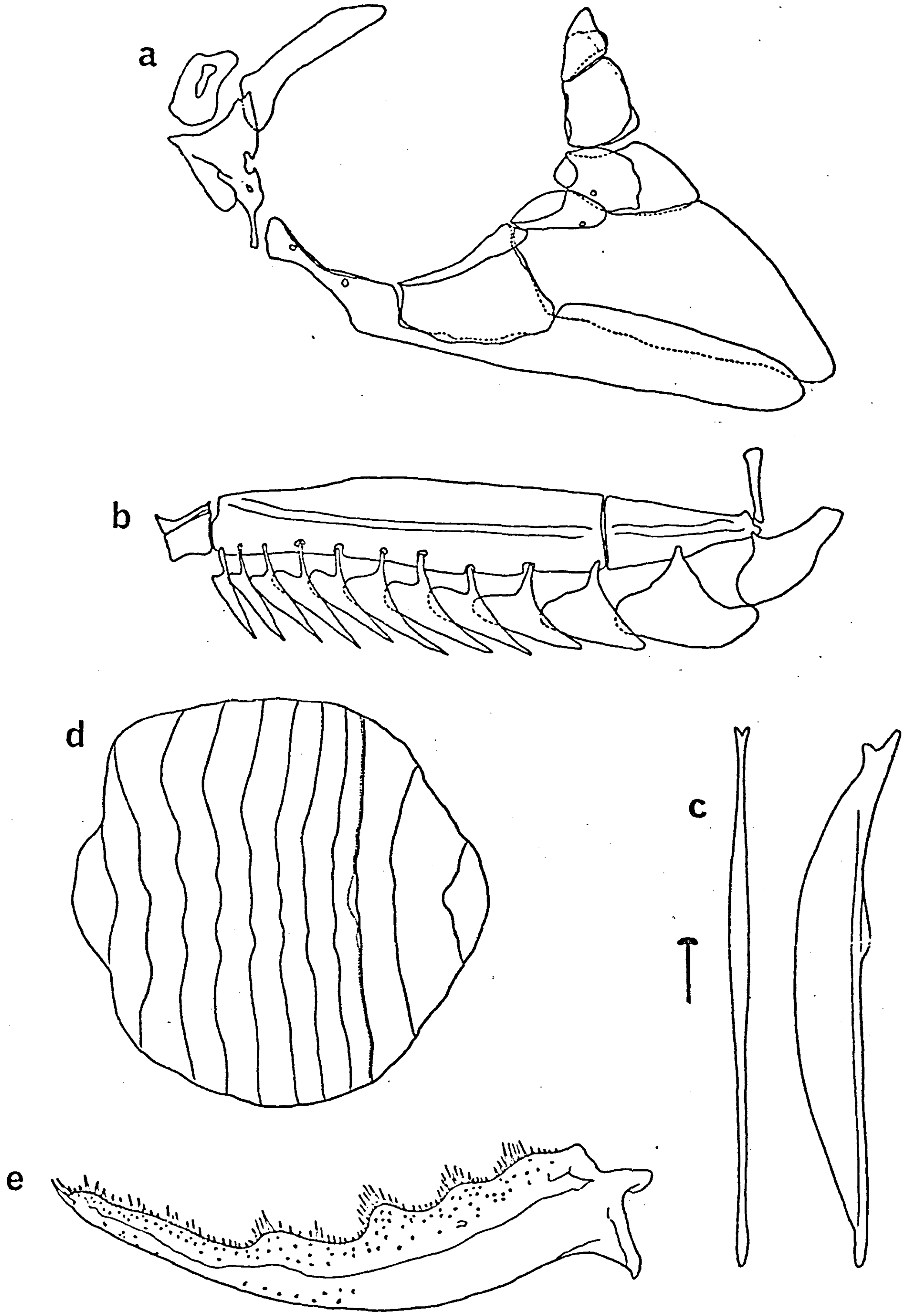


Plate 240. Thryssa (Scutengraulis) dussumieri:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1967. 11.20.163-304, 88.0 mm S.L.; d from BMNH. 1977.9.8.96-128, 85.0 mm S.L.).

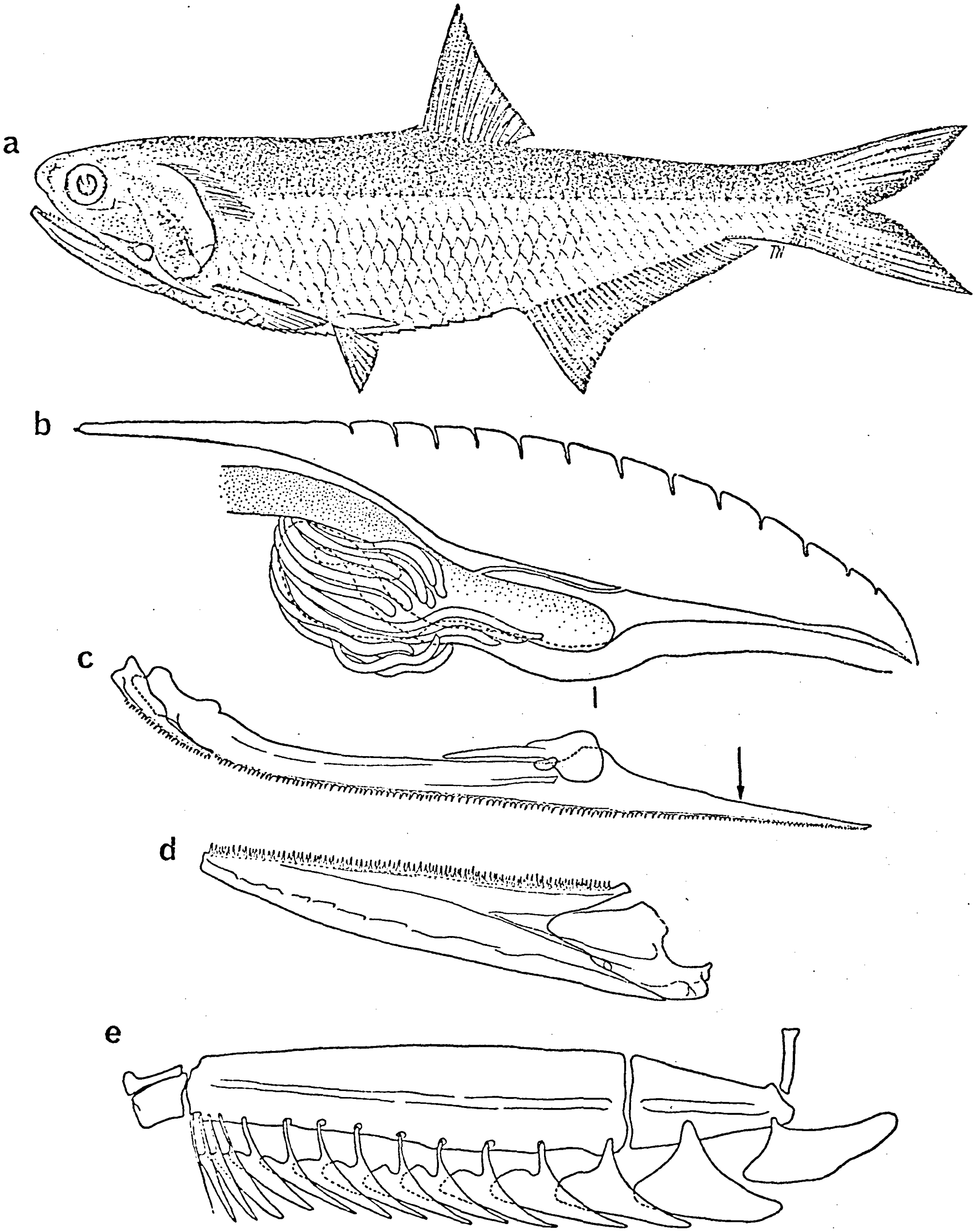


Plate 241. Thryssa (Scutengraulis) mystax:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum; e, hyoid arch (all from BMNH. 1966.2.28.34-37, 141.0 mm S.L. for a, 124.0 mm S.L. for others).

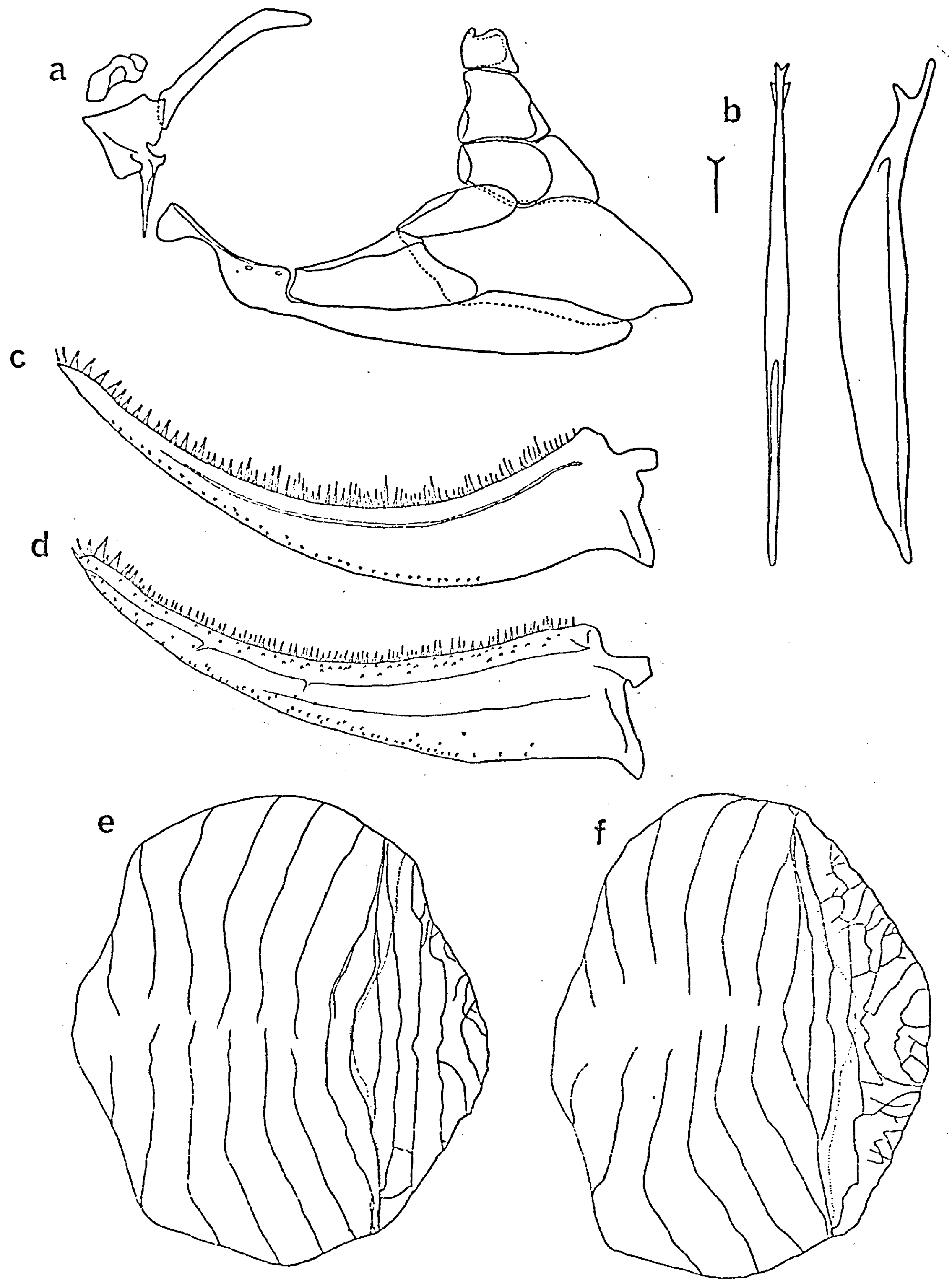


Plate 242. Thryssa (Scutengraulis) mystax:- a, circumorbital bones; b, urohyal· c, d, gillrakers; e, f, scales (a, b, d, f from BMNH. 1966.2.28.34-37, 124.0 mm S.L.; c from BMNH. 1889.2.1.1755, 150.0 mm S.L.; e from BMNH. 1977.9.8. 134, 145.0 mm S.L.).

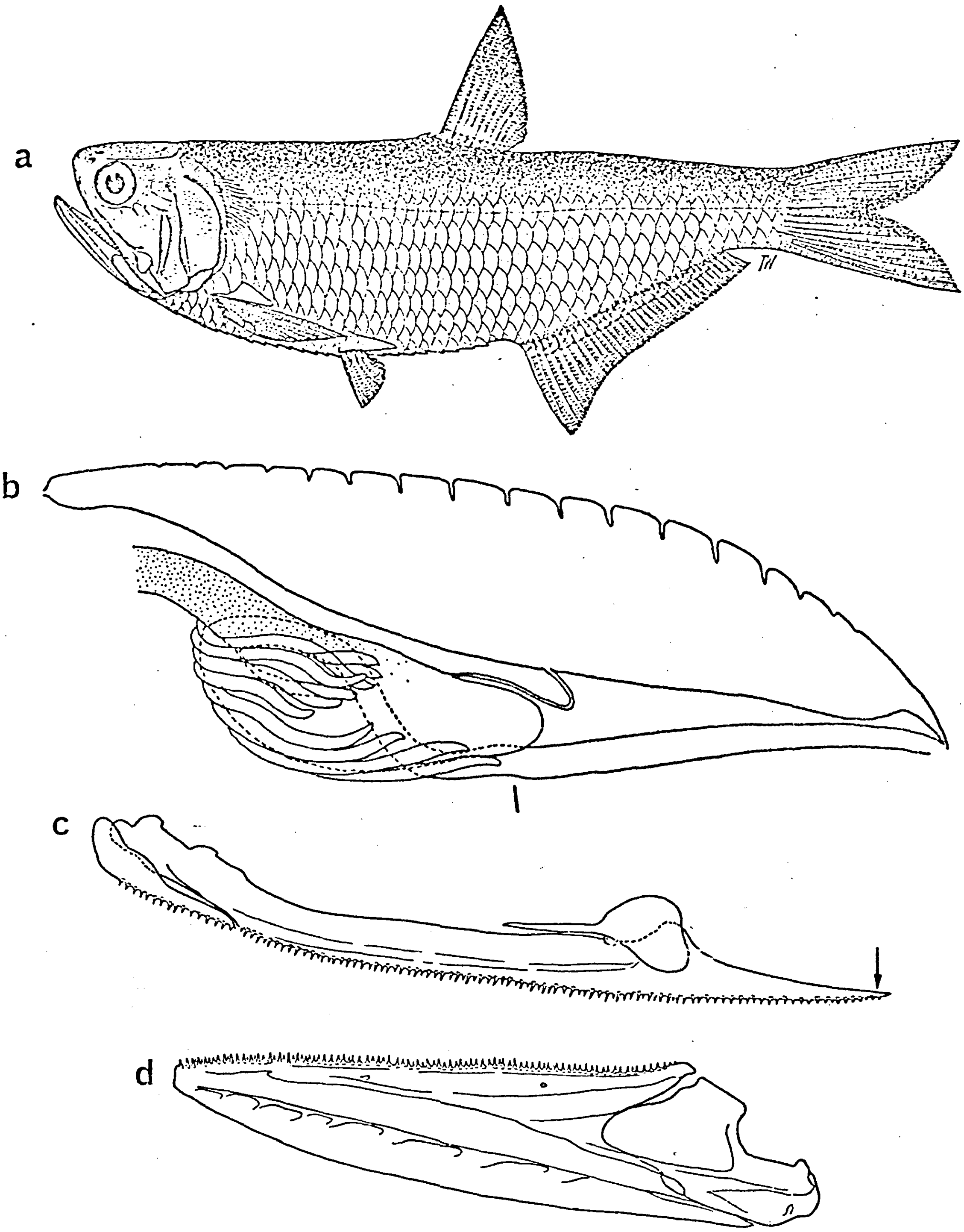


Plate 243. <u>Thryssa</u> (<u>Scutengraulis</u>) <u>polybranchialis</u>:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (all from BMNH. 1967.3.4.57, 121.0 mm S.L., paratype).

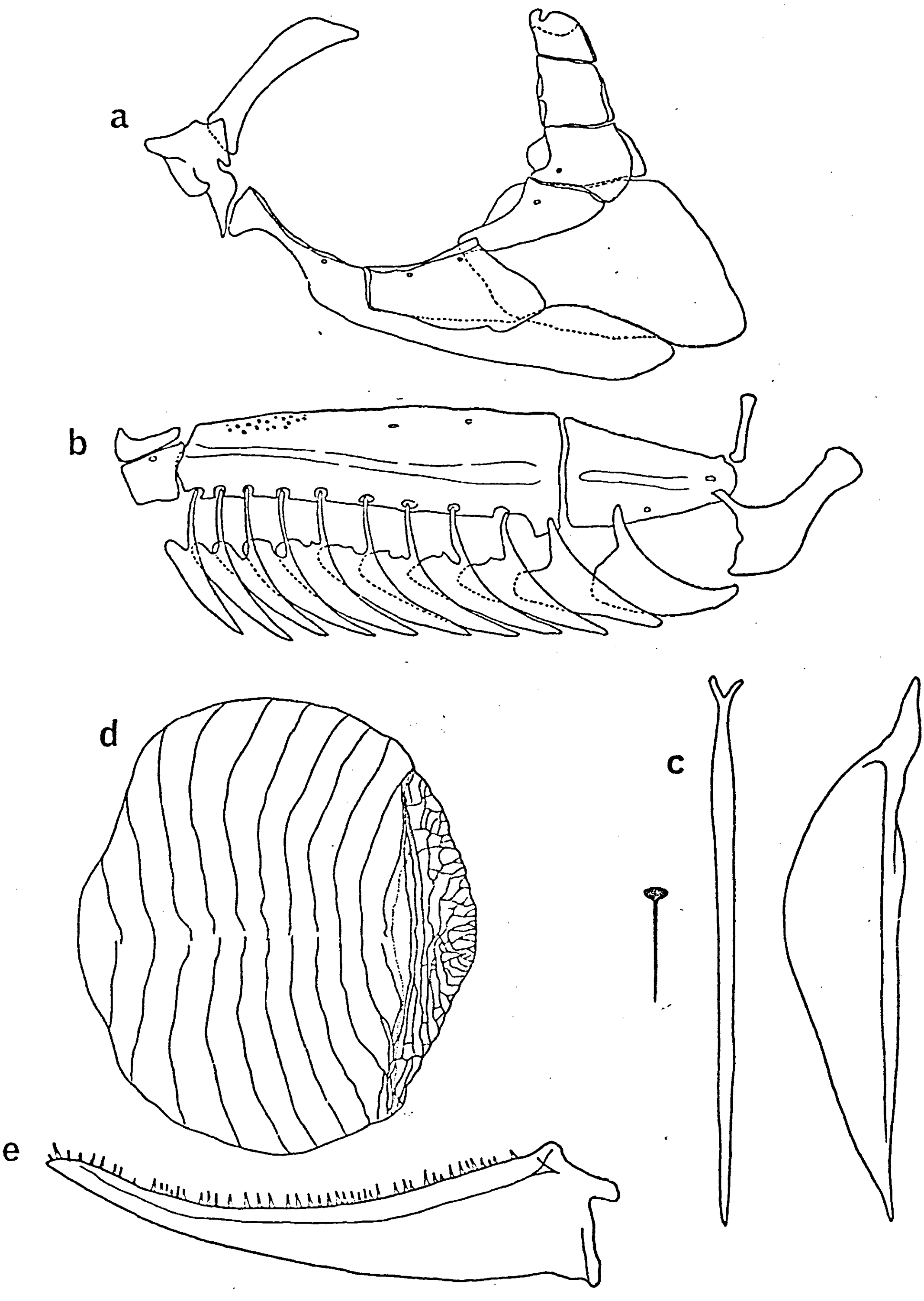


Plate 244. Thryssa (Scutengraulis) polybranchialis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1967.3.4.57, 121.0 mm S.L., paratype).

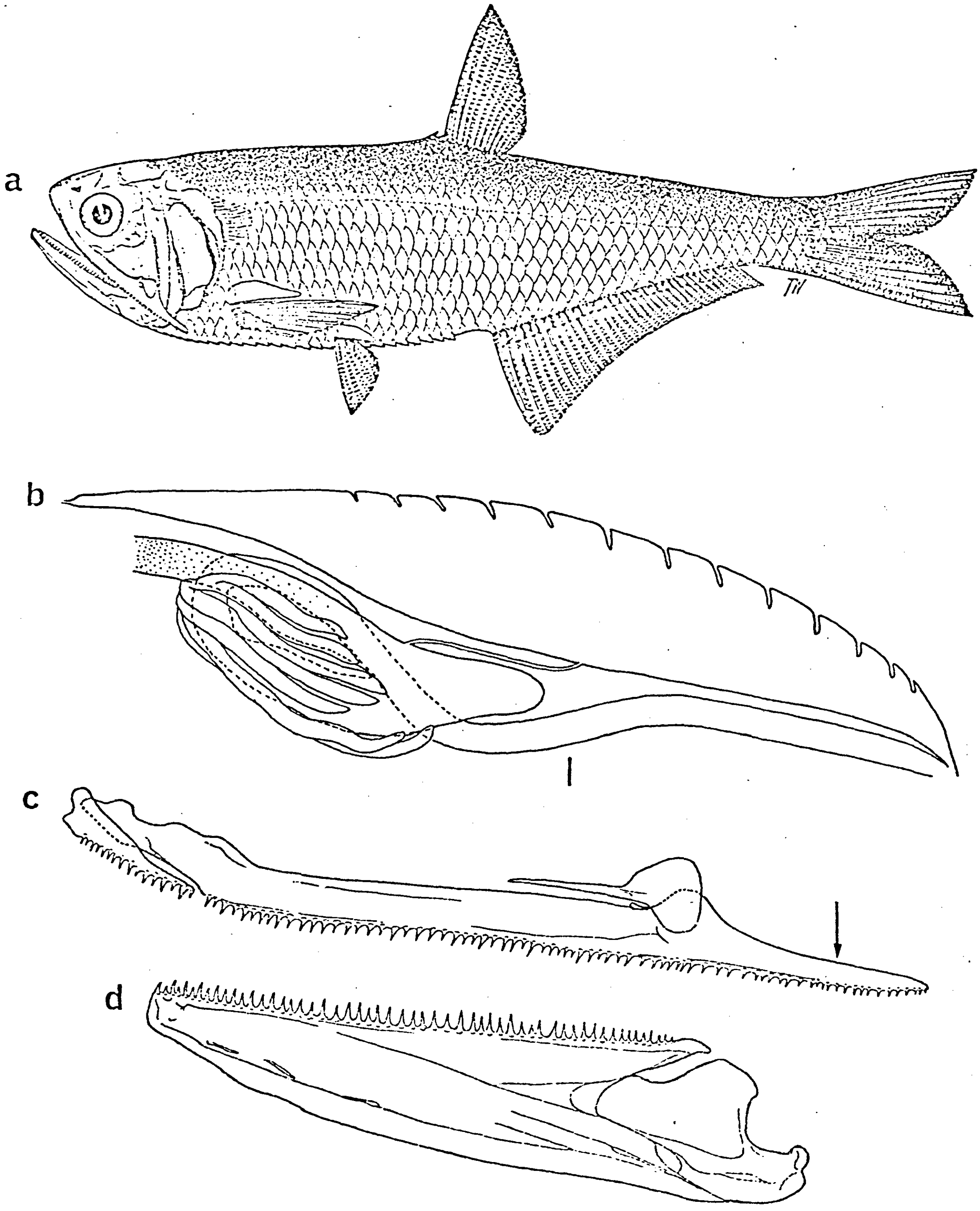


Plate 245. Thryssa (Scutengraulis) gautamiensis:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from BMNH. 1969.2.10.21-30, 85.0 mm S.L.; others from BMNH. 1973.6.4.73-84, 139.0 mm S.L.).

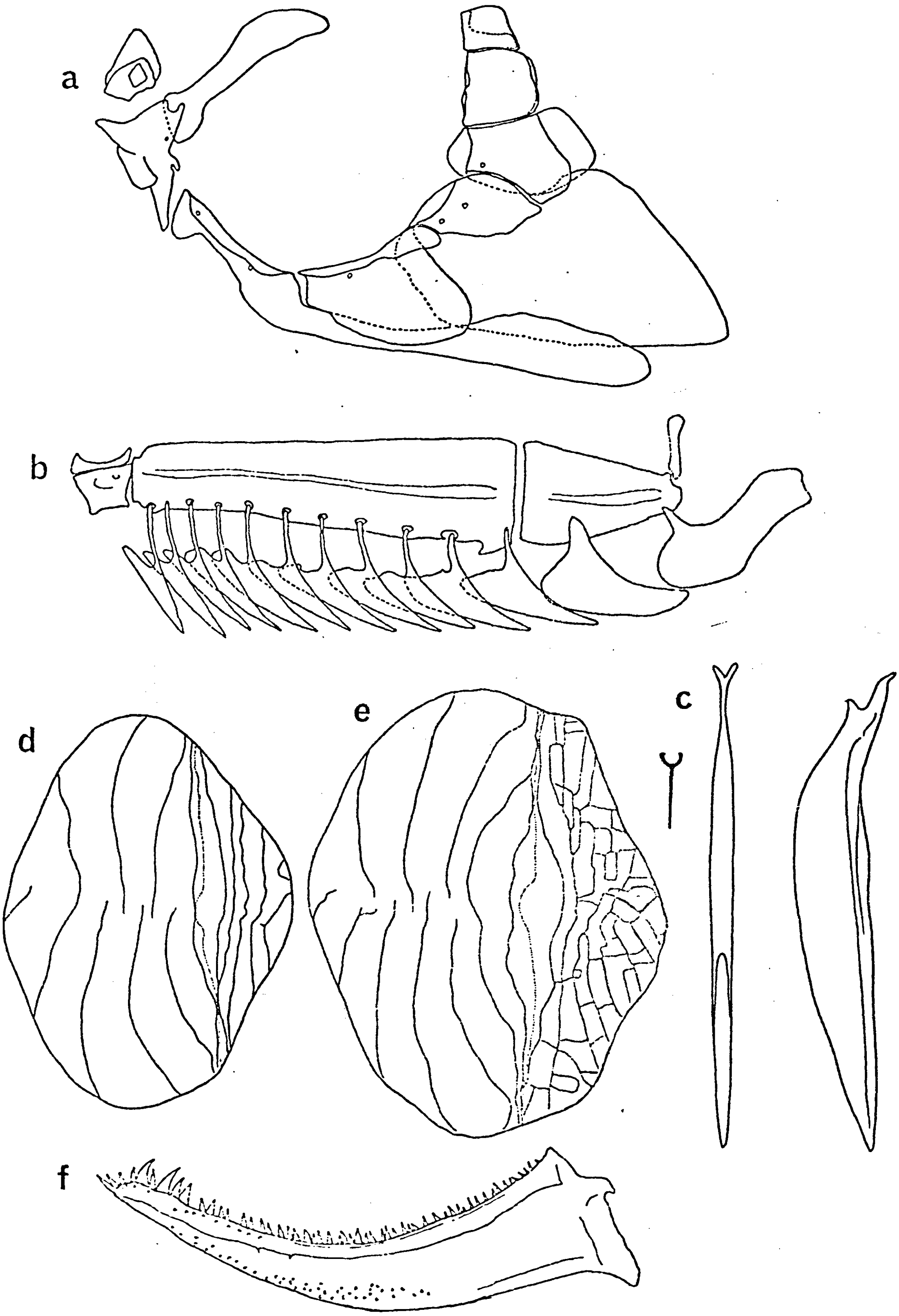


Plate 246. Thryssa (Scutengraulis) gautamiensis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, scales; f, gillraker (a, b, c, e, f from BMNH. 1973.6.4.73-84, 139.0 mm S.L. for a, b, c, f, and 180.0 mm S.L. for e; d from ZSI.F.4600/2, 107.0 mm S.L., holotype).

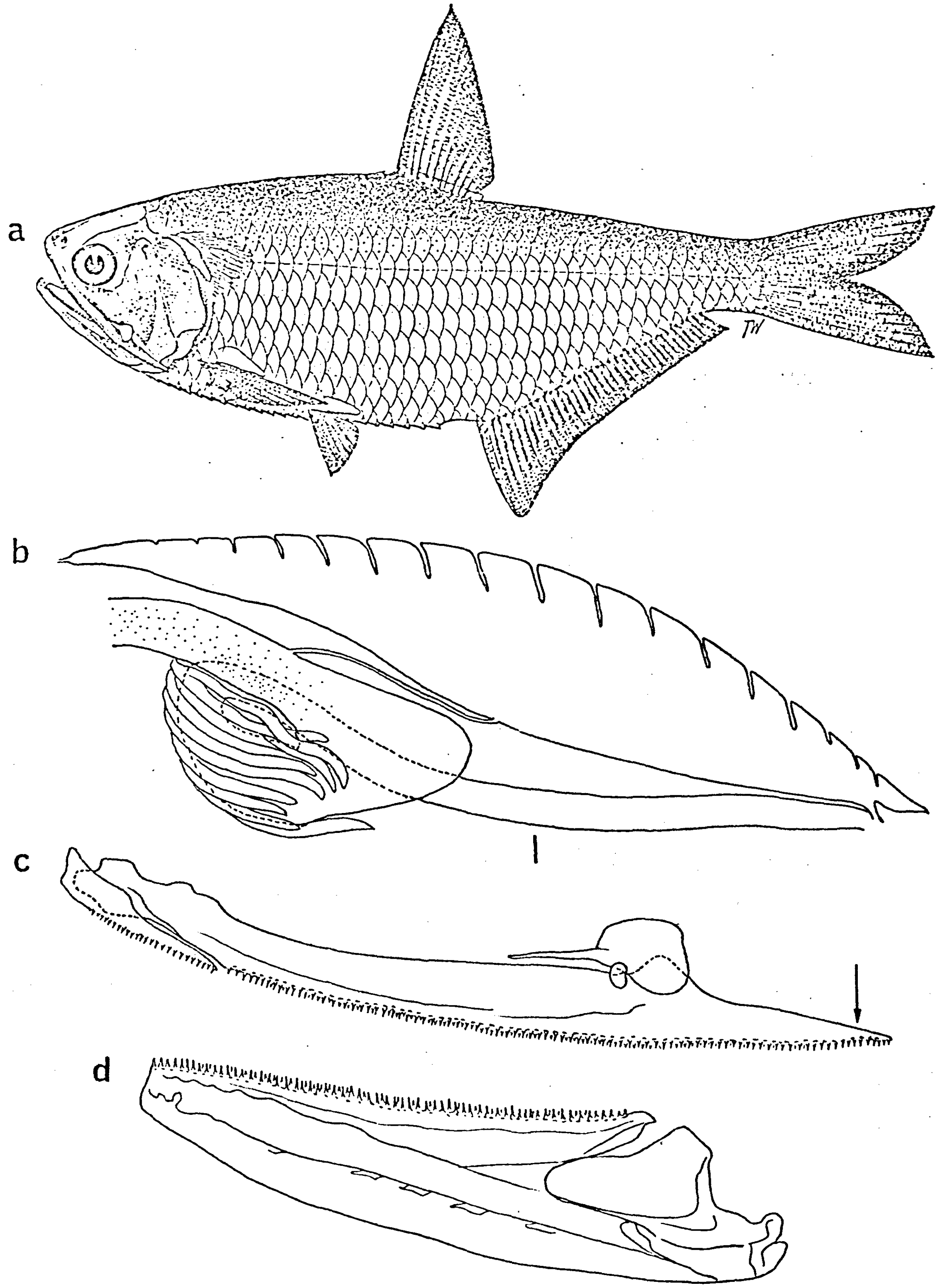


Plate 247. Thryssa (Scutengraulis) malabarica:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from BMNH. 1967.3.4.59, 122.0 mm S.L.; others from BMNH. 1970.10.21.48-51, 148.0 mm S.L.).

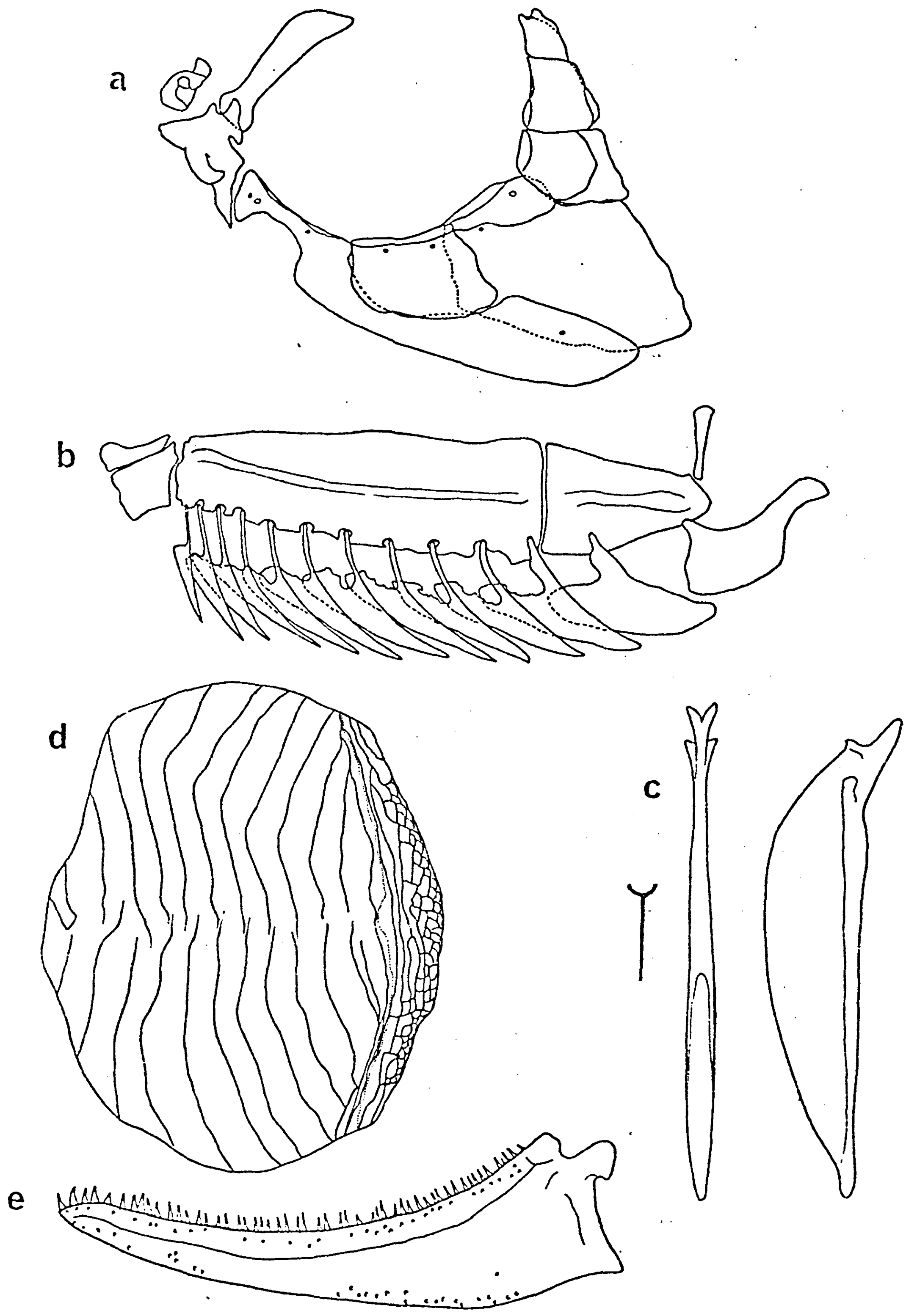


Plate 248. Thryssa (Scutengraulis) malabarica:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1970.10.21. 48-51, 148.0 mm S.L. for a, b, c, e and 156.0 mm S.L. for d).

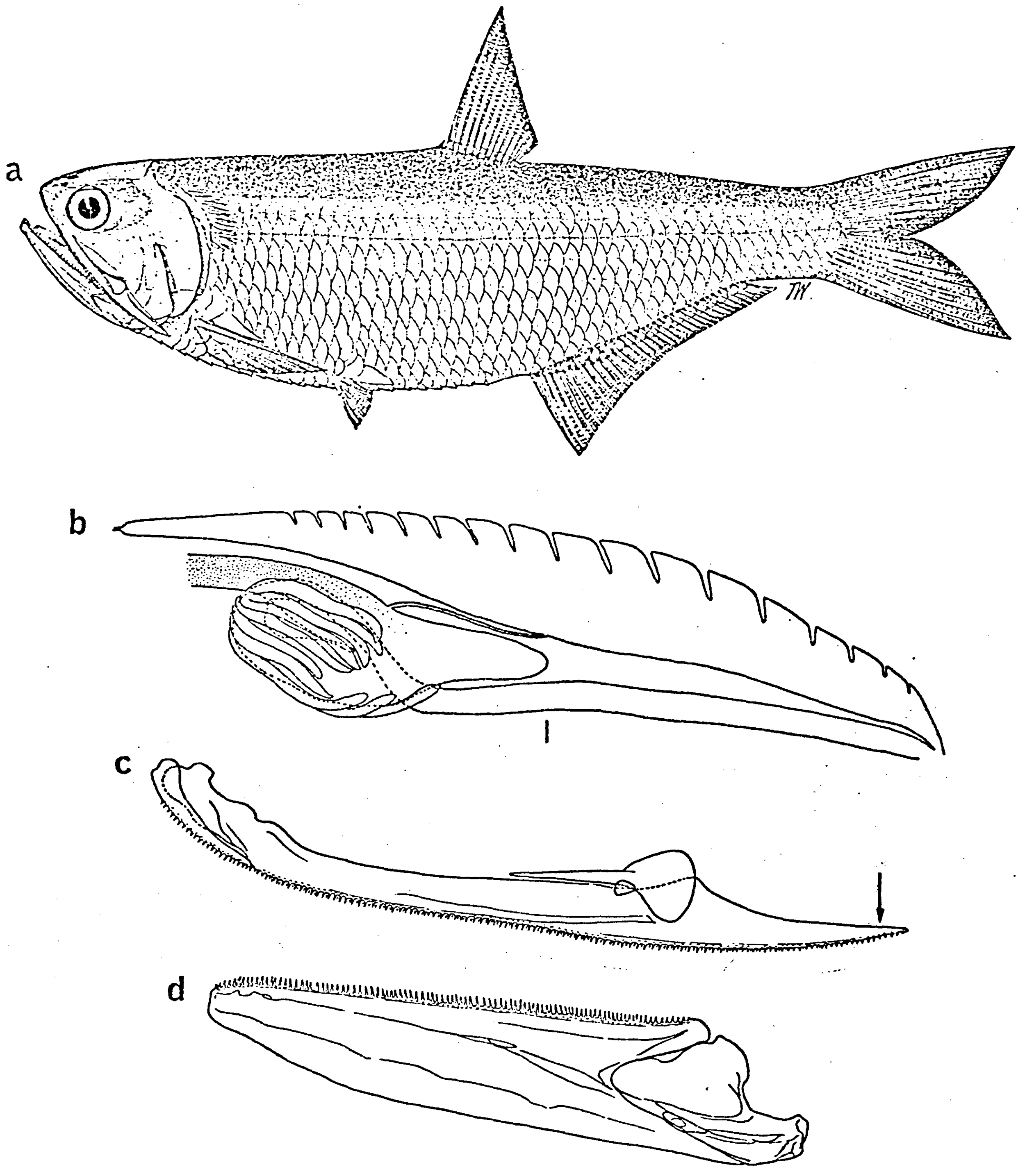


Plate 249. *Thryssa* (*Scutengraulis*) *hamiltonii*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from BMNH. 1867.11.28.51, 142.0 mm S.L., paralectotype of *Engraulis grayi*; others from BMNH. 1965.9.7.16-20, 130.0 mm S.L.).

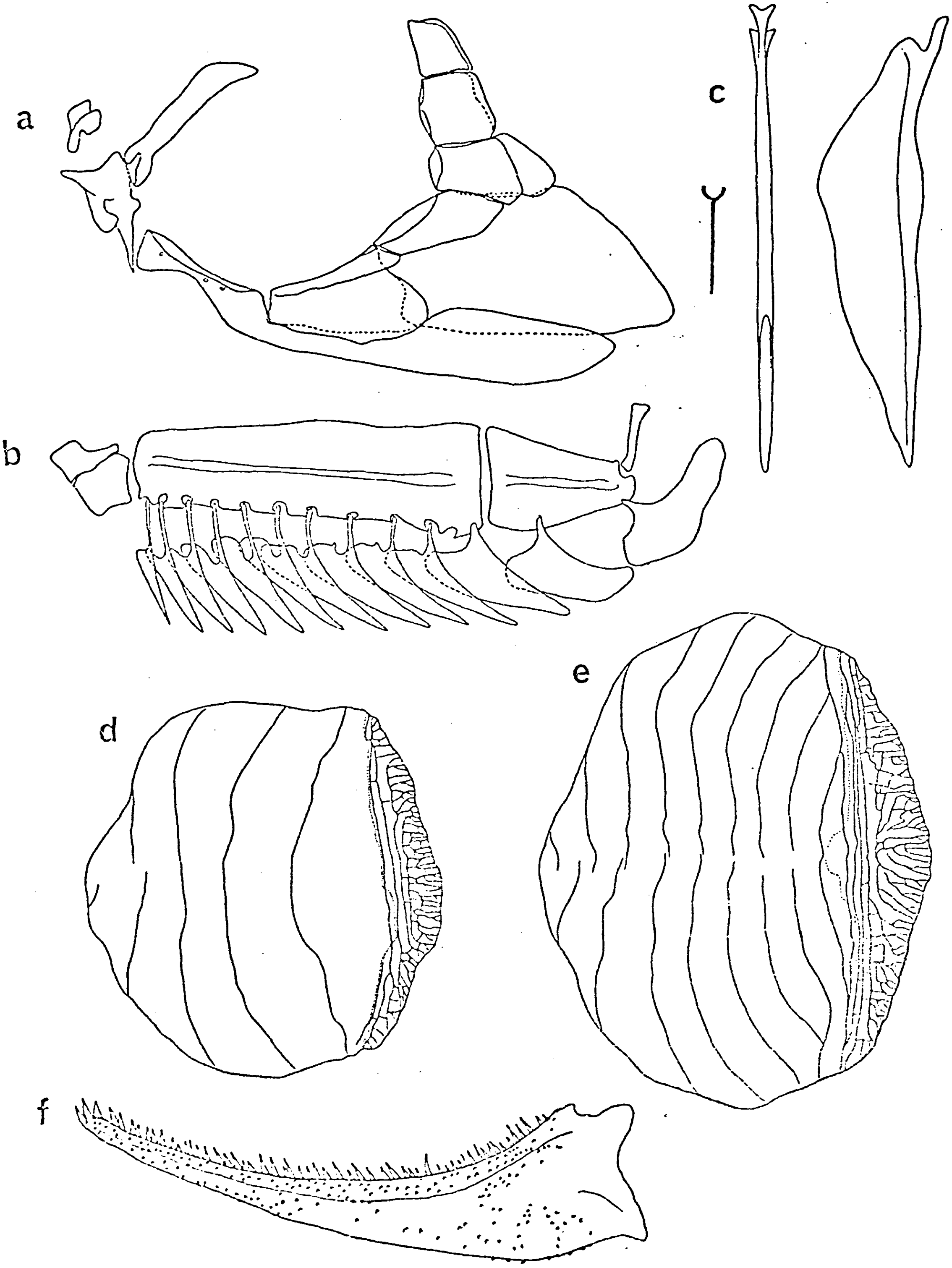


Plate 250. Thryssa (Scutengraulis) hamiltonii:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, e, scales; f, gillraker (a, b, c, f from BMNH. 1965.9.7.16-20, 130.0 mm S.L.; d, e from BMNH. 1966.3.8.54-65, 133.0 mm S.L. for d, 156.0 mm S.L. for e).

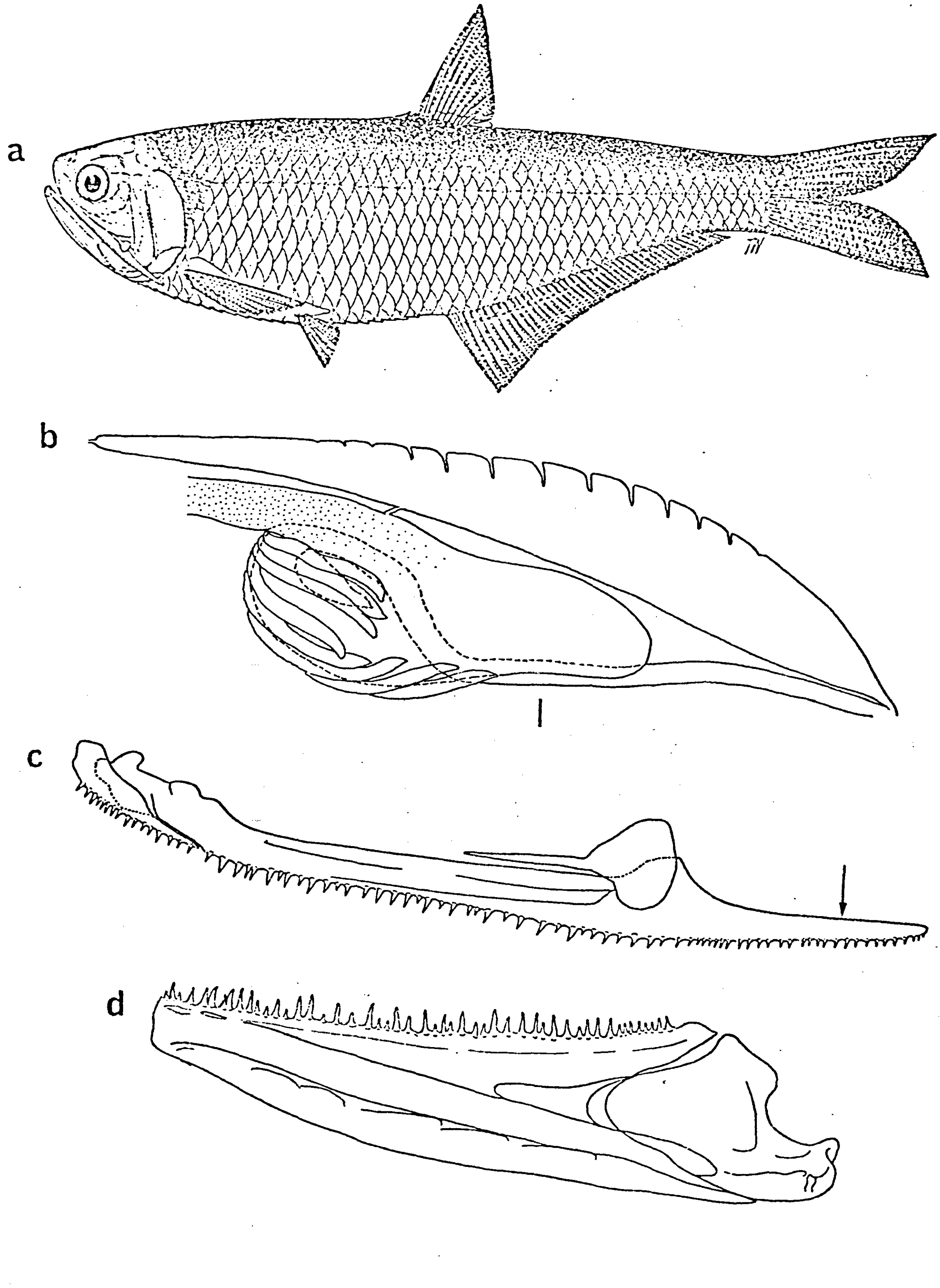


Plate 251. Thryssa (Scutengraulis) whiteheadi:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from BMNH. 1920.3.3.192, 111.5 mm S.L., holotype; others from BMNH. 1920.3.3.183-191, 115.0 mm S.L., paratype).

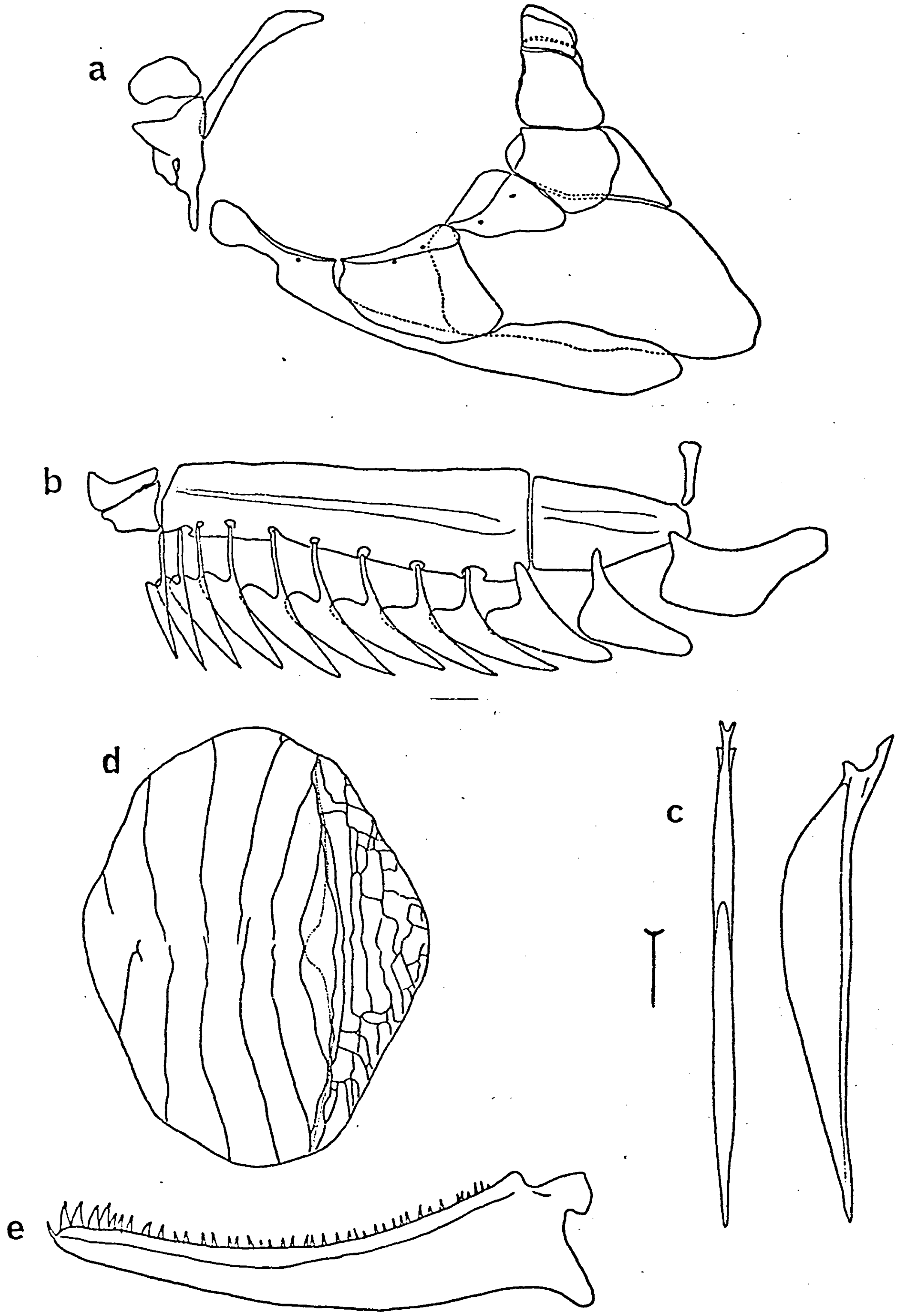


Plate 252. Thryssa (Scutengraulis) whiteheadi:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1920.3.3. 183-191, paratypes, 115.0 mm S.L. for a, b, c, e and 125.0 mm S.L. for d).

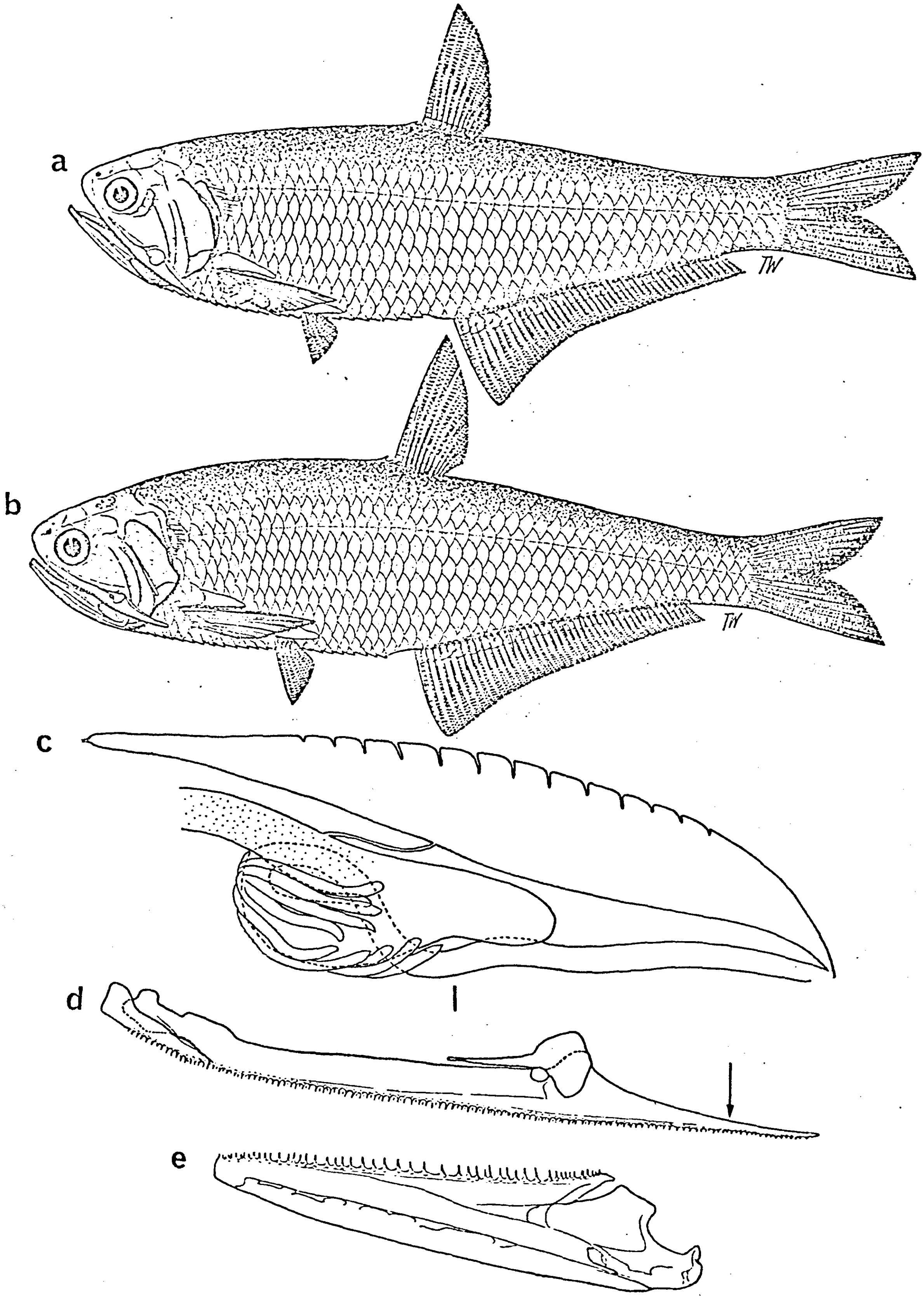


Plate 253. Thryssa (Scutengraulis) purava:- a, b, adults; c, gas bladder and digestive tract; d, e, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from BMNH. 1889.2.1.1804-1809, 89.0 mm S.L.; b, c, d, e from BMNH. 1969.2.10.1-10, 93.5 mm S.L. for b and 87.0 mm S.L. for others).

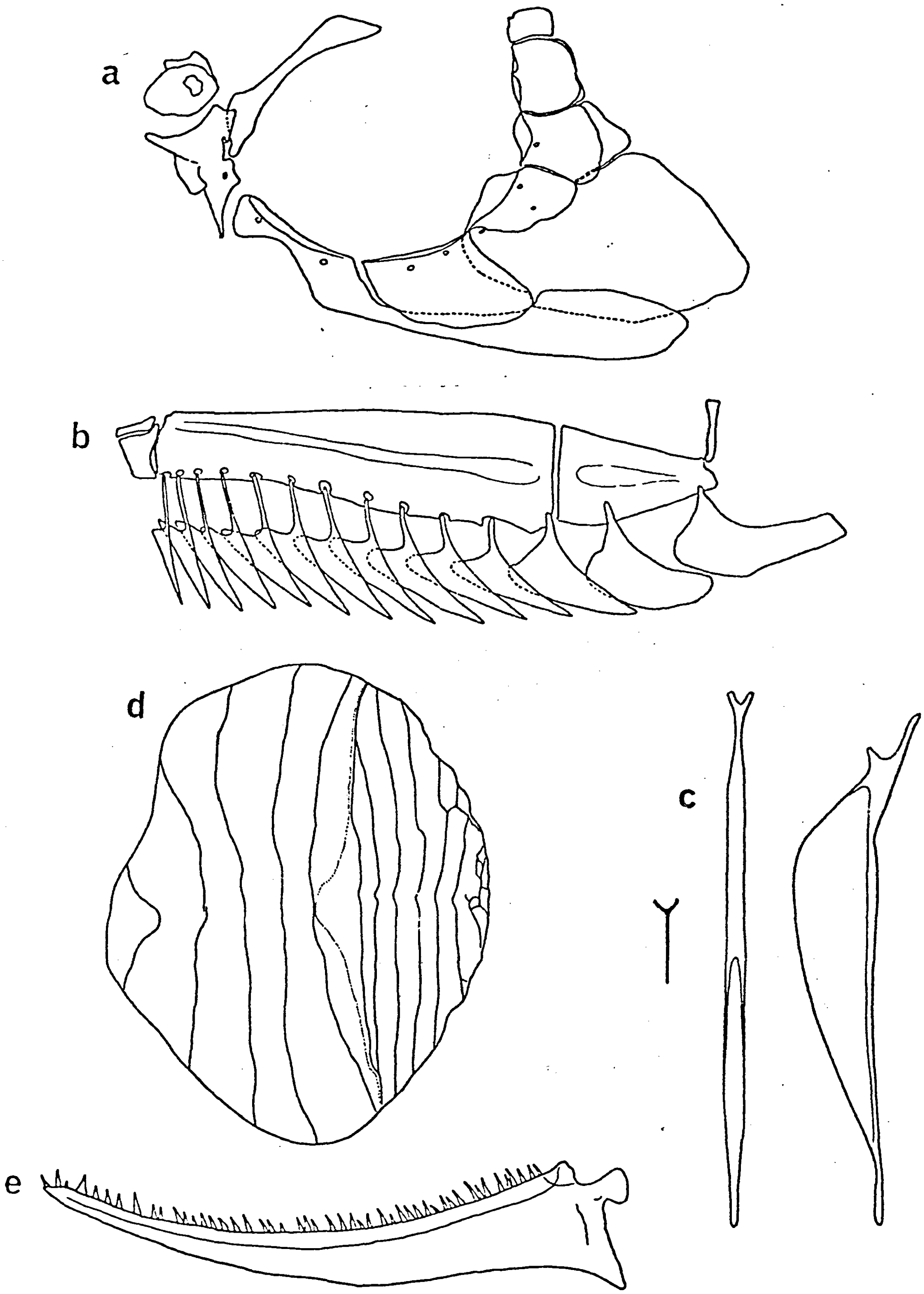


Plate 254. Thryssa (Scutengraulis) purava:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c from BMNH. 1969.2.10. 1-10, 87.0 mm S.L.; d, e from BMNH. 1889.2.1.1804-1809, 115.0 mm S.L. for d and 105.0 mm S.L. for e).

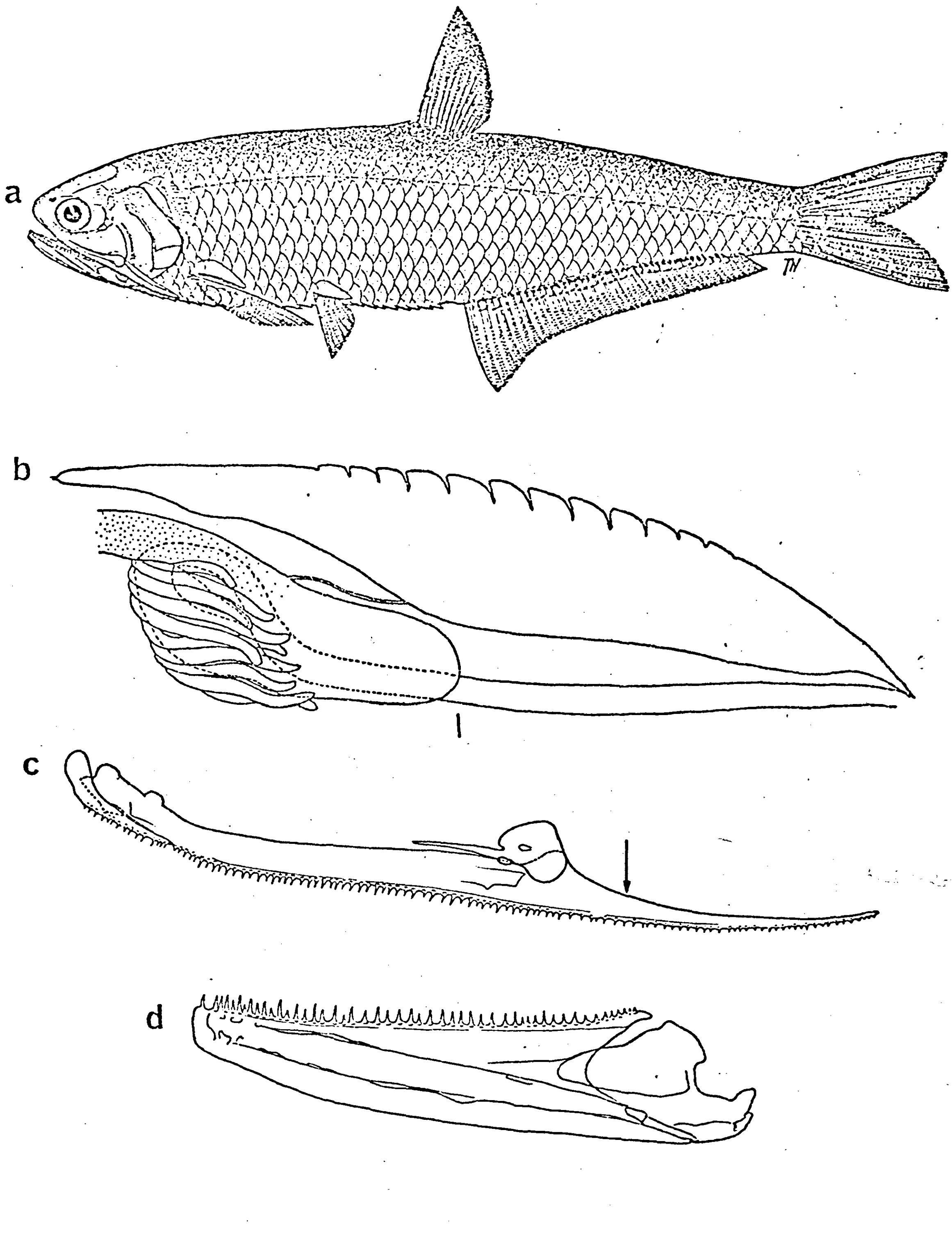


Plate 255. Thryssa (Scutengraulis) stenosoma:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from BMNH. 1965.7.12.231, holotype, 128.0 mm S.L.; others from BMNH. 1965.7.12.226-230, 148.0 mm S.L., paratype).

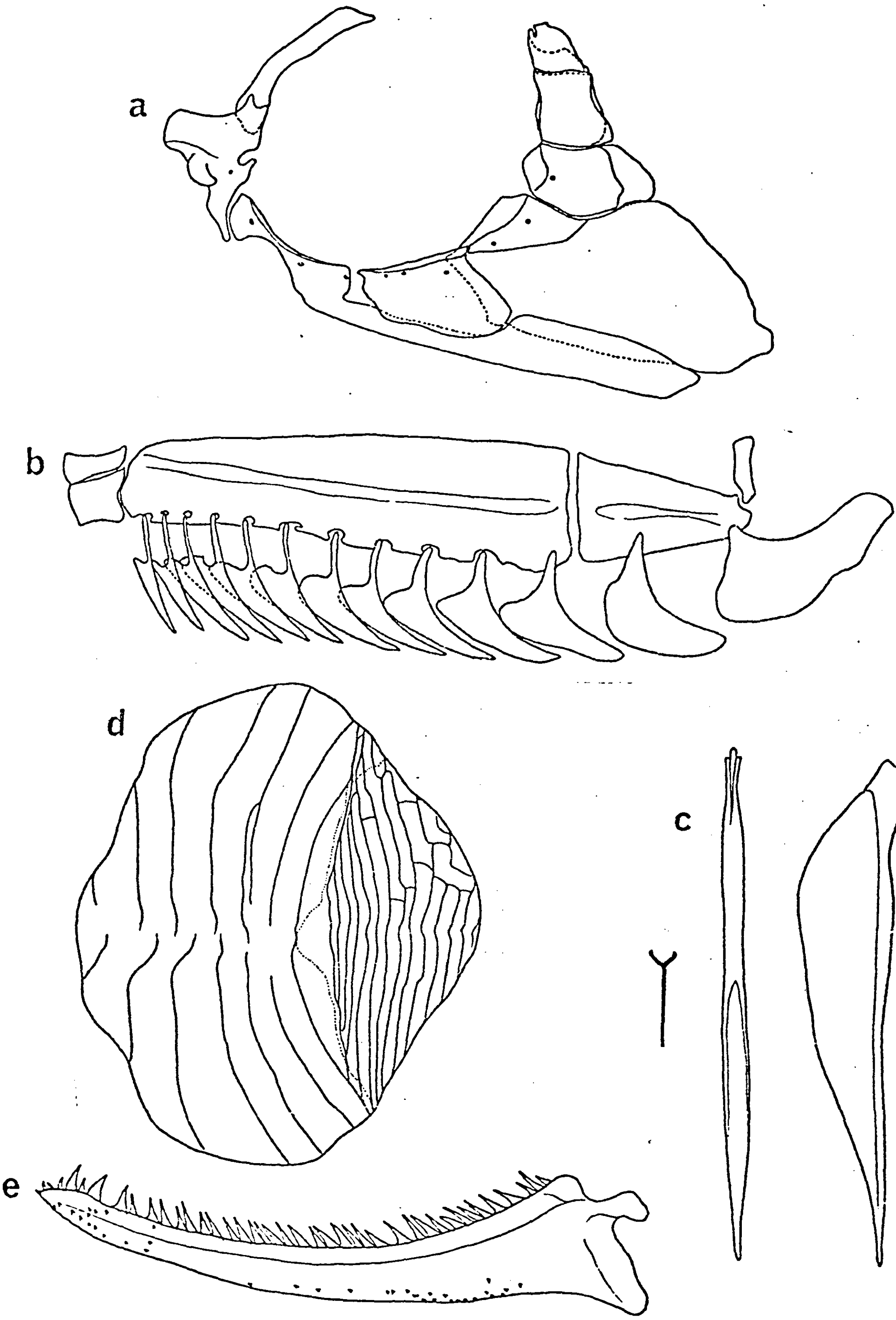


Plate 256. Thryssa (Scutengraulis) stenosoma:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1965.7.12. 226-230, 148.0 mm S.L., paratype).

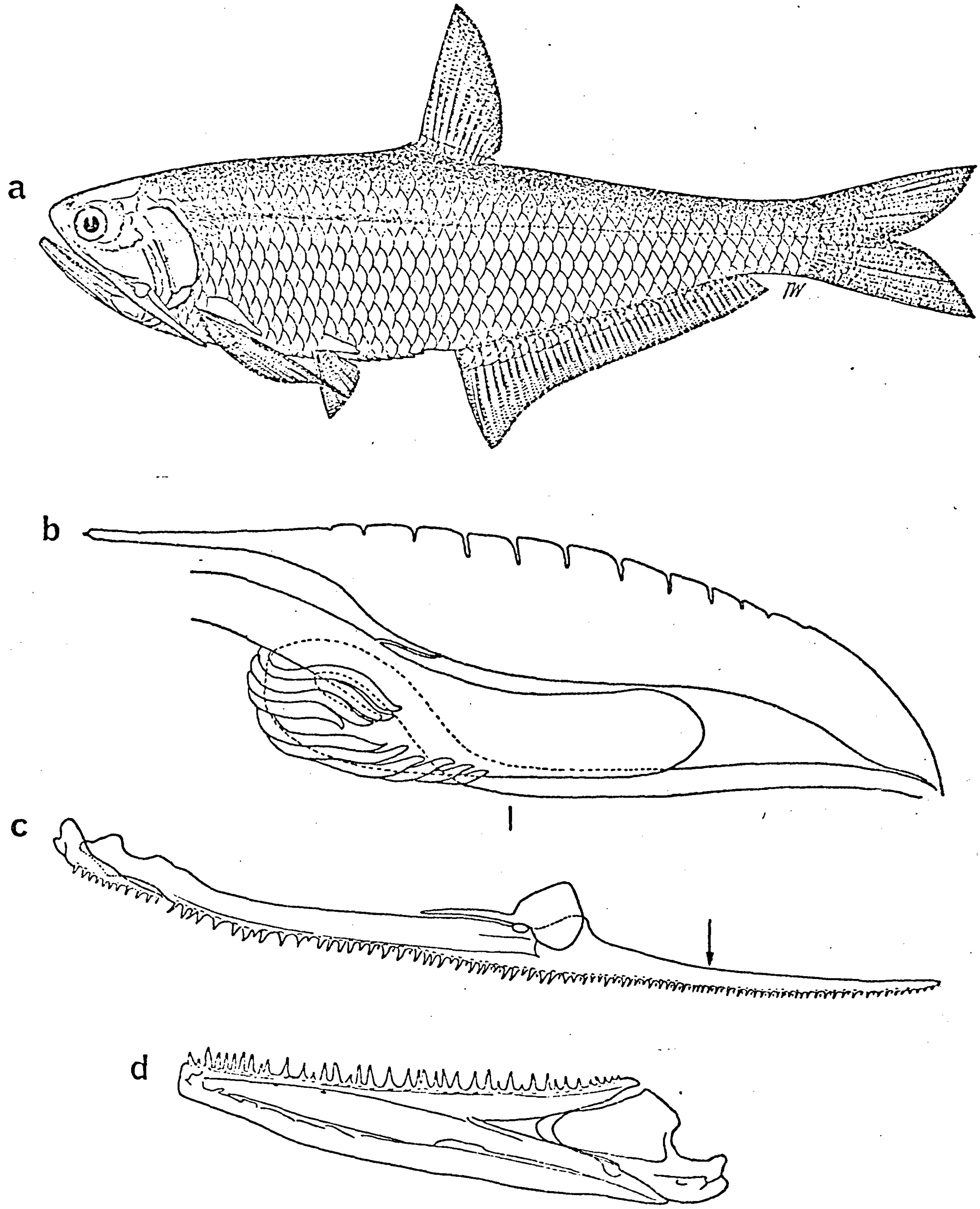


Plate 257. *Thryssa* (*Scutengraulis*) *dayi*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from BMNH. 1965.7.12.249-250, 128.0 mm S.L., paratype; b, c, d from BMNH. 1860.3.19.820, 145.0 mm S.L., paratype).

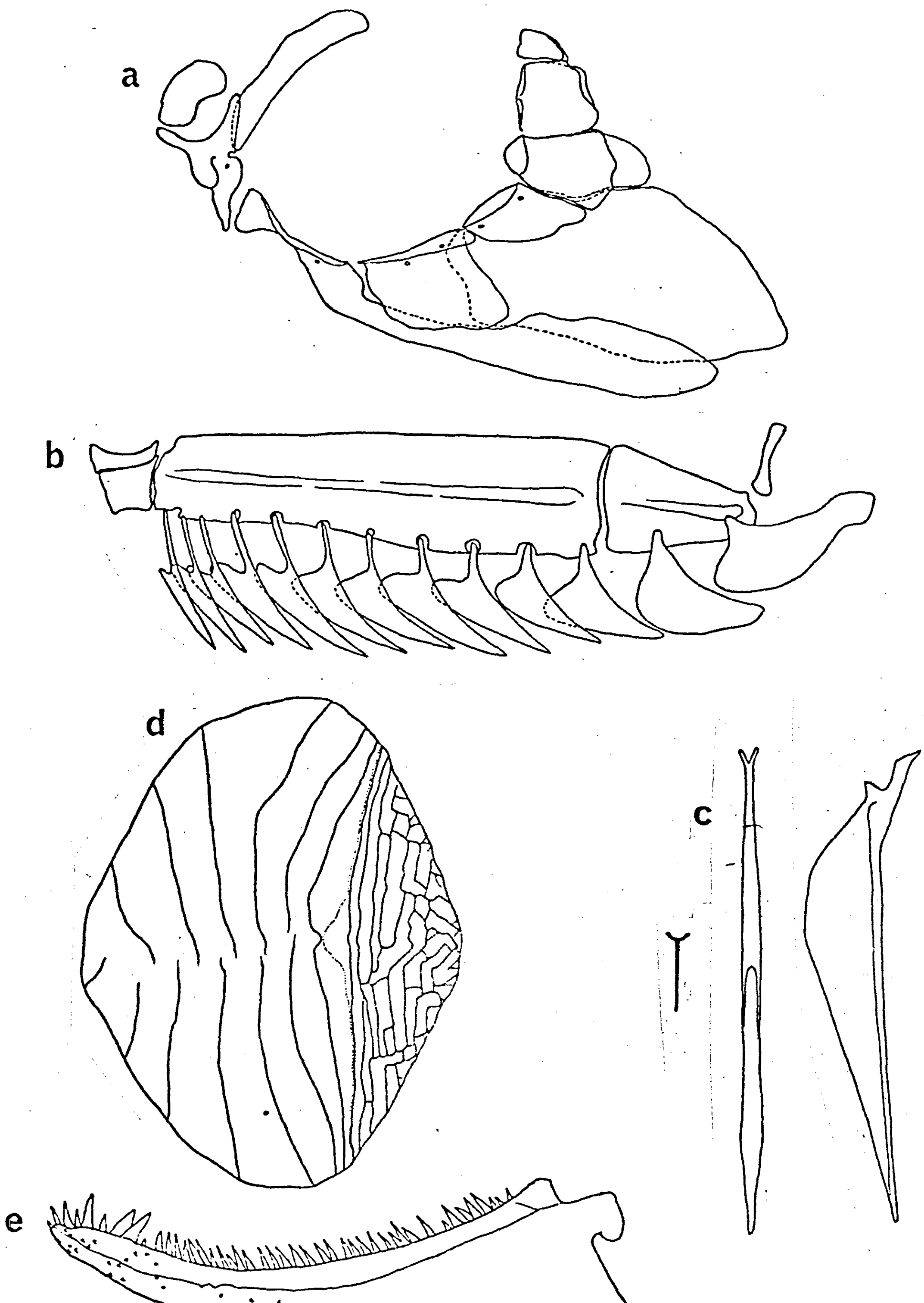


Plate 258. Thryssa (Scutengraulis) dayi:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, d from BMNH. 1965.7.12.251-255, paratypes, 152.0 mm S.L. for a and 146.0 mm S.L. for d; others from BMNH. 1860.3.9.820, 145.0 mm S.L., paratype).

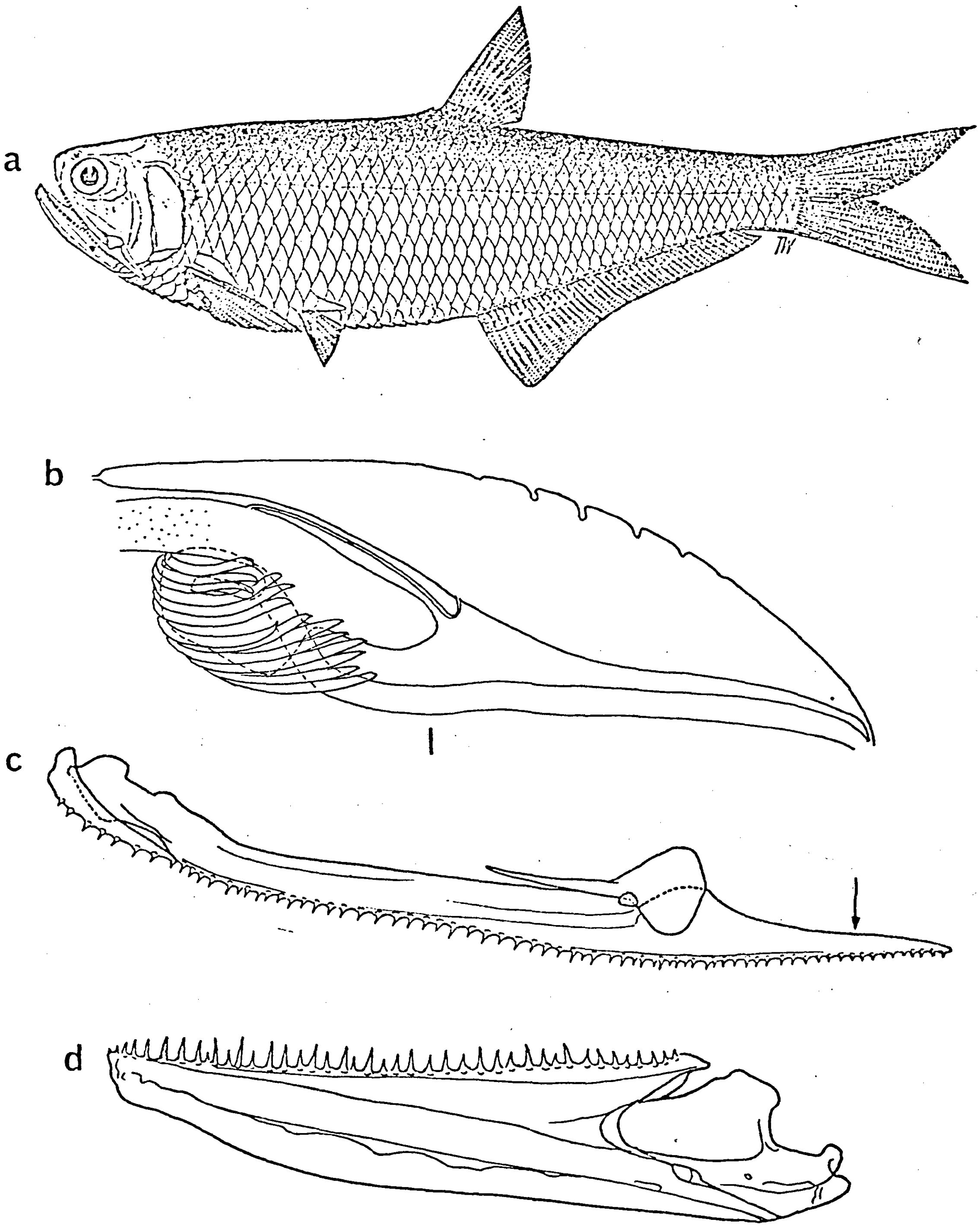


Plate 259. *Thryssa* (*Scutengraulis*) *spinidens*:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from MCZ. 31541, 162.0 mm S.L., paratype; others from BMNH. 1891.11.30.384-388, 122.0 mm S.L.).

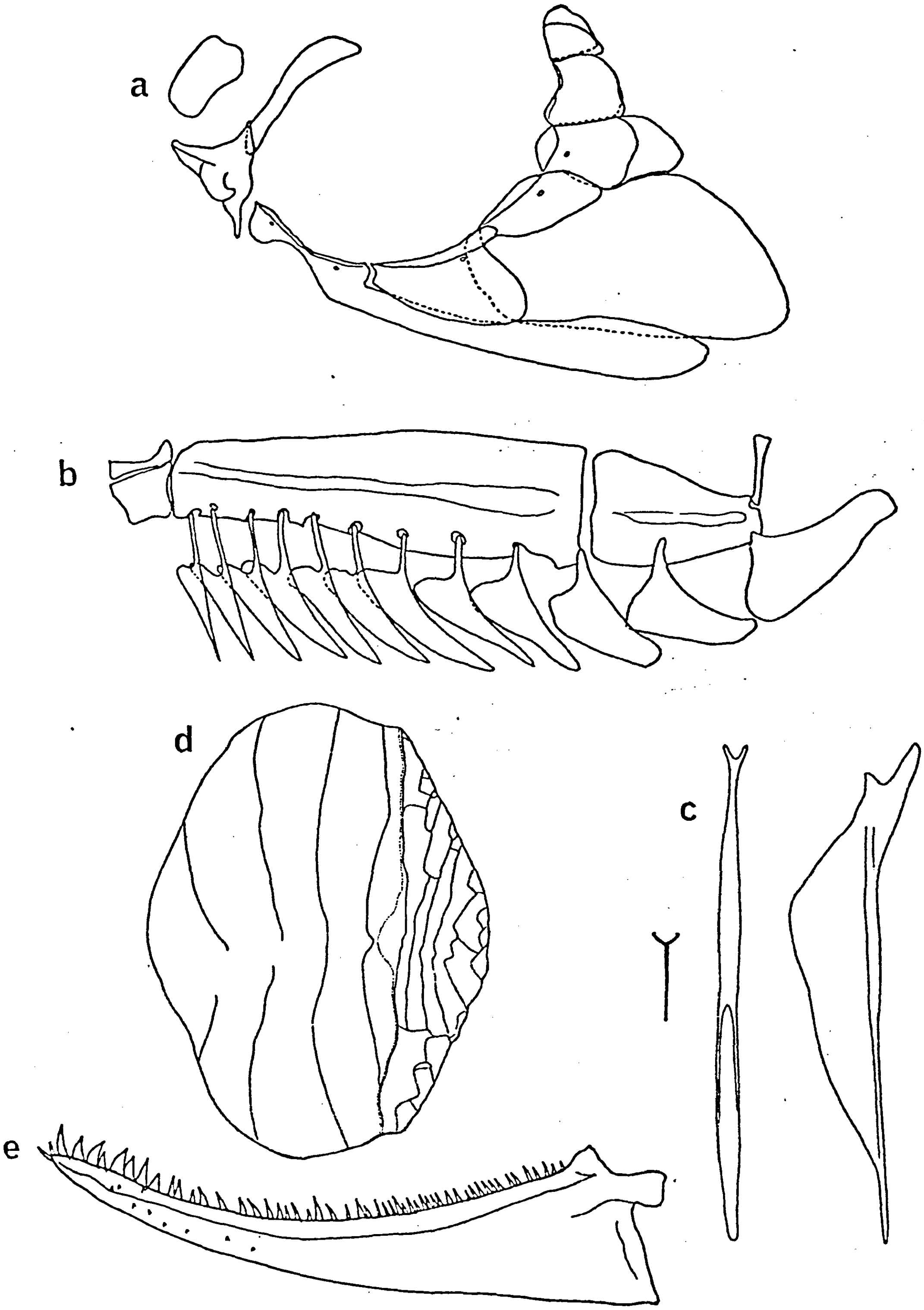


Plate 260. Thryssa (Scutengraulis) spinidens:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1891. 11.30.384-388, 122.0 mm S.L.; d from MCZ. 17967, 155.0 mm S.L.).

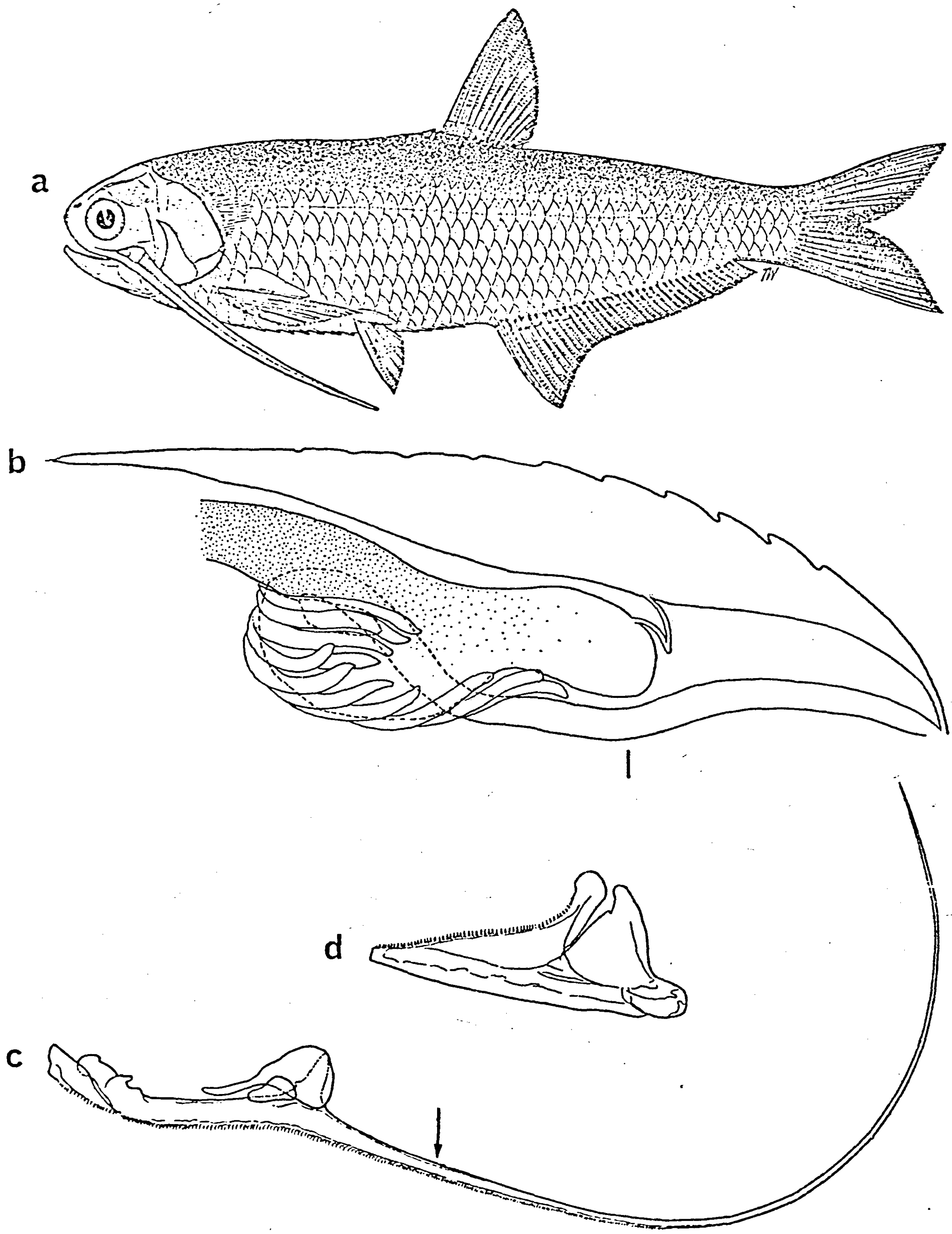


Plate 261. Thryssa (Thryssa) setirostris:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from BMNH. 1867.11.28.58, 127.5 mm S.L.; others from BMNH. 1963.12.9.60-80, 96.0 mm S.L.).

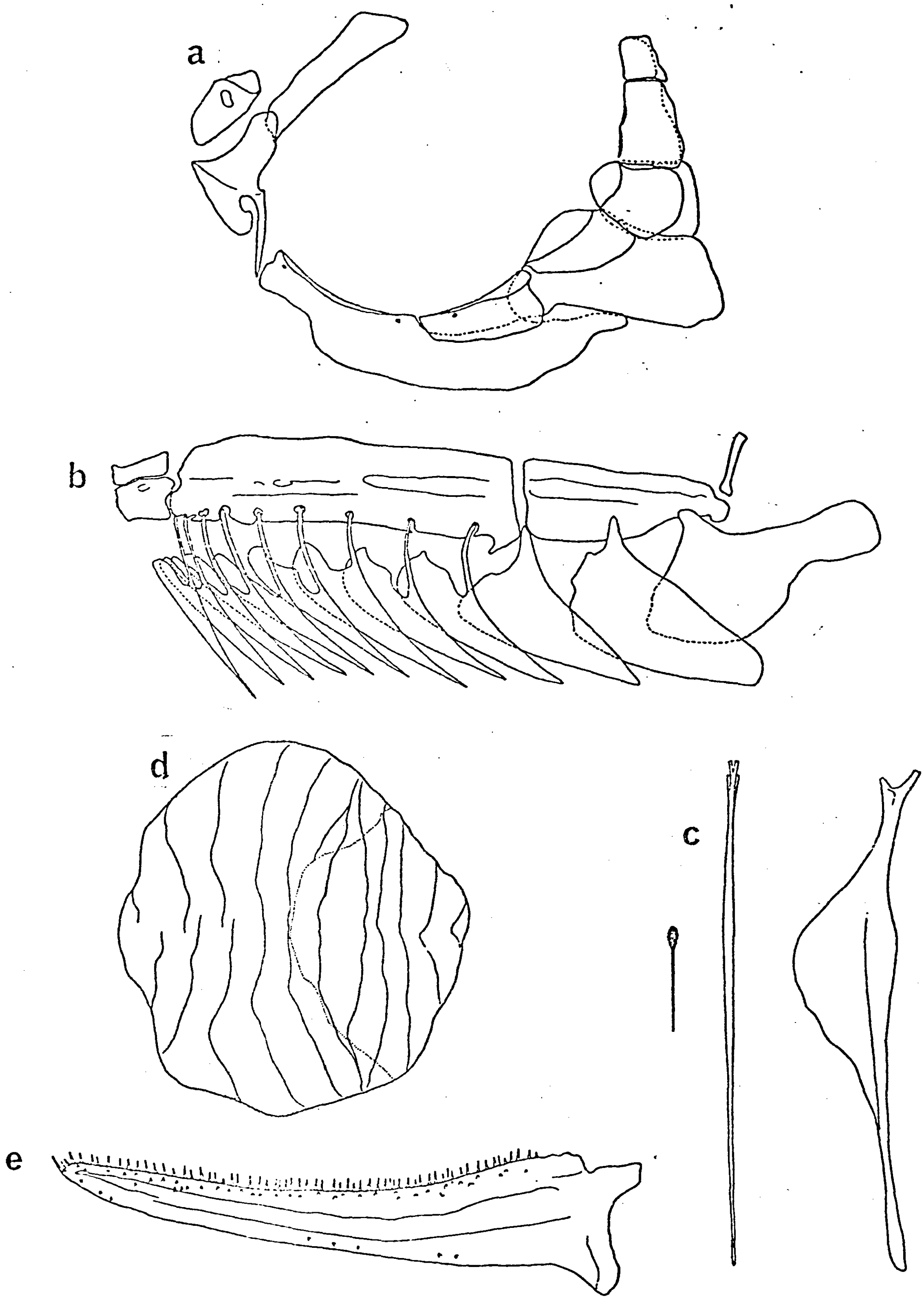


Plate 262. Thryssa (Thryssa) setirostris:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1963.12.9. 60-80, 96.0 mm S.L.; d from BMNH. 1867.11.28.58, 127.5 mm S.L.).

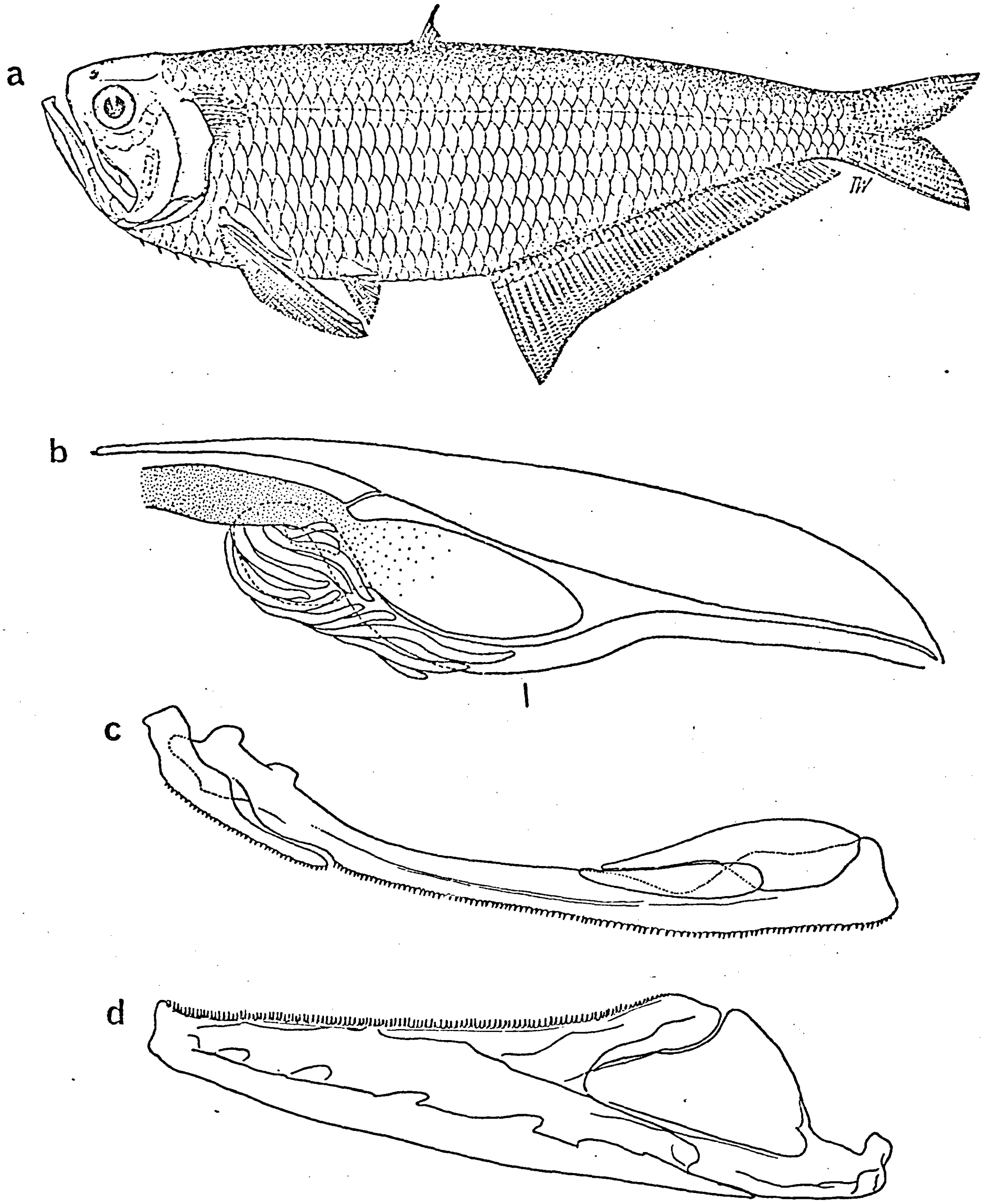


Plate 263. Papuengraulis micropinna:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from CSIRO.C. 3518, 117.0 mm S.L., paratype; others from RMNH. uncat. coll. 304; U.W. 106; 106.0 mm S.L.).

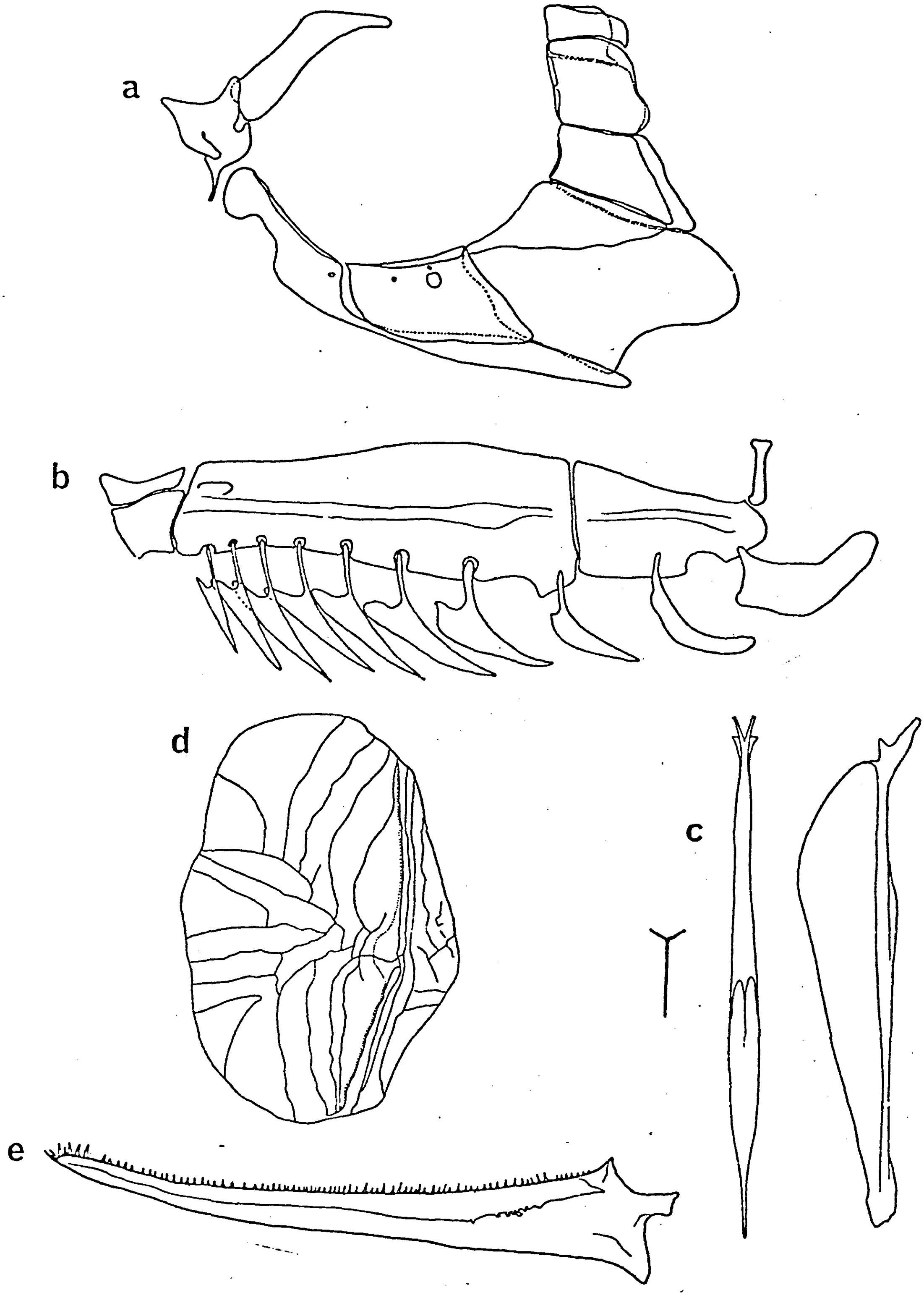


Plate 264. Papuengraulis micropinna:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from RMNH. uncat. coll. 304; U.W. 106; 106.0 mm S.L. for a, b, c and 108.5 mm S.L. for e; d from CSIRO. C. 3517, 116.0 mm S.L., paratype).

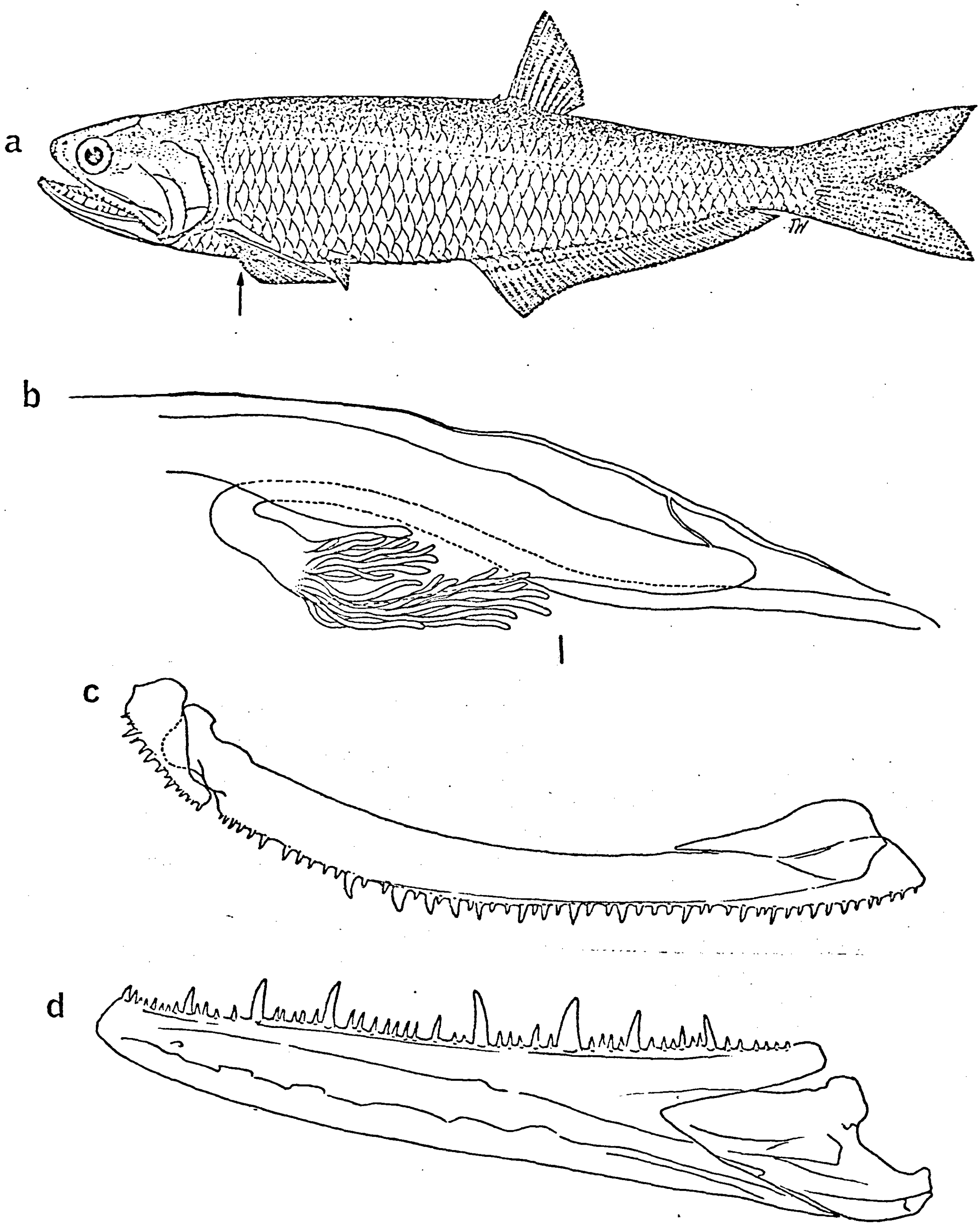


Plate 265. Lycothrissa crocodilus:- a, adult, arrow indicates position of anteriormost prepelvic scute; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1867.11.28.48, 129.0 mm S.L.; others from ANSP. 61496-61501, 60552-60564, 124.0 mm S.L.).

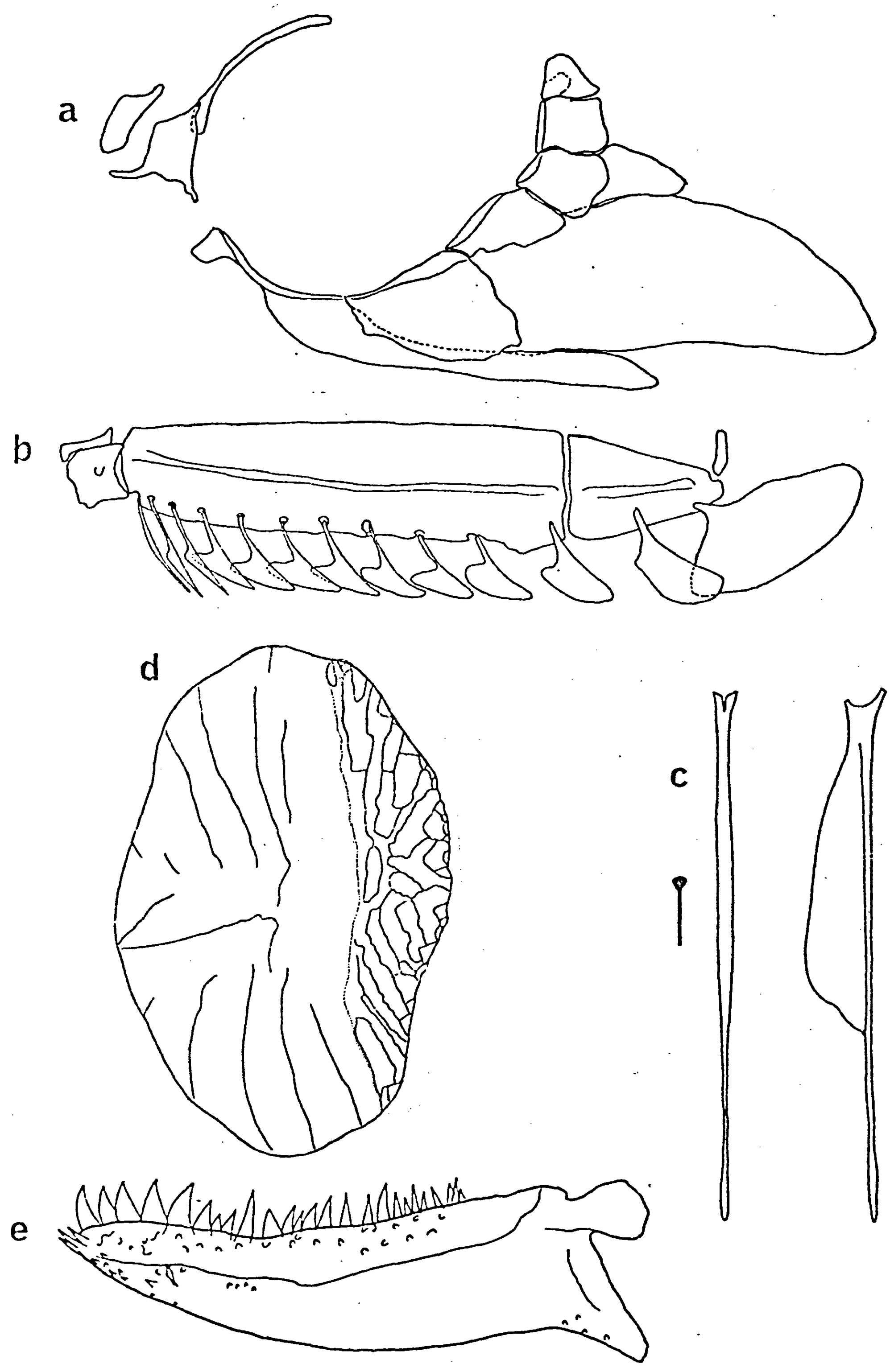


Plate 266. Lycothrissa crocodilus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from ANSP. 61496-61501, 60552-60564, 124.0 mm S.L. for a, b, c, e and 191.0 mm S.L. for d).

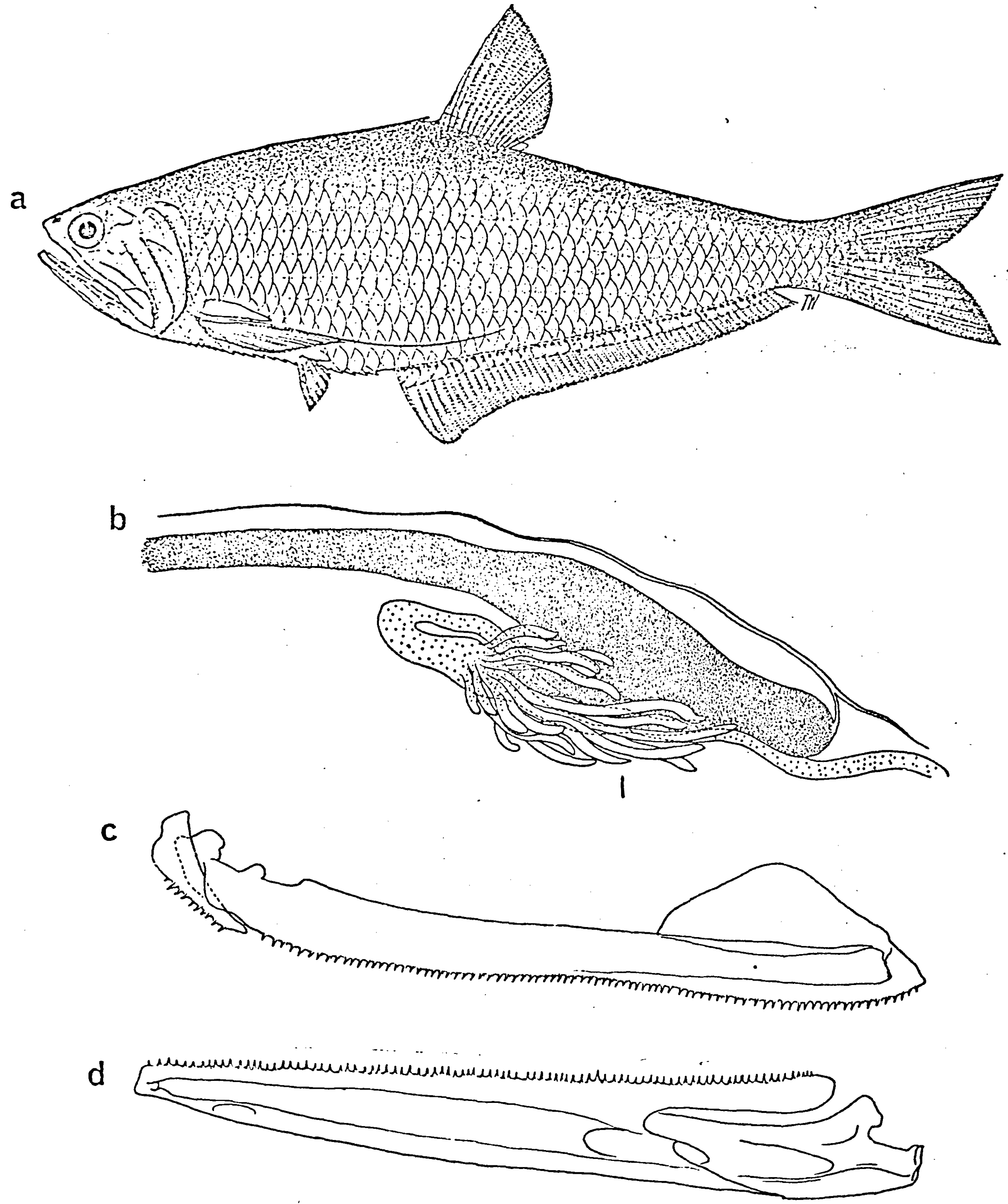


Plate 267. Setipinna tenuifilis tenuifilis:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1973.6.4.1-6, 118.0 mm S.L. for a and 103.0 mm S.L. for others).

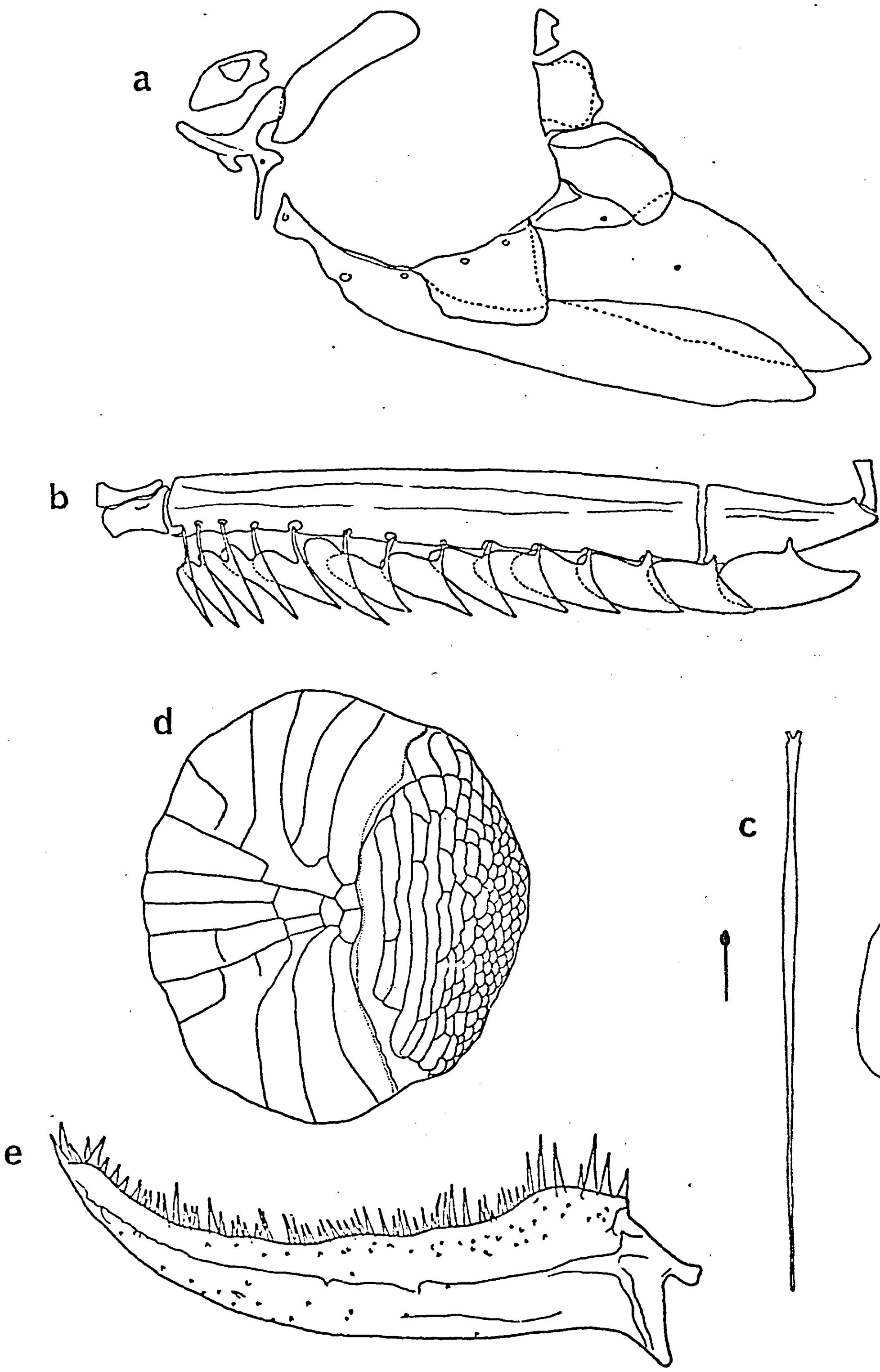


Plate 268. Setipinna tenuifilis tenuifilis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1973.6.4. 1-6, 103.0 mm S.L. for a, b, c, e and 108.0 mm S.L. for d).

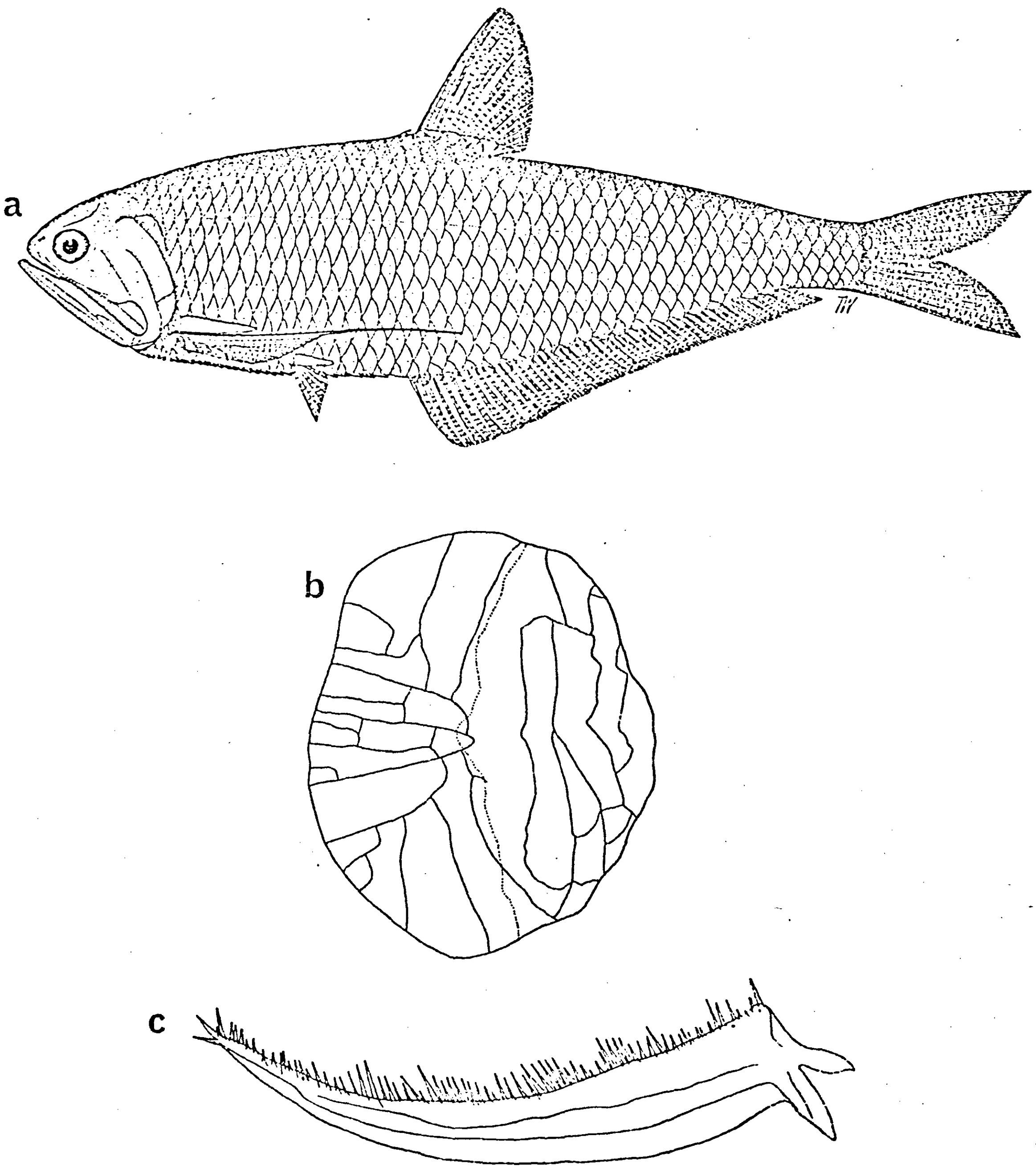


Plate 269. Setipinna tenuifilis gilberti:- a, adult; b, scale; c, gillraker (a, c from BMNH. 1928.6.22.3, 131.0 mm S.L.; b from USNM. 37766, 125.0 mm S.L., holotype of Setipinna gilberti).

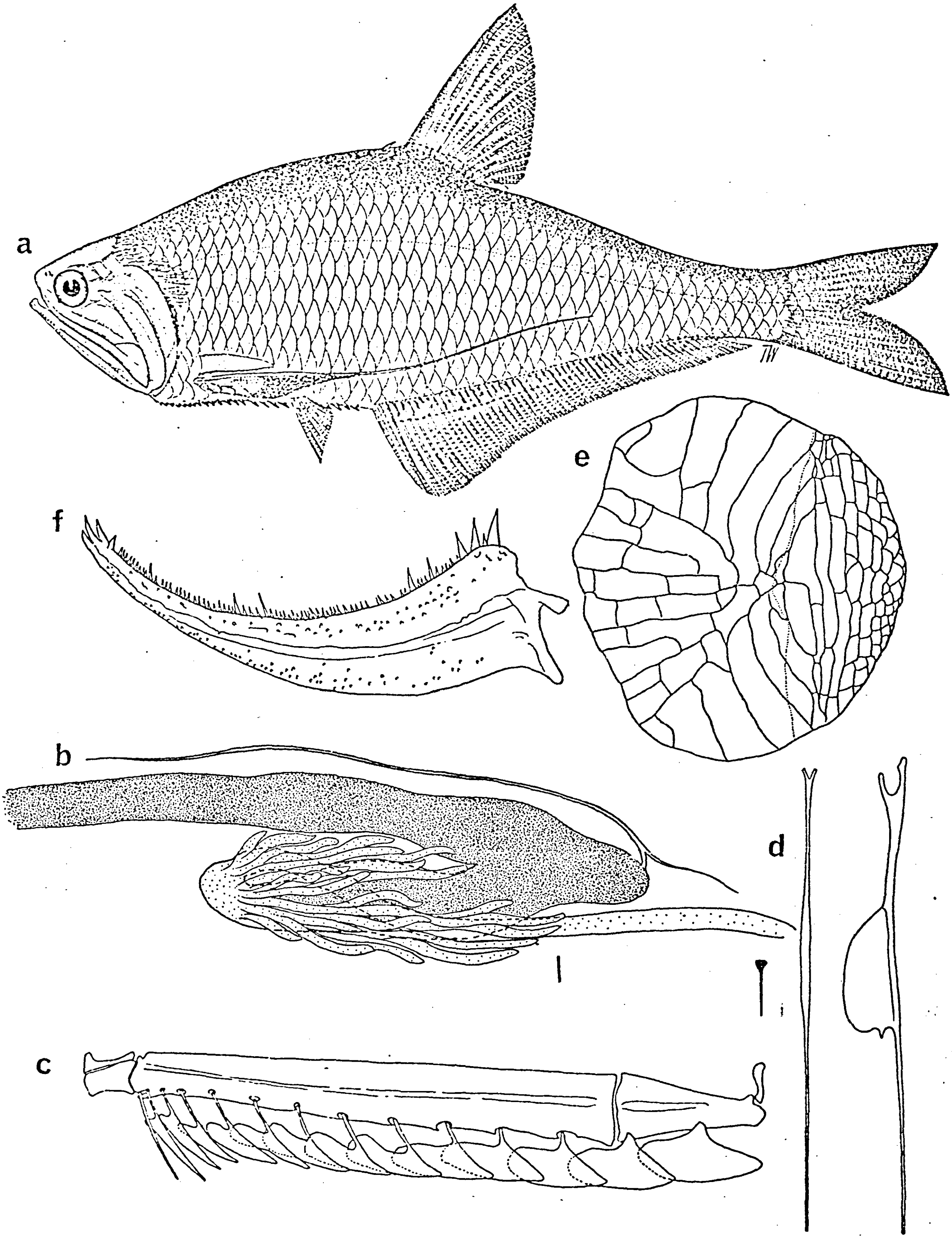


Plate 270. Setipinna papuensis:- a, adult; b, gas bladder and digestive tract; c, hyoid arch; d, urohyal; e, scale; f, gillraker (all from WAM.P. 16267-16270, 110.0 mm S.L. for a and 96.0 mm S.L. for others).

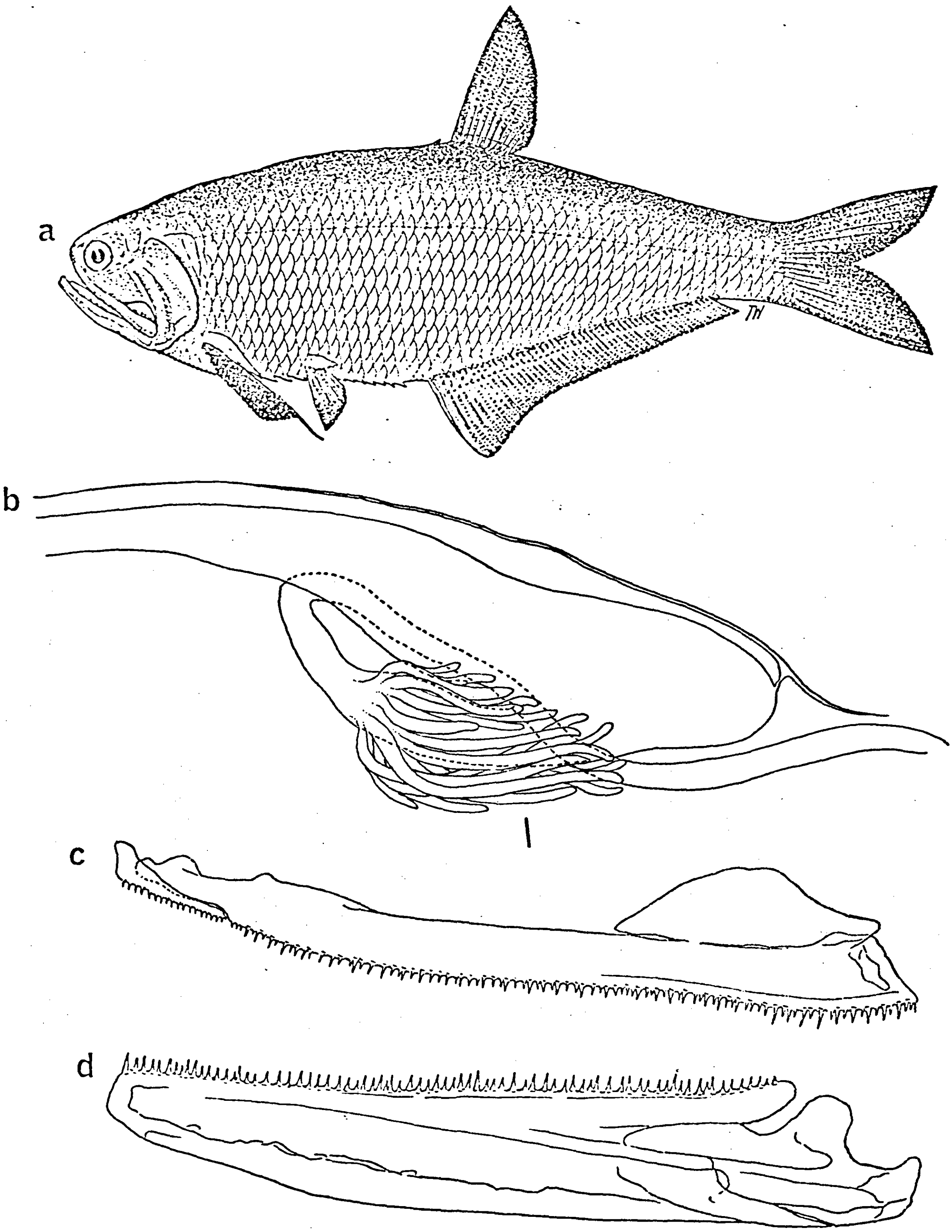


Plate 271. Setipinna melanochir:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1966.3.8.72, 154.0 mm S.L.).

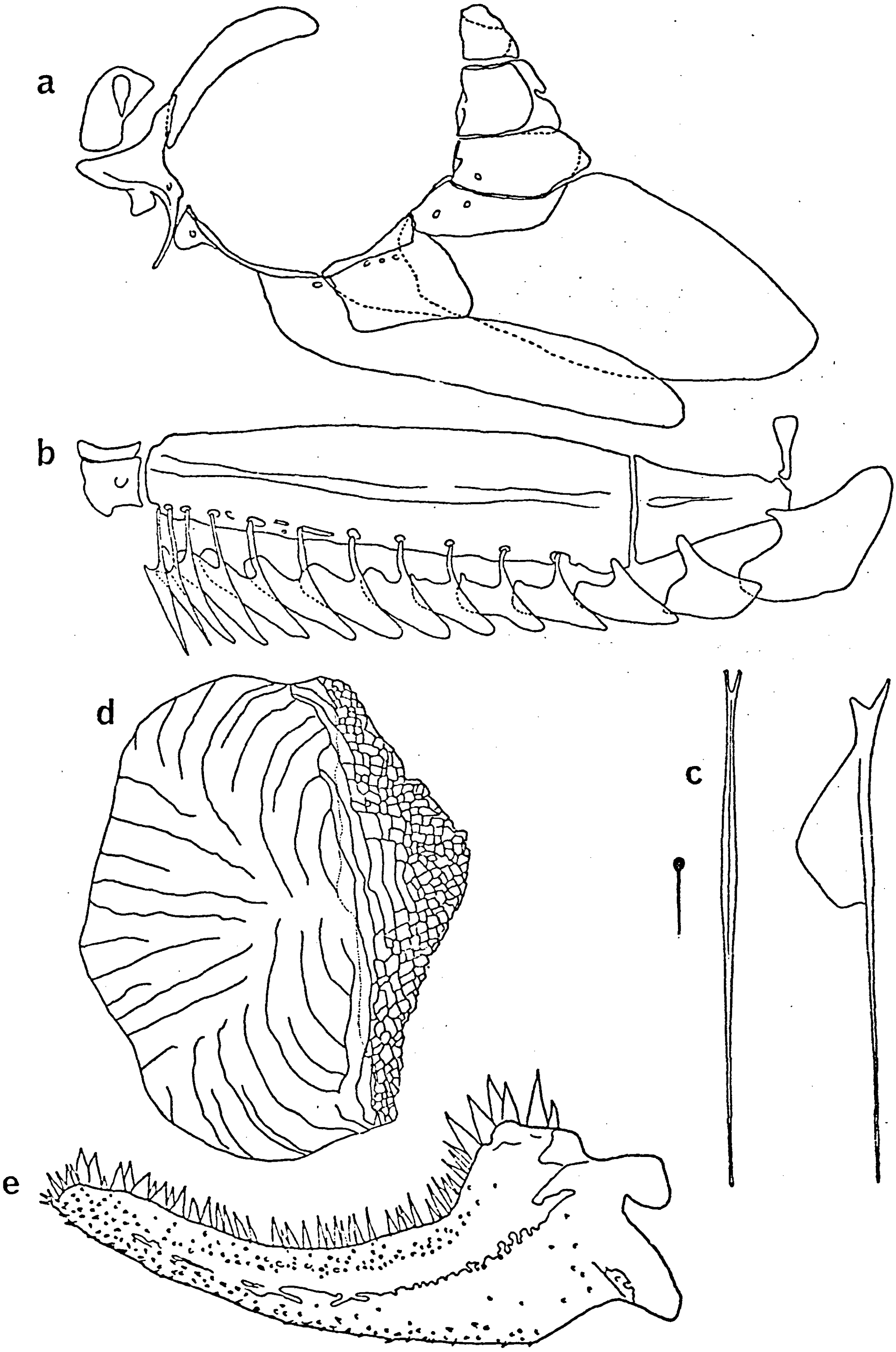


Plate 272. *Setipinna melanochir*:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1966.3.8.72, 154.0 mm S.L.; d from BMNH. 1867.11.28.52, 218.0 mm S.L.).

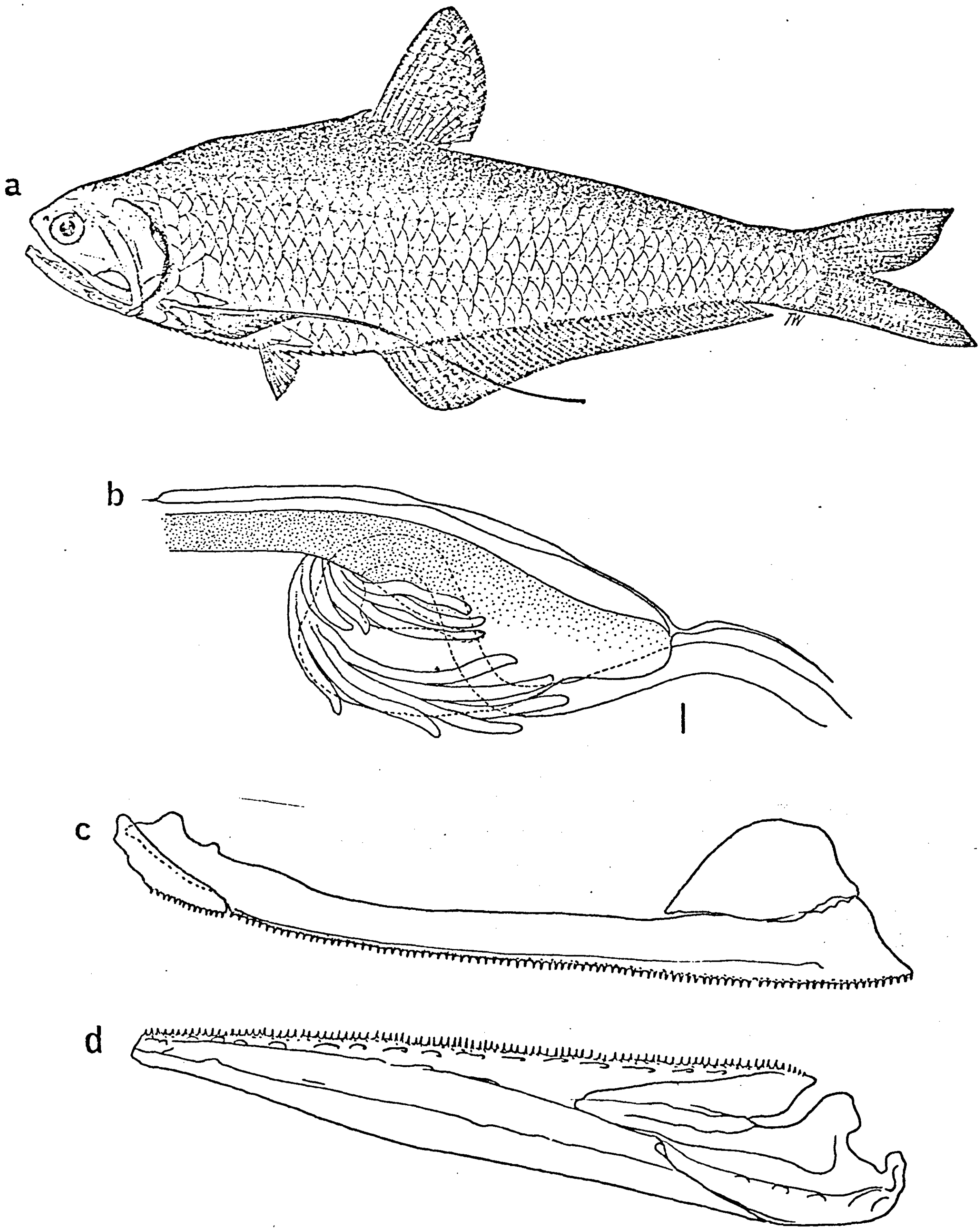


Plate 273. <u>Setipinna</u> <u>taty</u>:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1966.3.8.61-71, 135.0 mm S.L.; others from BMNH. 1979.8.21.1-5, 113.0 mm S.L.).

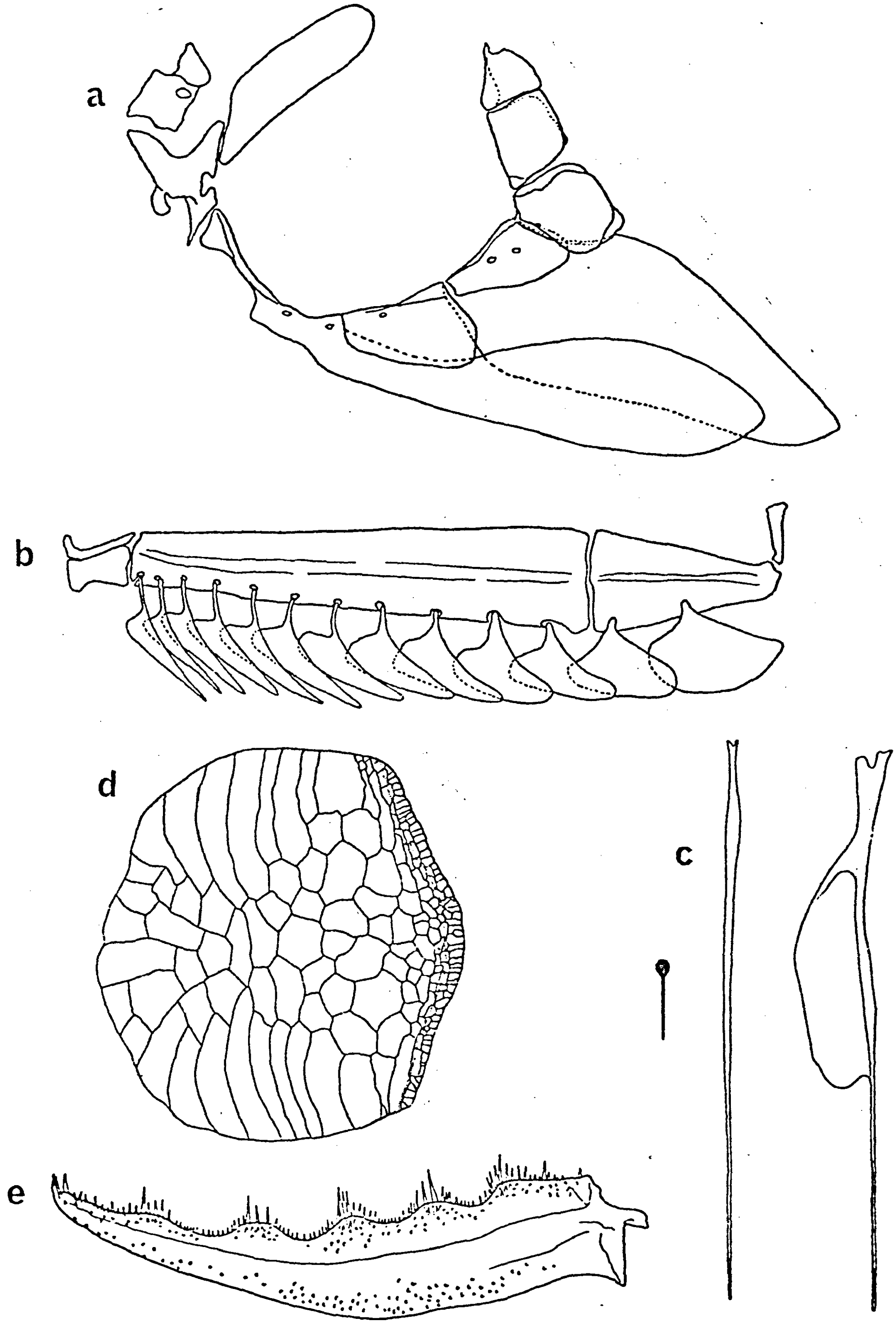


Plate 274. Setipinna taty:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1979.8.21.1-5, 113.0 mm S.L. for a, b, c and 90.0 mm S.L. for e; d from BMNH. 1977.9.8. 44-50, 116.0 mm S.L.).

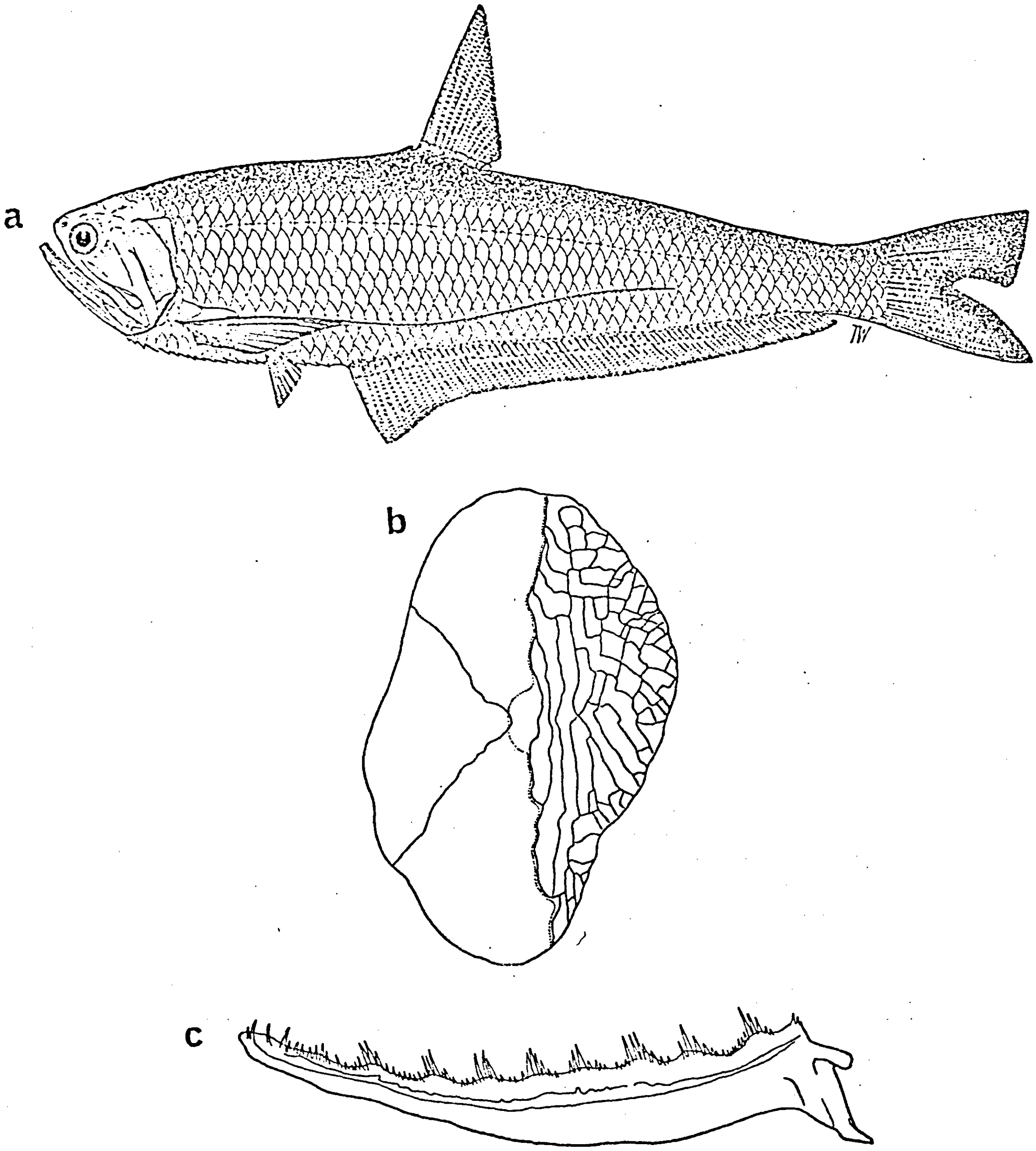


Plate 275. Setipinna wheeleri:- a, adult; b, scale; c, gillraker (a, b from BMNH. 1889.2.1.1788-1789, 185.0 mm S.L.; c from BMNH. 1891.11.30.390, 116.5 mm S.L.).

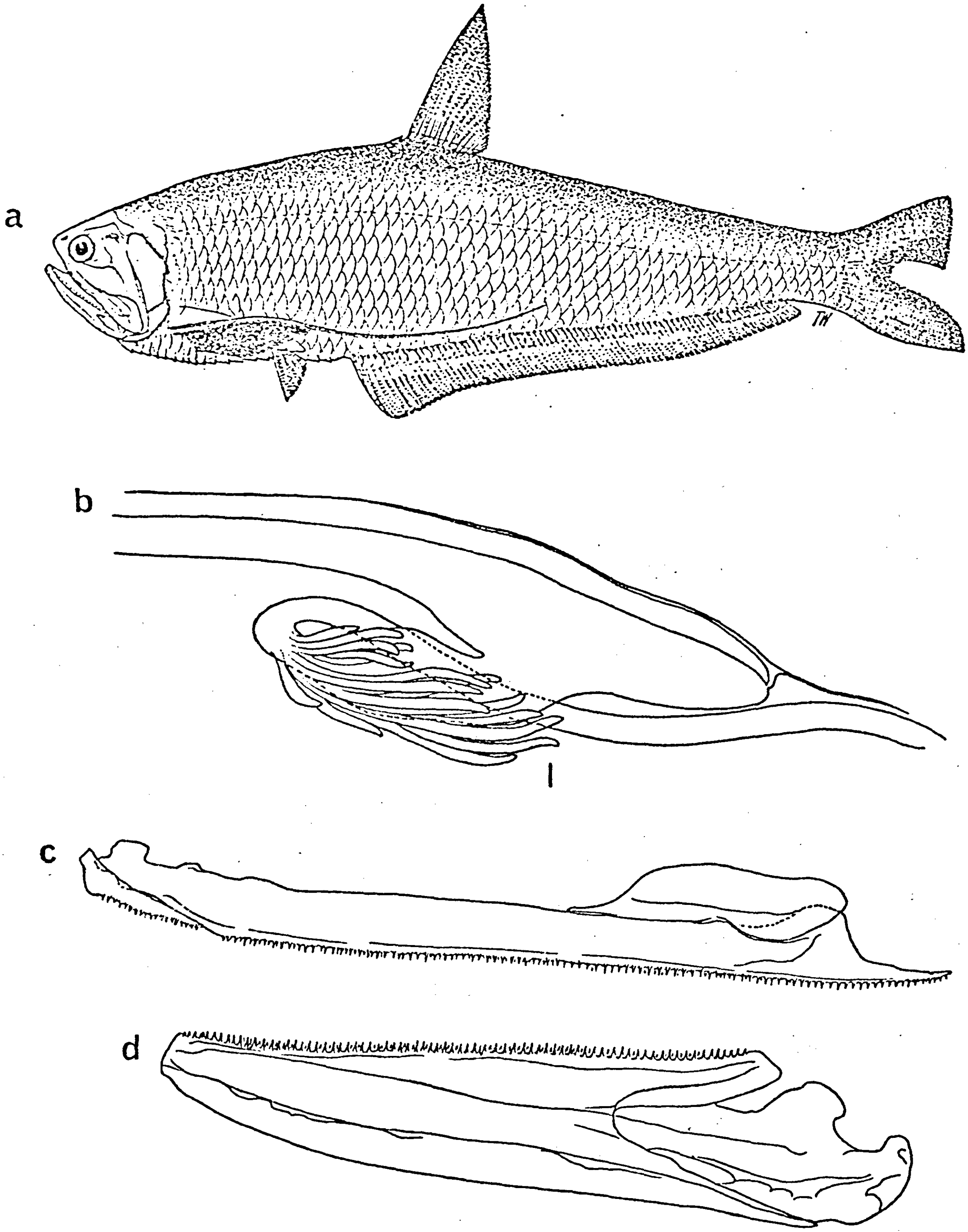


Plate 276. Setipinna phasa:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1973.6.4.7-9, 238.0 mm S.L. for a, 218.0 mm S.L. for others).

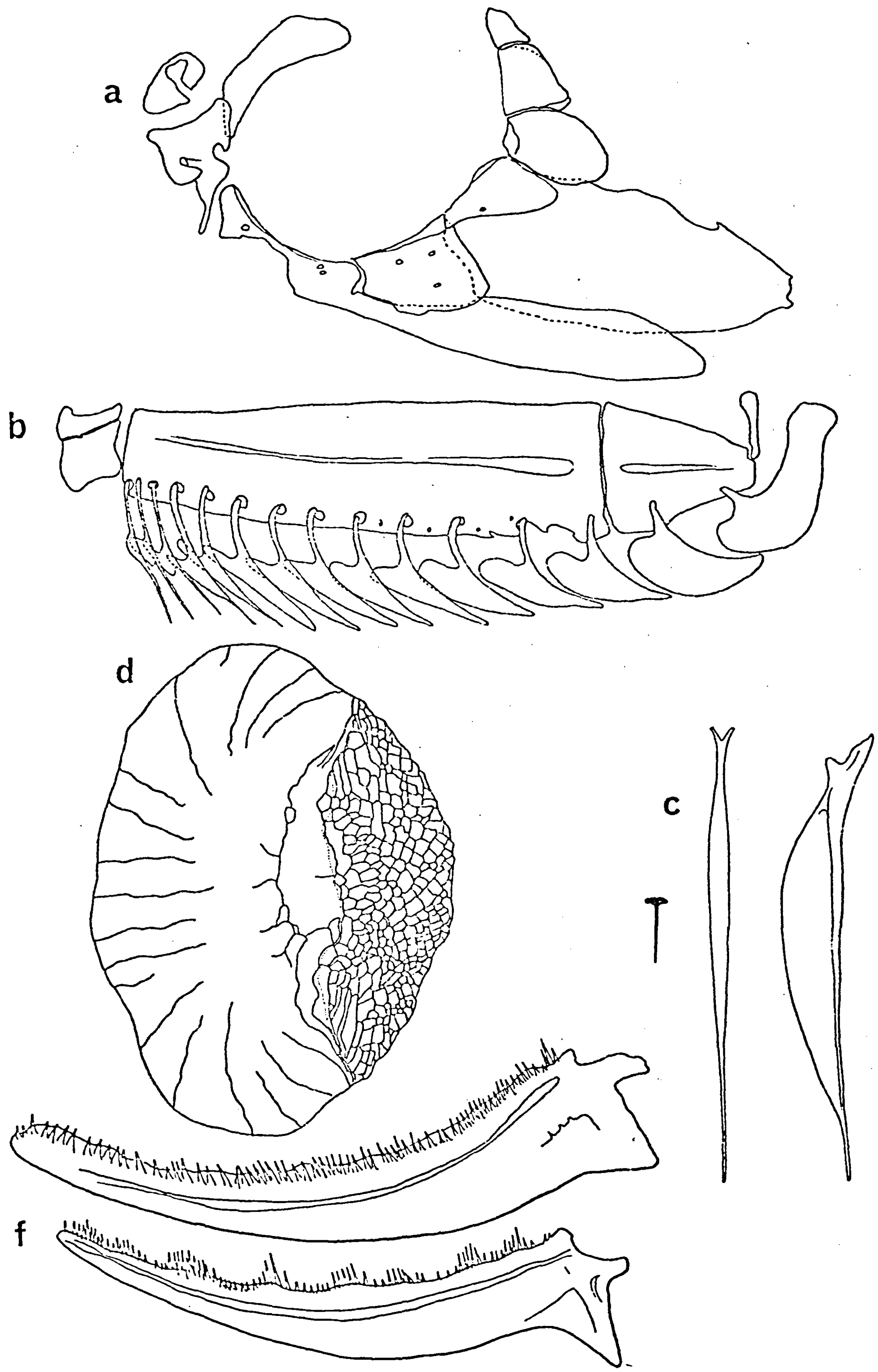


Plate 277. *Setipinna phasa*:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, f, gillraker (a, b, c, d from BMNH. 1973.6.4.7-9, 218.0 mm S.L.; e from BMNH. 1867.11.28.63, 133.0 mm S.L.; f from BMNH. 1889.2.1.1785, 209.0 mm S.L.).

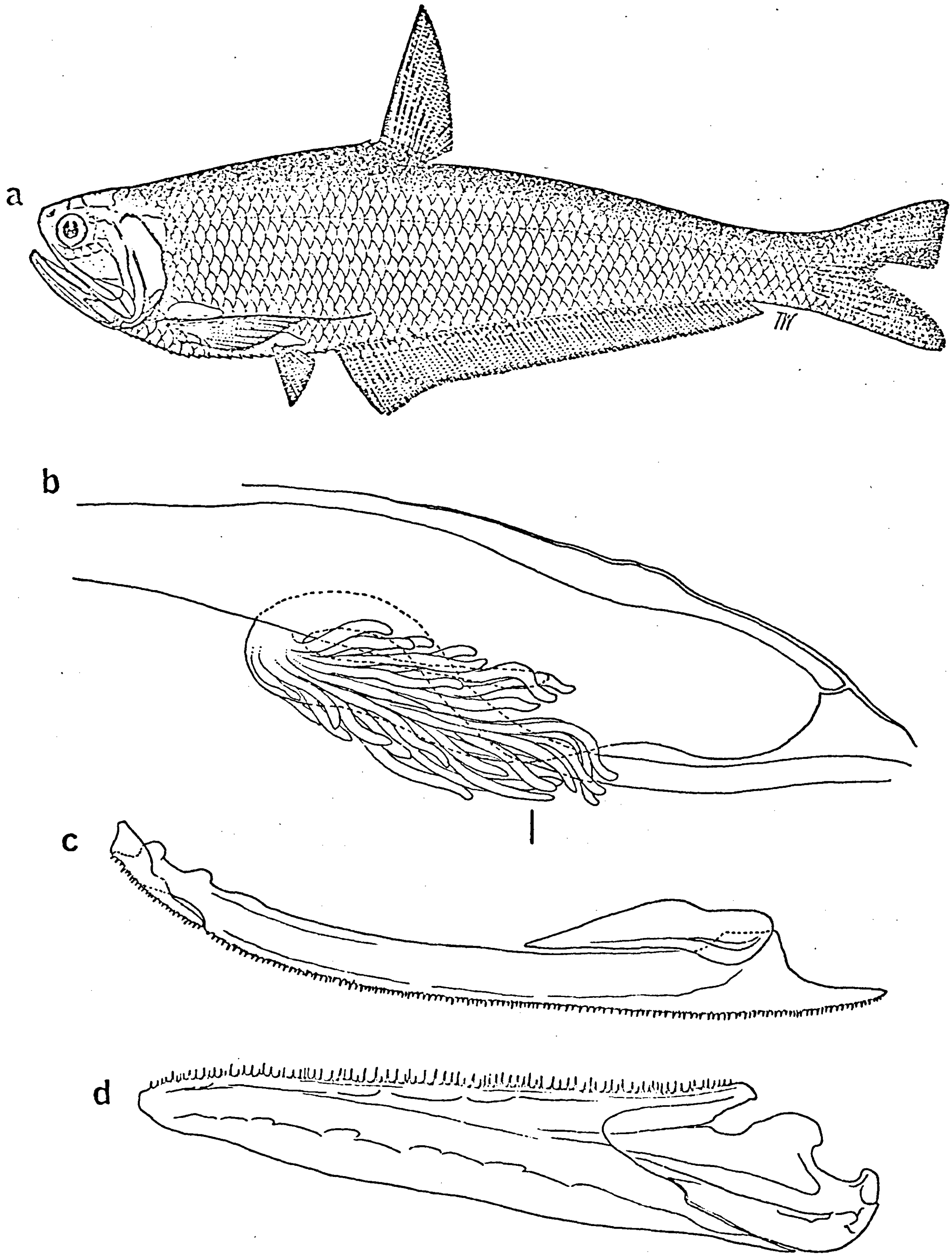


Plate 278. Setipinna brevifilis:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1889.2.1.4857, 160.0 mm S.L.; others from BMNH. 1934.10.17.22-25, front half of body only approx. 263.0 mm S.L.).

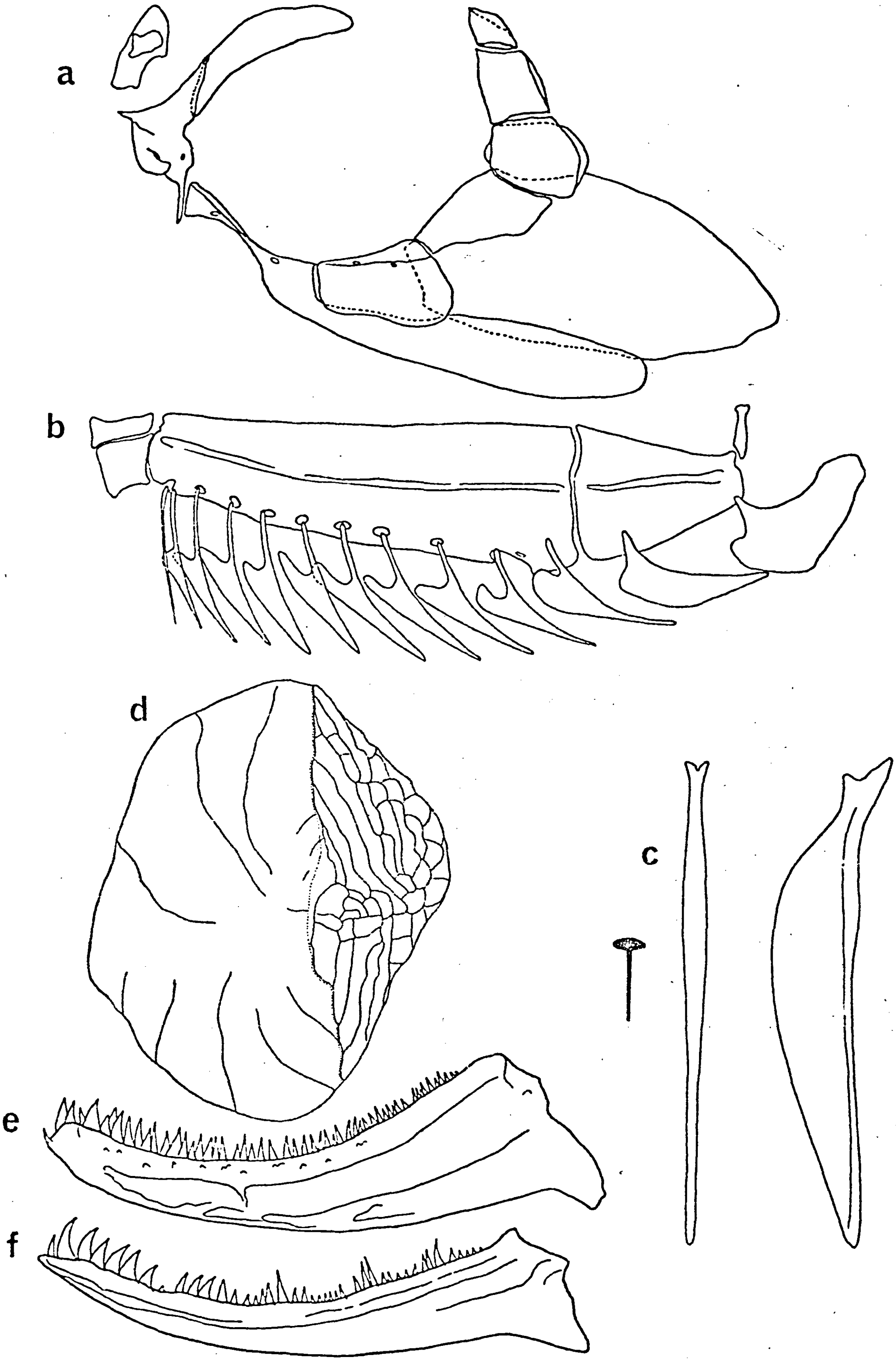


Plate 279. Setipinna brevifilis:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, f, gillrakers (a, b, c, d, e from BMNH. 1934.10. 17.22-25, front half of body only, approx. 263.0 mm S.L. for a, b, c, e and 200.0 mm S.L. for d; f from BMNH. 1889.2.1.1786-1787, 102.0 mm S.L.).

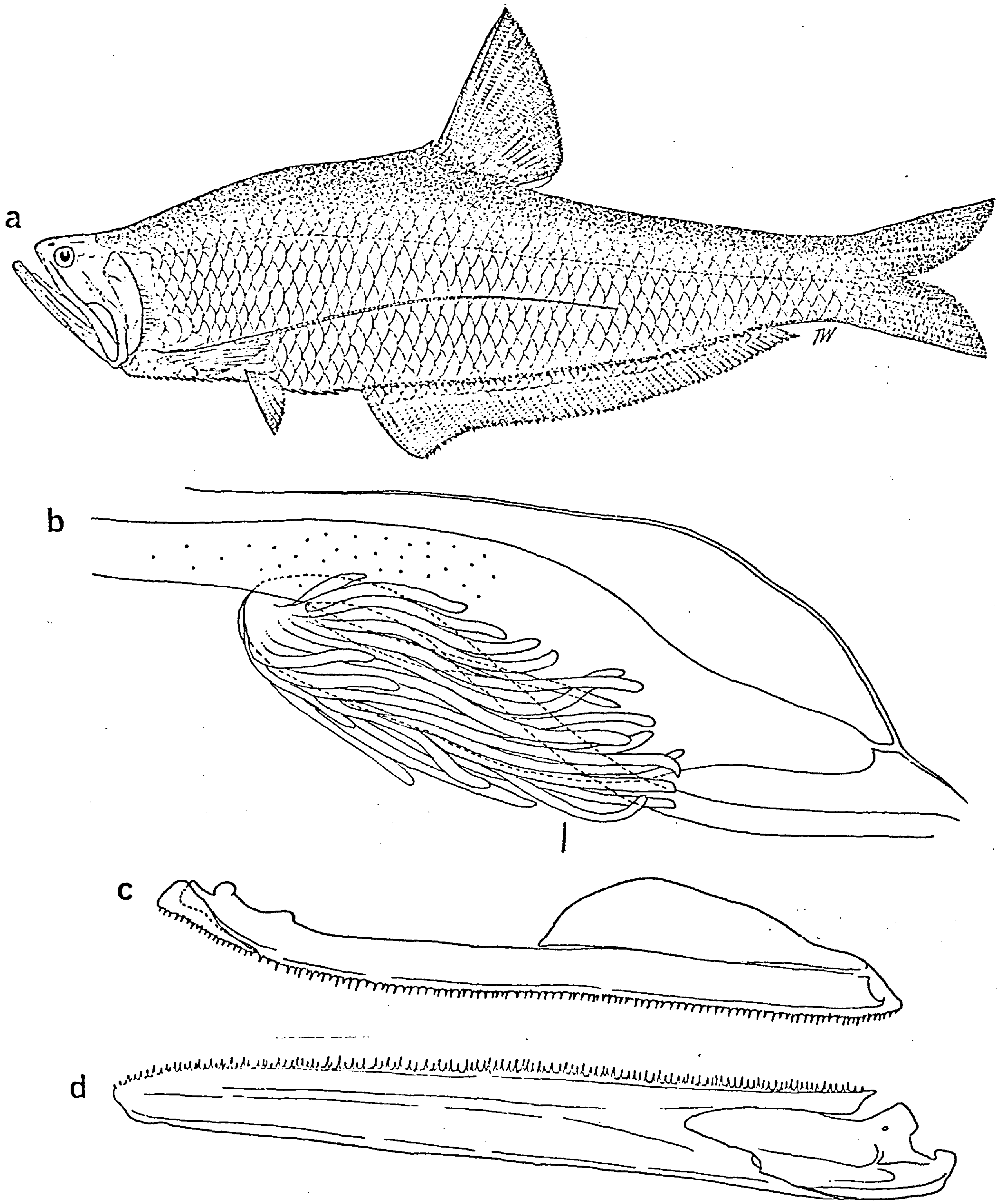


Plate 280. <u>Heterothrissa</u> <u>breviceps</u>:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a, c, d from BMNH. 1979.8.16.513-514, 223.0 mm S.L.; b from BMNH. 1894.1.19.81, 210.0 mm S.L.).

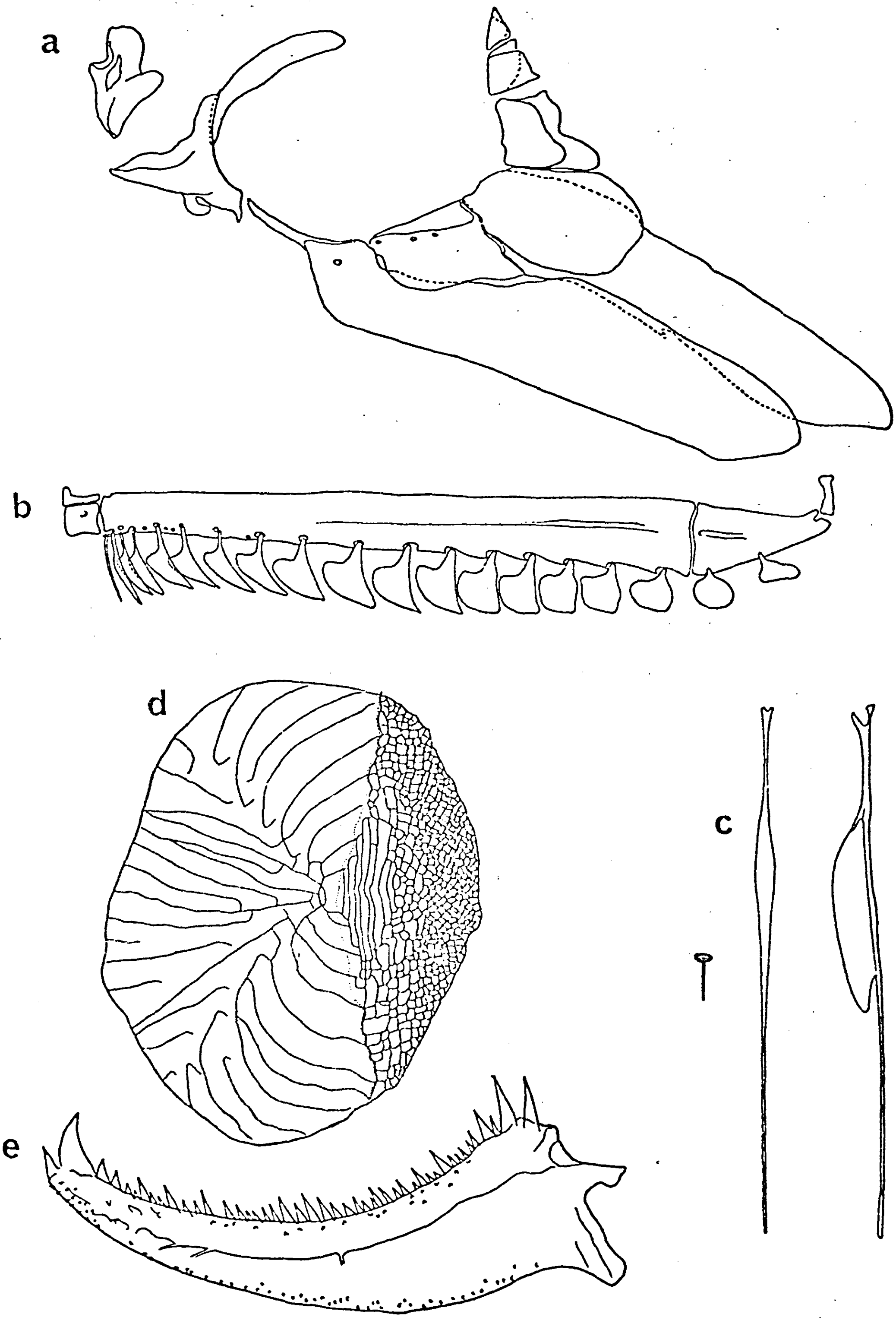


Plate 281. Heterothrissa breviceps:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1979.8.16.513-514, 223.0 mm S.L.).

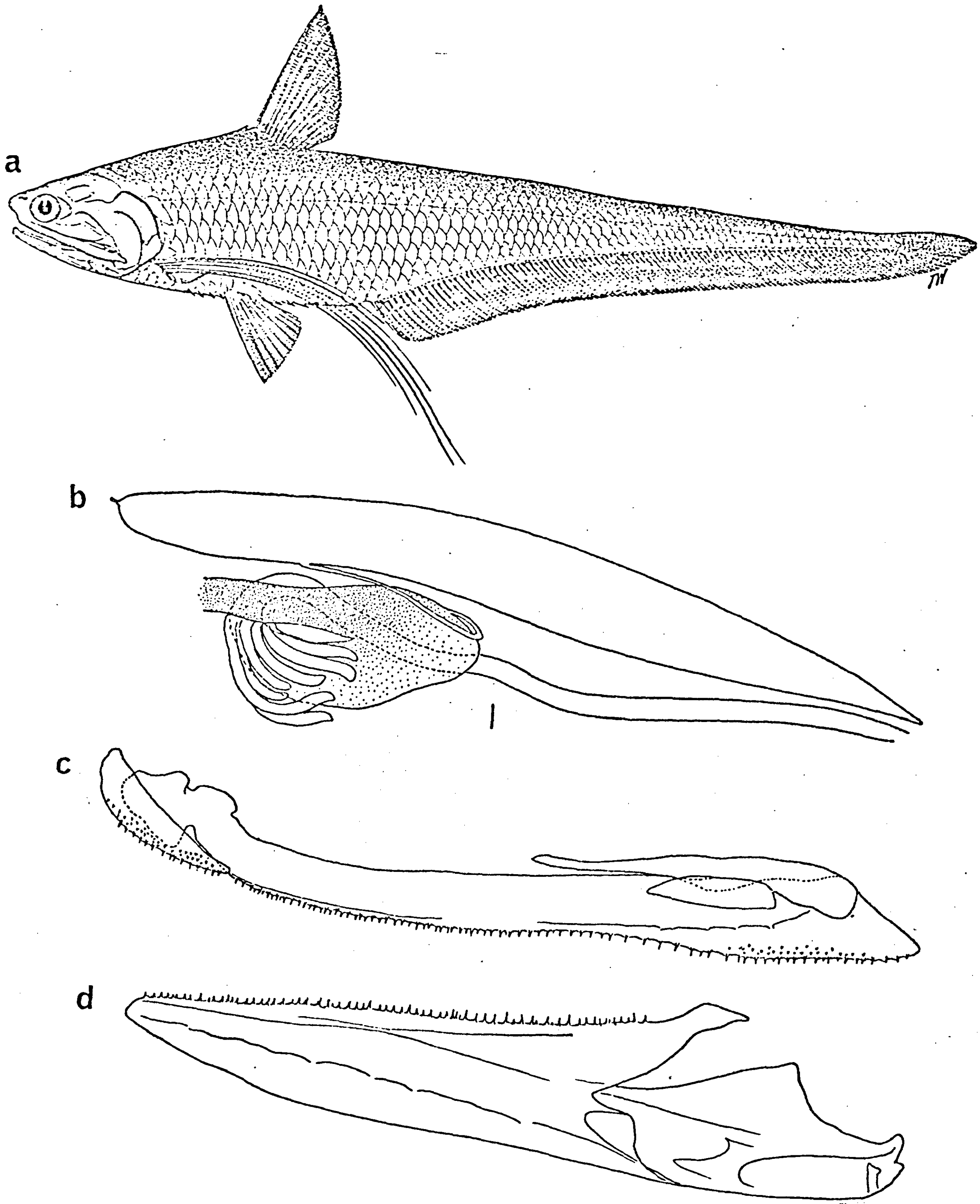


Plate 282. Coilia ramcarati:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1860.3.19.8110, 162.0 mm S.L.; others from BMNH. 1848.8.22.74, 106.0 mm S.L.).

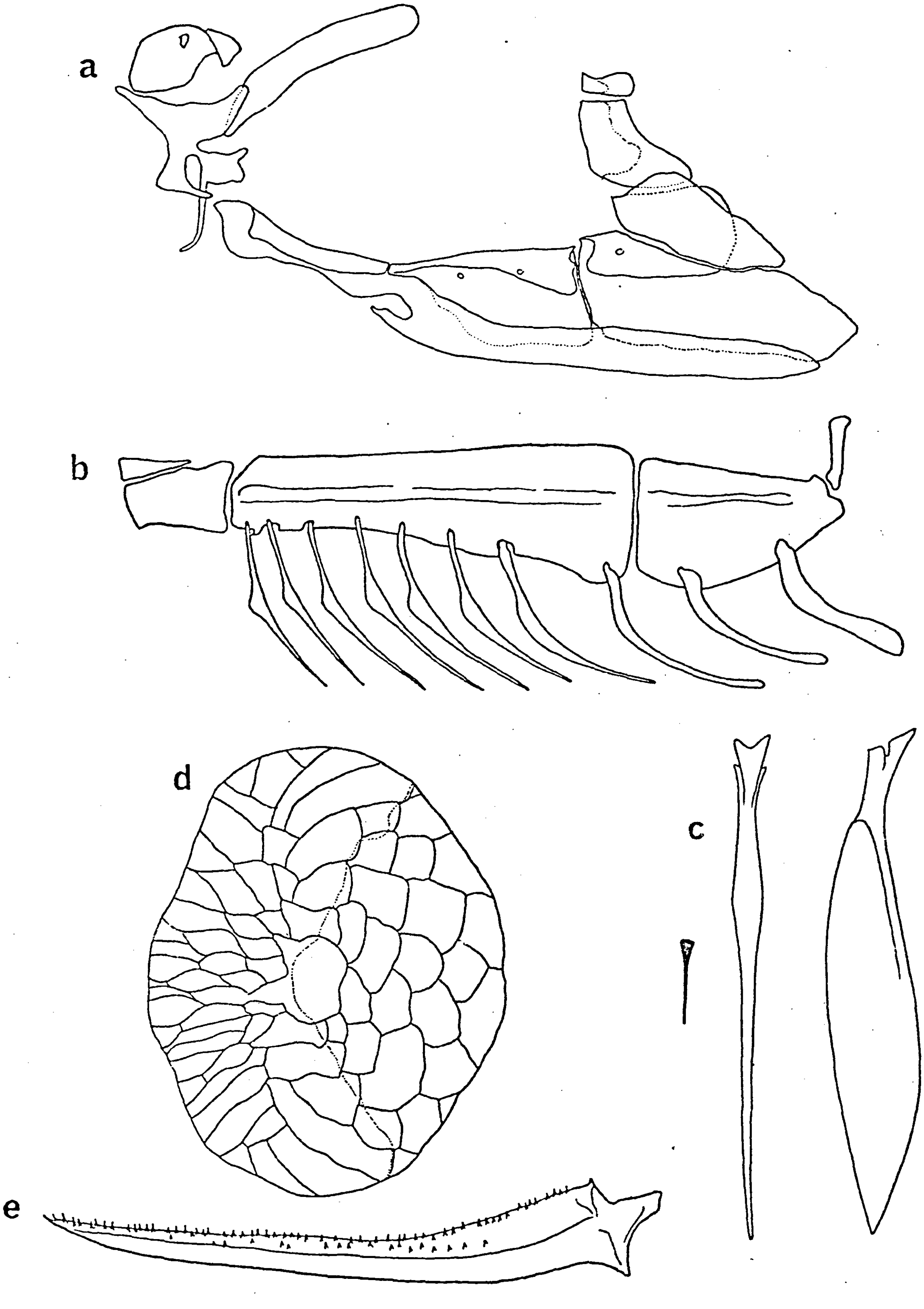


Plate 283. Coilia ramcarati:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1848.8.22.74, 106.0 mm S.L.).

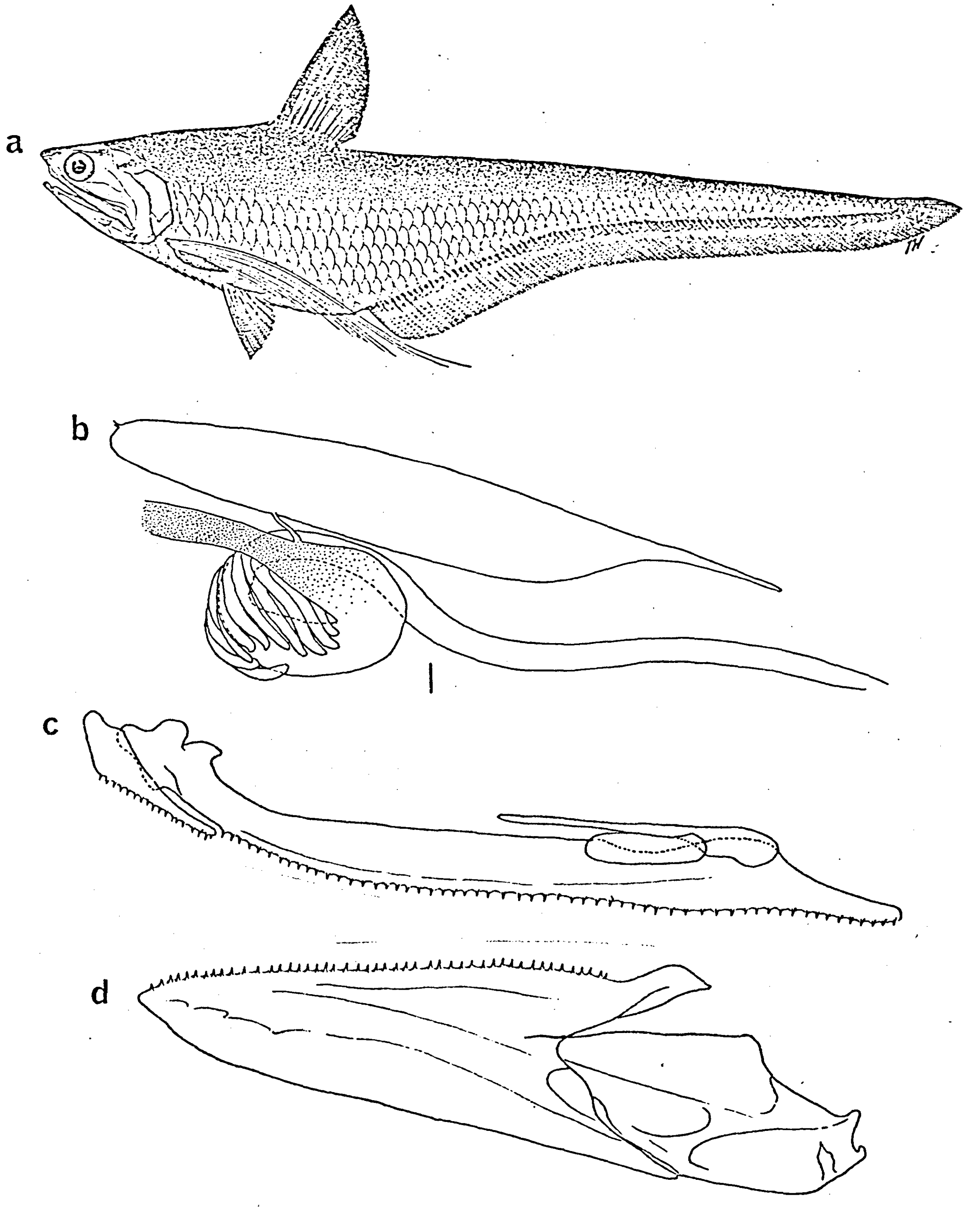


Plate 284. Coilia reynaldi: a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1974.9.29.1-5, 114.0 mm S.L., paratype of Coilia whiteheadi; others from BMNH. 1977.6.17.7-12, 110.0 mm S.L.)

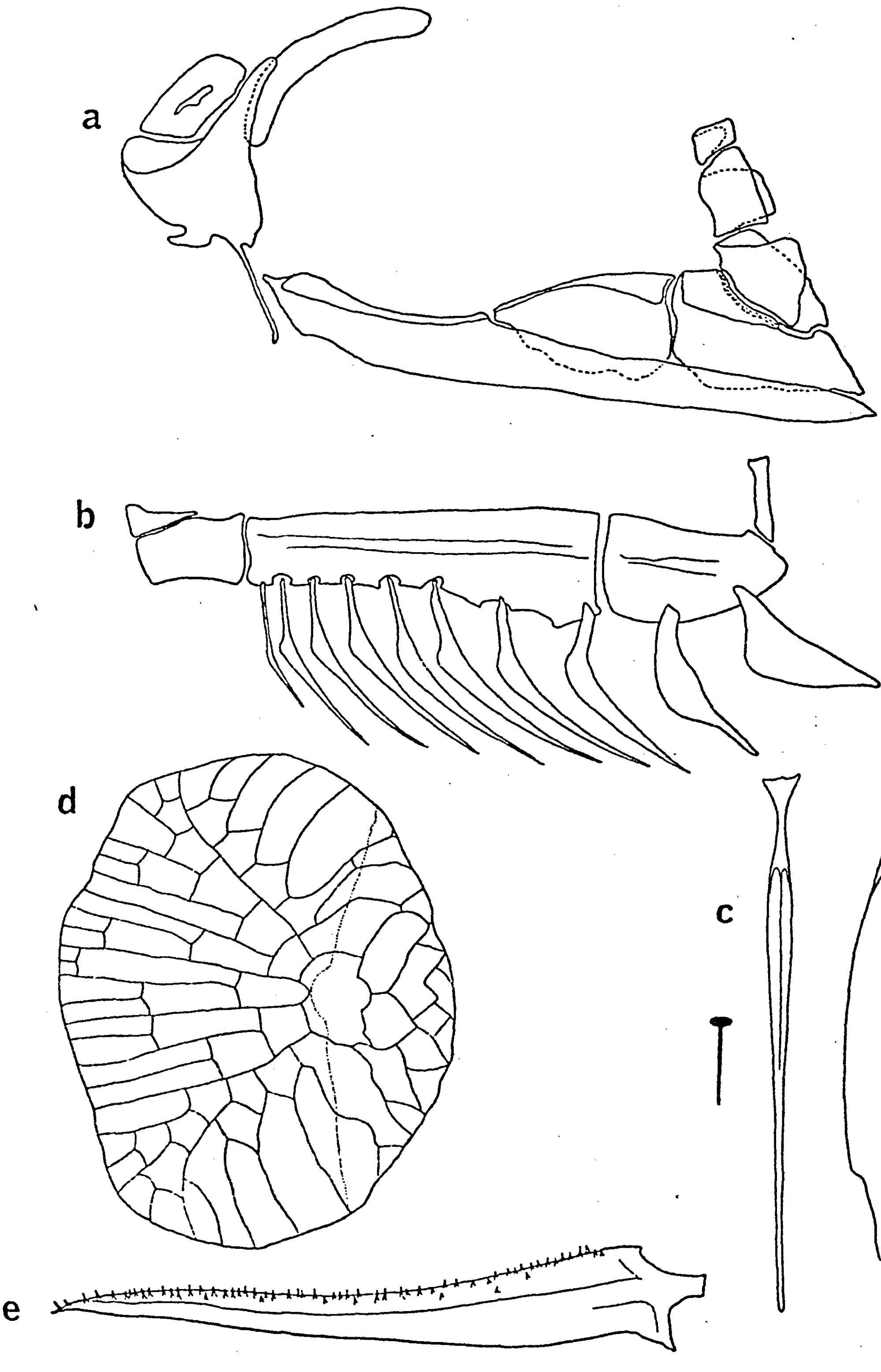


Plate 285. Coilia reynaldi:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1977.6.17.7-12, 110.0 mm S.L. for a, b, c, e and 116.0 mm S.L. for d).

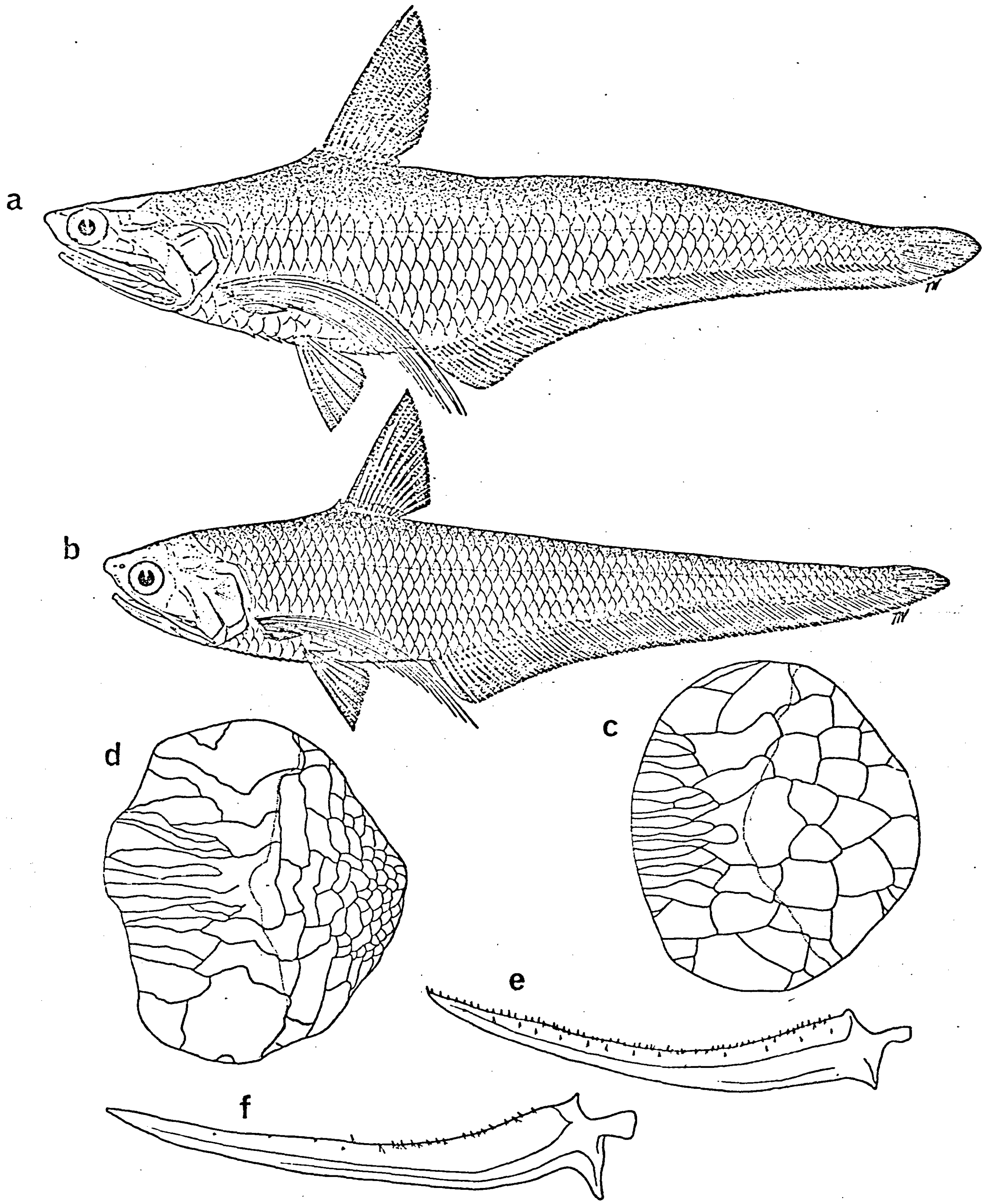


Plate 286. *Coilia borneensis*:- a, adult; d, scale; f, gillraker (all from BMNH. 1867.11.28.78, 104.0 mm S.L., putative neotype of *C. borneensis*).

Coilia coomansi:- b, adult; c, scale; e, gillraker (all from RMNH. 27711, 88.5 mm S.L.

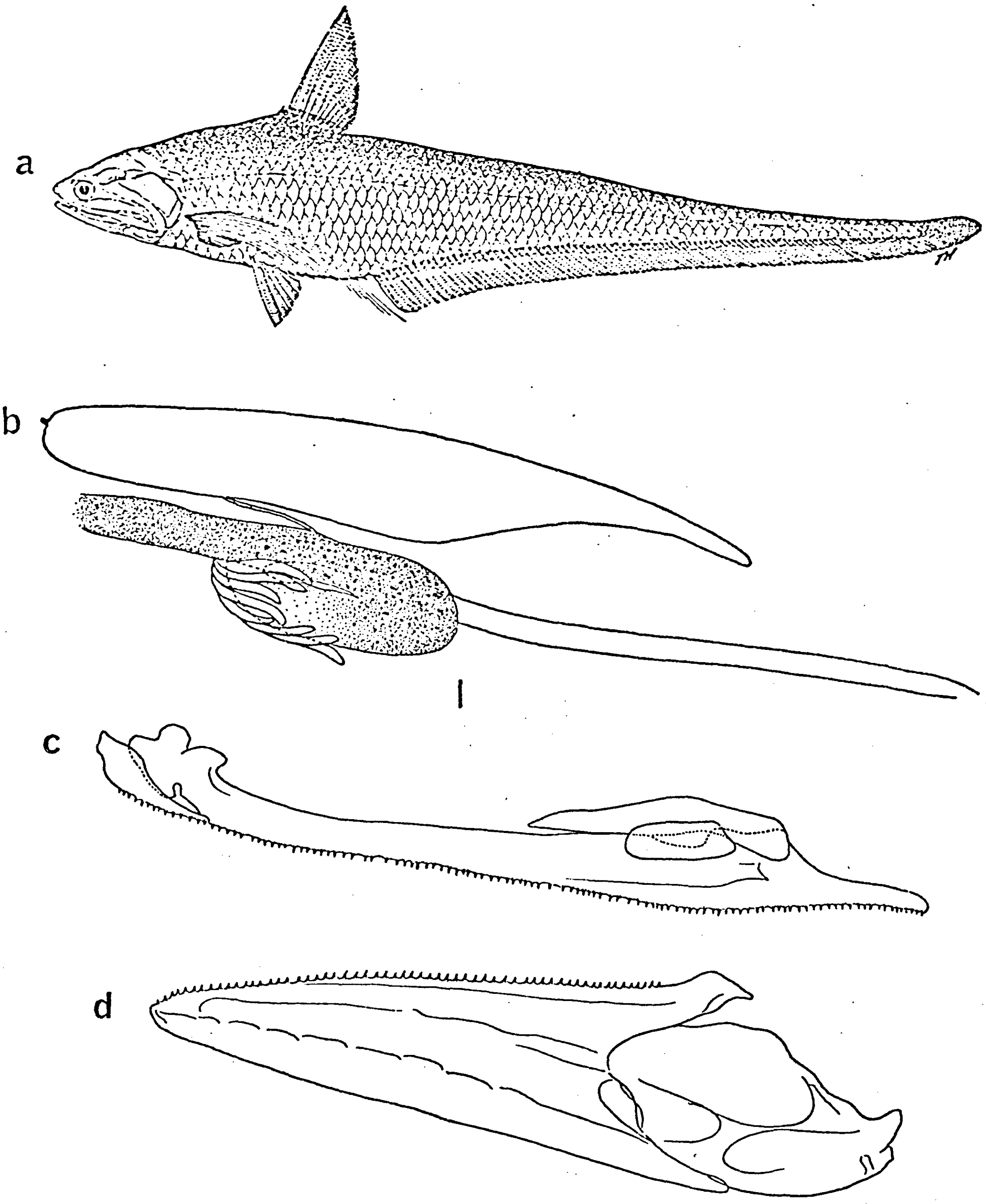


Plate 287. Coilia rebentischii:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1867.11.28.74, 143.0 mm S.L., holotype of C. rebentischii; others from BMNH. 1905.11.14.1-6, 143.0 mm S.L.).

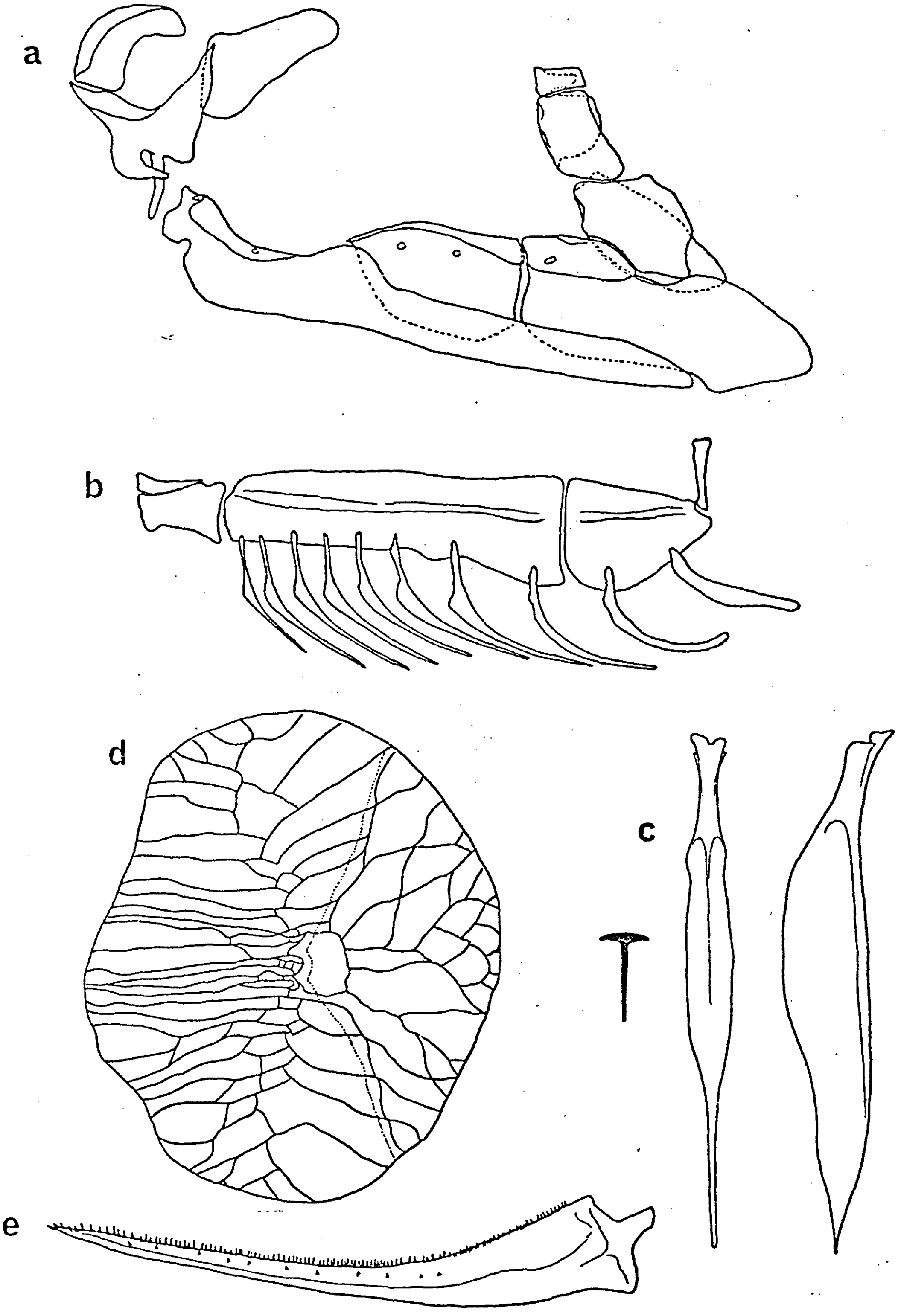


Plate 288. Coilia rebentischii:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1905.11.14.1-6, 143.0 mm S.L.).

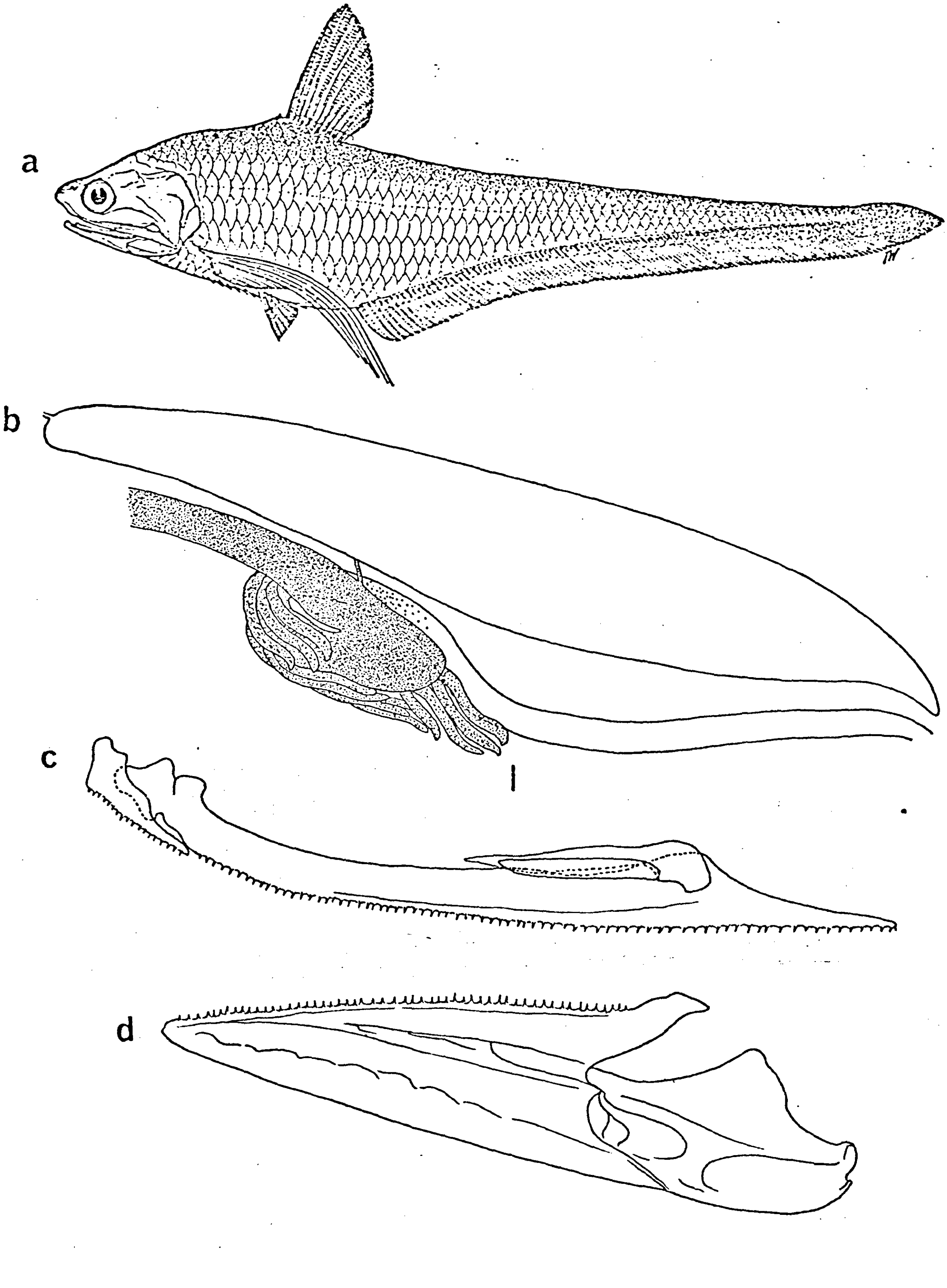


Plate 289. Coilia neglecta:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (all from BMNH. 1967.11.13.950-973, 125.0 mm S.L. for a, 137.0 mm S.L. for others).

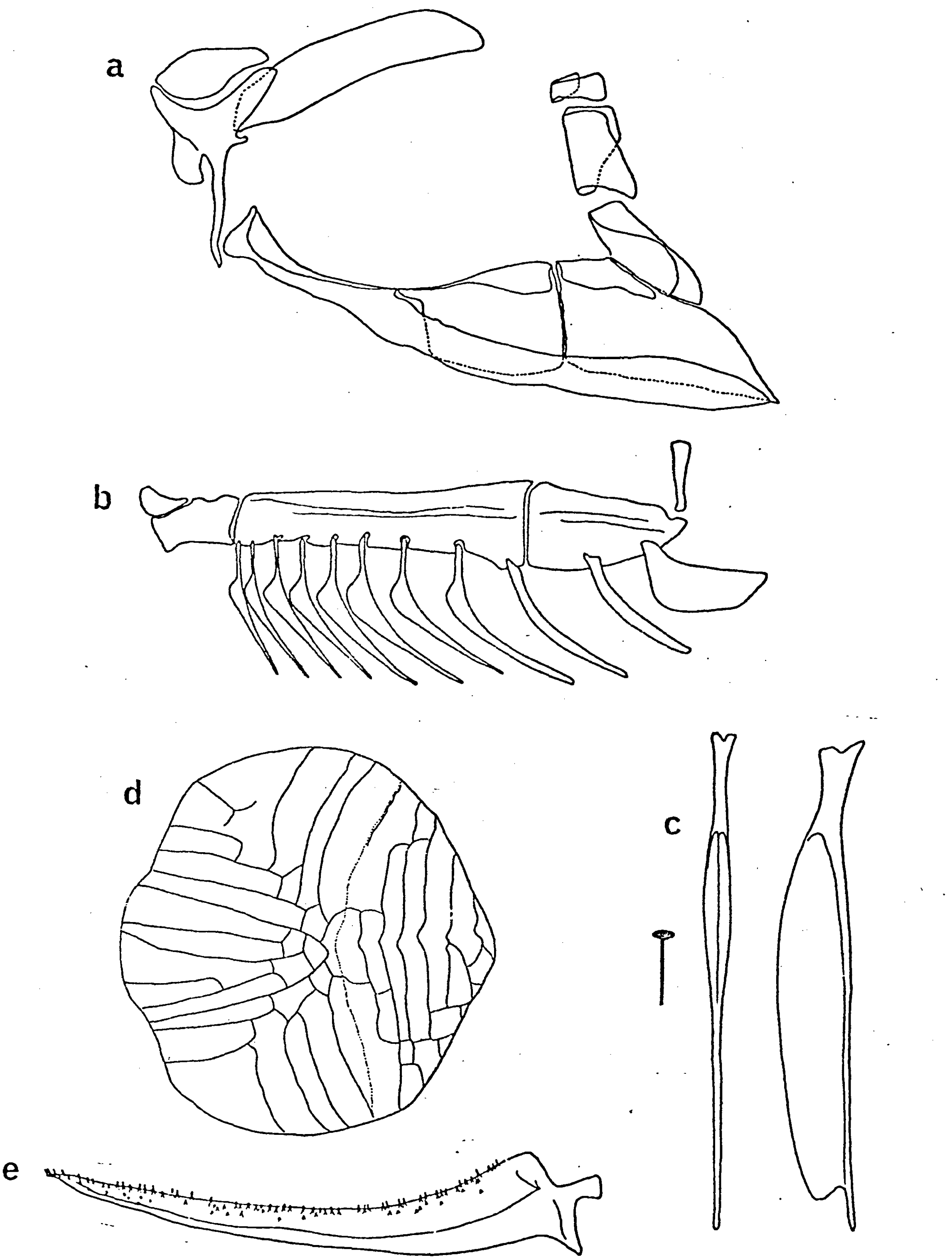


Plate 290. Coilia neglecta:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (all from BMNH. 1967.11.13.950-973, 137.0 mm S.L. for a, b, c, e and 130.0 mm S.L. for d).

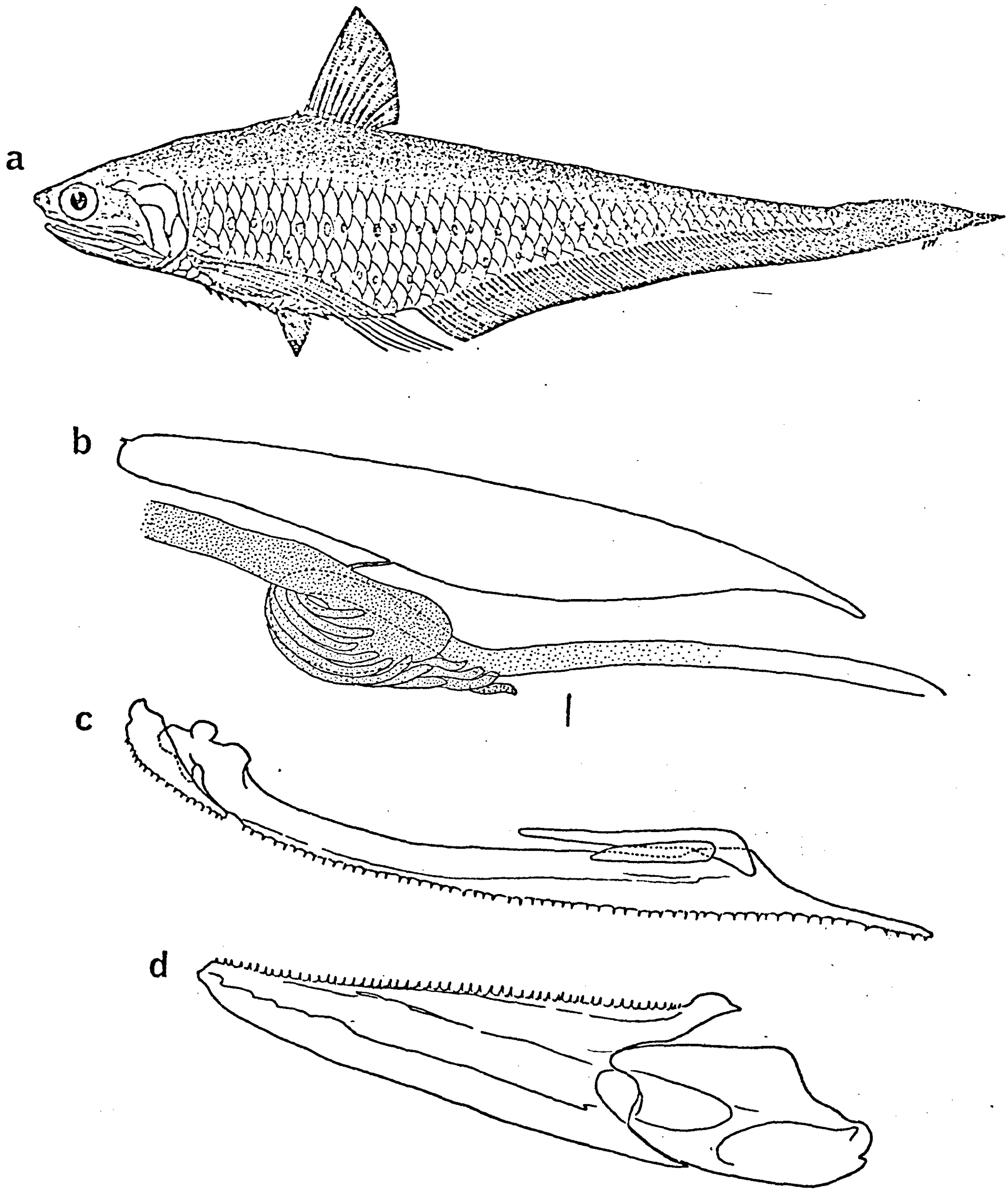


Plate 291. Coilia dussumieri:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws (a from BMNH. 1867.11.28.75, 130.0 mm S.L.; b from BMNH. 1889.2.1.1856-1857, 110.0 mm S.L.; e, d from BMNH. 1889.2.1.1846-1851, 143.0 mm S.L.).

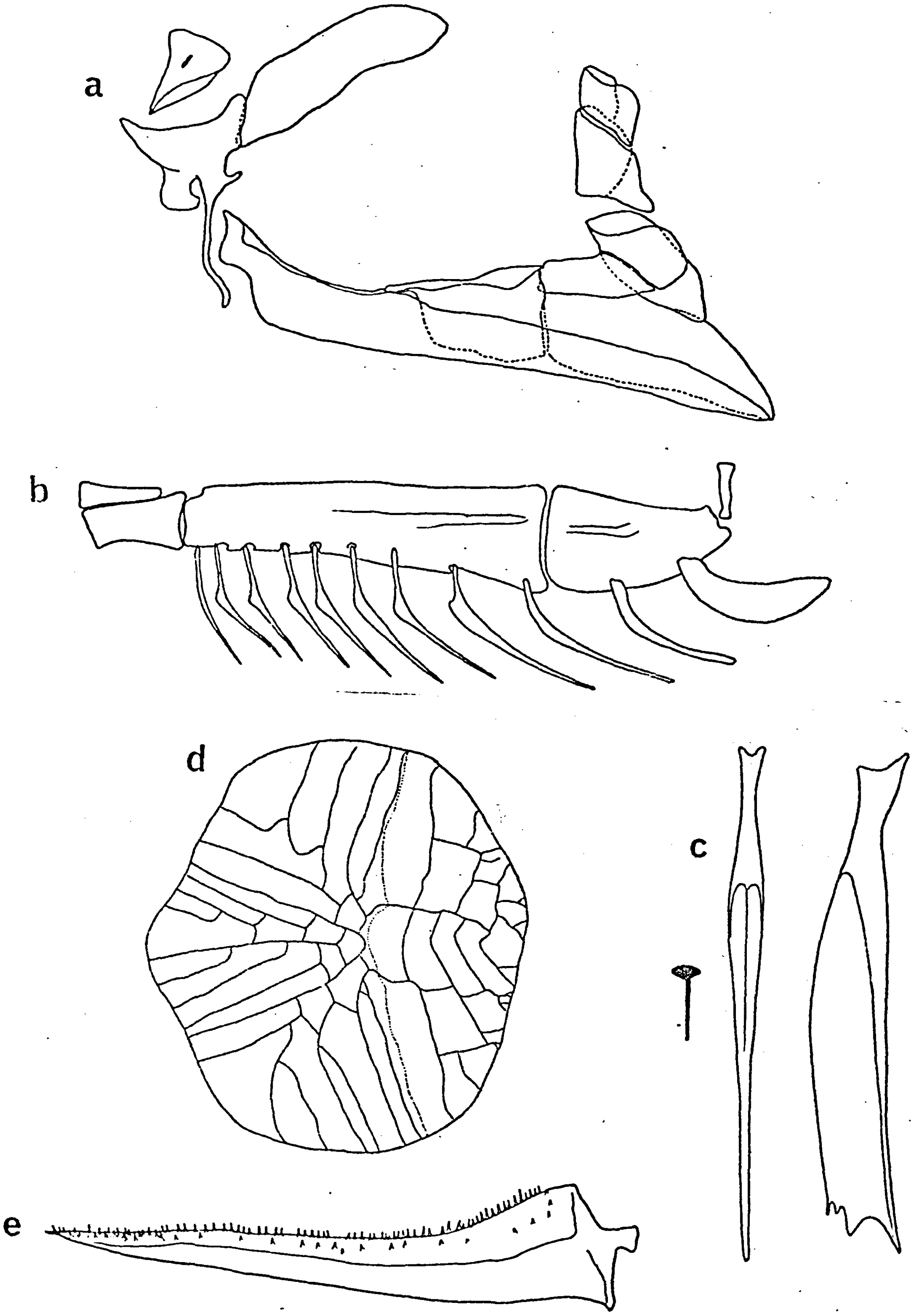


Plate 292. Coilia dussumieri:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, d from BMNH. 1889.2.1.1856-1857, 110.0 mm S.L.; b, c, e from BMNH. 1889.2.1.1846-1851, 143.0 mm S.L.).

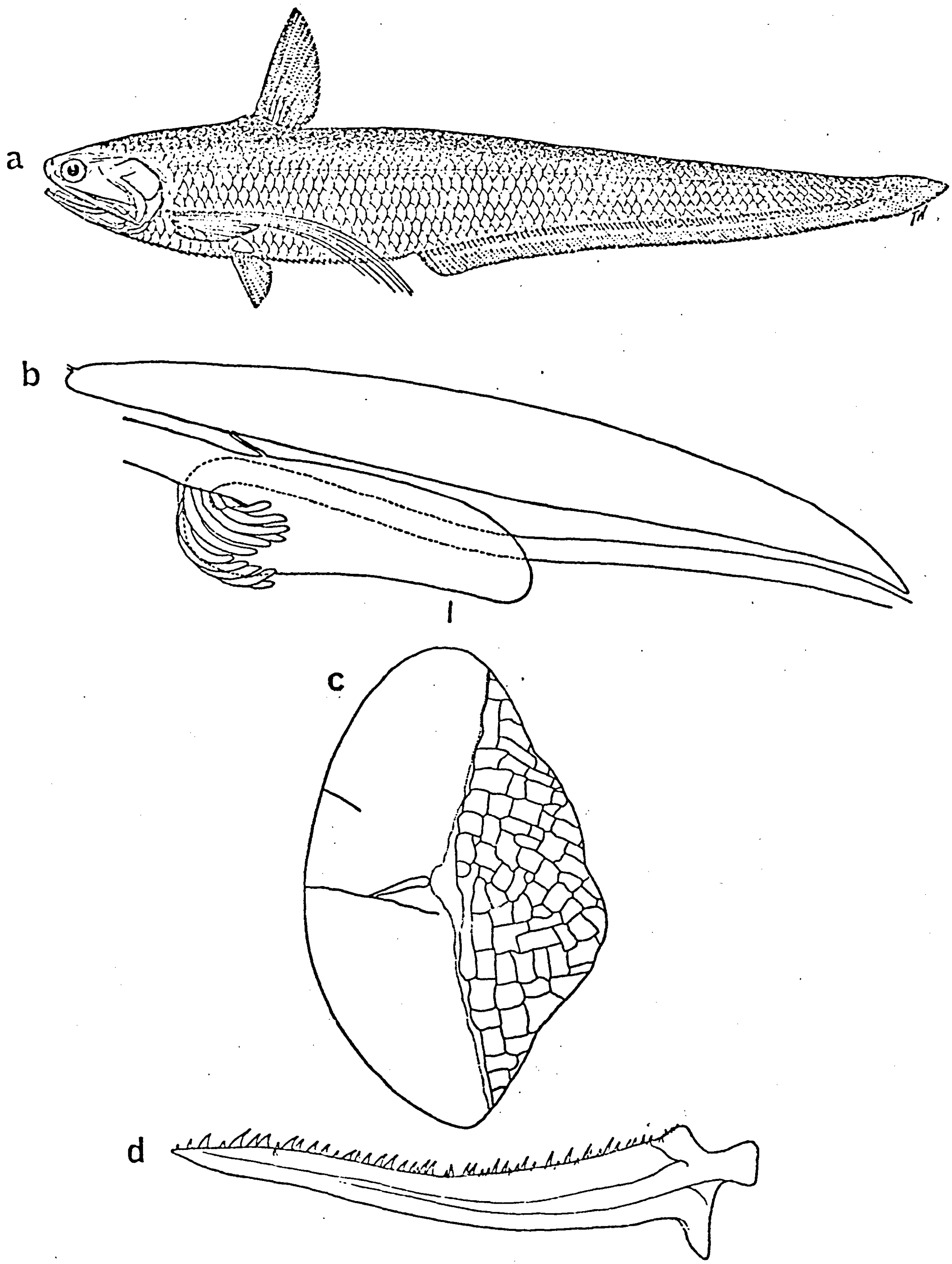


Plate 293. Coilia rendahli:- a, adult; b, gas bladder and digestive tract; c, scale; d, gillraker (a, b, c from BMNH. 1926.10.14.1, 205.0 mm S.L.; d from BMNH. 1927.3.26.2, 270.0 mm S.L.).

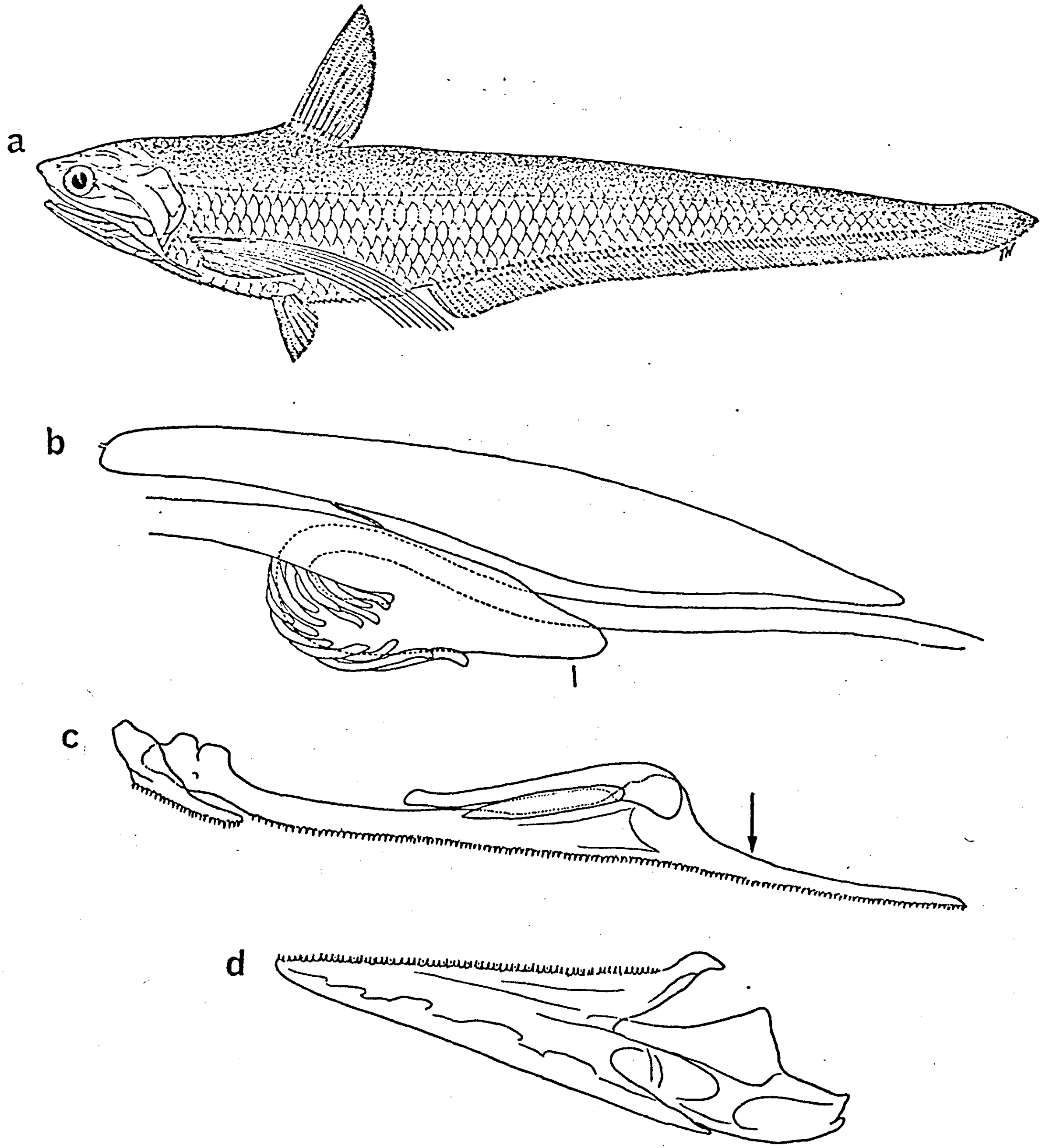


Plate 294. Coilia grayii:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from BMNH. 1933.3.11.839, 210.0 mm S.L.; others from BMNH. 1851.12.27.193-195, 140.0 mm S.L.).

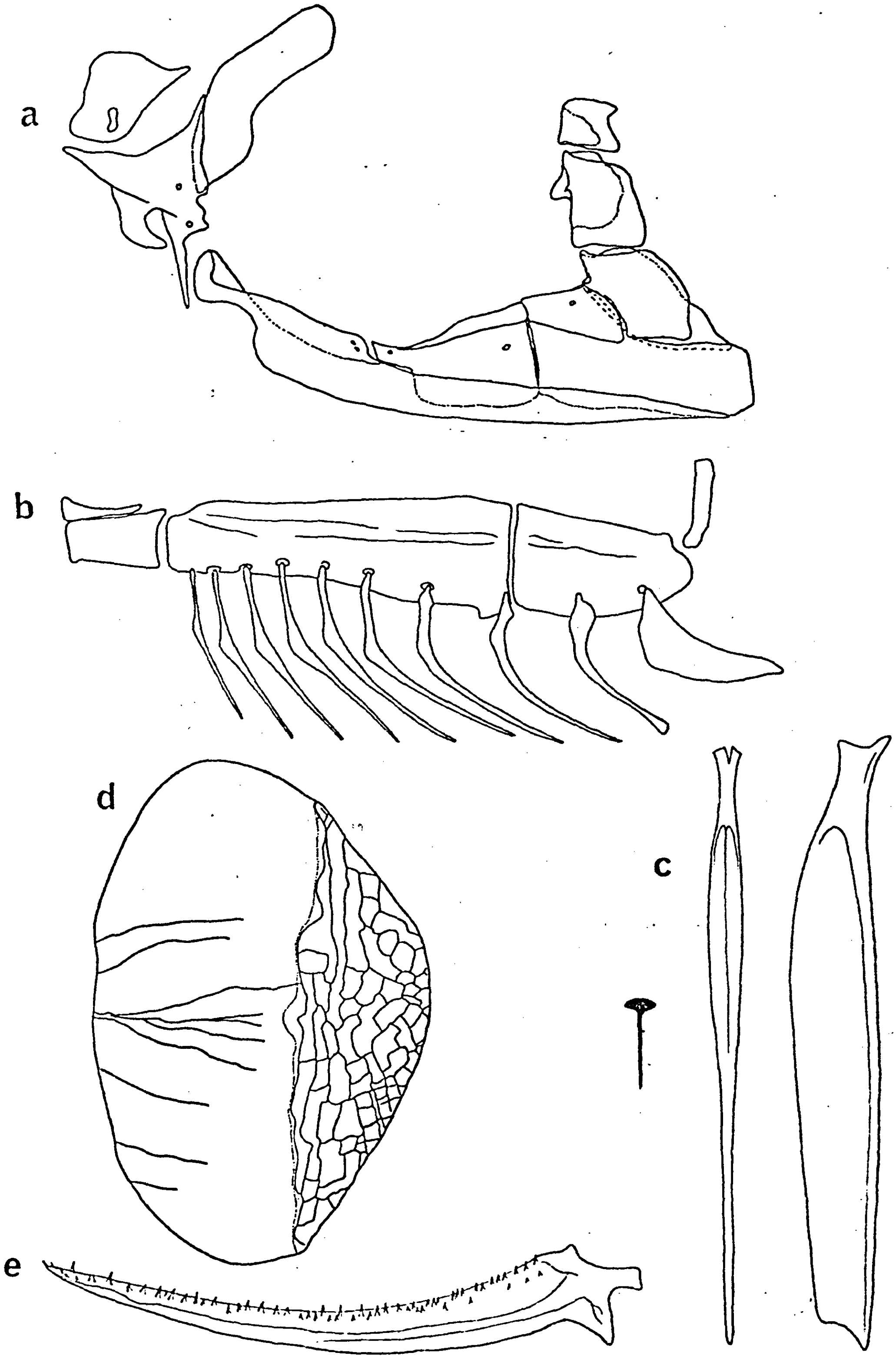


Plate 295. Coilia grayii:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1851.12.27.193-195, 140.0 mm S.L.; d from BMNH. 1933.3.11.839, 210.0 mm S.L.).

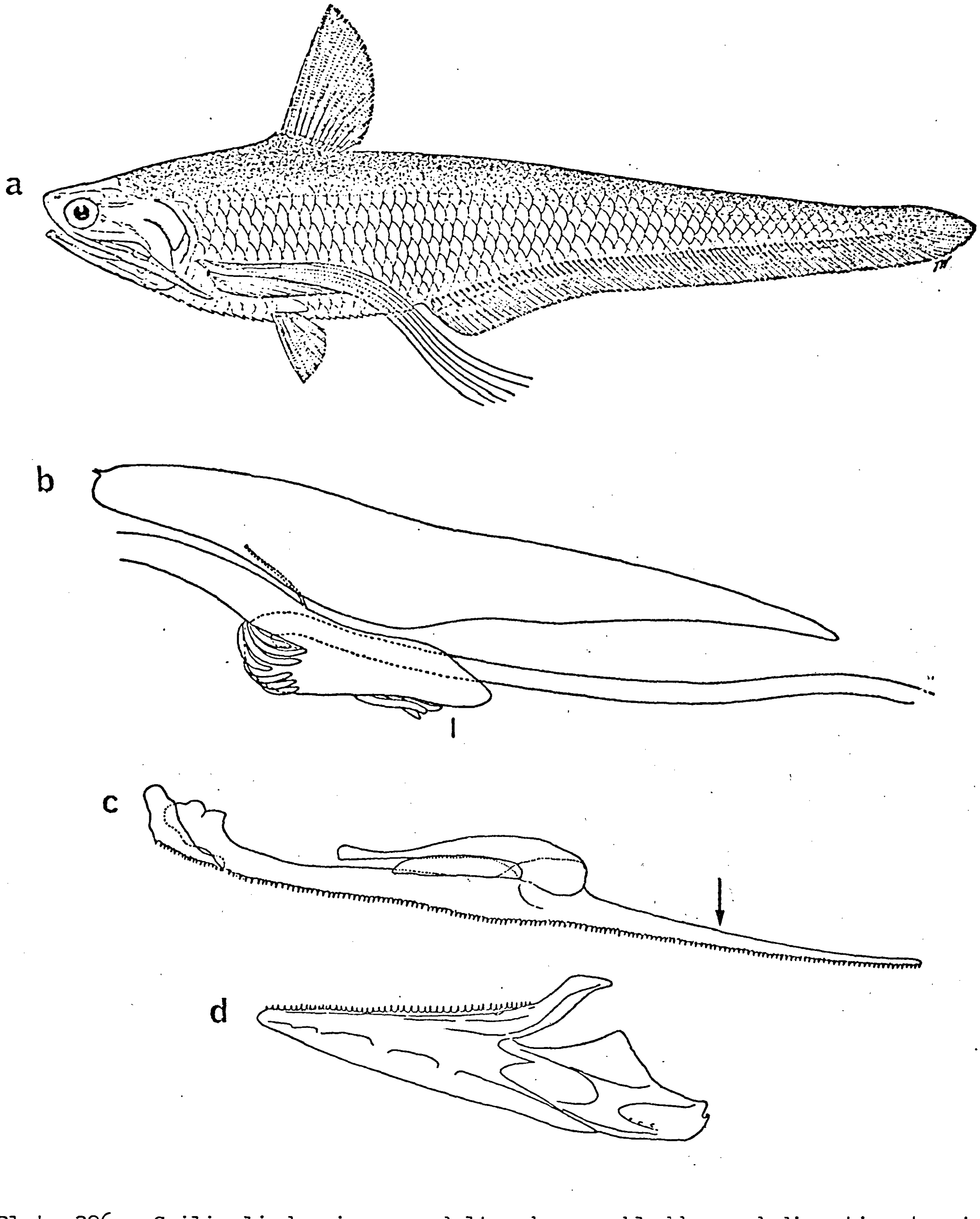


Plate 296. Coilia lindmani:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a, b, from BMNH. 1898.4.2.246-250, 190.0 mm S.L. for a and 141.0 mm S.L. for b; c, d from BMNH. 1966.2.28.41-42, 154.0 mm S.L.).

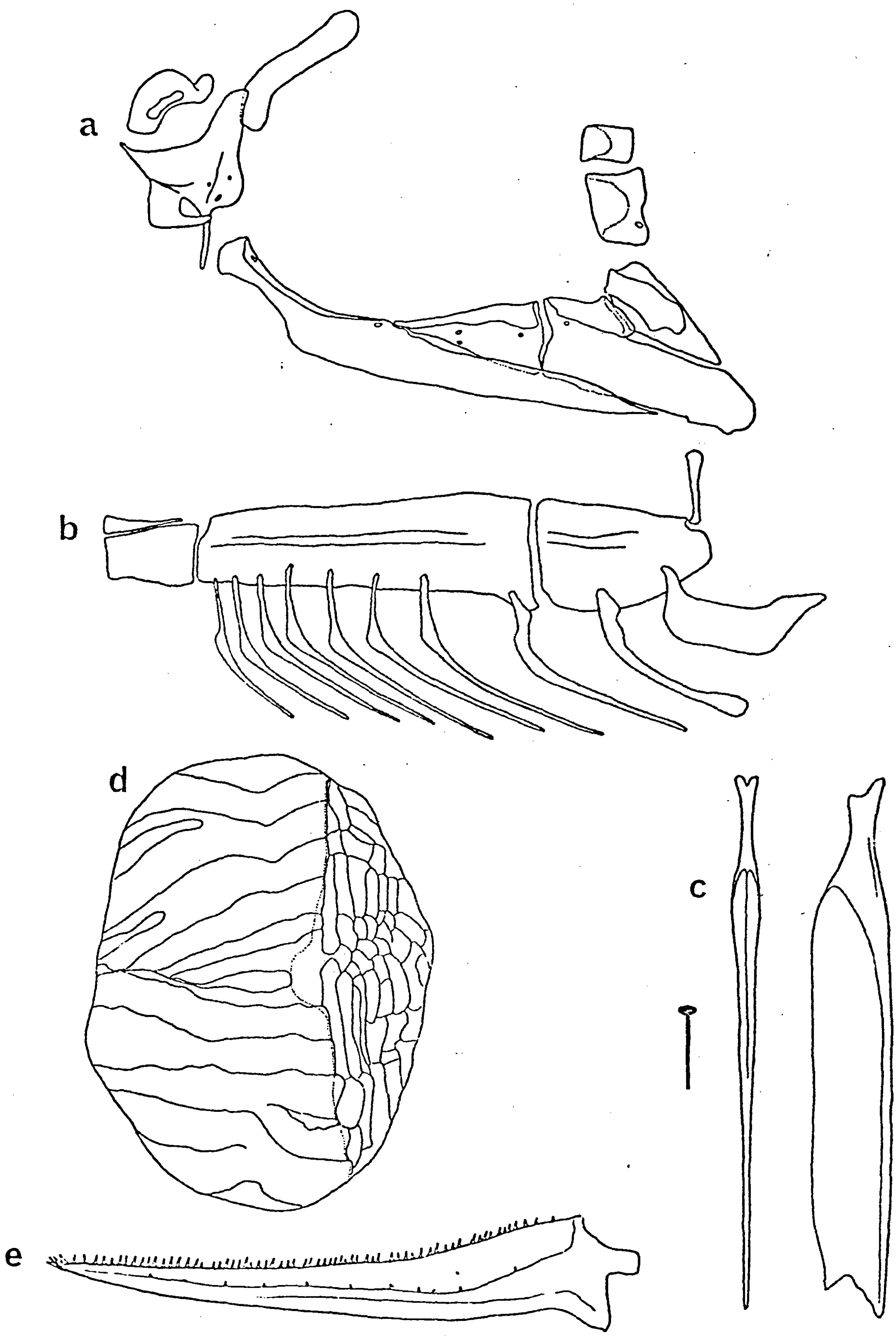


Plate 297. Coilia lindmani:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1966.2.28.41-42, 154.0 mm S.L.; d from BMNH. 1898.4.2.246-250, 190.0 mm S.L.).

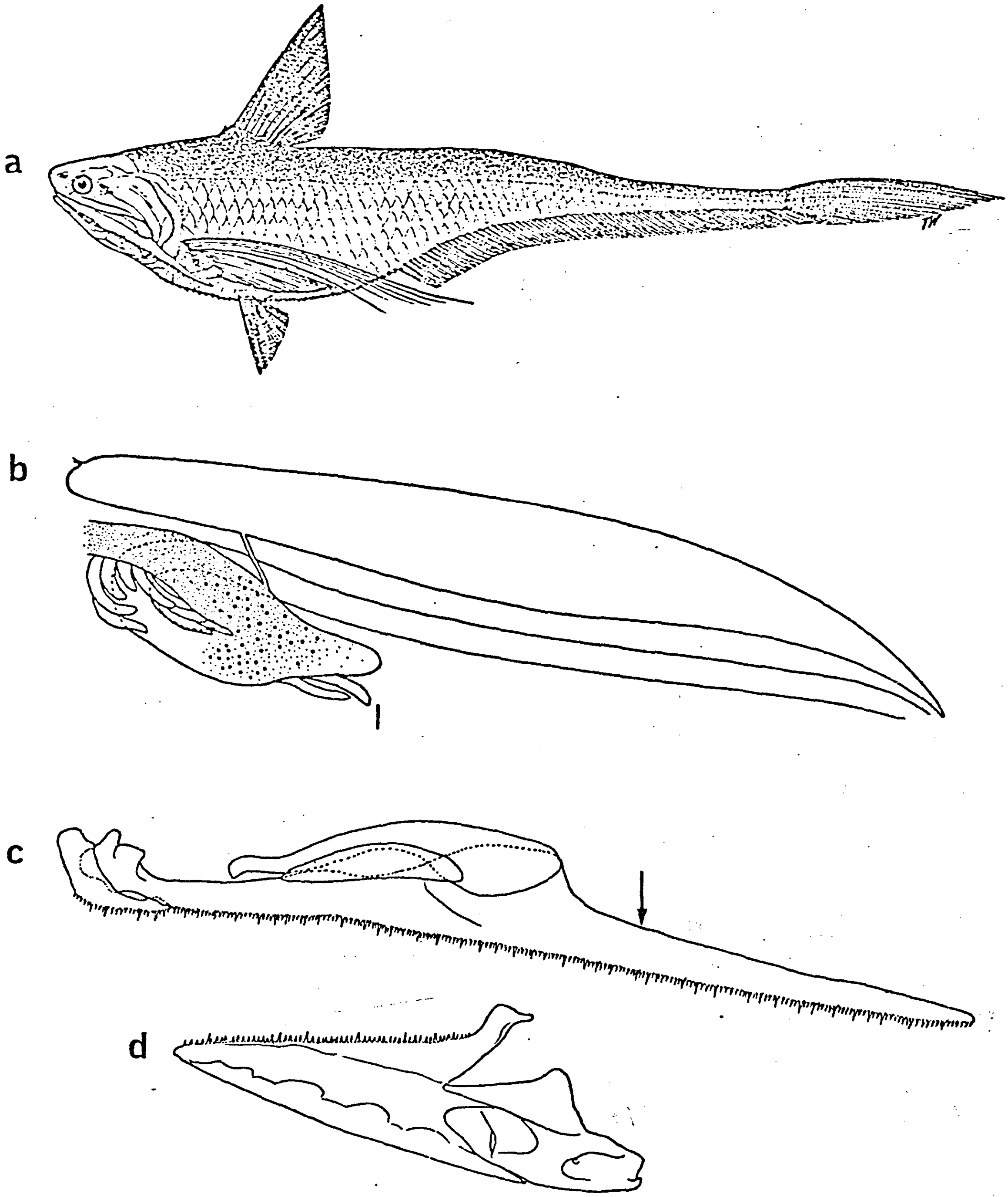


Plate 298. Coilia macrognathos:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (all from BMNH. 1979.8.16.3-4, 140.0 mm S.L.).

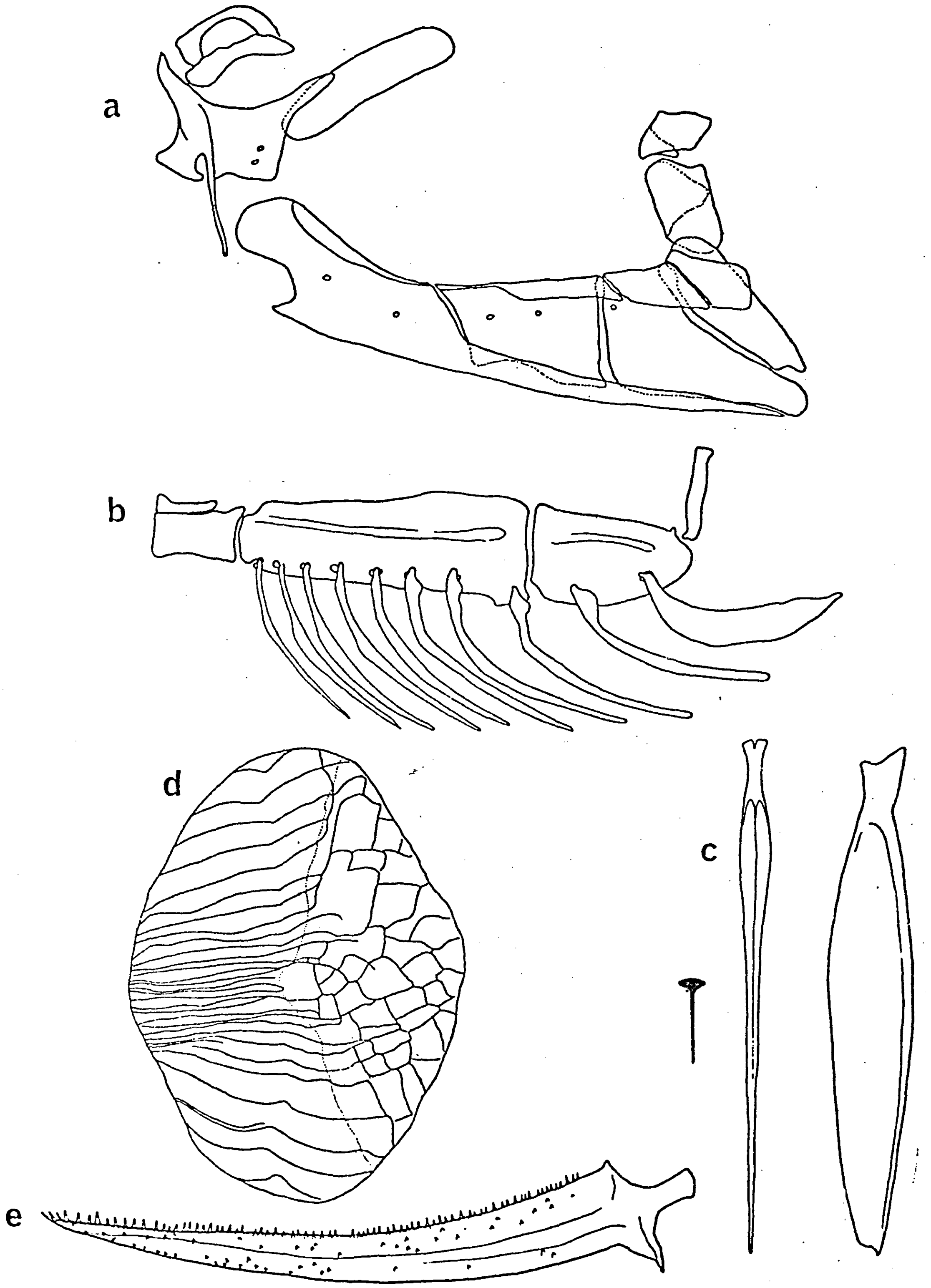


Plate 299. Coilia macrognathos:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1979.8.16.3-4, 140.0 mm S.L.; d from BMNH. 1867.11.28.73, 198.0 mm S.L.).

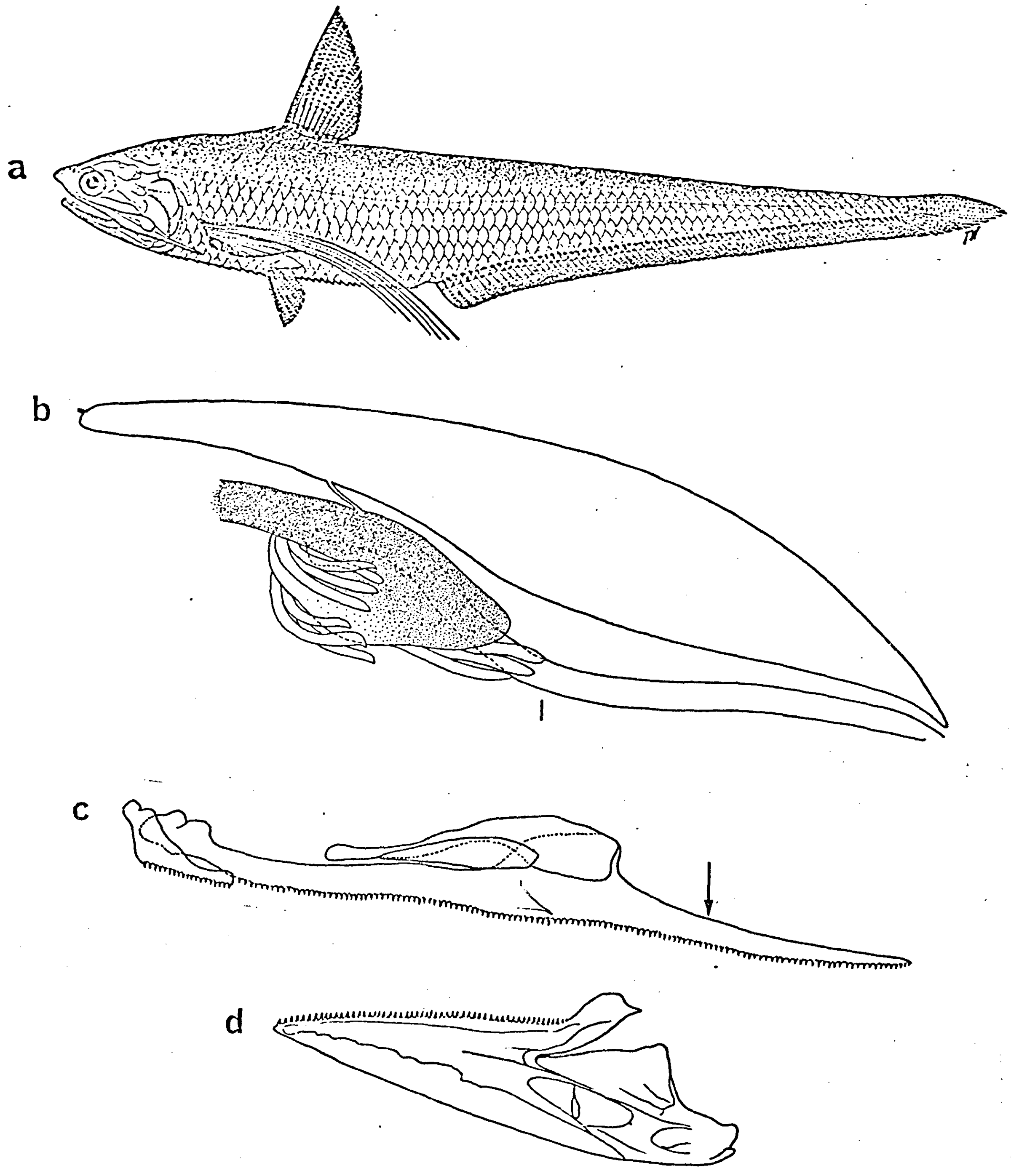


Plate 300. Coilia mystus:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from BMNH. 1860.7.20.35-36, 191.0 mm S.L.; others from BMNH. 1851.12.27.196, 175.0 mm S.L.).

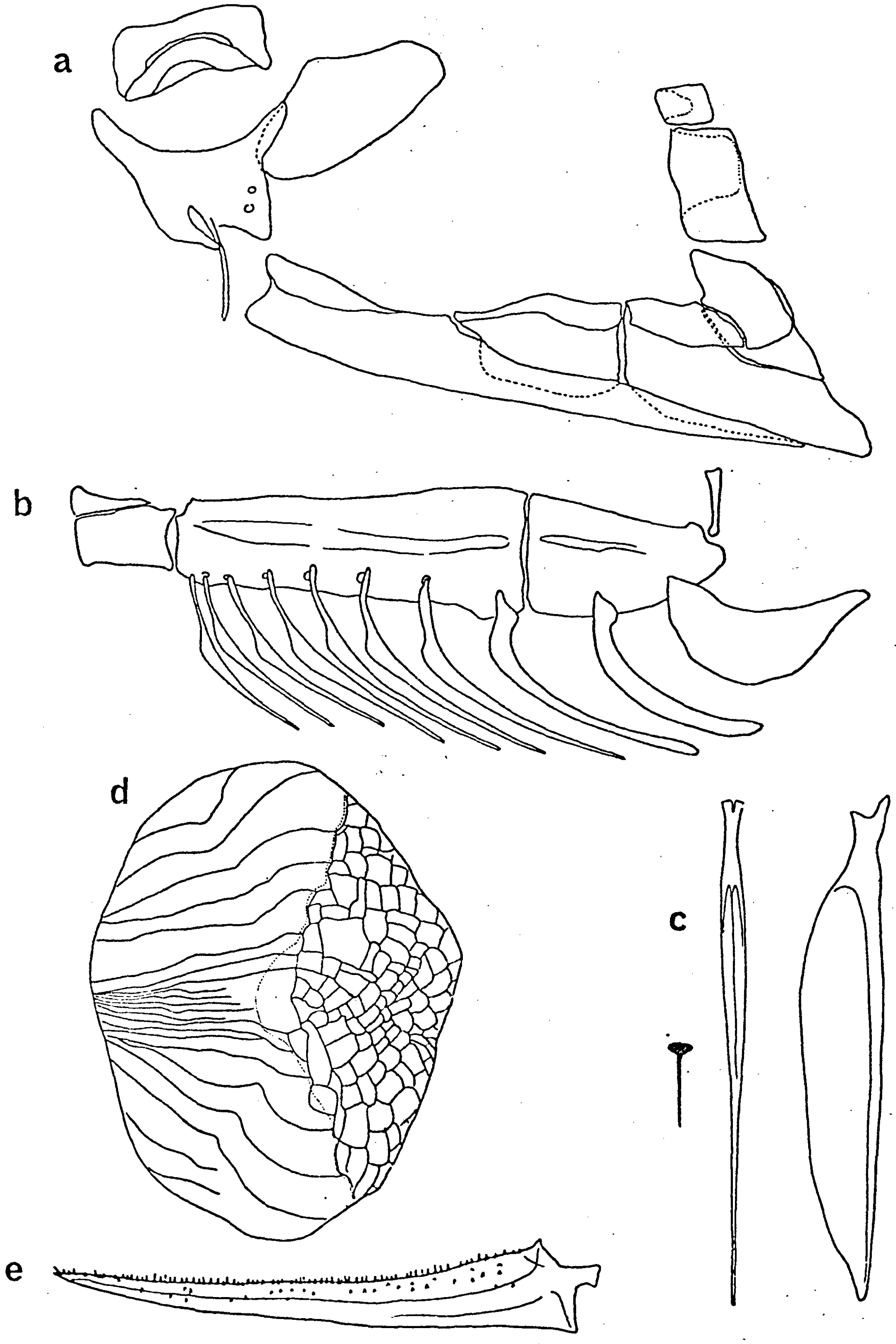


Plate 301. Coilia mystus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillraker (a, b, c, e from BMNH. 1851.12.27.196, 175.0 mm S.L.; d from BMNH. 1860.7.20.35-36, 175.0 mm S.L.).

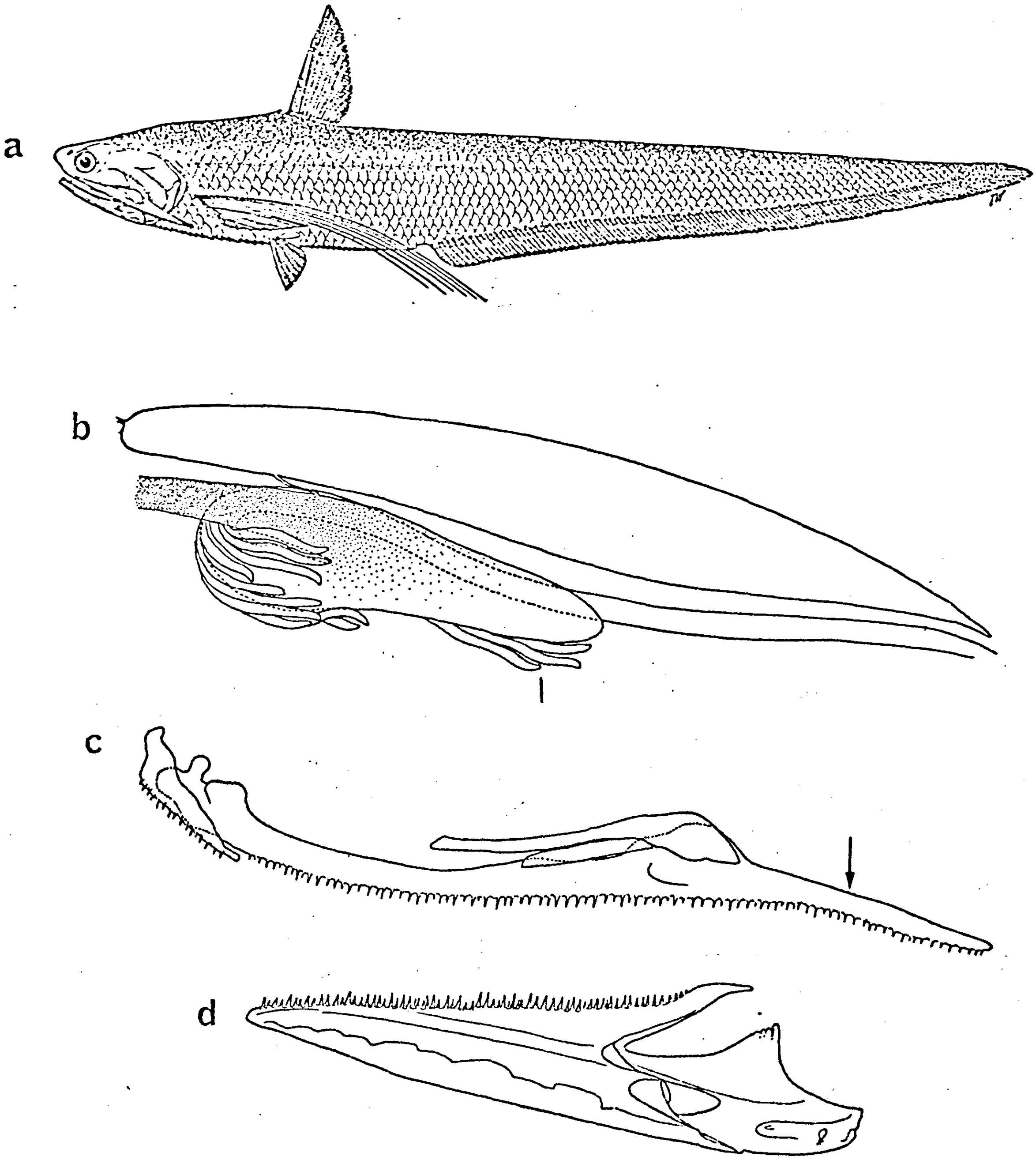


Plate 302. Coilia nasus:- a, adult; b, gas bladder and digestive tract; c, d, upper and lower jaws, arrow indicates position of hind margin of interoperculum (a from BMNH. 1889.6.8.74-77, 287.0 mm S.L.; others from BMNH. 1936.10.19.3-7, 151.0 mm S.L.).

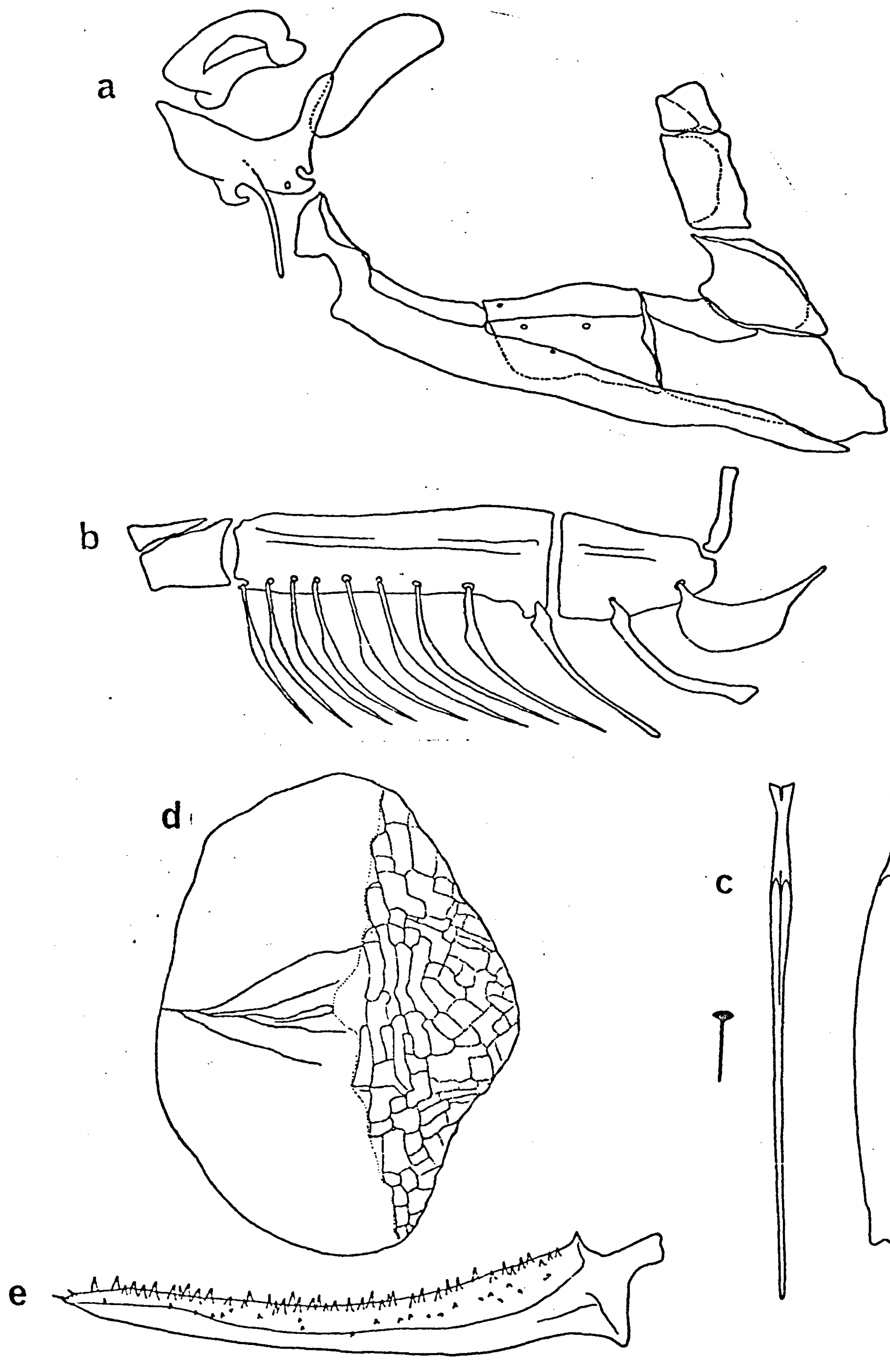


Plate 303. Coilia nasus:- a, circumorbital bones; b, hyoid arch; c, urohyal; d, scale; e, gillarker (a, b, c, e from BMNH. 1936.10.19.3-7, 151.0 mm S.L.; d from BMNH. 1873.7.30.109-113, 258.0 mm S.L.).

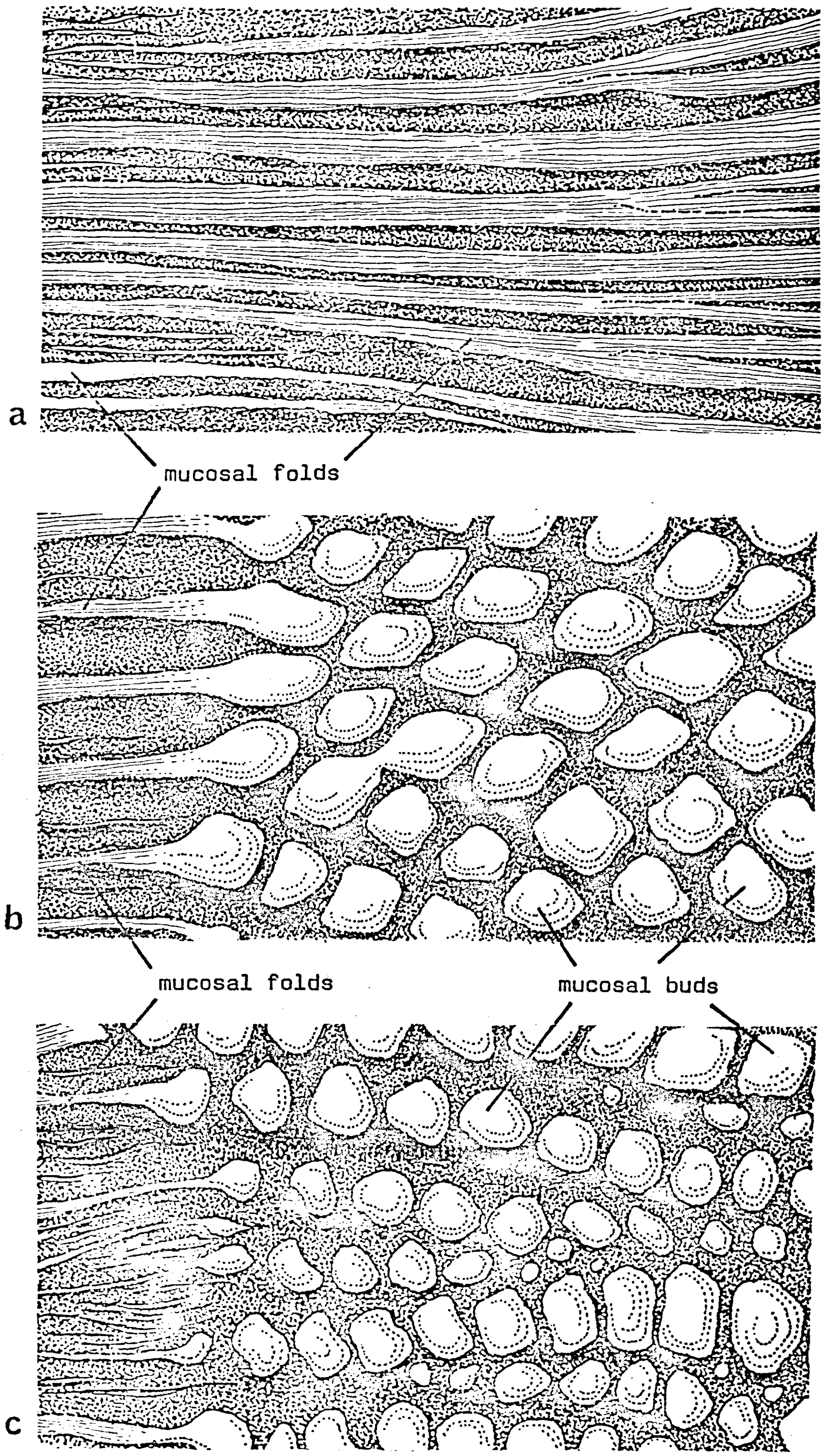


Plate 304. Semi-diagrammatic illustrations showing the pattern of the mucosal folds and buds on inner surface of oesophagus of: a, Dussumieria acuta; Sardinella (Clupeonia) atricauda; c, Herklotsichthys koningsbergeri. Anterior is to left.

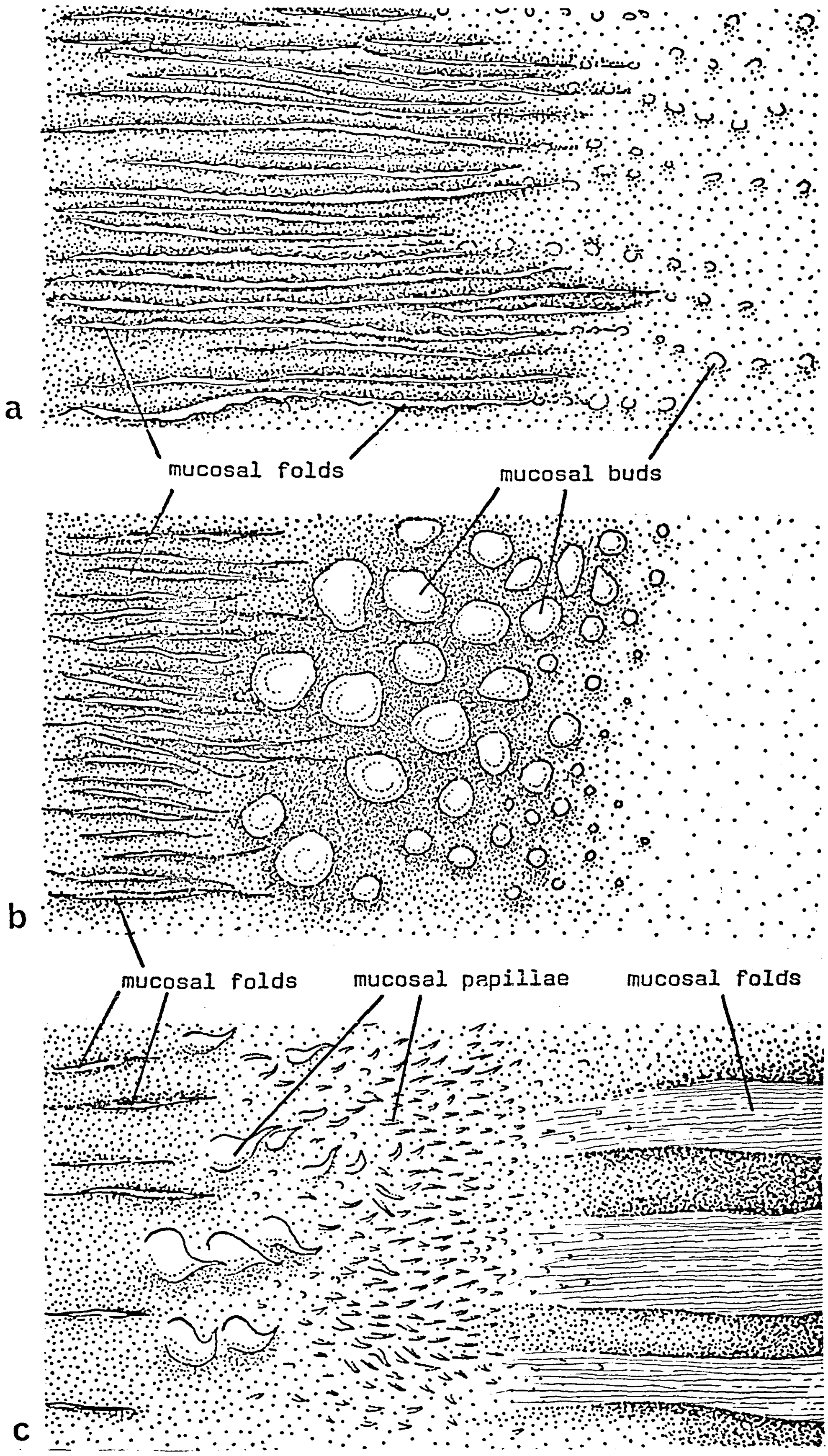


Plate 305. Semi-diagrammatic illustrations showing the pattern of the mucosal folds and buds or papillae on inner surface of oesophagus of: a, Tenualosa toli; b, Nematalosa papuensis; c, Anodontostoma thailandiae. Smooth surface pattern of Escualosa, all Pristigasterinae and most Engraulidae is not shown here. Anterior is to left.

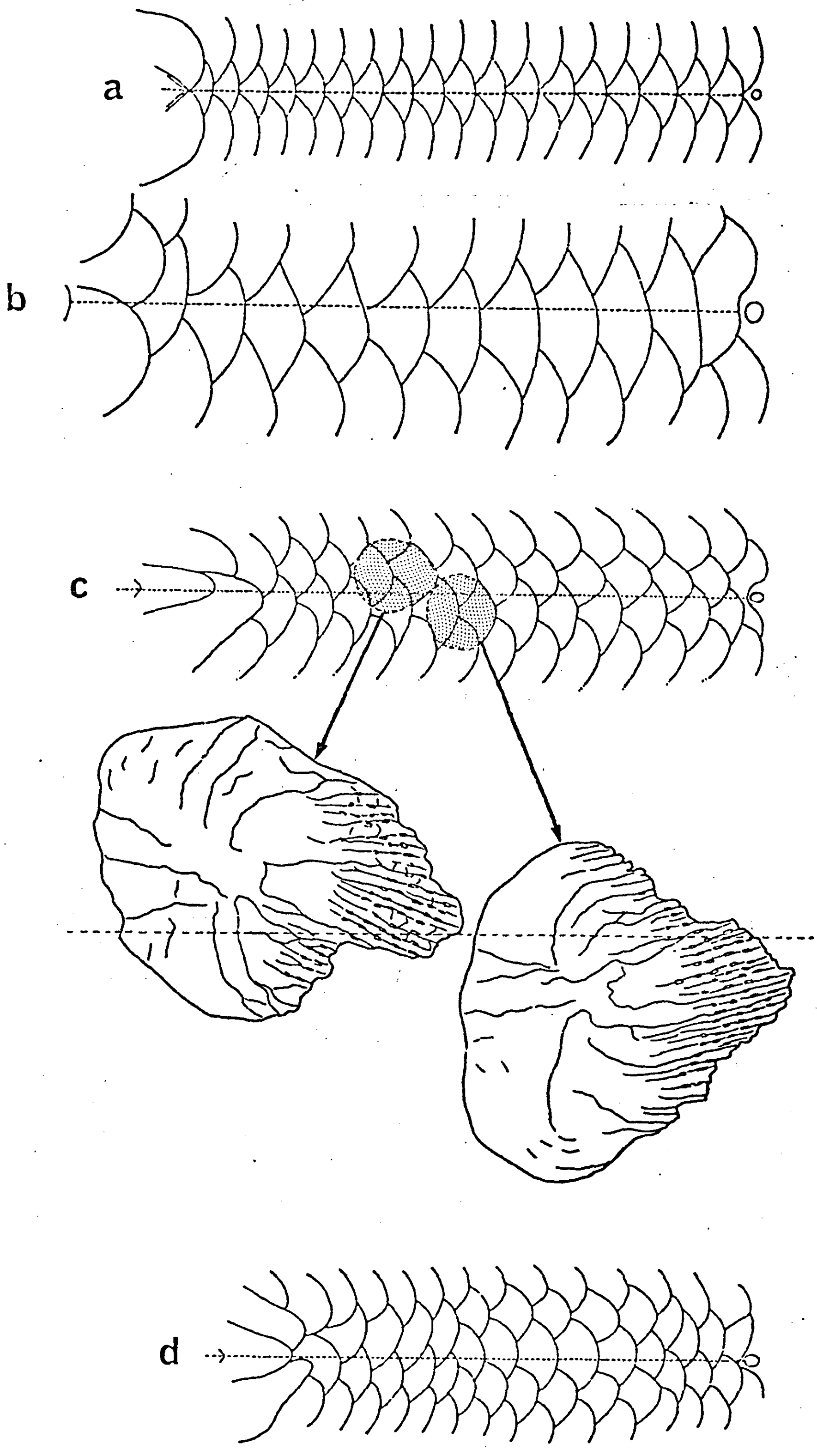


Plate 306. Arrangements of predorsal scales: a, Etrumeus teres; b, Spratelloides delicatulus; c, Sardinella (Clupeonia) brachysoma; d, S. (Clupeonia) marquesensis. Anterior is to left.

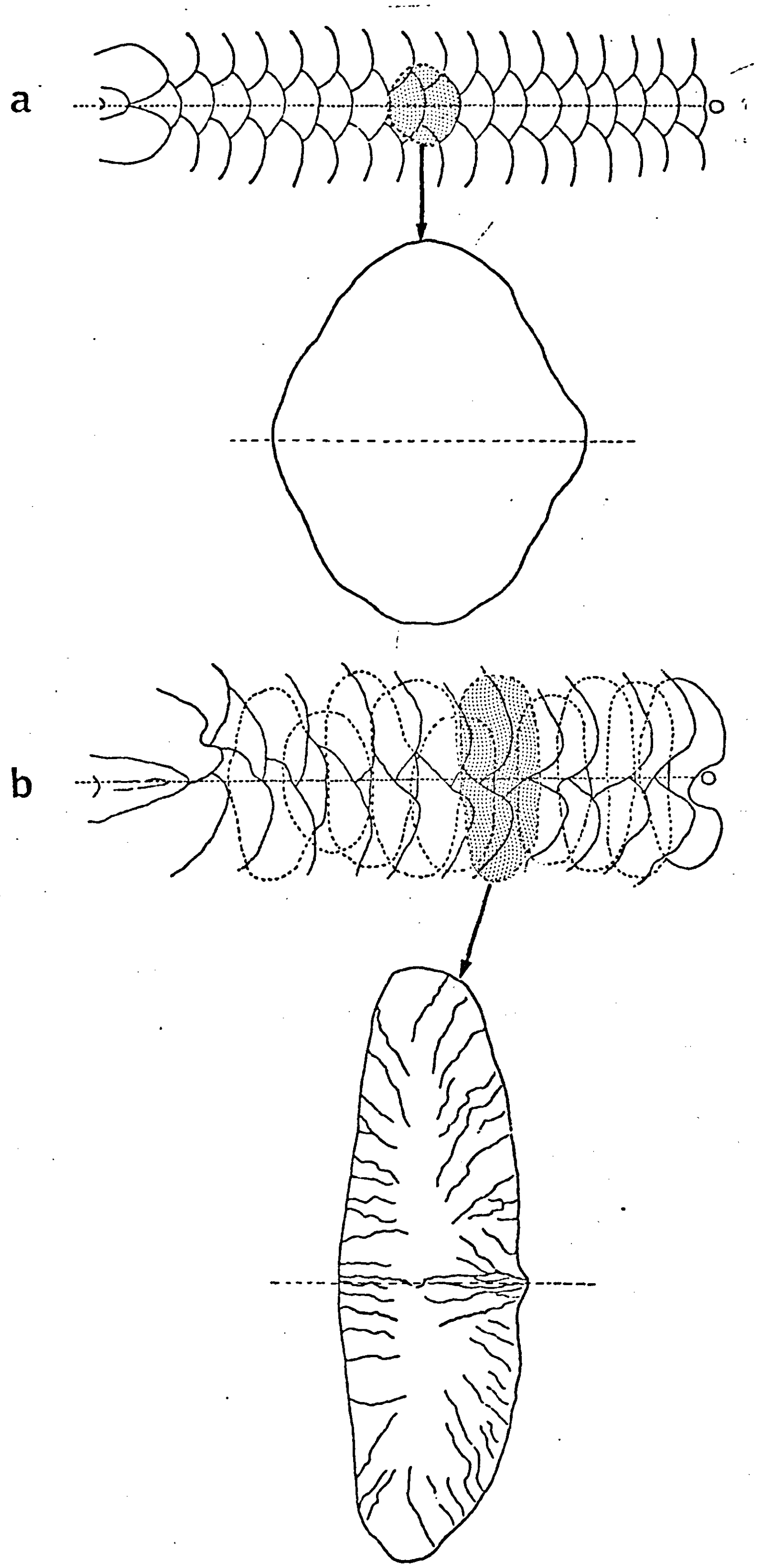


Plate 307. Arrangements of predorsal scales: a, Amblygaster leiogaster; b, Herklotsichthys quadrimaculatus. Anterior is to left.

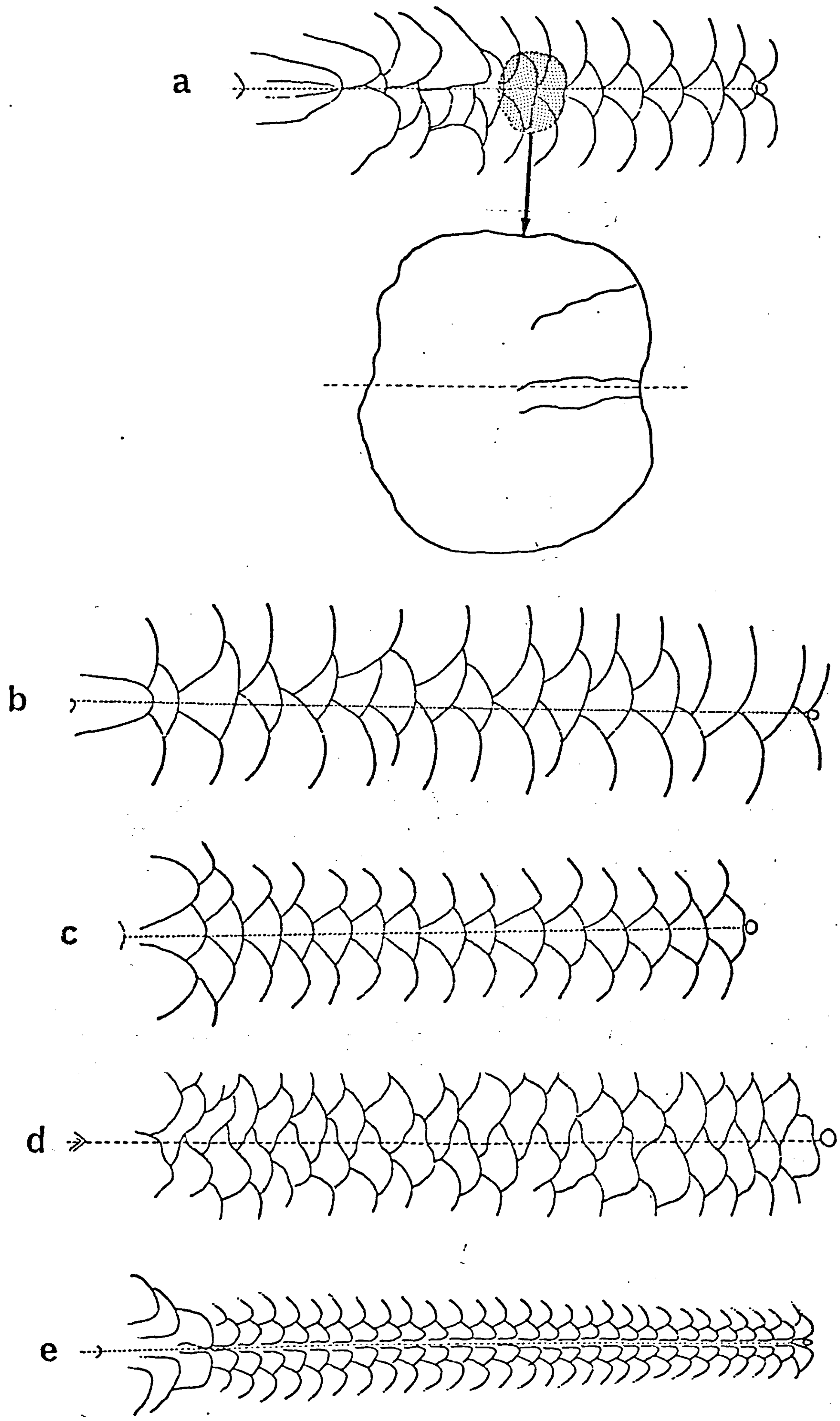


Plate 308. Arrangements of predorsal scales: a, Herklotsichthys punctatus; b, H. dispilonotus; c, Escualosa thoracata; d, Tenualosa thibaudeaui; e, Konosirus punctatus. Anterior is to left.

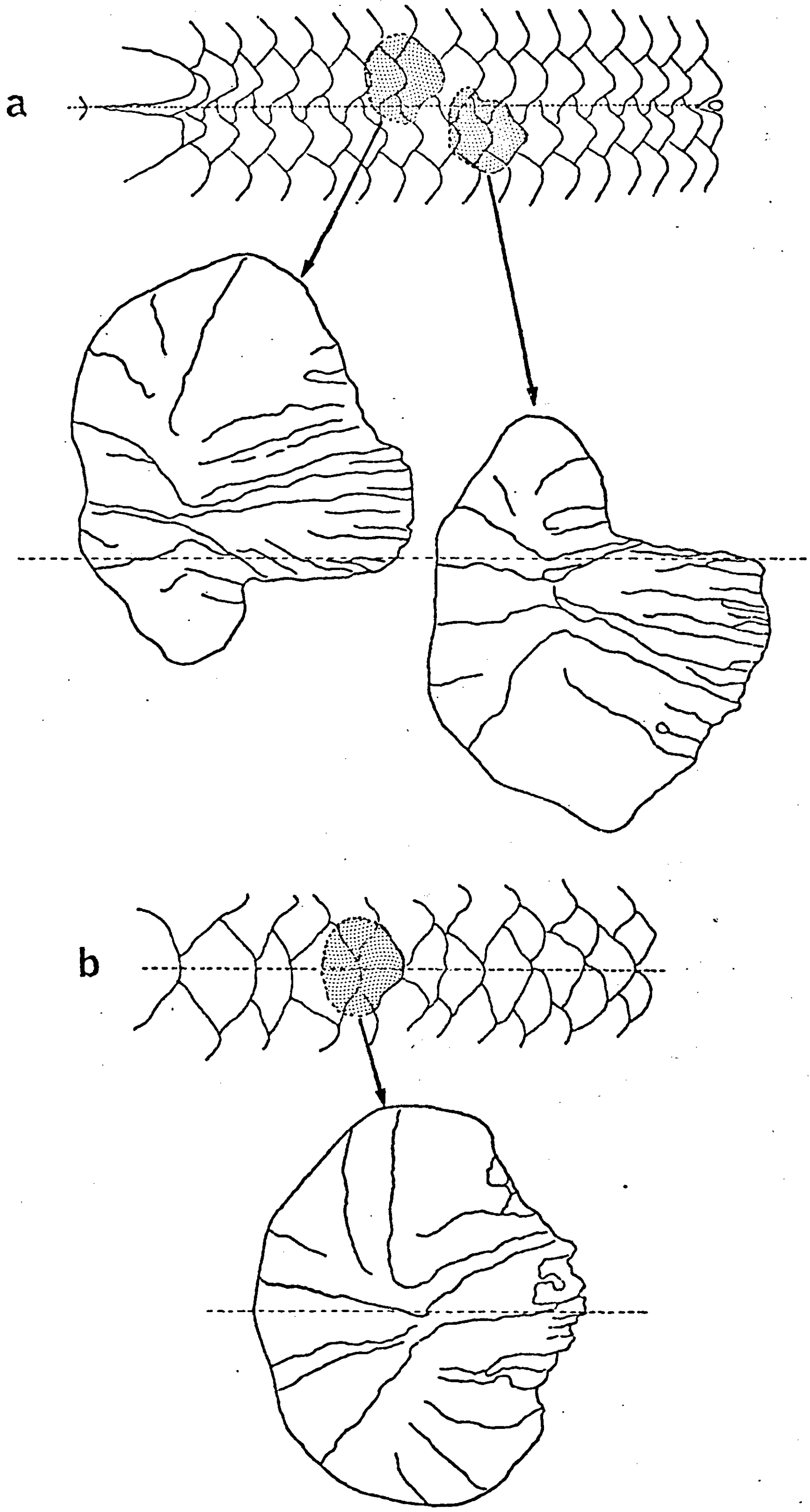


Plate 309. Arrangements of predorsal scales: a, and postdorsal scales; b, of Nematalosa nasus. Anterior is to left.

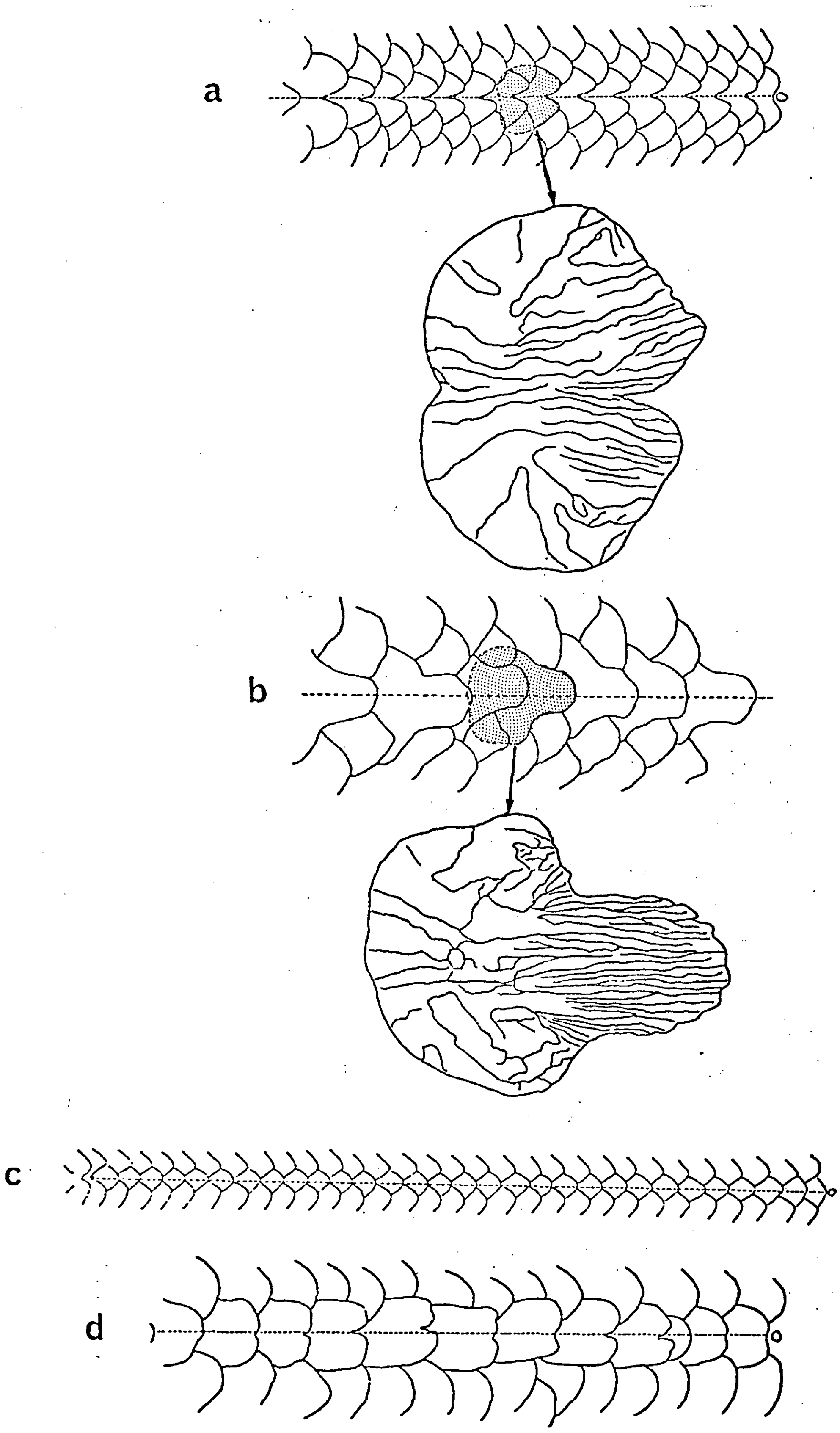


Plate 310. Arrangements of predorsal scales: a, Anodontostoma thailandiae with b, arrangement of postdorsal scales of the same species; c, Opisthopterus tardoore; d, Clupeoides borneensis. Anterior is to left.

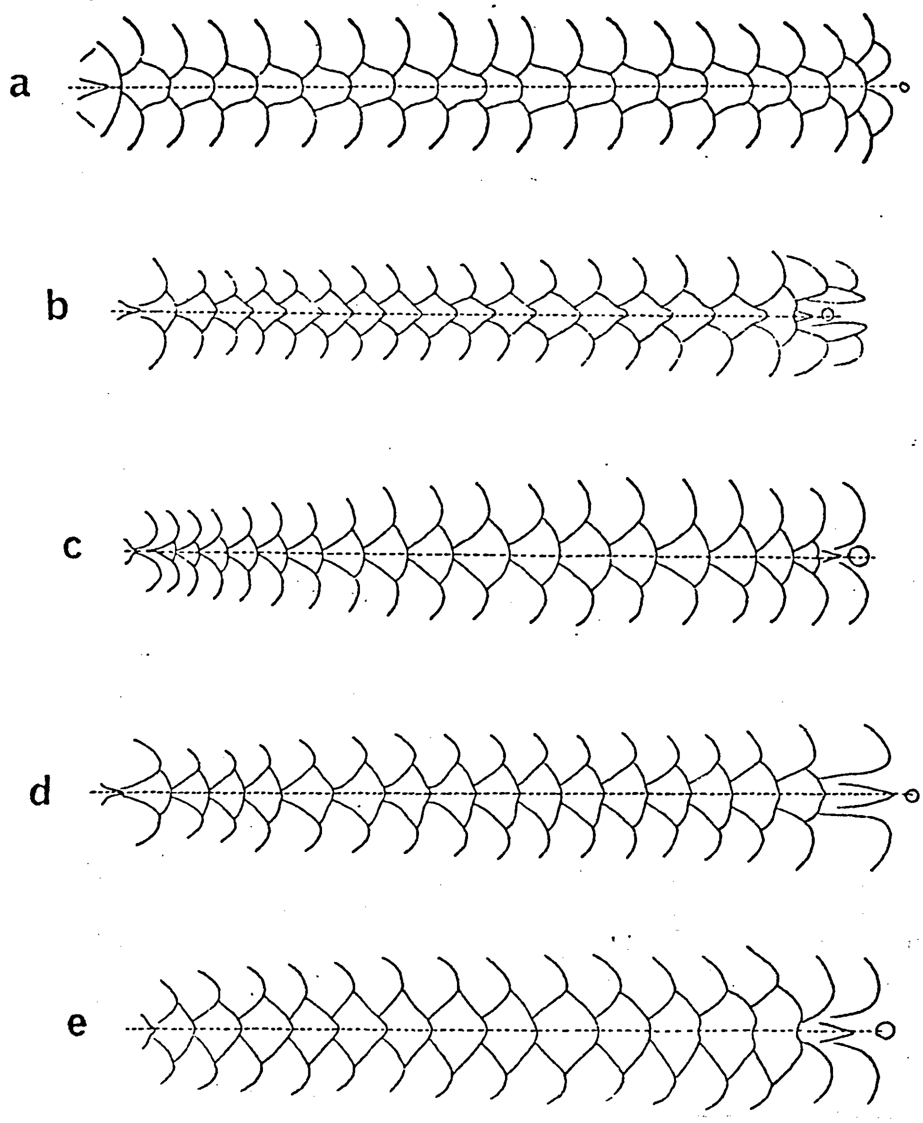


Plate 311. Arrangements of predorsal scales: a, Corica laciniata; b, Stolephorus dubiosus; c, Thryssa (Scutengraulis) dussumieri; d, Setipinna taty; e, Coilia ramcarati. Anterior is to left.

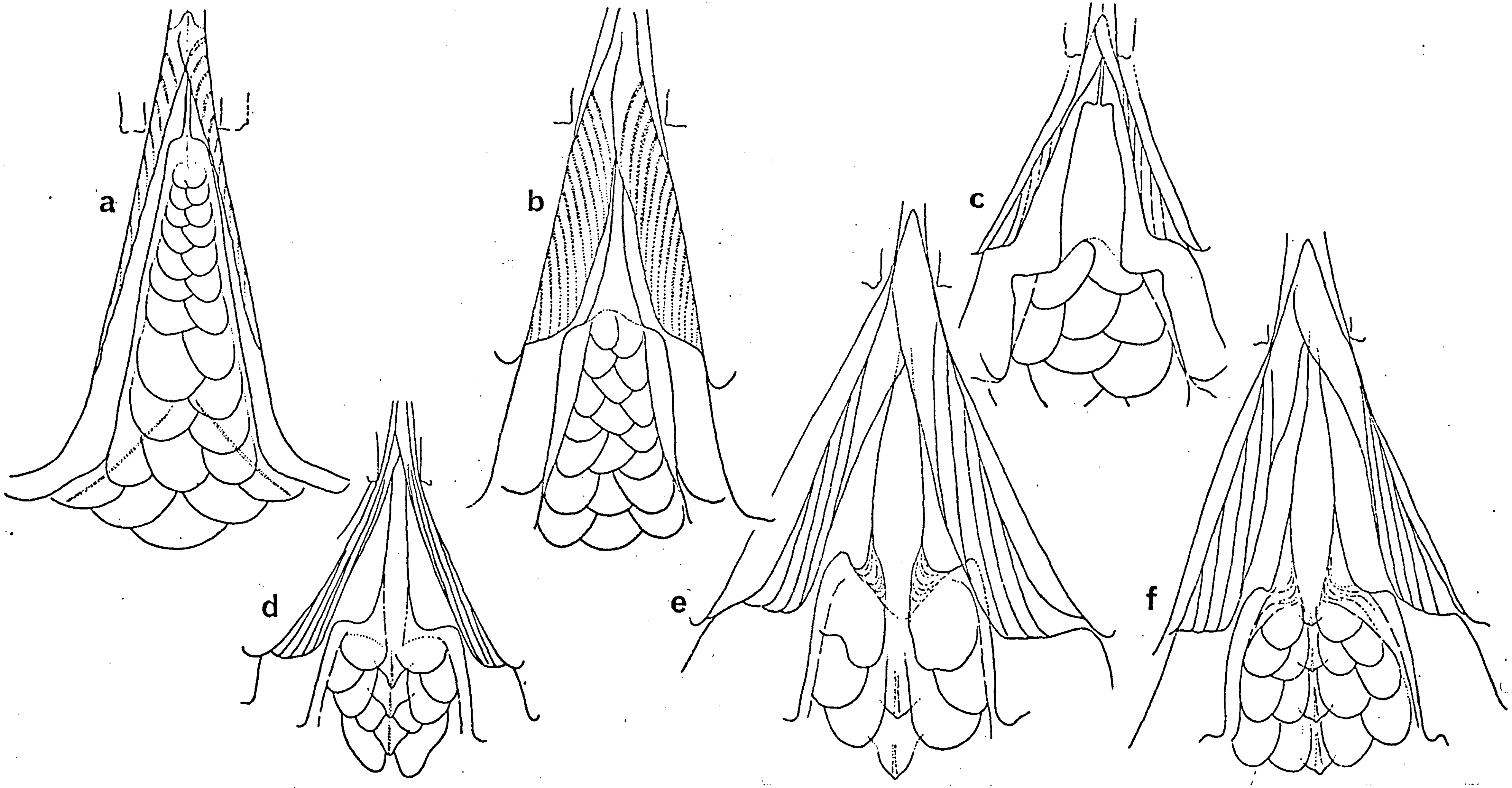


Plate 312. Diagrammatic illustrations of isthmus shape and arrangement of scales on it with relation to branchiostegal membranes and rays: a, Etrumeus teres; b, Dussumieria acuta; c, Spratelloides delicatulus; d, Sardinella neglecta; e, Amblygaster sirm; f, Herklotsichthys koningsbergeri.

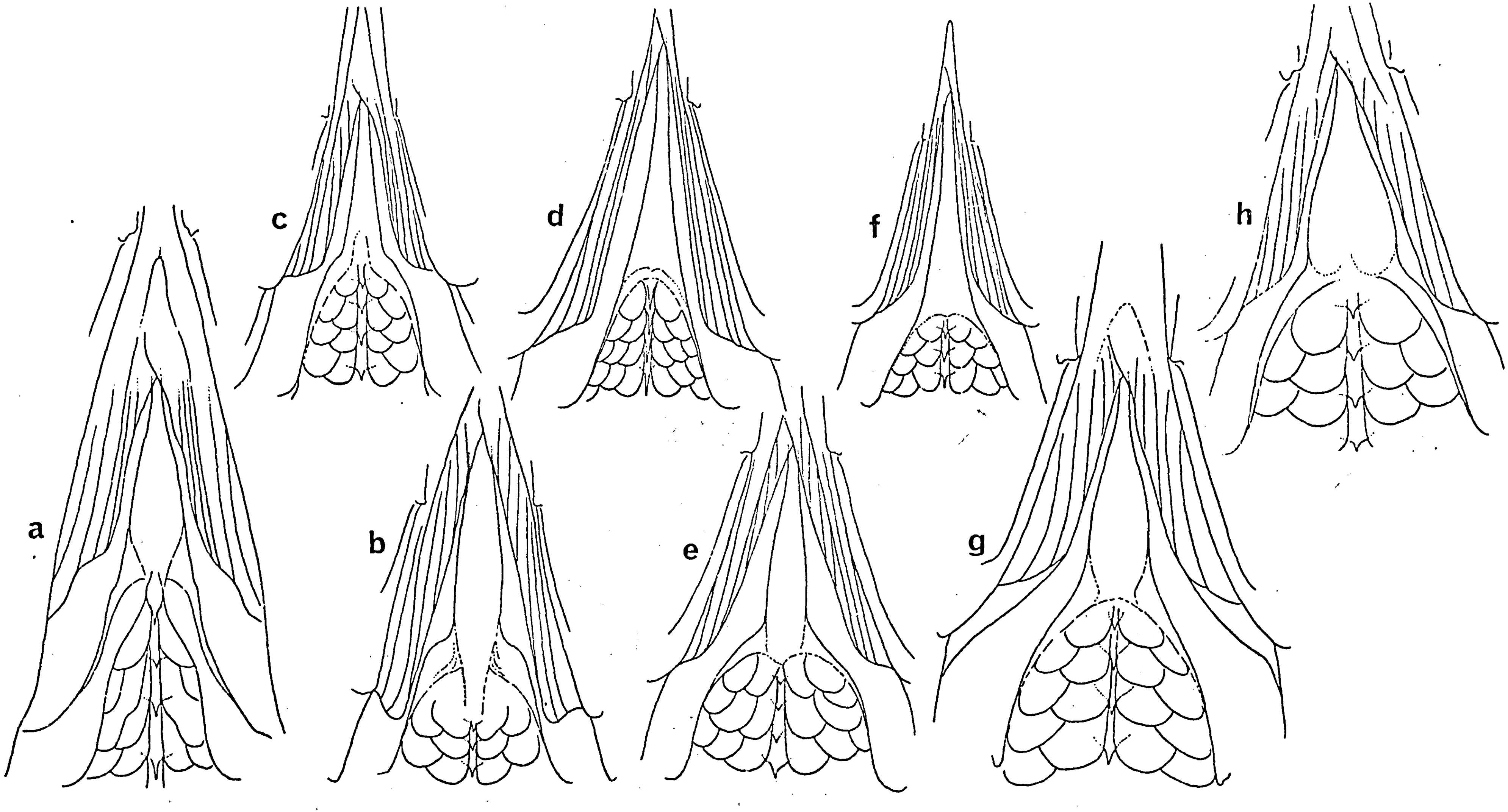


Plate 313. Diagrammatic illustrations of isthmus shape and arrangement of scales on it in relation to branchiostegal membranes and rays: a, Escualosa thoracata; b, Hilsa kelee; c, Tenualosa ilisha; d, Gudusia chapra; e, Konosirus punctatus; f, Clupanodon thrissa; g, Nematalosa papuensis; h, Gonialosa manmina.

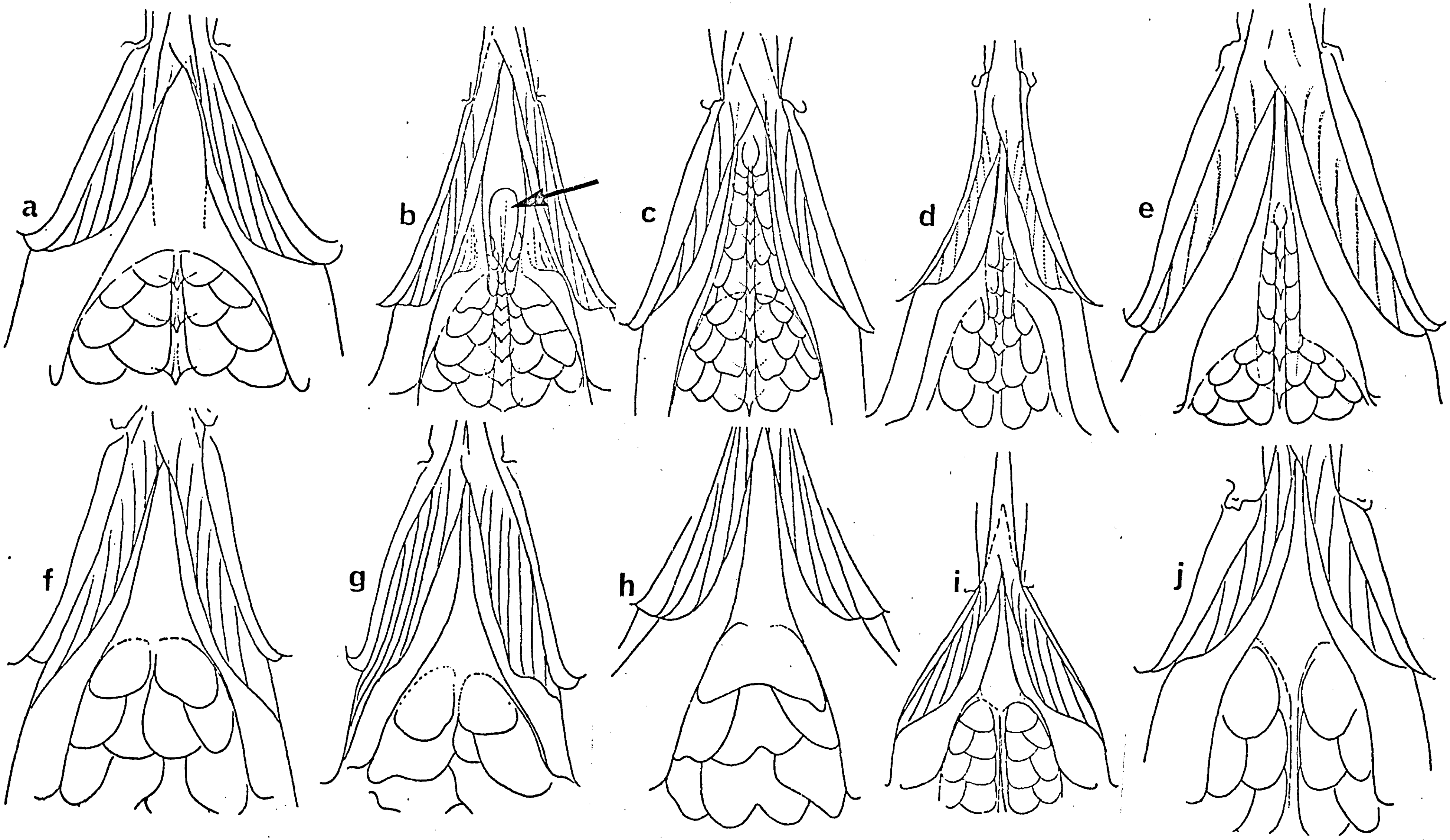


Plate 314. Diagrammatic illustrations of isthmus shape and arrangement of scales on it in relation to branchiostegal membranes and rays: a, *Anodontostoma thailandiae*; b, *Pellona dayi* (arrow indicates enlarged anteriormost prepelvic scute); c, *Ilisha megaloptera*; d, *Opisthopterus valenciennesi*; e, *Raconda russeliana*; f, *Ehirava fluviatilis*; g, *Clupeoides venulosa*; h, *Corica laciniata*; i, *Clupeichthys aesarnensis*; j, *Clupeichthys goniognathus*.

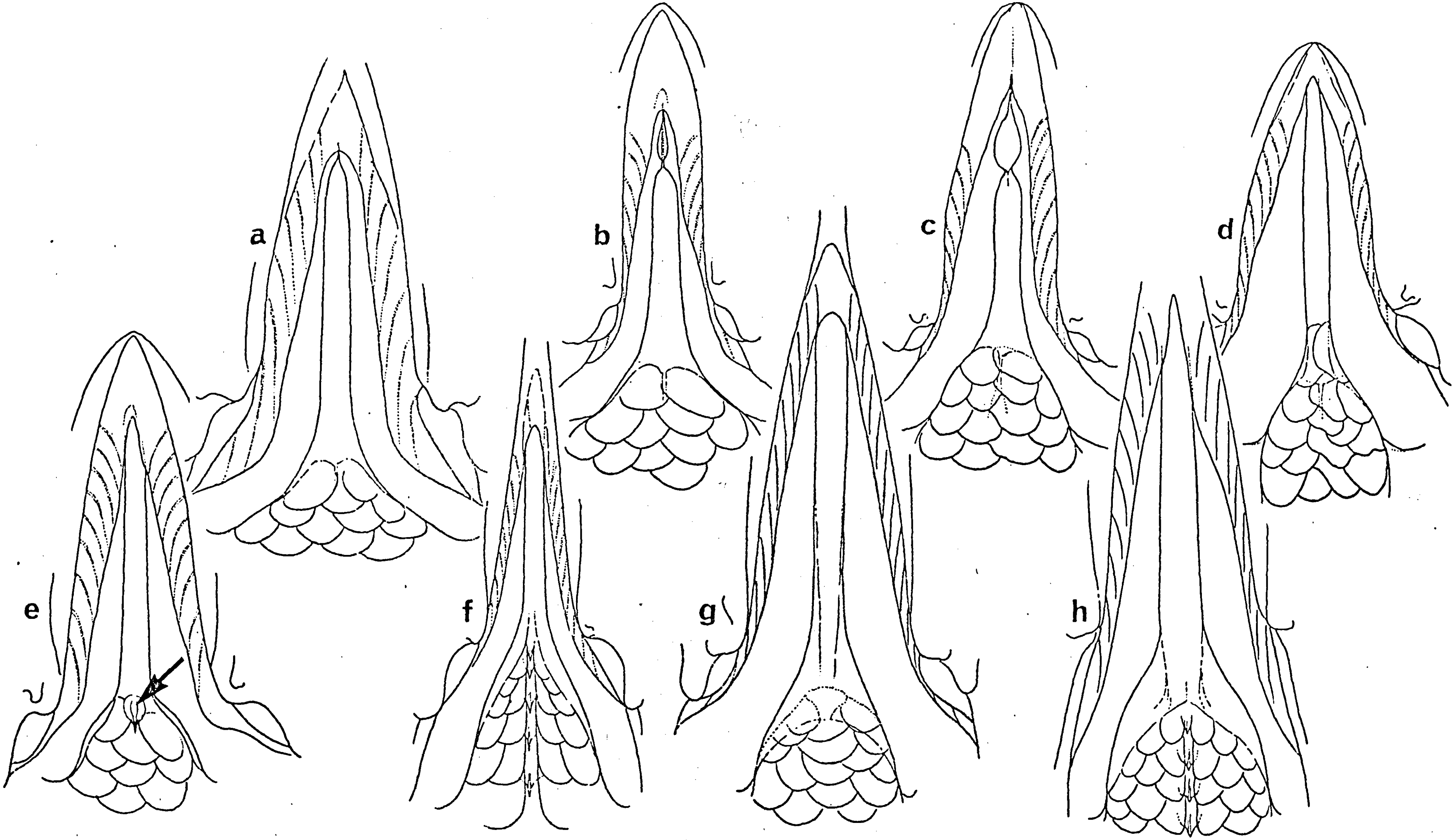


Plate 315. Diagrammatic illustrations of isthmus shape and arrangement of scales on it in relation to branchiostegal membranes and rays: a, *Engraulis japonicus*; b, *Stolephorus buccaneeri*; c, *Stolephorus heterolobus*; d, *Stolephorus tri*; e, *Thryssa* (*Thrissina*) *baelama* (arrow indicates prepectoral scutes found in Bleeker specimen, MNHN. 3721 and RMNH. 23365); f, *Thryssa* (*Scutengraulis*) *spinidens*; g, *Lycothrissa crocodilus*; h, *Papuengraulis micropinna*.

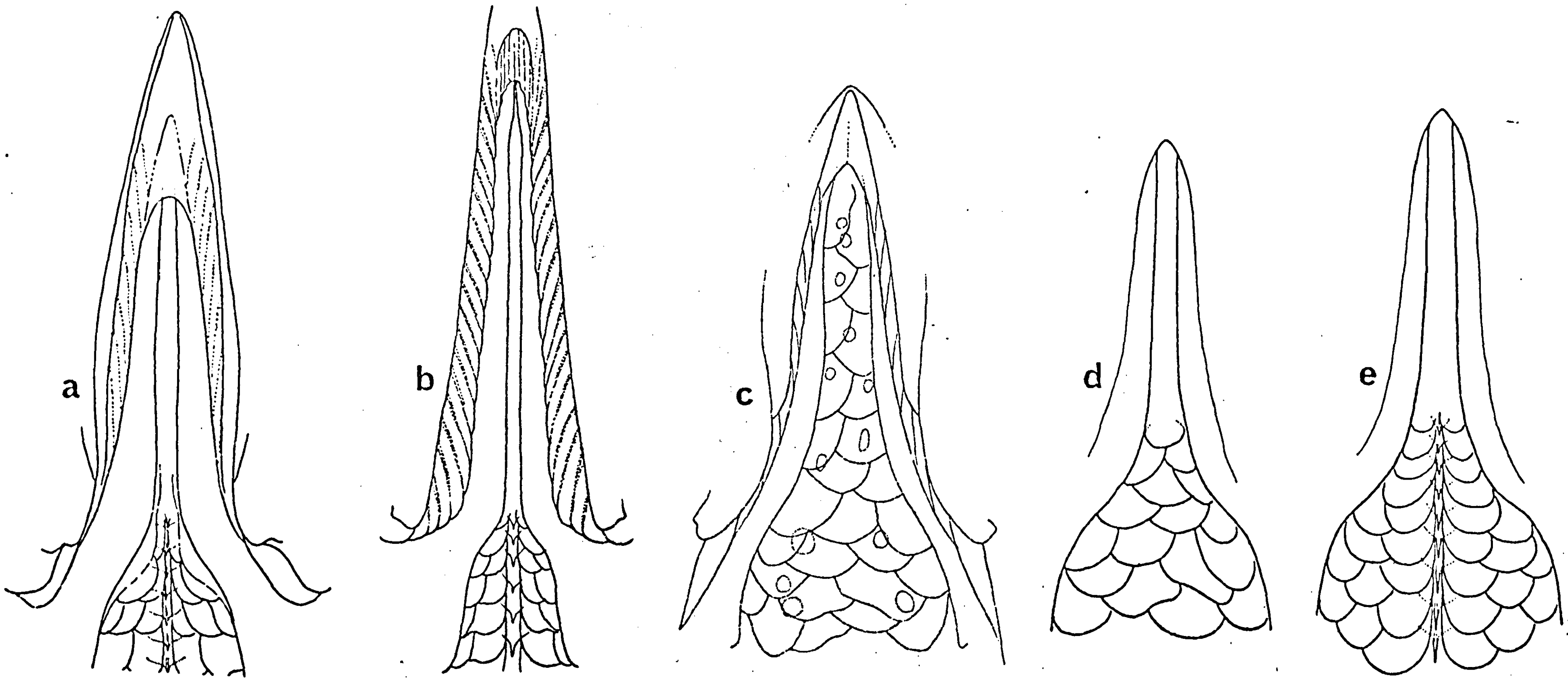


Plate 316. Diagrammatic illustrations of isthmus shape and arrangement of scales on it in relation to branchiostegal membranes and rays: a, Setipinna taty; b, Heterothrissa breviceps; c, Coilia dussumieri; d, Coilia borneensis; e, Coilia lindmani.

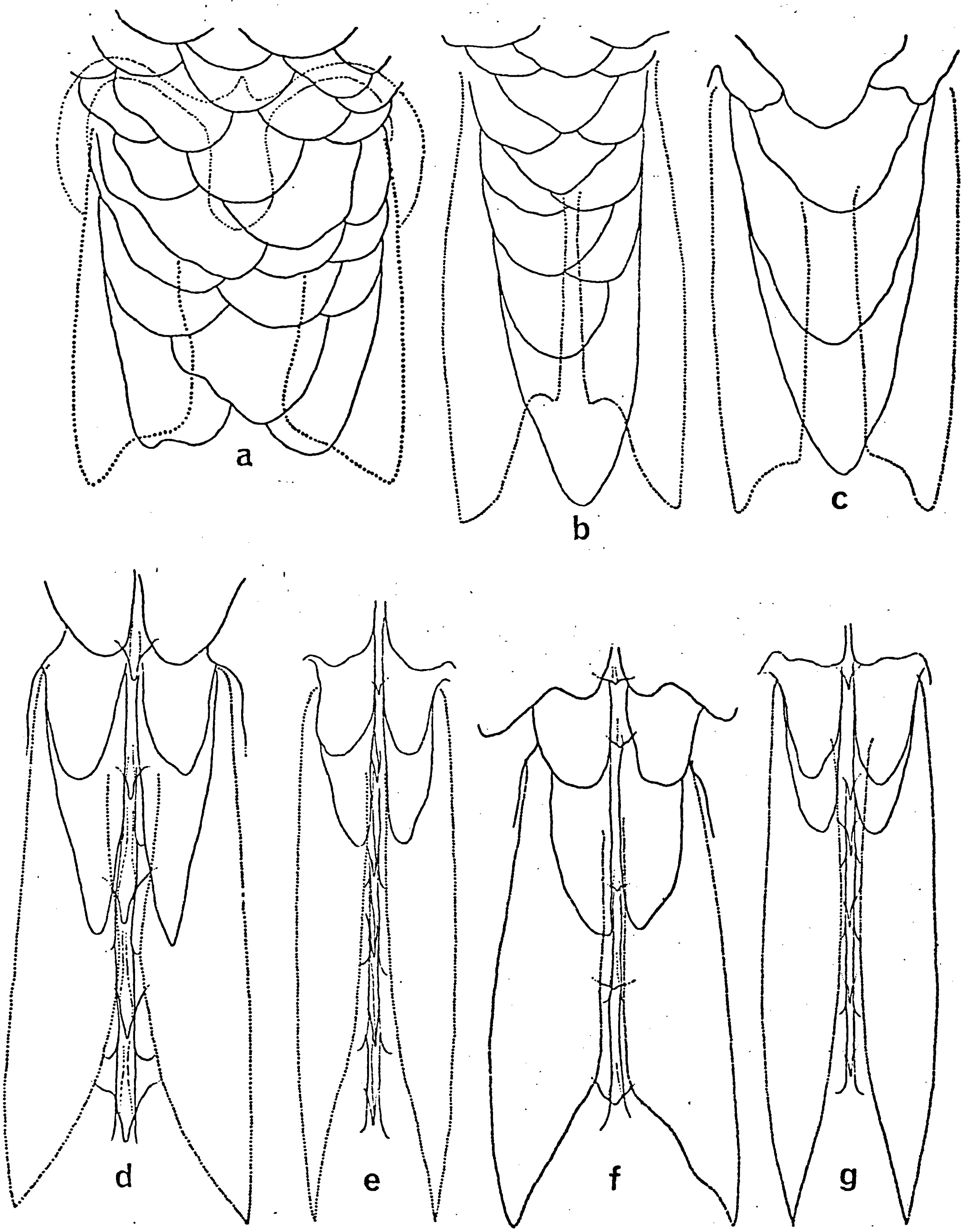


Plate 317. Arrangements of interpelvic scales in relation to length of pelvic fins: a, Etrumeus teres; b, Dussumieria acuta; c, Spratelloides delicatulus; d, Sardinella (Sardinella) neglecta; e, Sardinella (Clupeonia) dayi; f, Amblygaster sirm; g, Herklotsichthys quadrimaculatus.

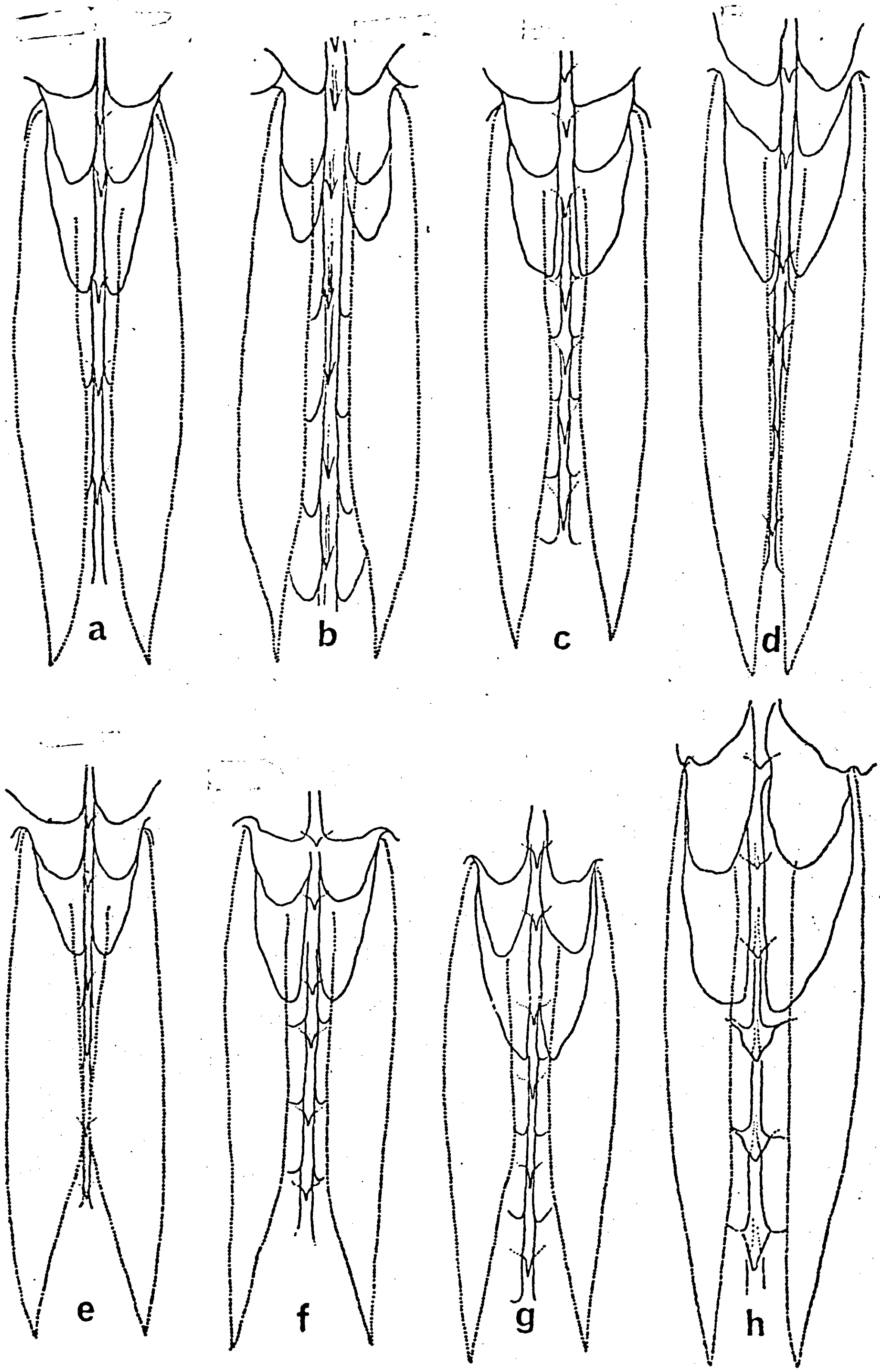


Plate 318. Arrangements of interpelvic scales in relation to length of pelvic fins: a, Escualosa thoracata; b, Hilsa kelee; c, Tenualosa ilisha; d, Konosirus punctatus; e, Clupanodon thrissa; f, Nematalosa nasus; g, Gonialosa manmina; h, Anodontostoma thailandiae.

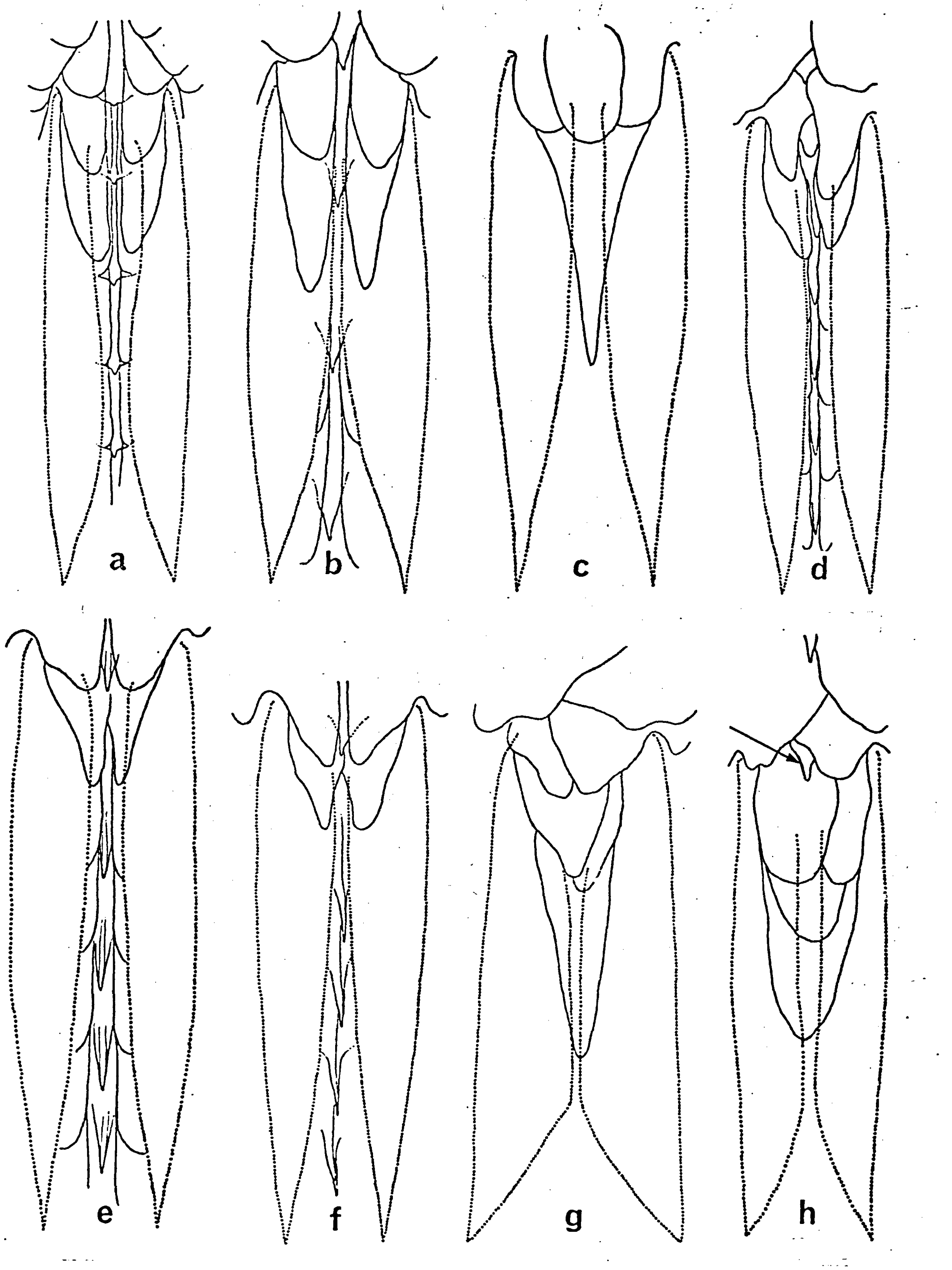


Plate 319. Arrangements of interpelvic scales in relation to length of pelvic fins: a, Pellona dayi; b, Ilisha melastoma; c, Ehirava fluviatilis; d, Clupeoides venulosus; e, Corica laciniata; f, Corica soborna; g, Engraulis japonicus; h, Stolephorus dubiosus (arrow indicates interpelvic scute).

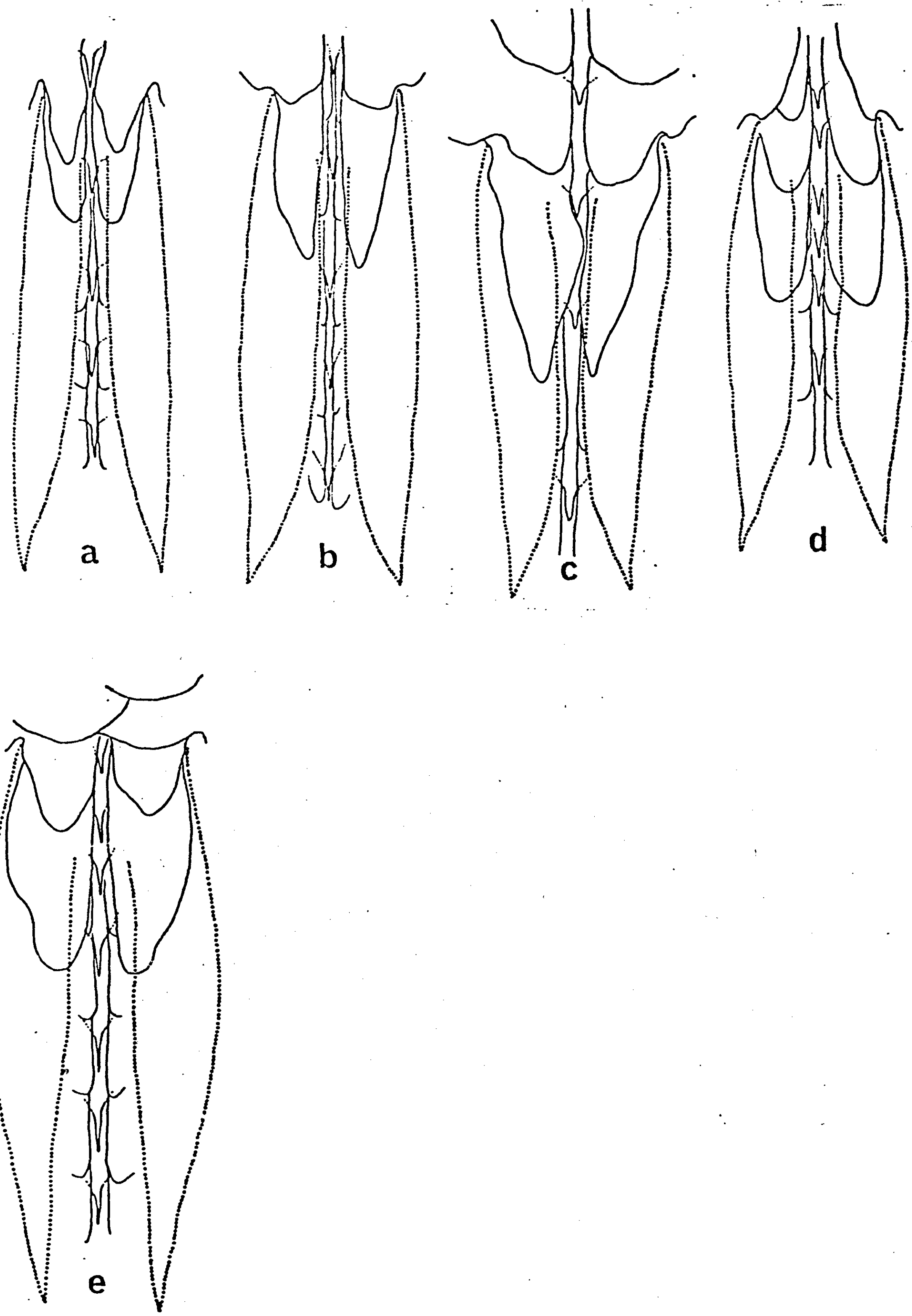


Plate 320. Arrangements of interpelvic scales in relation to length of pelvic fins: a, Thryssa (Thrissina) baelama; b, T. (Scutengraulis) spinidens; c, Lycothrissa crocodilus; d, Setipinna taty; e, Coilia rebentischii.

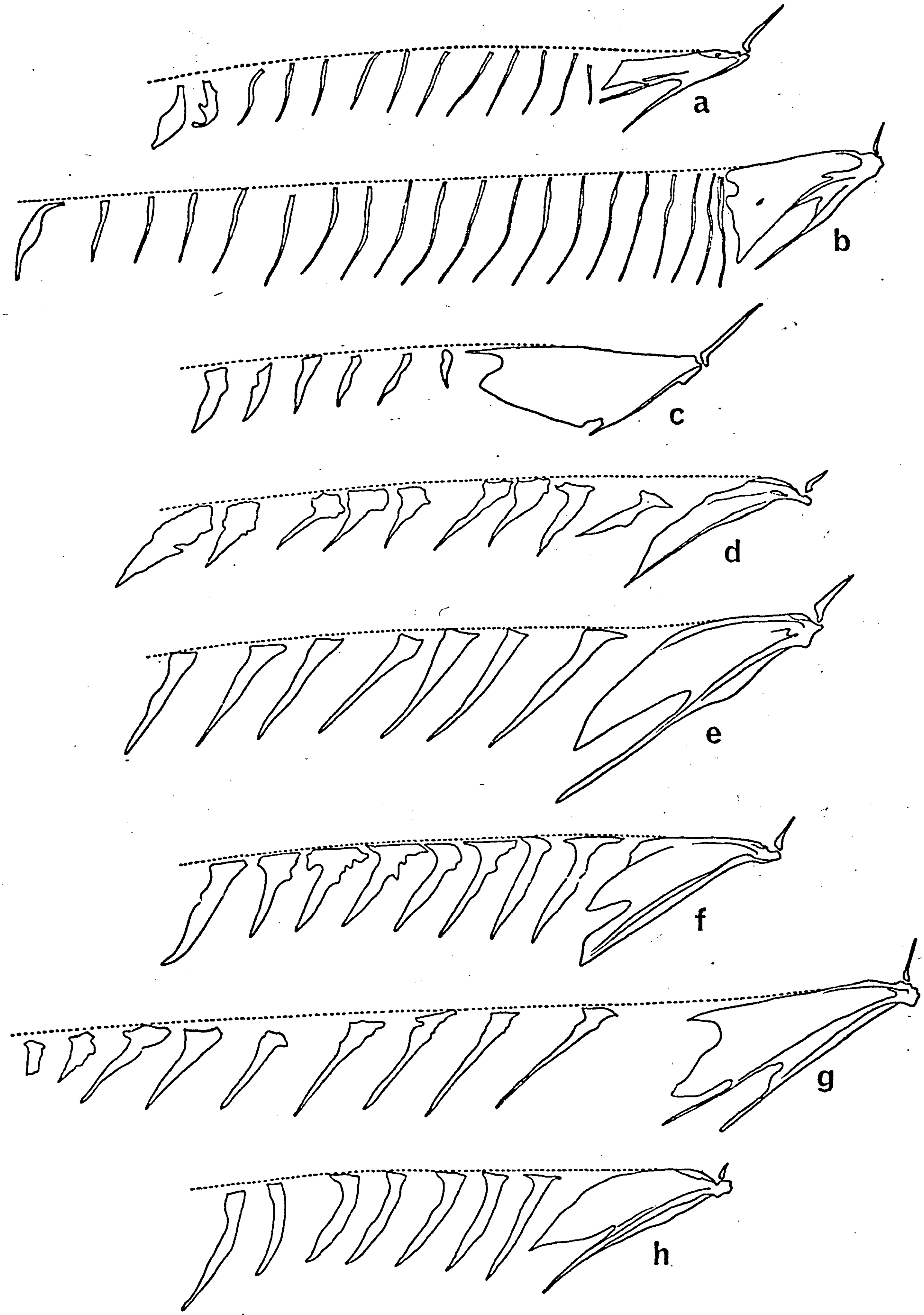


Plate 321. Patterns of predorsal bones: a, Etrumeus whiteheadi; b, Dussumieria elopsoides; c, Spratelloides lewisi; d, Sardinella (Sardinella) longiceps; e, S. (Clupeonia) albella; f, S. (C.) richardsoni; g, Amblygaster leiogaster; h, Herklotsichthys dispilonotus.

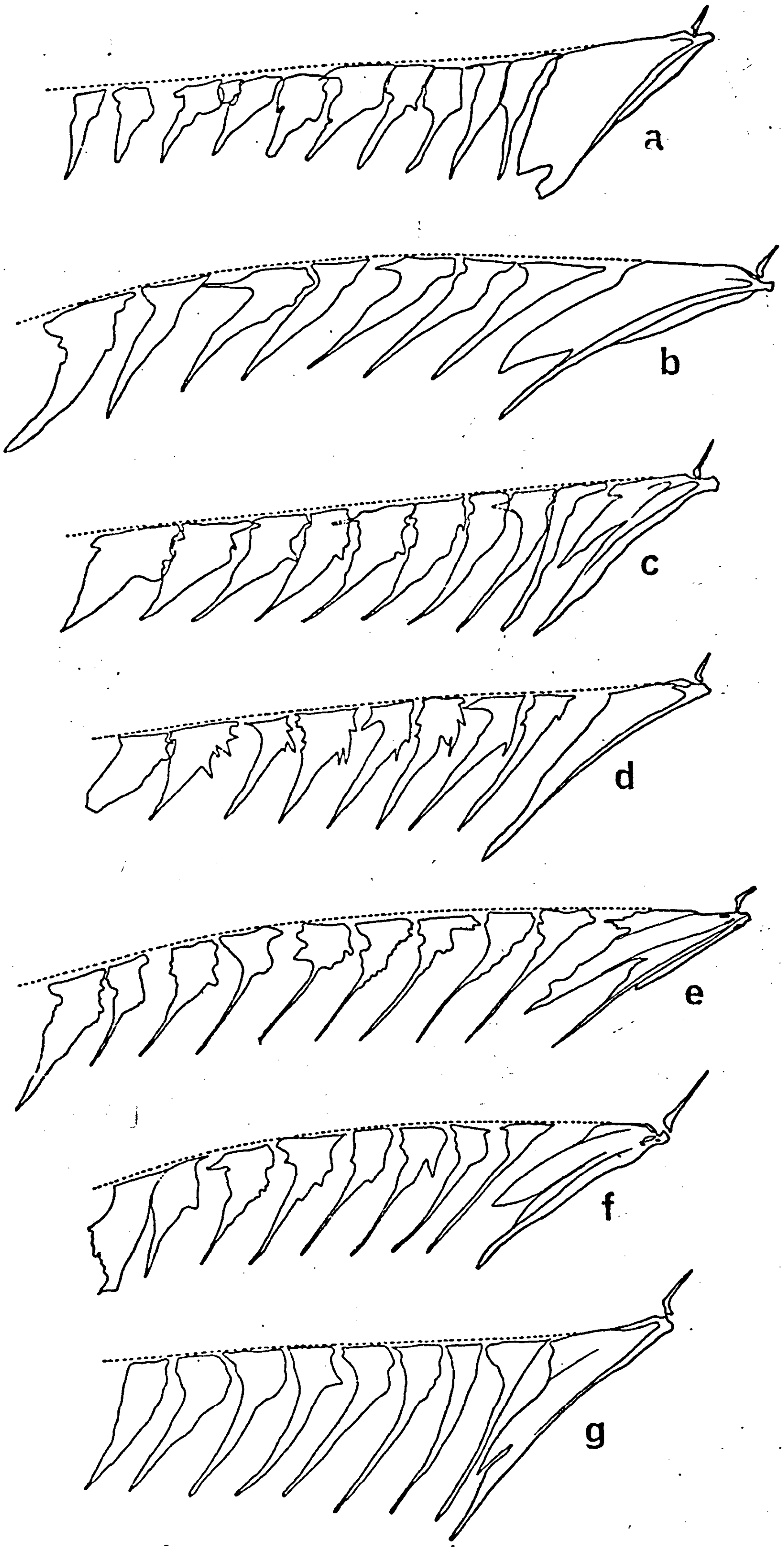


Plate 322. Patterns of predorsal bones: a, Escualosa thoracata; b, Hilsa kelee; c, Tenualosa ilisha; d, Gudusia chapra; e, Konosirus punctatus; f, Clupanodon thrissa; g, Nematalosa nasus.

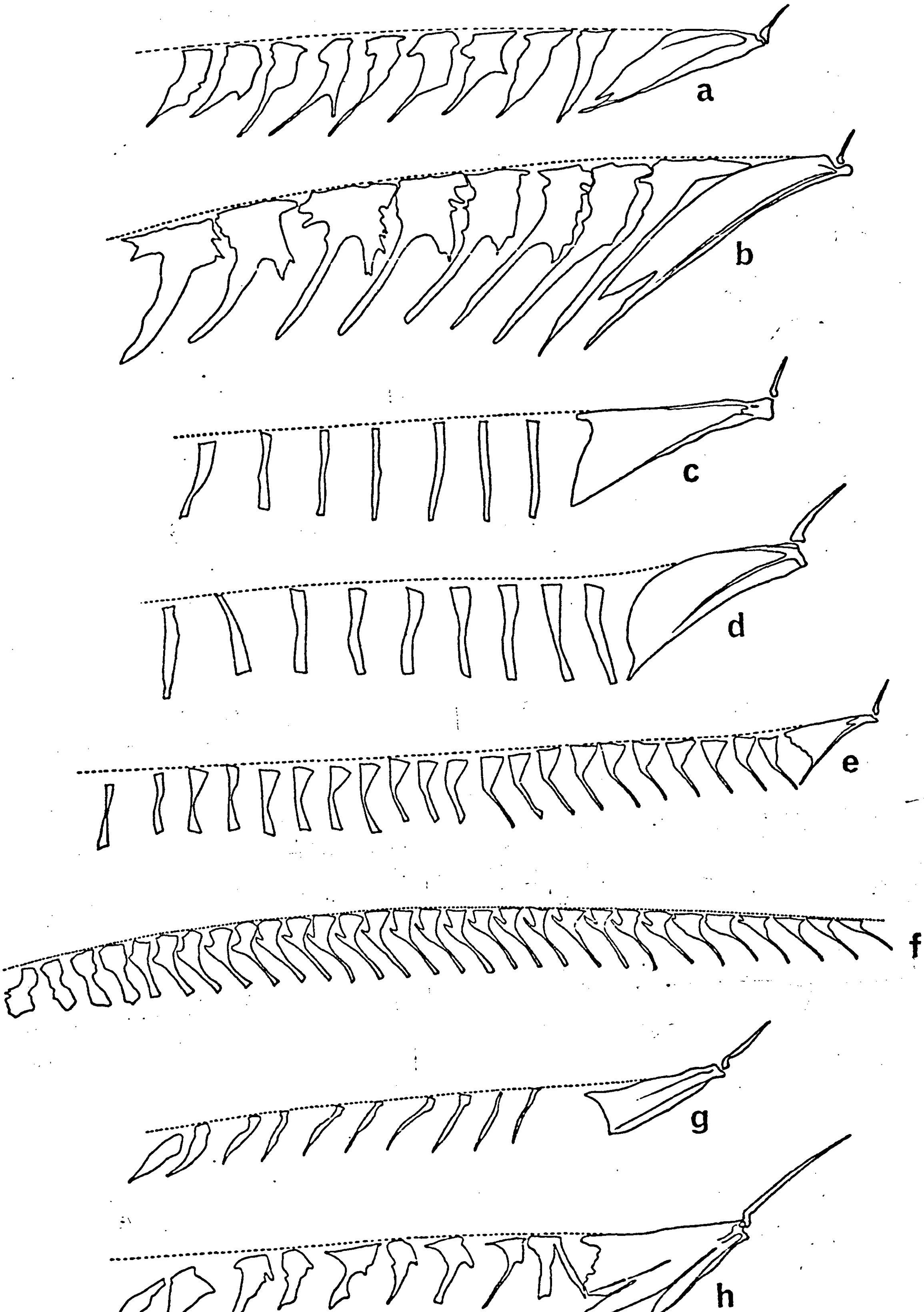


Plate 323. Patterns of predorsal bones: a, Gonialosa modesta; b, Anodontostoma thailandiae; c, Pellona ditchela; d, Ilisha striatula; e, Opisthopterus tardoore; f, Raconda russeliana; g, Ehirava fluviatilis; h, Dayella malabarica

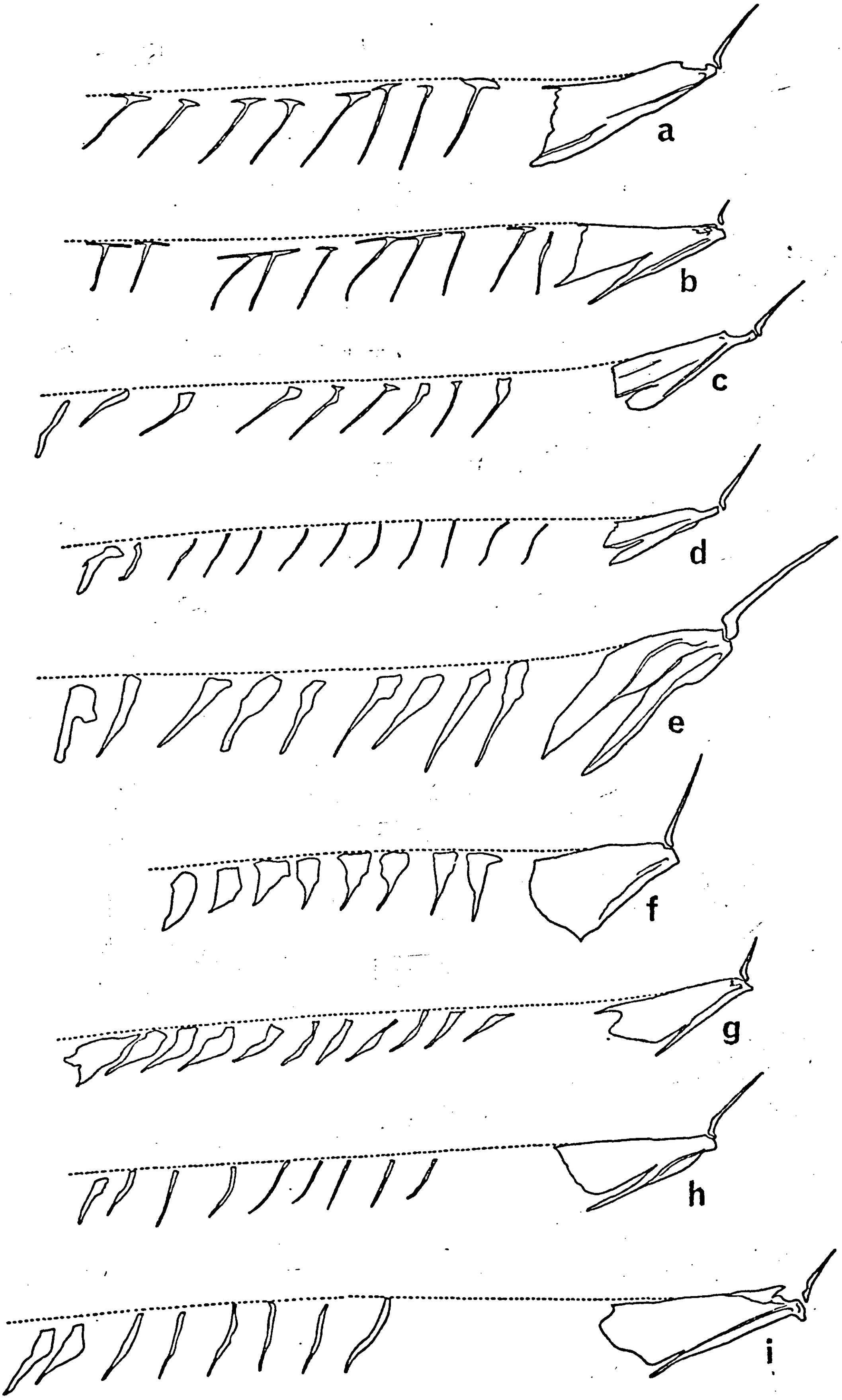


Plate 324. Patterns of predorsal bones: a, Clupeoides borneensis; b, Clupeoides papuensis; c, Corica laciniata; d, Corica soborna; e, Clupeichthys aesarnensis; f, Clupeichthys perakensis; g, Engraulis japonicus; h, Stolephorus purpureus; i, Stolephorus dubiosus.

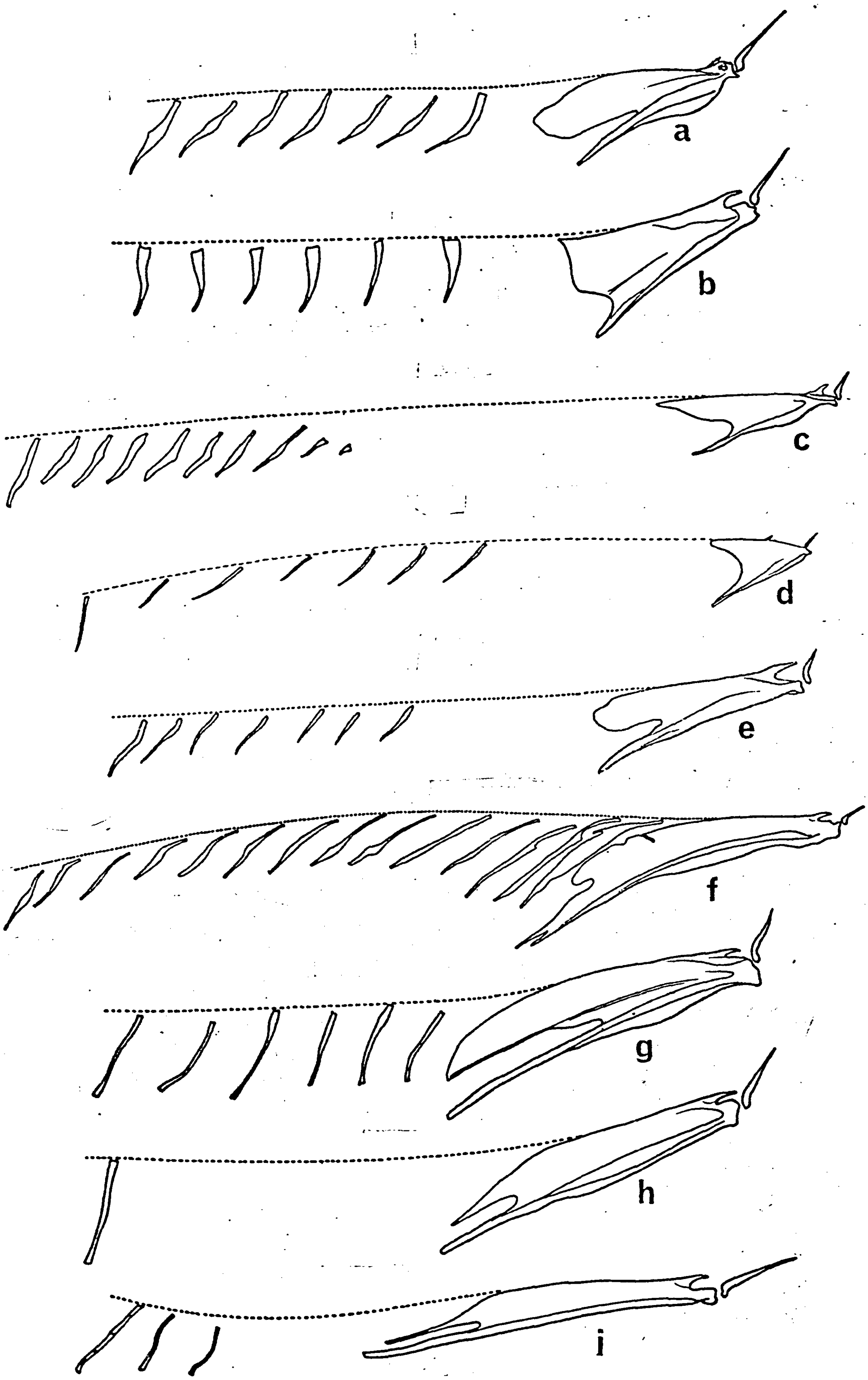


Plate 325. Patterns of predorsal bones: a, Thryssa (Thryssina) baelama; b, T. (Scutengraulis) kammalensis; c, Lycothryssa crocodilus; d, Papuengraulis micropinna; e, Setipinna taty; f, Setipinna phasa; g, Coilia neglecta; h, Coilia macrognathus; d, Coilia lindmani.

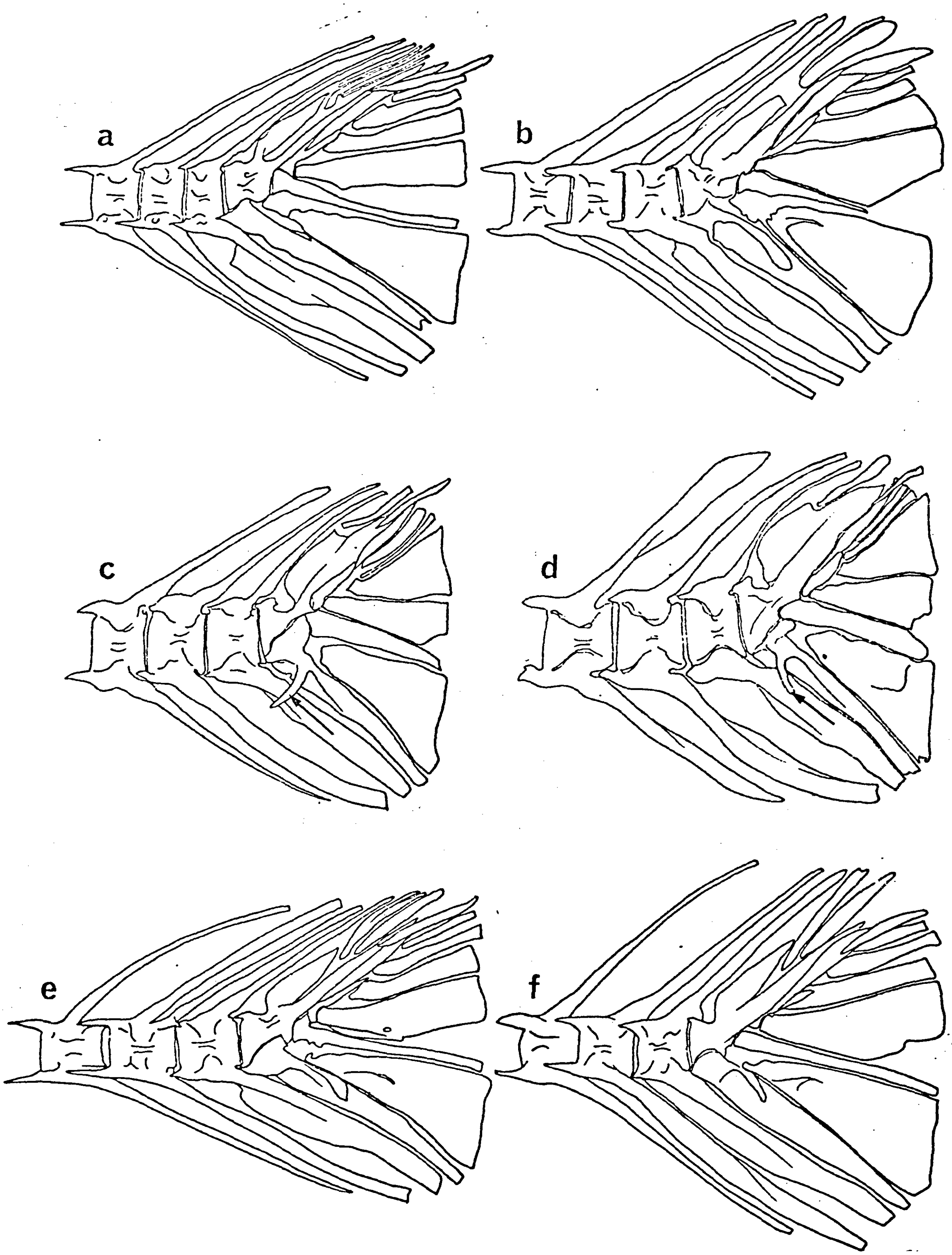


Plate 326. Caudal skeletons: a, Etrumeus teres (BMNH. 1965.7.5.76-79; 59.0 mm S.L.); b, Dussumieria acuta (BMNH. 1935.4.12.3-12, 114.0 mm S.L.); c, Spratelloides gracilis (BMNH. 1969.8.19.56-66; 64.0 mm S.L.); d, S. lewisi (BMNH. 1979.8.16.504, 55.0 mm S.L.); e, Sardinella (Sardinella) lemusu (BMNH. 1960.4.7.42-51, 109.0 mm S.L.); f, S. (Clupeonia) brachysoma (BMNH. 1870.6.7.9-10, 126.0 mm S.L.) (arrows indicate curvature of parhypural process in two species of Spratelloides).

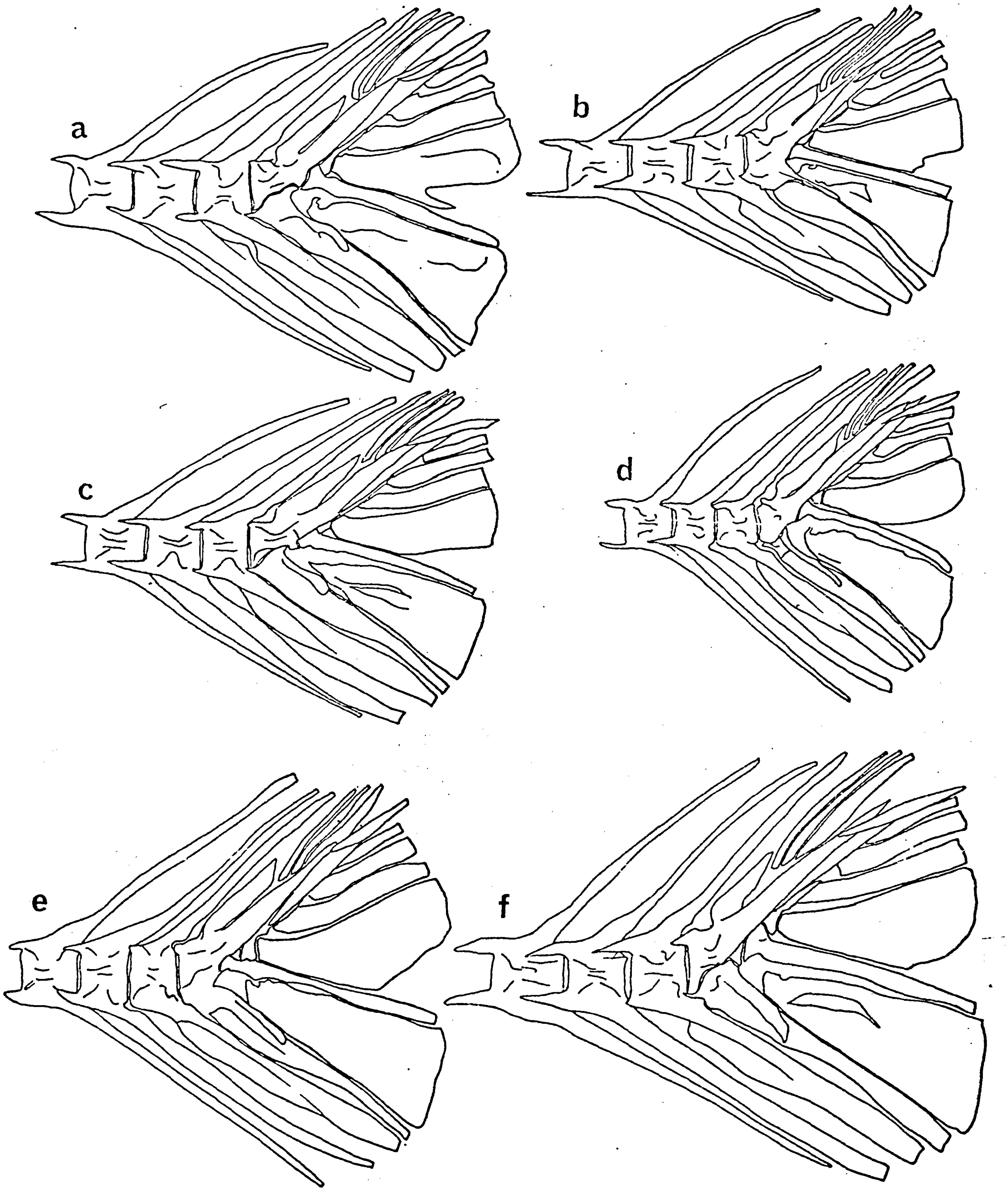


Plate 327. Caudal skeletons: a, Sardinella (Clupeonia) melanura (BMNH. 1970. 4.9.11.20, 93.0 mm S.L.; b, Amblygaster clupeoides (BMNH. 1936.10.21.1, 102.0 mm S.L.); c, Herklotsichthys quadrimaculatus (BMNH. 1974.8.19.1-12, 100.0 mm S.L.); d, H. dispilonotus (BMNH. 1066.2.28.21-23, 65.0 mm S.L.); e, Escualosa thoracata (BMNH. 1870.5.18.5, 90.0 mm S.L.); f, Hilsa kelee (BMNH. 1973.6.4. 15-19, 128.0 mm S.L.).

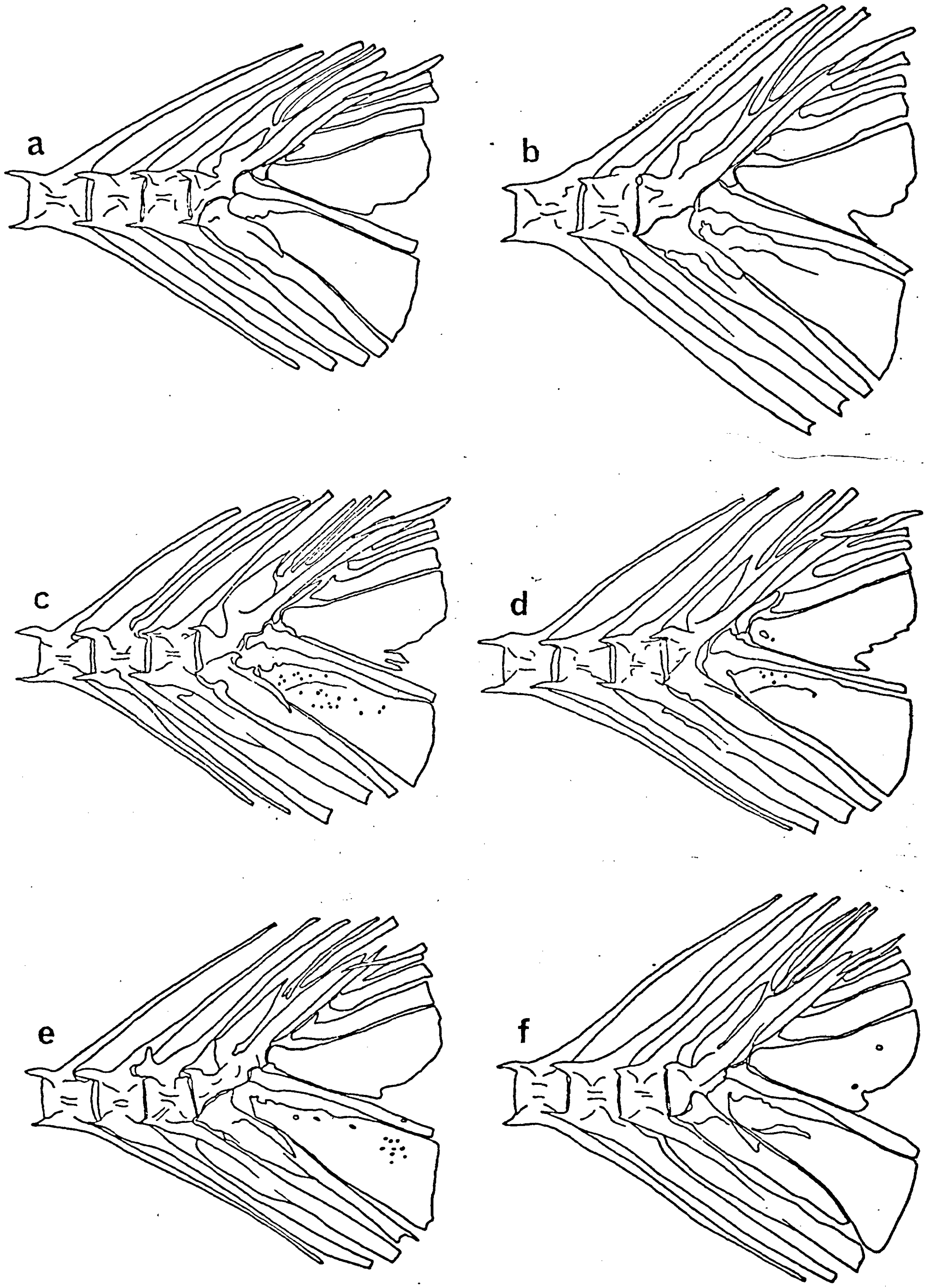


Plate 328. Caudal skeletons: a, Tenualosa ilisha (BMNH. 1923.6.30.1-10, 140.0 mm S.L.); b, Gudusia chapra (BMNH. 1934.10.17.1-6, 94.0 mm S.L.); c, Konosirus punctatus (BMNH. 1874.1.16.48, 152.0 mm S.L.); d, Clupanodon thrissa (BMNH. 1979.8.15.33-35, 132.0 mm S.L.); e, Nematalosa japonica (BMNH. 1965.7.5.34-44, 72.0 mm S.L.); f, N. chanpole (BMNH. 1889.2.1.1877, 124.0 mm S.L.).

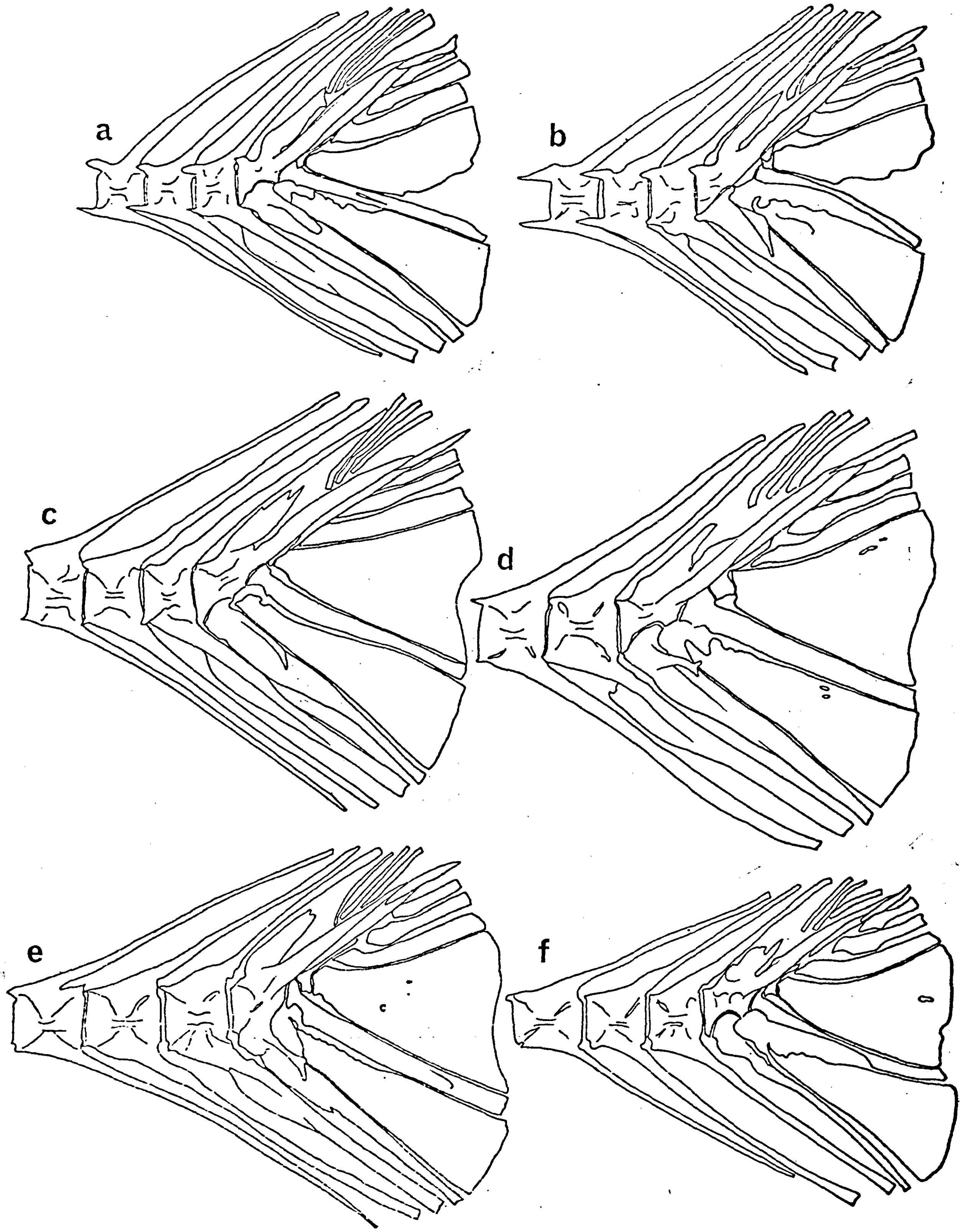


Plate 329. Caudal skeletons: a, Gonialosa manmina (BMNH. 1872.4.17.40, 94.0 mm S.L.); b, Anodontostoma thailandiae (MFLB. uncat. 118.0 mm S.L.); c, Pellona ditchela (BMNH. 1966.11.16.312-318, 57.0 mm S.L.); d, Ilisha striatula (BMNH. 1970.10.21.18-27, 111.0 mm S.L.); e, Opisthopterus valenciennesi (BMNH. 1965.7.5.48, 145.0 mm S.L.); f, Raconda russeliana (BMNH. 1973.6.4.60-71, 162.0 mm S.L.).

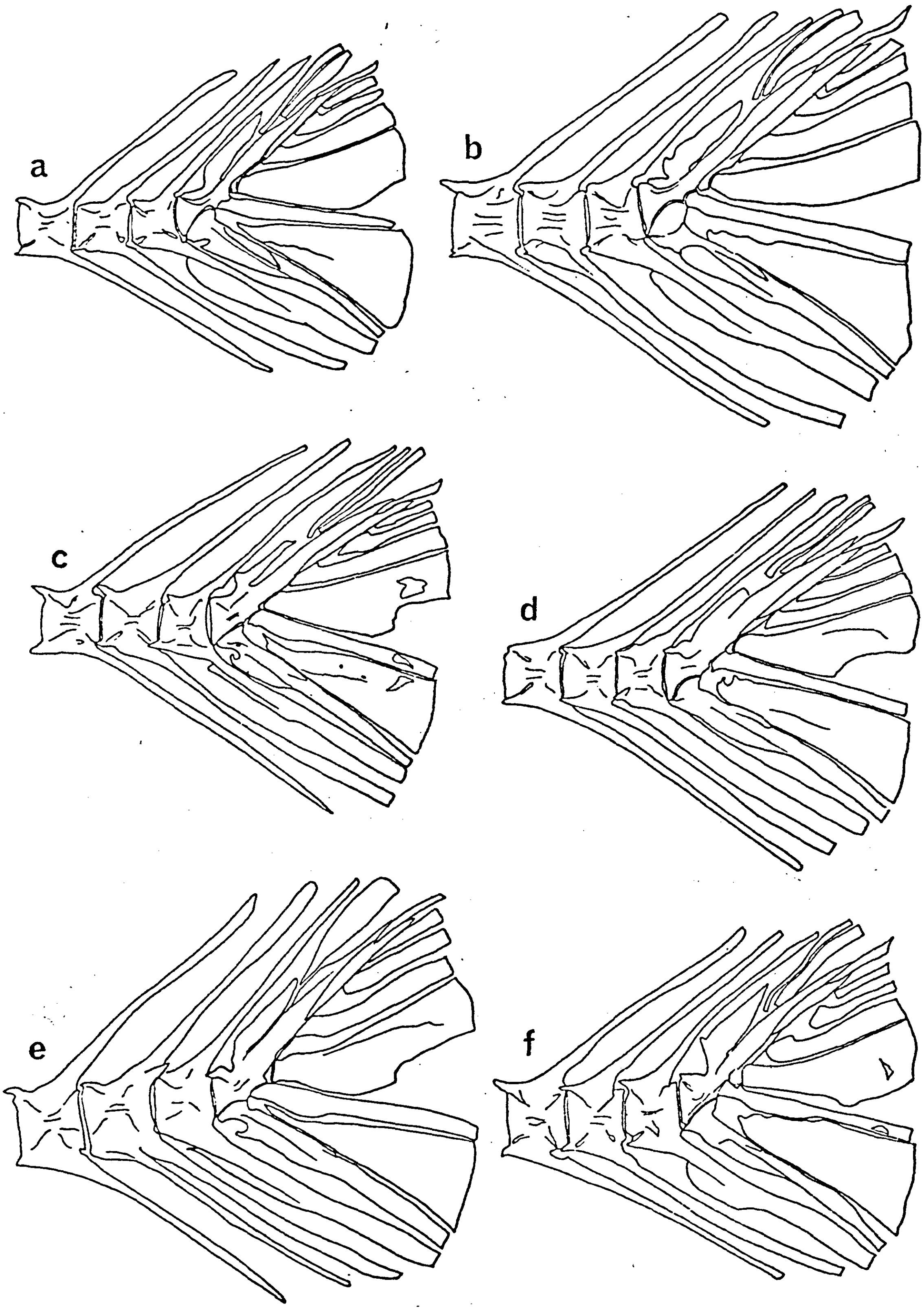


Plate 330. Caudal skeletons: a, Ehirava fluviatilis (BMNH. 1889.2.1.2051, 48.0 mm S.L.); b, Dayella malabarica (BMNH. 1889.2.1.2048, 46.9 mm S.L.); c, Clupeoides borneensis (BMNH. 1979.8.17.4-5, 48.0 mm S.L.); d, C. papuensis (BMNH. 1977.11.17.1-19, 42.0 mm S.L.); e, Corica laciniata (BMNH. 1979.8.16.850, 39.0 mm S.L.); f, Clupeichthys aesarnensis (BMNH. 1979.8.16.80-502, 37.0 mm S.L.).

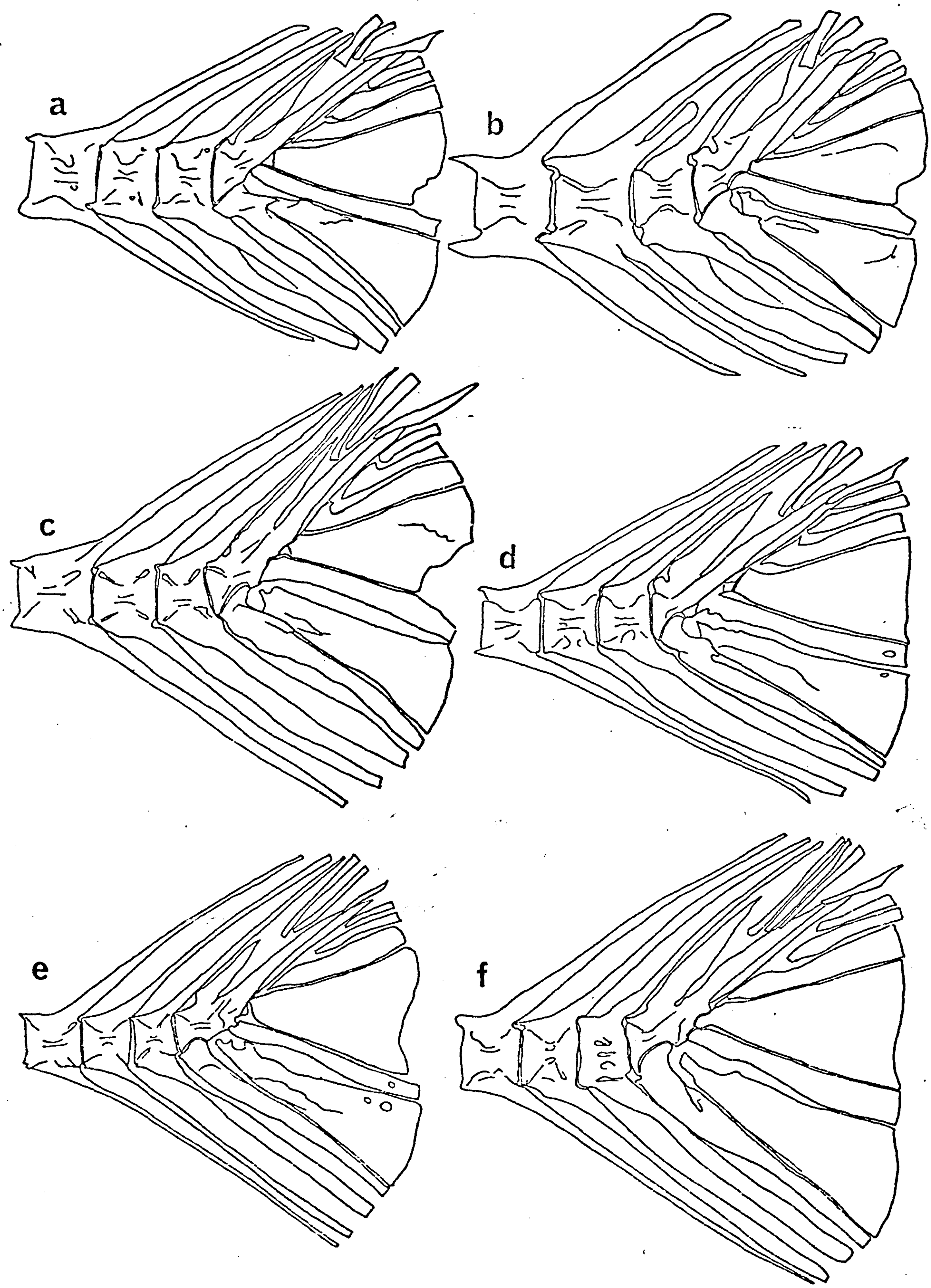


Plate 331. Caudal skeletons: a, *Engraulis japonicus* (BMNH. 1979.8.16.24-35, 109.0 mm S.L.; b, *Stolephorus purpureus* (BMNH. 1979.8.16.587-694, 60.0 mm S.L.); c, *Stolephorus tri* (BMNH. 1937.9.8.73-95, 75.5 mm S.L.); d, *Thryssa* (*Thrissina*) *baelama* (BMNH. 1883.3.11.32, 56.0 mm S.L.); e, *T.* (*Scutengraulis*) *puruva* (BMNH. 1969.2.10.1-10, 87.0 mm S.L.); f, *T.* (*Thryssa*) *setirostris* (BMNH. 1963.12.9. 60-80, 96.0 mm S.L.).

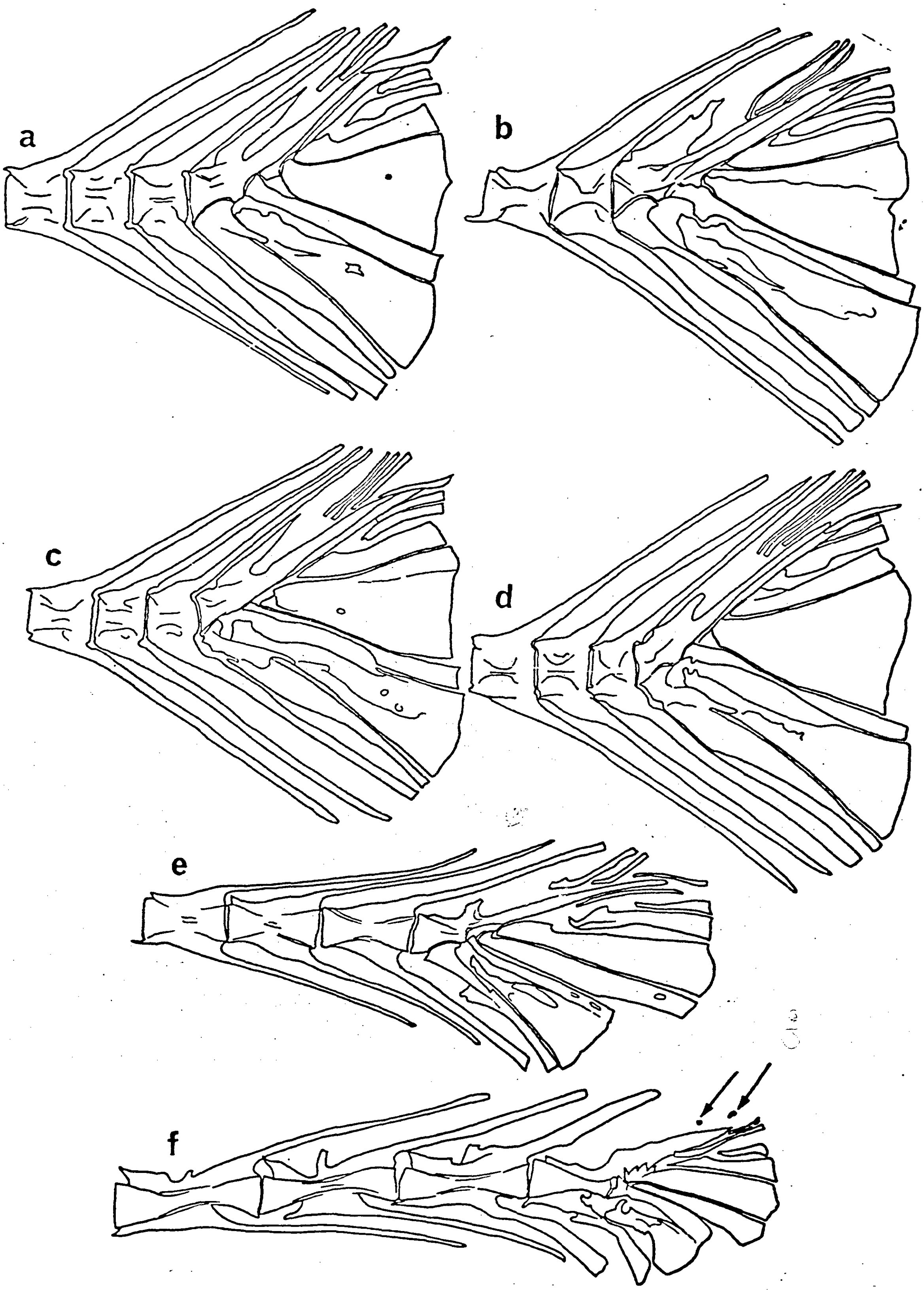


Plate 332. Caudal skeletons: a, Lycothrissa crocodilus (ANSP. 61496-61501, 60552-60564, 124.0 mm S.L.); b, Papuengraulis micropinna (RMNH. uncat. coll., 304; U.W. 106, 106.0 mm S.L.); c, Setipinna tenuifilis tenuifilis (BMNH. 1973. 6.4.1-6, 118.0 mm S.L.); d, S. taty (BMNH. 1966.3.8.61-71, 135.0 mm S.L.); e, Coilia ramcarati (BMNH. 1848.8.22.74, 106.0 mm S.L.); f, Coilia dussumieri (BMNH. 1889.2.1.1846-1851, 143.0 mm S.L., arrows indicate its degenerated epurals).

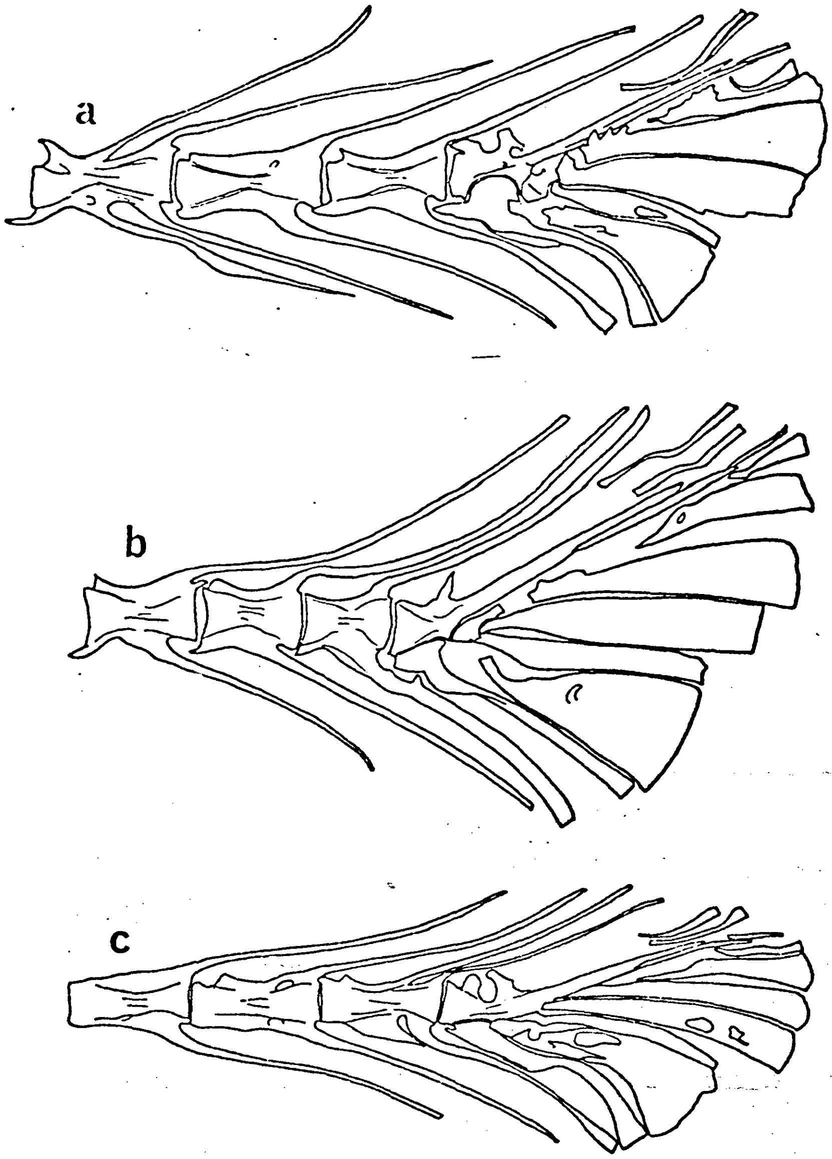


Plate 333. Caudal skeletons: a, Coilia macrognathus (BMNH. 1879.8.16.3-4, 140.0 mm S.L.); b, C. lindmani (BMNH. 1855.9.19.1163-1165, 92.0 mm S.L.); c, C. mystus (BMNH. 1851.12.27.196, 175.0 mm S.L.).

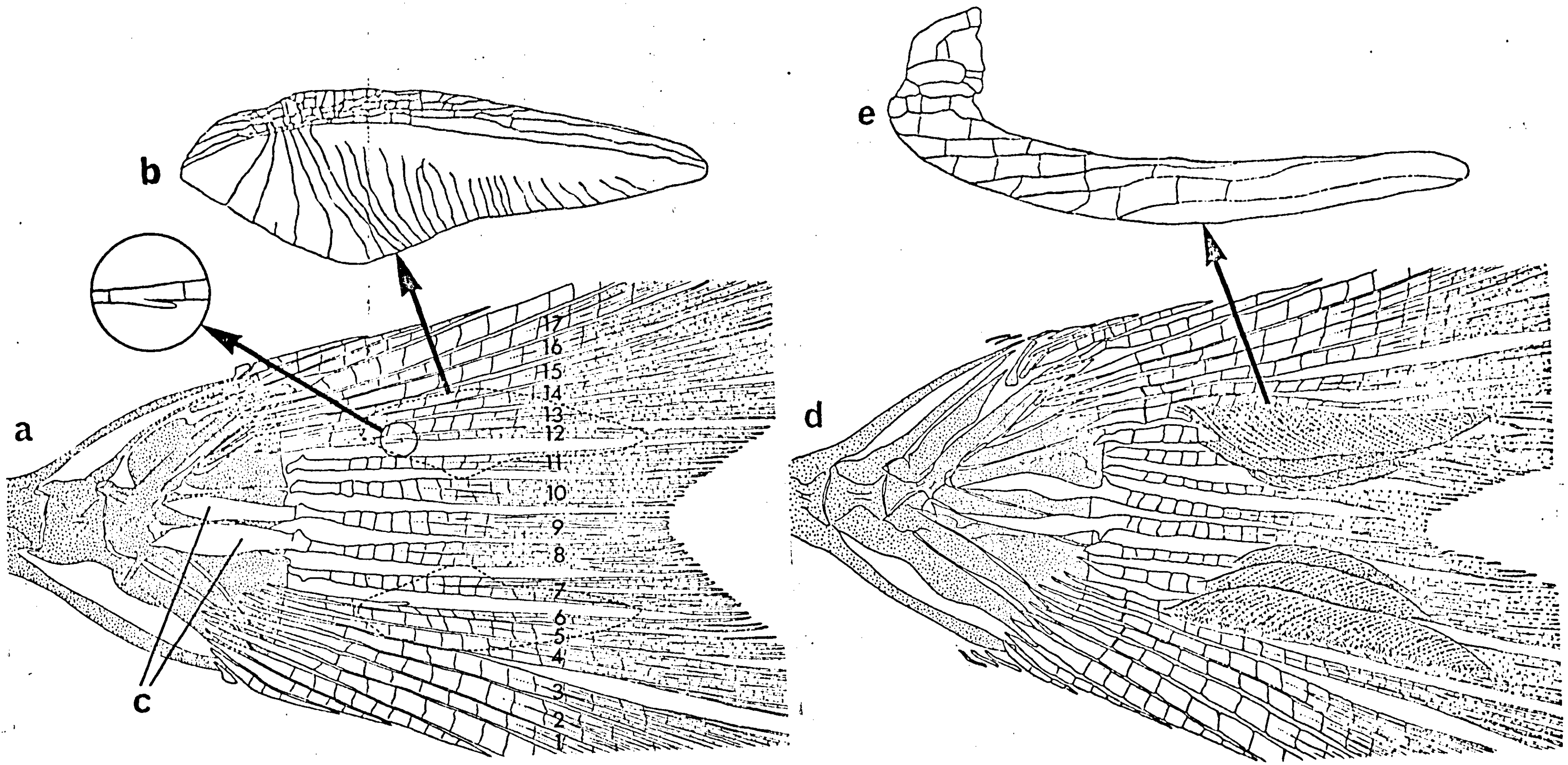


Plate 334. Attachment of caudal fin rays to caudal skeletons and morphology of alar scales in: a, <u>Spratteloides gracilis</u>, inset showing inner bony process on sixth and twelfth principal caudal fin rays (a subfamilial character); b, its upper alar scale; c, basal laminae of pair of innermost principal caudal fin rays; and d, <u>Stolephorus heterolobus</u>, e, one of its several dozen scales which form a compound alar scale.

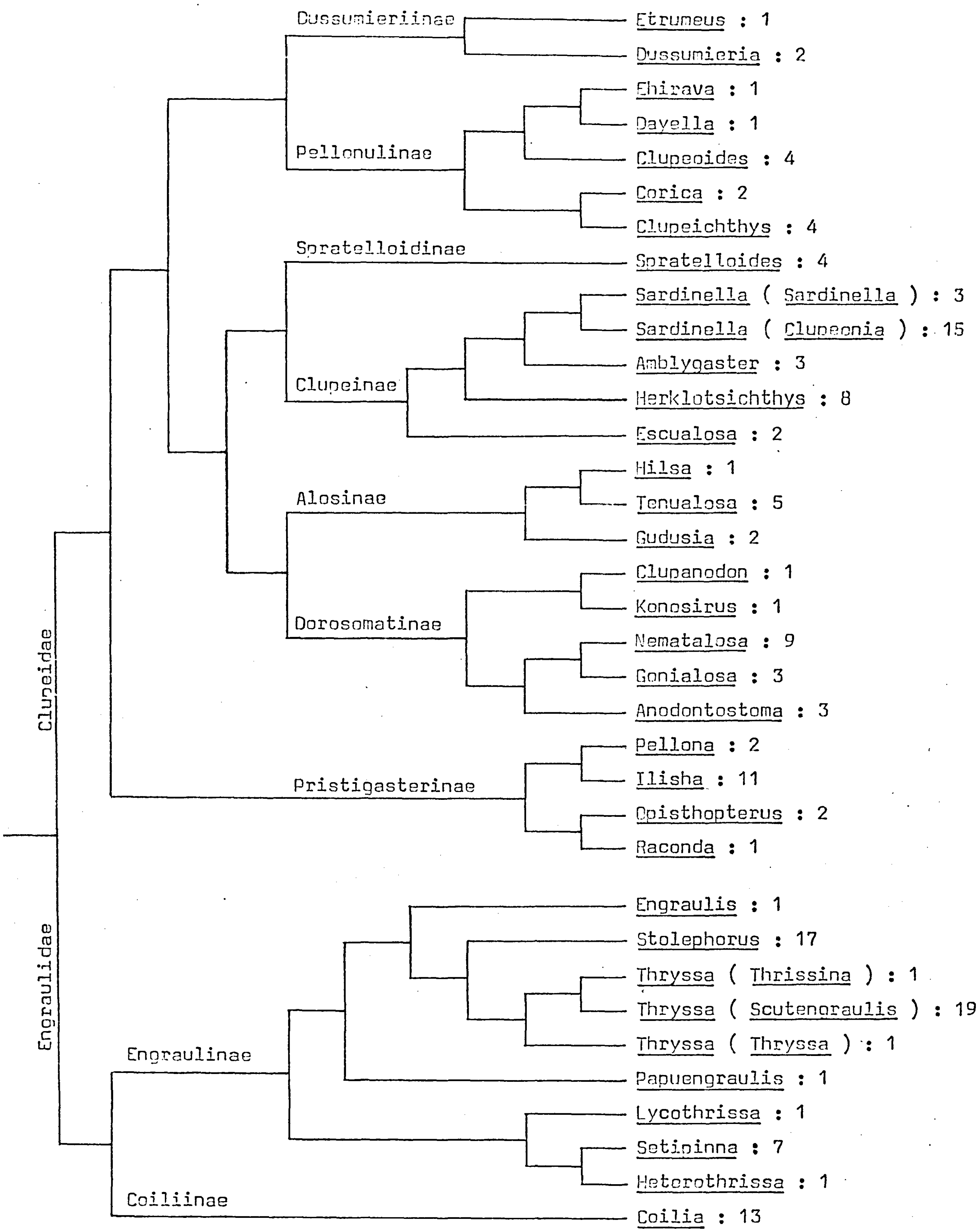


Figure 1. Diagram of possible relationships of nine subfamilies and thirty - two genera of the Indo-Pacific clupeoid fishes. Each generic name follows by a number of species occurred in the area.

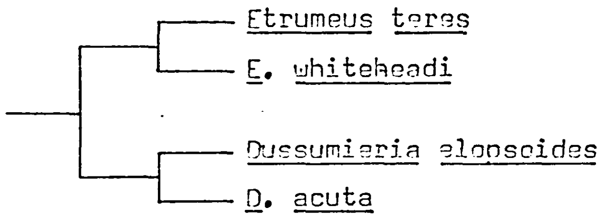


Figure 2 . Diagram of possible relationships of the species of *Etrumeus* and *Dussumieria*.

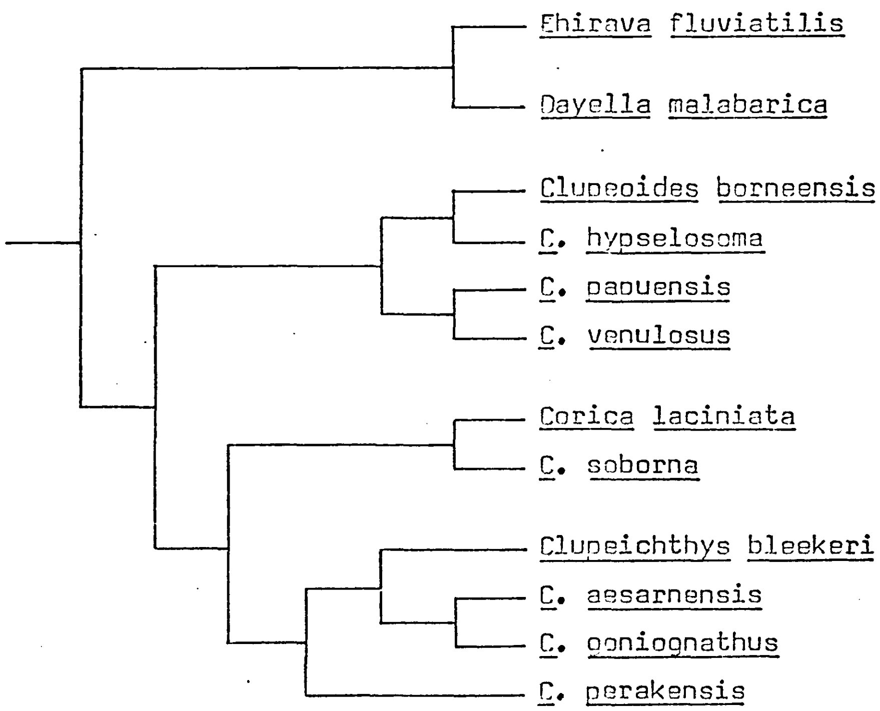


Figure 3 . Diagram of possible relationships of the species of *Ehirava*, *Dayella*, *Clupeoides*, *Corica* and *Clupeichthys*.

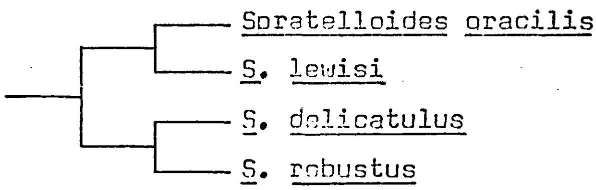


Figure 4 . Diagram of possible relationships of the species of *Spratelloides*.

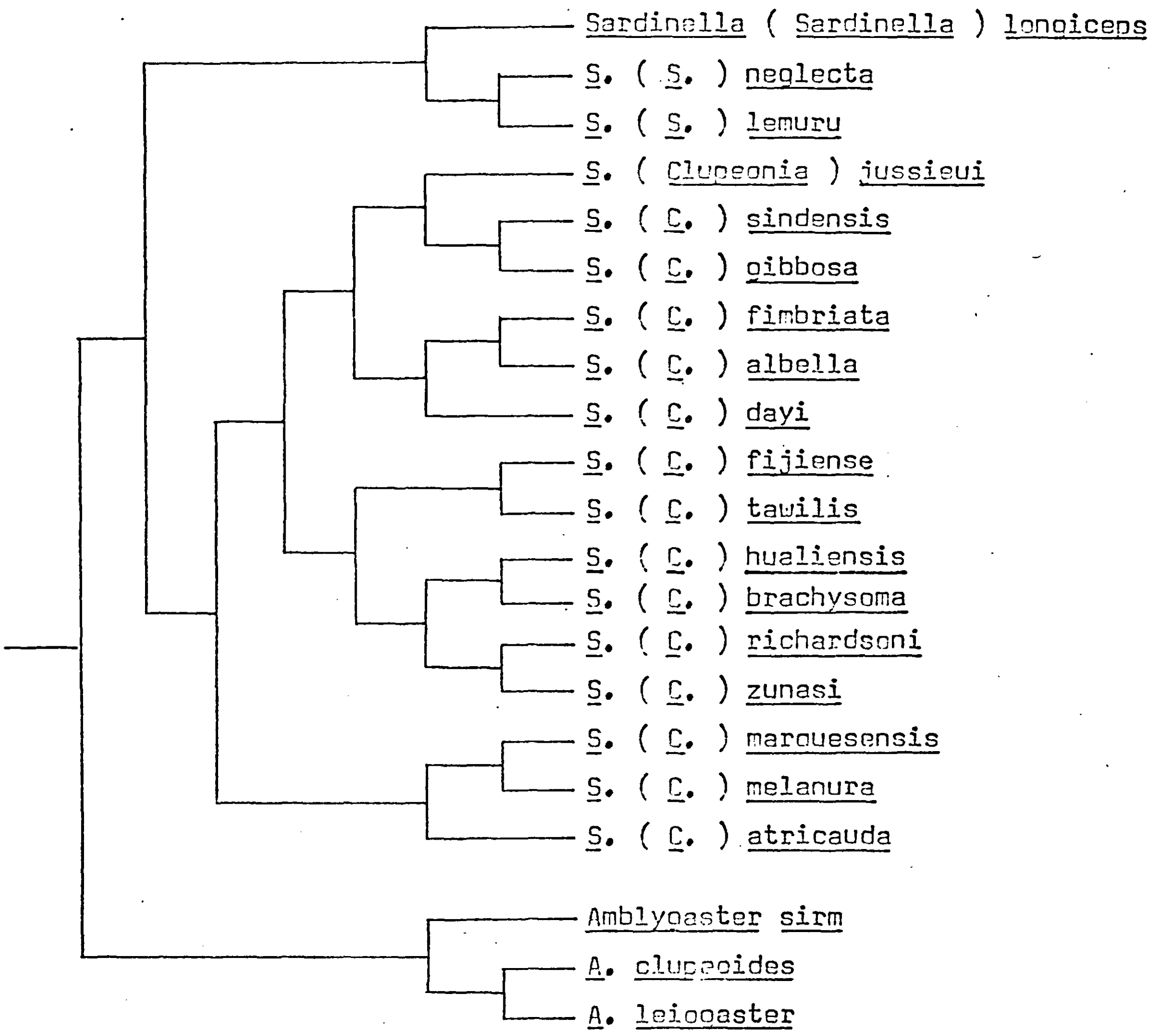


Figure 5 . Diagram of possible relationships of the species of Sardinella (Sardinella), S. (Clupeonia) and Amblygaster.

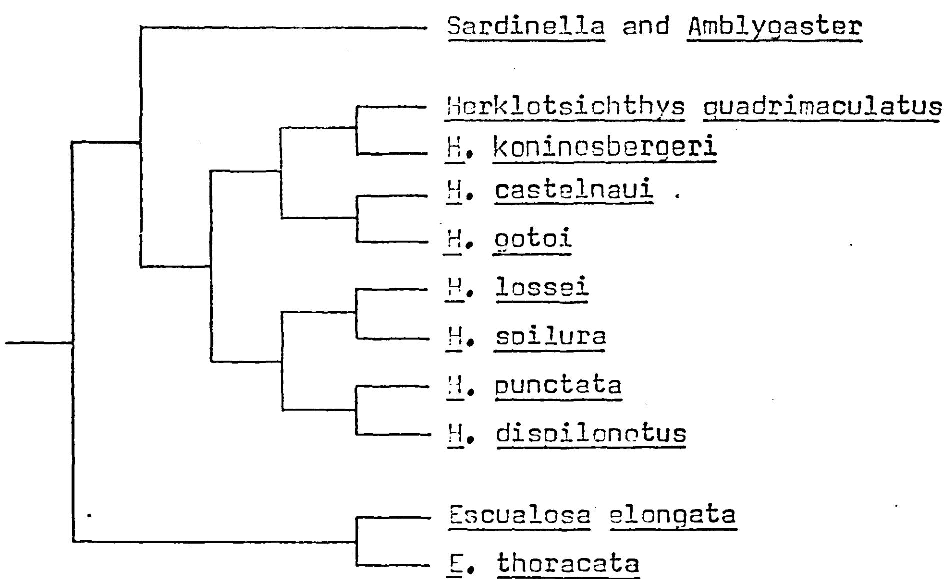


Figure 6 . Diagram of possible relationships of the species of Herklotsichthys and Escualosa.

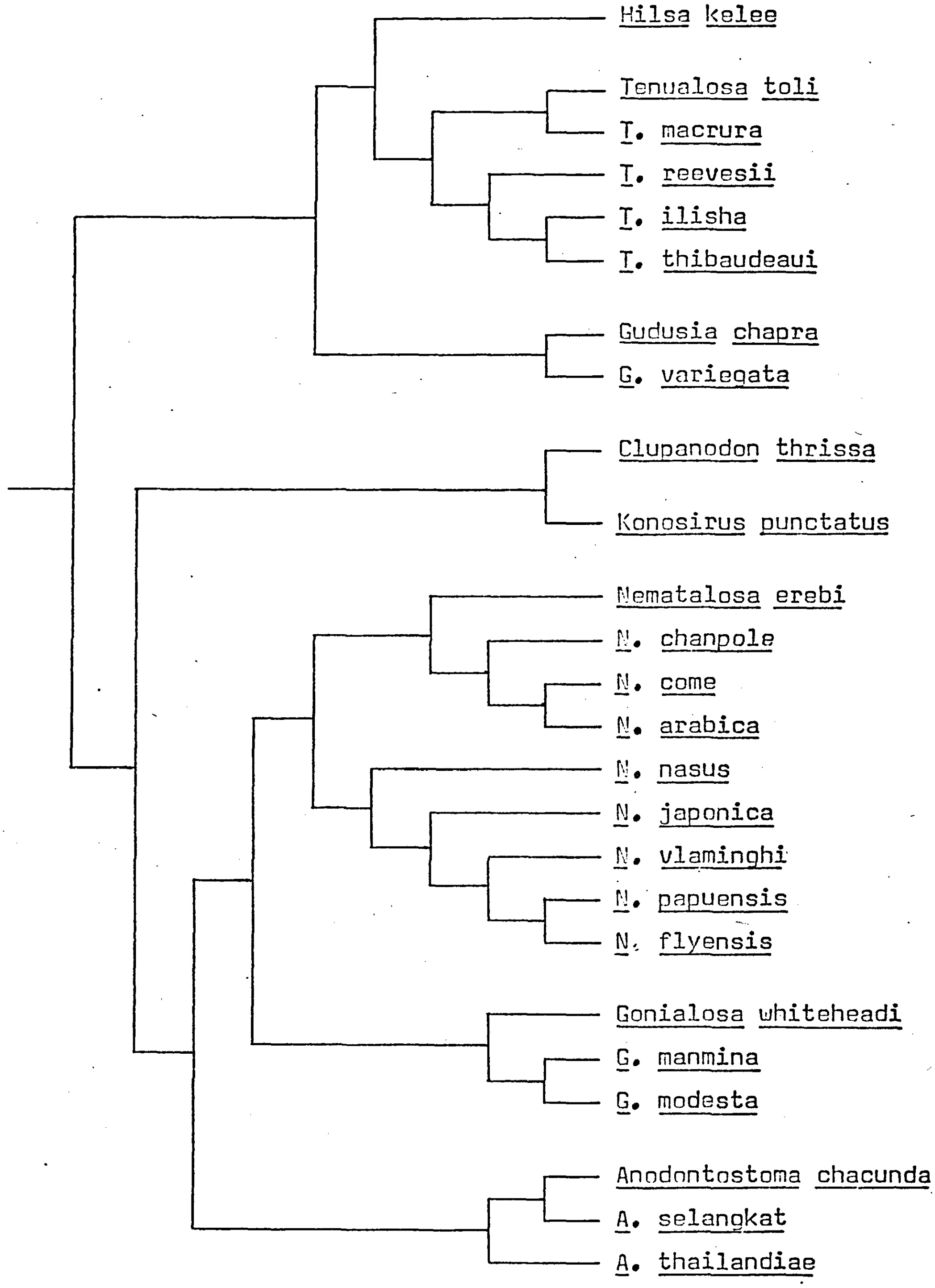


Figure 7 . Diagram of possible relationships of the species of Hilsa, Tenualosa, Gudusia, Clupanodon, Konosirus, Nematalosa, Gonialosa and Anodontostoma.

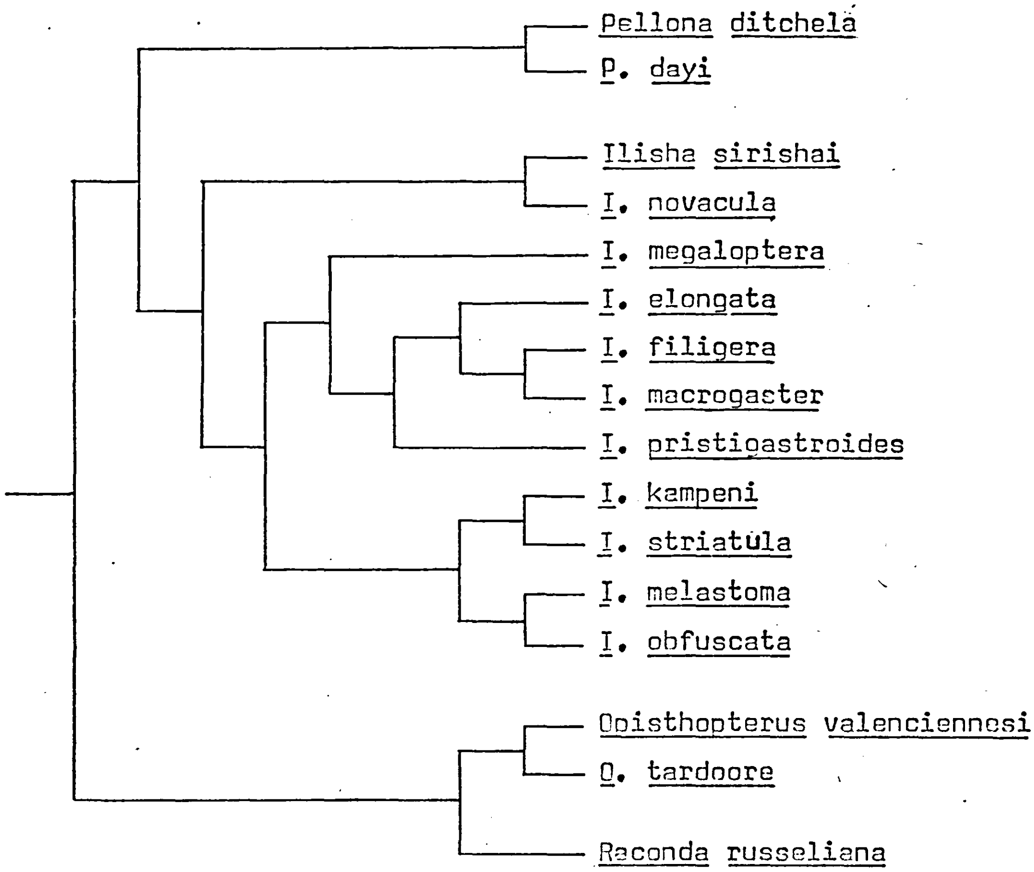


Figure 8 . Diagram of possible relationships of the species of *Pellona*, *Ilisha*, *Opisthopterus* and *Raconda*.

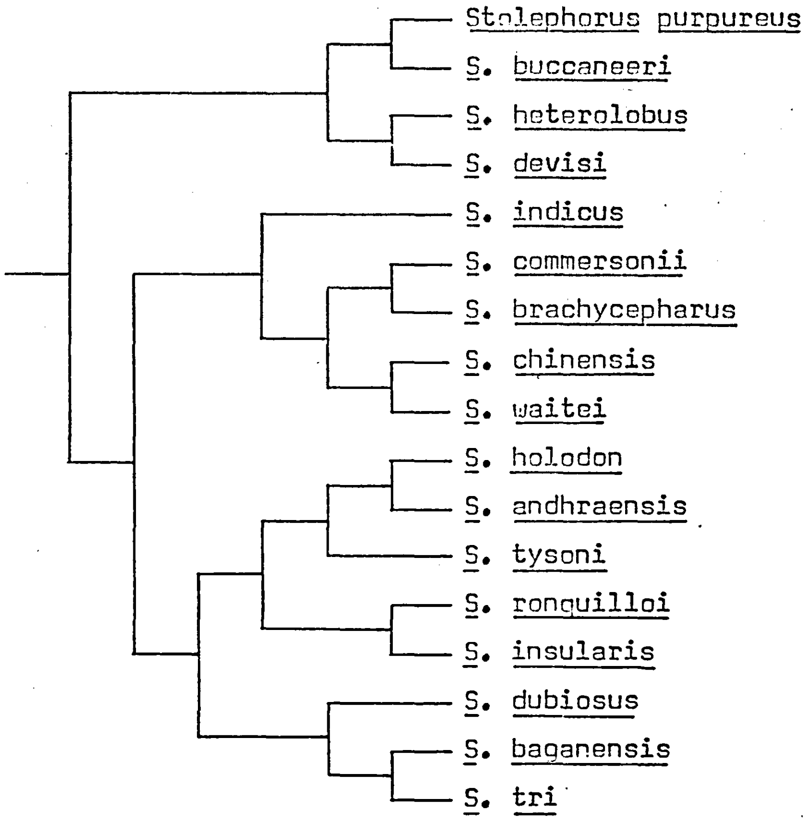


Figure 9 . Diagram of possible relationships of the species of *Stolephorus*.

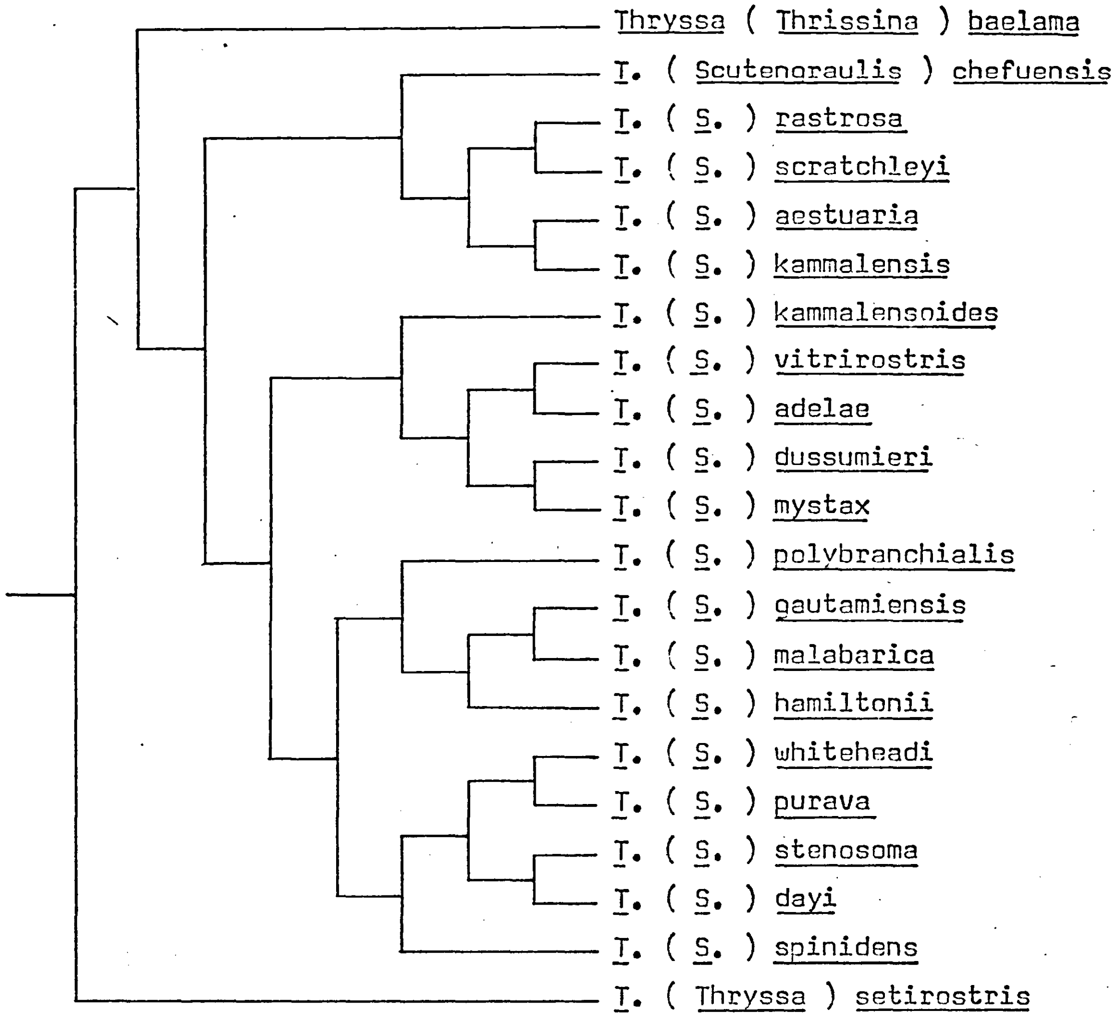


Figure 10 . Diagram of possible relationships of the species of Thryssa (Thrissina), T. (Scutenoraulis) and T. (Thryssa).

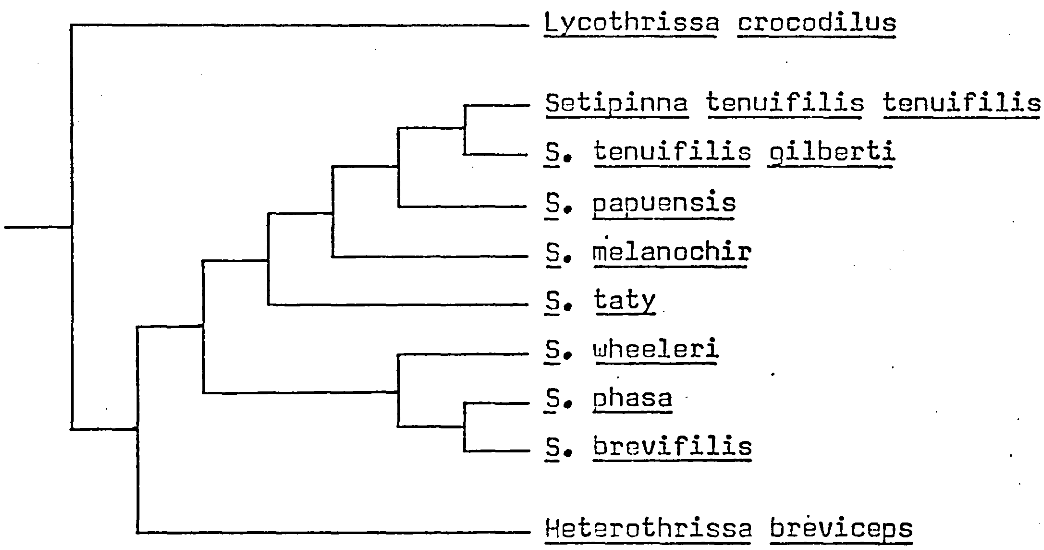


Figure 11. Diagram of possible relationships of the species of Lycothrissa, Setipinna and Heterothrissa.

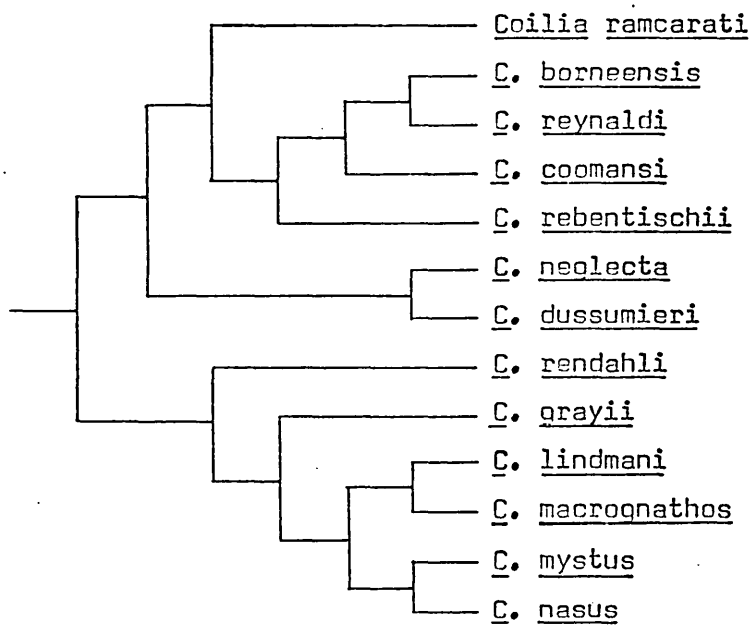


Figure 12 . Diagram of possible relationships of the species of *Coilia*.

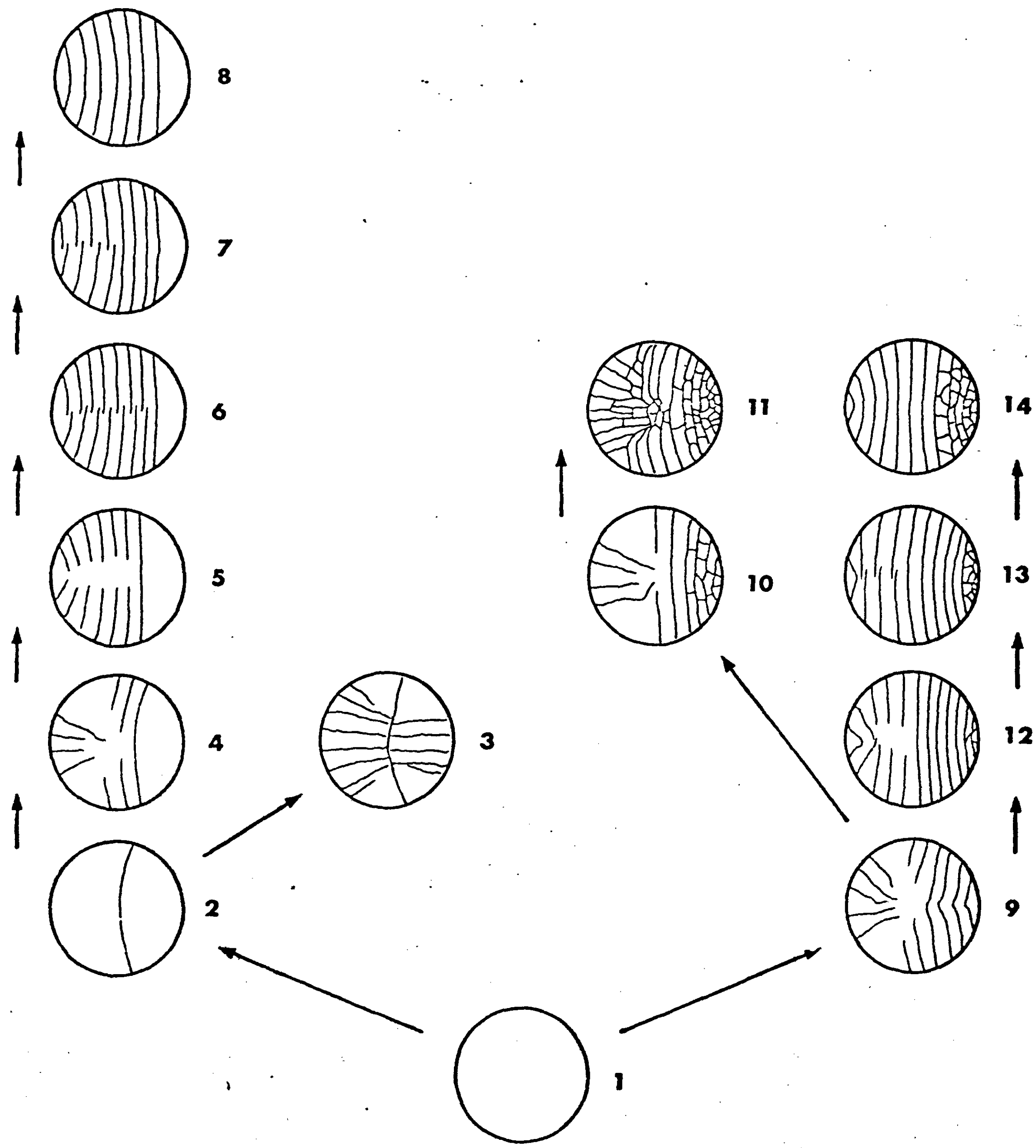


Figure 13 . Possible phyletic trends of the formation of the striation on the scales above anal origin but at just on horizontal septum. (1, hypothetical primitive type; 2, in, e.g. Ehirava and Clupeichthys perakensis; 3, in, e.g. Clupeoides papuensis and C. venulosus; 4, in, e.g. Etrumeus, Dussumieria, Dayella, Clupeoides borneensis and Corica; 5, in, e.g. Spratelloides gracilis, S. lewisi, and some species of Sardinella, Amblygaster, Tenualosa thibaudeaui, Gudusia, Nematalosa, Opisthopterus and some species of Ilisha; 6, in, e.g. some species of Sardinella, Hilsa, Anodontostoma and Pellona ditchela; 7, in, e.g. some species of Sardinella, Escualosa and Ilisha melastoma; 8, in, e.g. Spratelloides delicatulus, S. robustus, Herklotsichthys and some species of Tenualosa; 9, in, e.g. Engraulis and some species of Stolepholus; 10, in, e.g. some species of Stolepholus, Setipinna and Coilia; 11, in, e.g. some species of Setipinna and Coilia; 12, in, e.g. some species of Stolepholus; 13-14, in, e.g. some species of Thryssa).

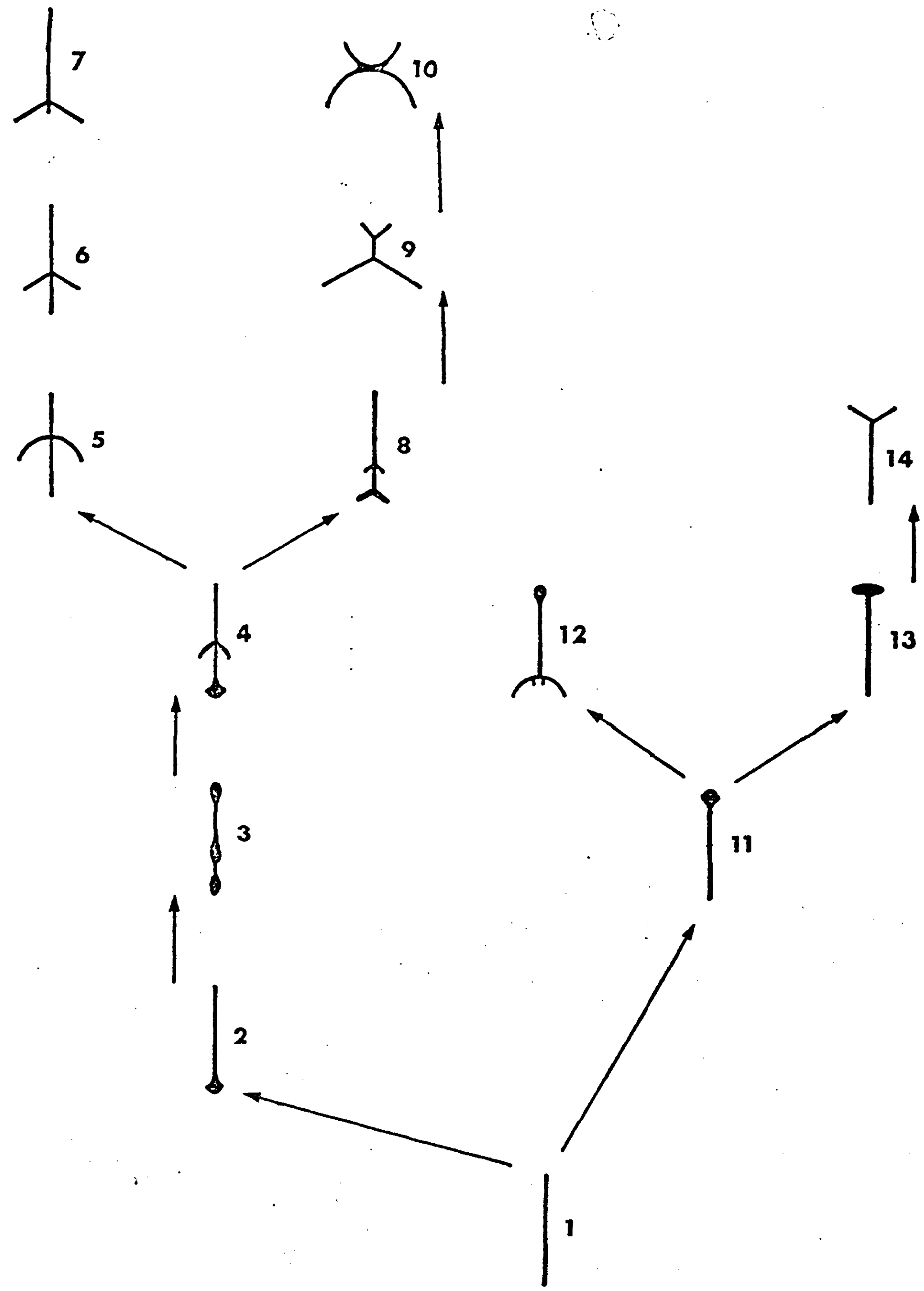


Figure 14 . Possible phyletic trends of formation of the shape of cross-section of the urohyals.(1, hypothetical primitive type found in, e.g. Corica, Clupeichthys and Engraulis; 2, in, e.g. Ehirava, Dayella, Clupeoides and Raconda, 3, in, e.g. Ilisha melastoma and Opisthopterus valenciennes e.g. most species of Herklotsichthys, Escualosa, Ilisha elongata and I. kampeni; 5,in, e.g. Dussumieria; 6, in, e.g. Sardinella, Amblygaster, some species of Herklotsichthys and Tenualosa; 7, in, e.g. Etrumeus, Spratelloides, Hilsa, Nematalosa, Gonialosa and Anodontostoma; 8, in, e.g. Pellona, Ilisha sirishai and I. striatula; 9, in, e.g. Opisthopterus tardoore and Clupanodon thrissa; 10, in, e.g. Gudusia chapra; 11 and 13, in, e.g. most species of Stolephorus, some species of Thryssa, Lycothrissa, Setipinna, Heterothryssa and Coilia; 12, in Stolephorus heterolobus and S. devisi; 14, in some species of Thryssa and Papuengraulis).

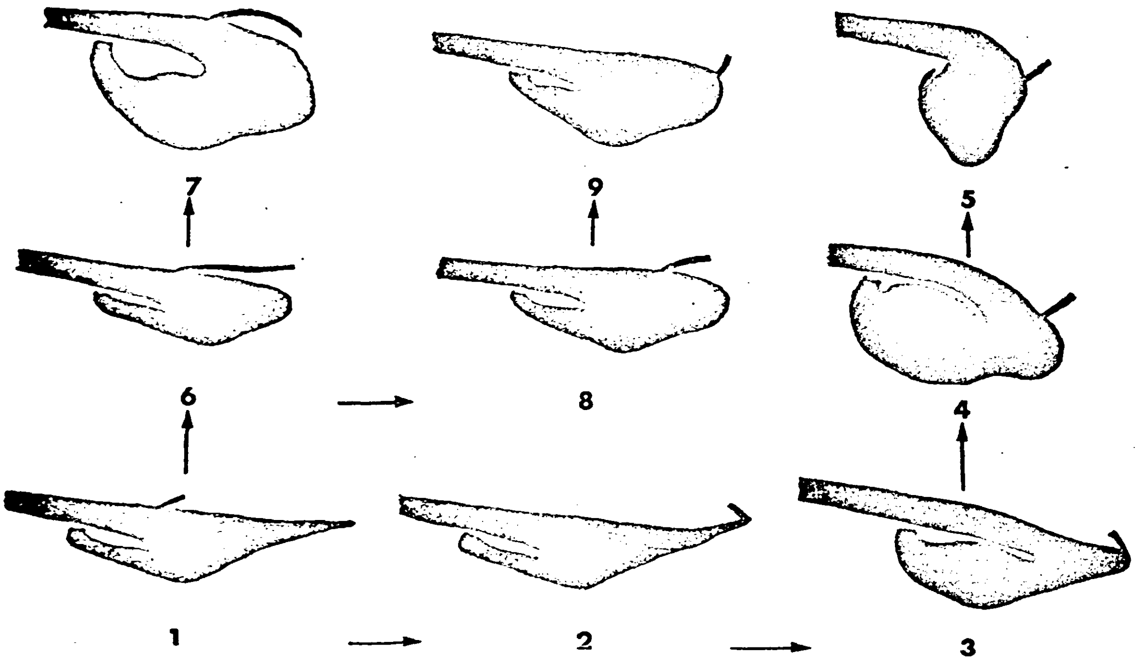


Figure 15 . Gut shapes and their possible phyletic trends in connection with the position of pneumatic duct (modified from Harder, 1960; and Nelson, 1970a). (1, hypothetical primitive type found in, e.g. Dussumieria and Pellona; 2, in, e.g. Etrumeus, Spratelloides and Sardinella; 3, in, e.g. Hilsa kelee, Tenualosa toli and T. macrura; 4, in, e.g. Tenualosa reevesii, T. ilisha and Gudusia; 5, in, e.g. Dorosomatinae; 6, in, e.g. Opisthopterus tardoore, Raconda, Engraulis, Stolephorus and Lycothrissa; 7, in, e.g. Stolephorus and Coilia; 8, in, e.g. Clupeoides and some species of Thryssa; and 9, in, e.g. Escualosa).

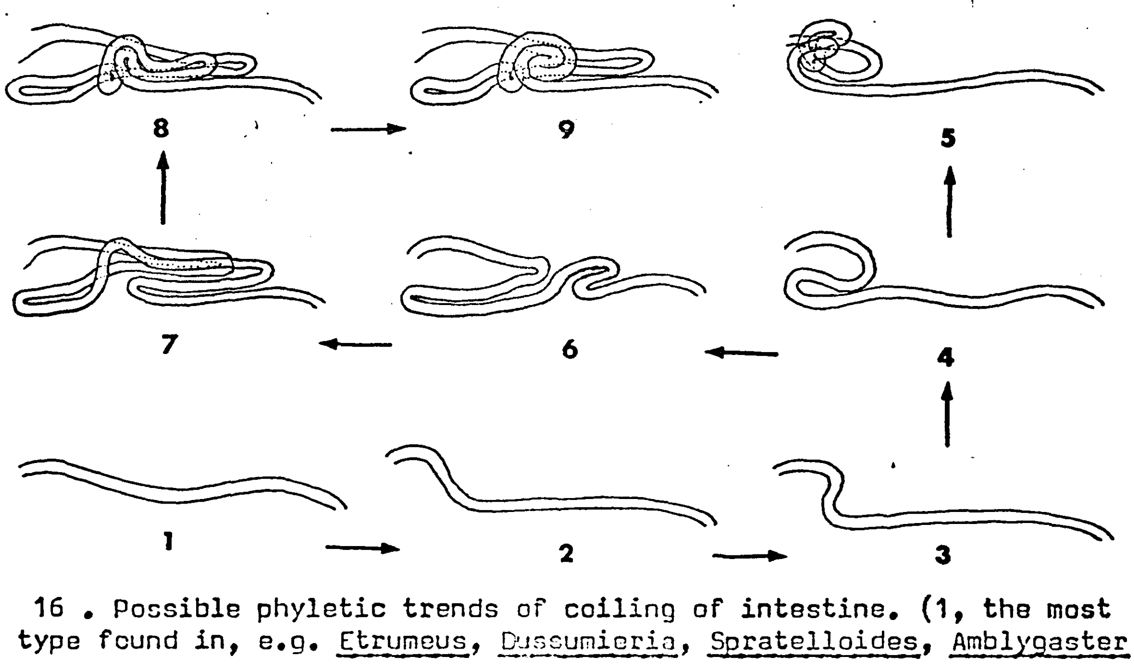


Figure 16 . Possible phyletic trends of coiling of intestine. (1, the most simple type found in, e.g. Etrumeus, Dussumieria, Spratelloides, Amblygaster and Coilia; 2, in, e.g. Ilisha, species of Stolephorus and Thryssa, and Papuengraulis; 3, in, e.g. Opisthopterus, Raconda, and some species of Stolephorus; 4, in, e.g. Sardinella (Clupeonia), Herklotsichthys quadrimaculatus, H. koningsbergeri, Escualosa and some species of Tenualosa; 5, in, e.g. Sardinella (Sardinella); 6, in, e.g. Tenualosa macrura and T. reevesii; 7, in, e.g. Tenualosa ilisha, Nematalosa, Gonialosa and Anodontostoma; 8, in Gudusia chapra and Clupanodon thrissa; and 9, in Konosirus thrissa. An extraordinary twisted intestine of Engraulis which is near to 2 is not herein shown).

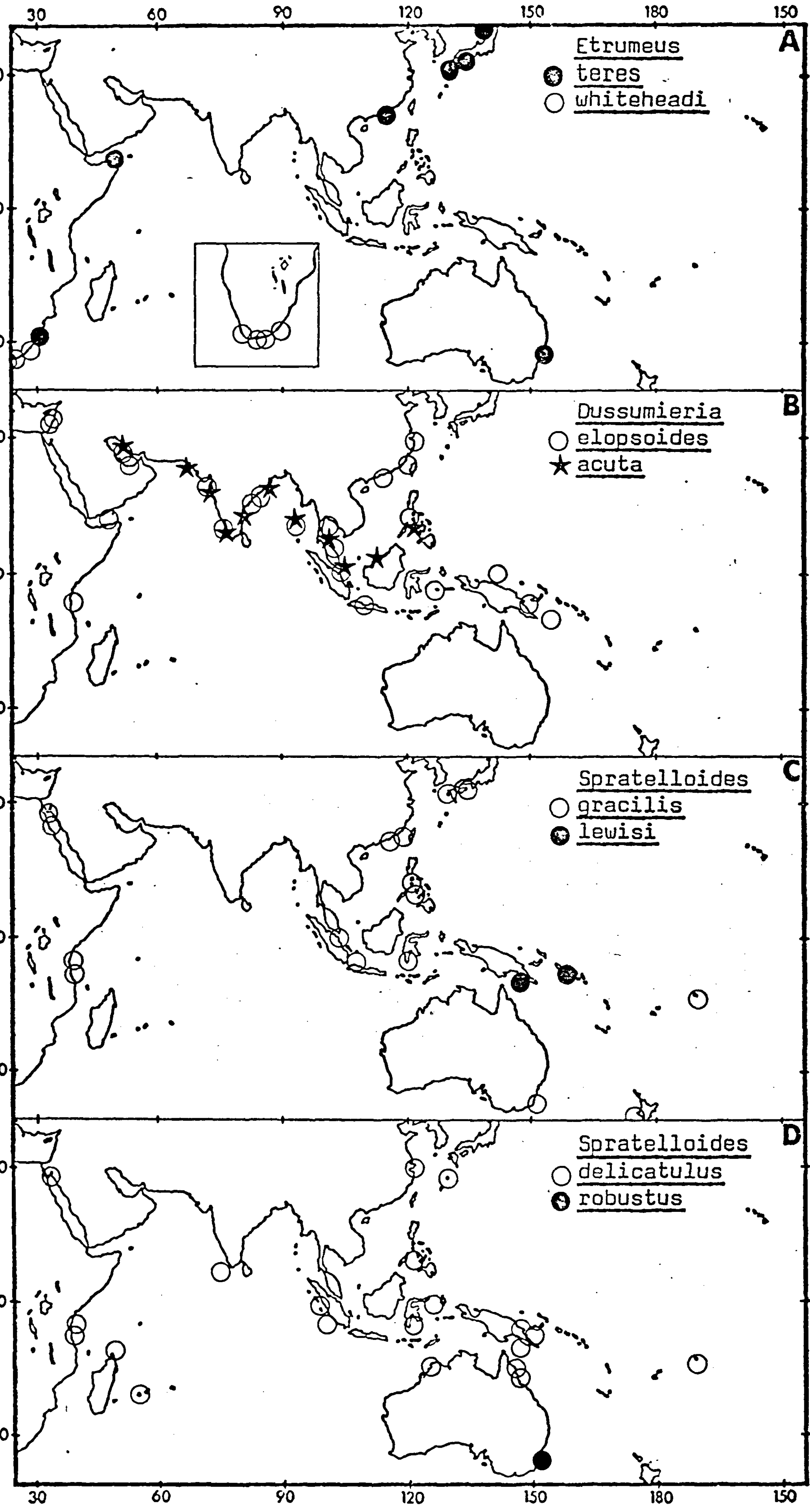


Figure 17 . Distribution of the species of Etrumeus , Dussumieria and Spratelloides. Inset , South Africa showing distribution of Etrumeus whiteheadi in the Atlantic coast.

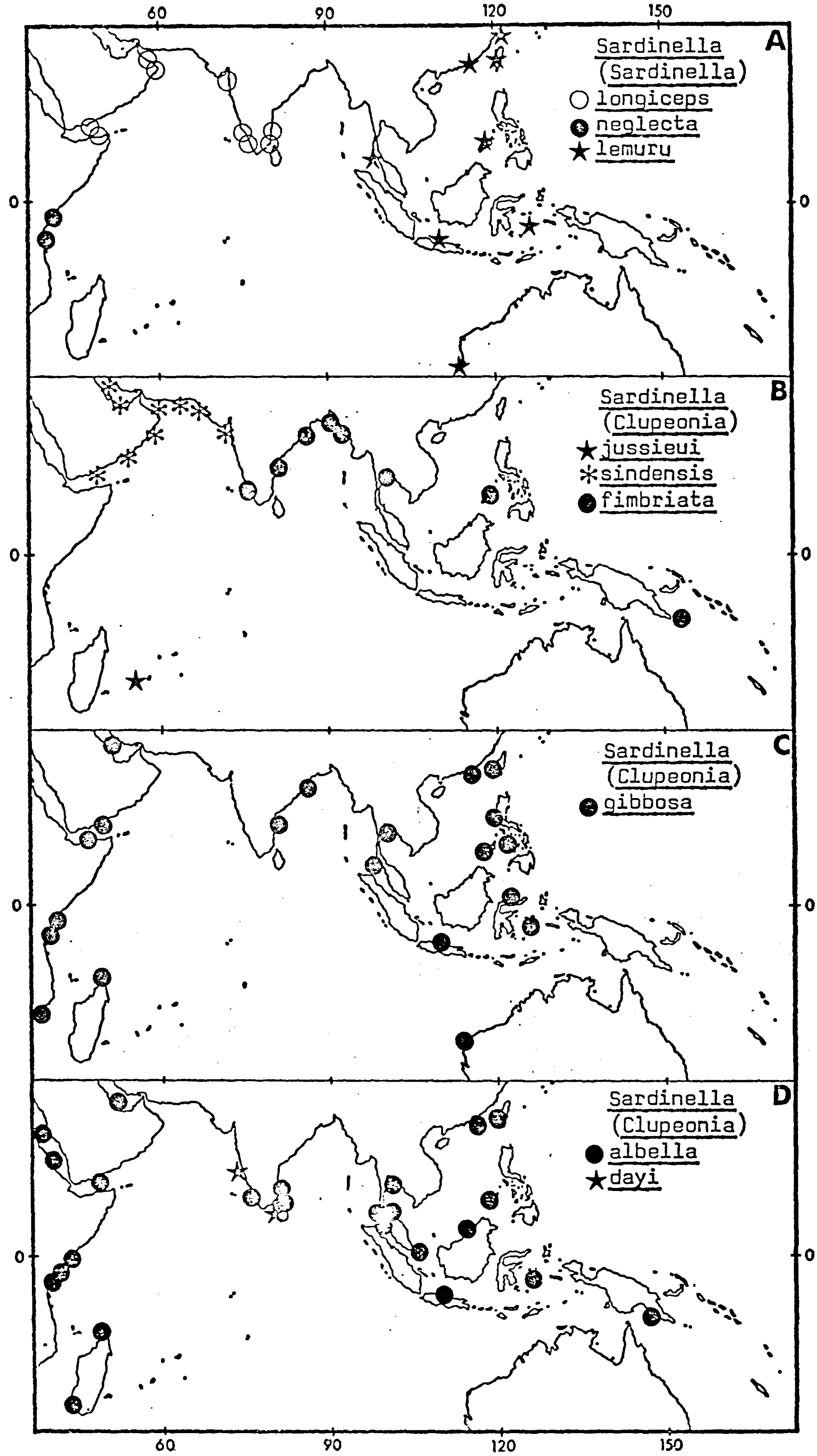


Figure 16 . Distribution of the species of Sardinella (Sardinella) and Sardinella (Clupeonia).

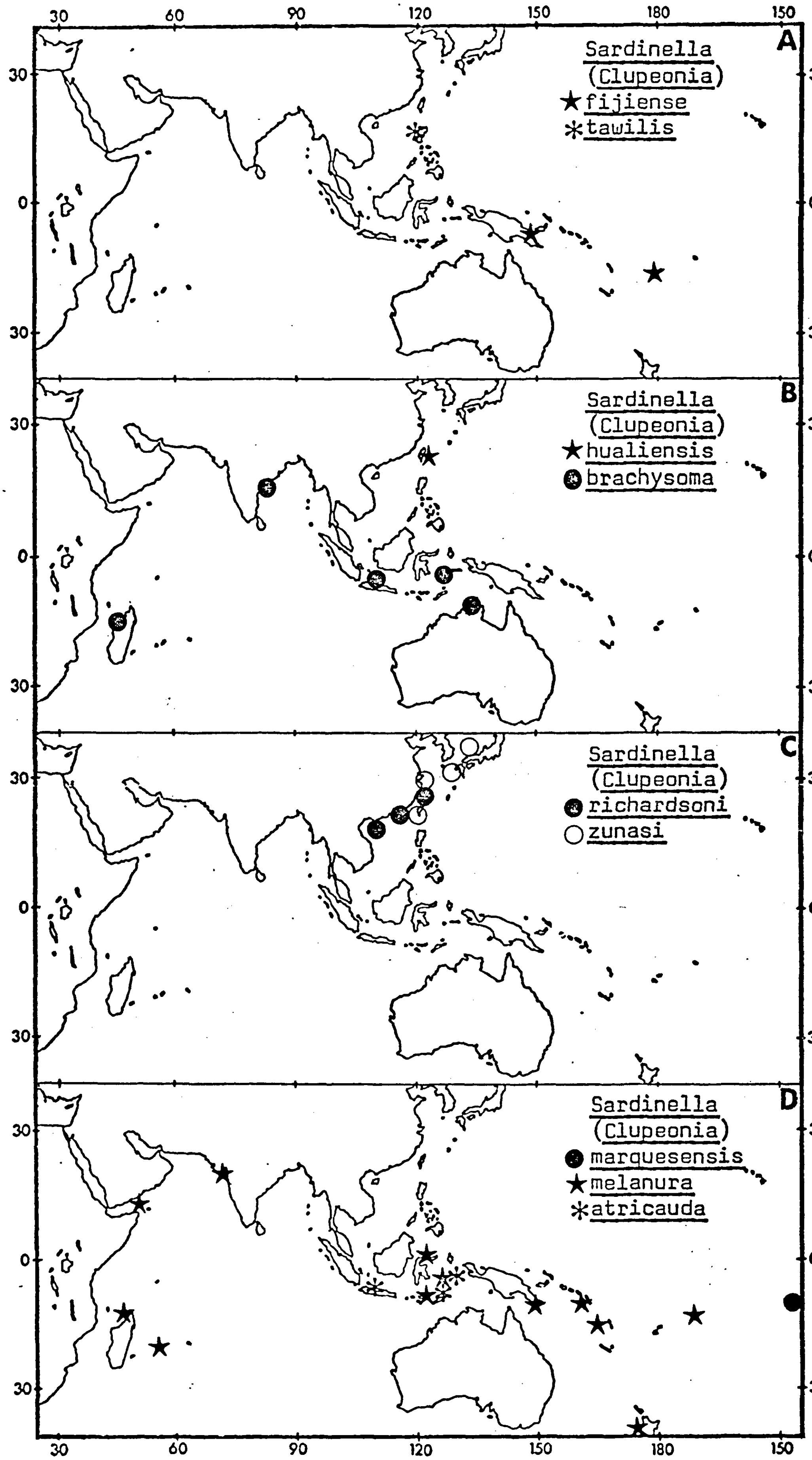


Figure 19 . Distribution of the species of <u>Sardinella</u> (<u>Clupeonia</u>).

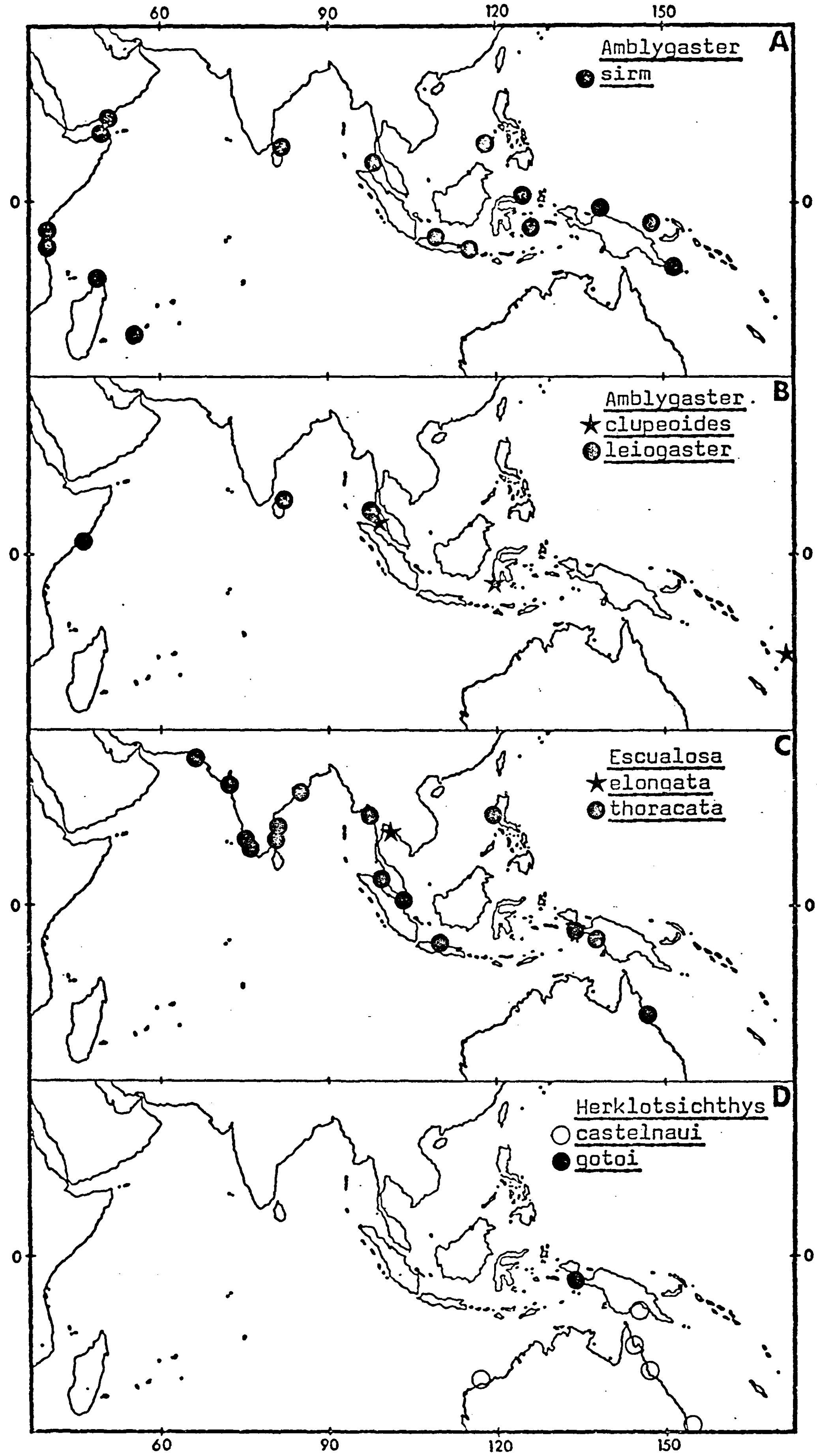


Figure 20 . Distribution of the species of Amblygaster, Escualosa and Herklotsichthys.

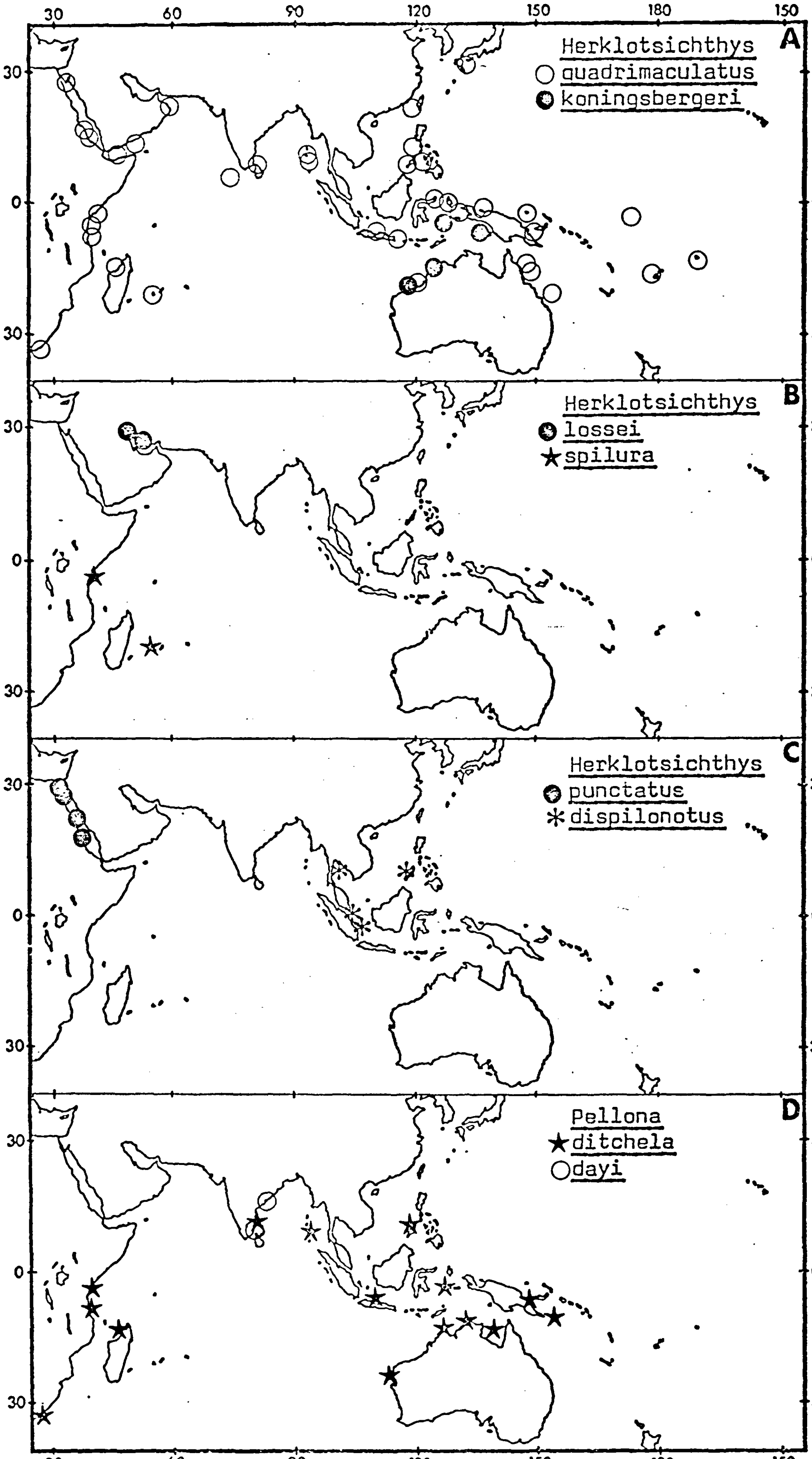


Figure 21 . Distribution of the species of Herklotsichthys and Pellona.

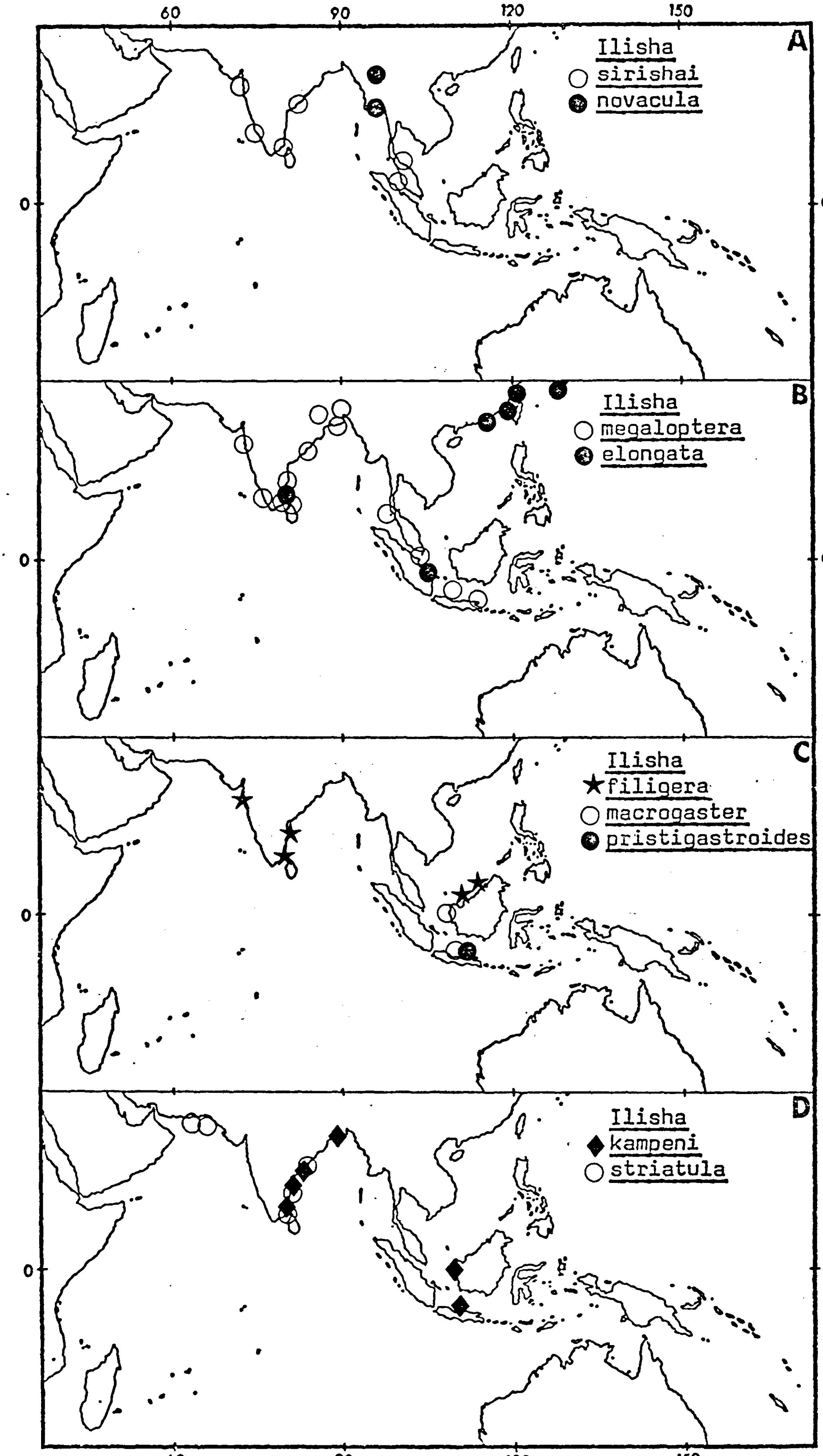


Figure 22 . Distribution of the species of Ilisha.

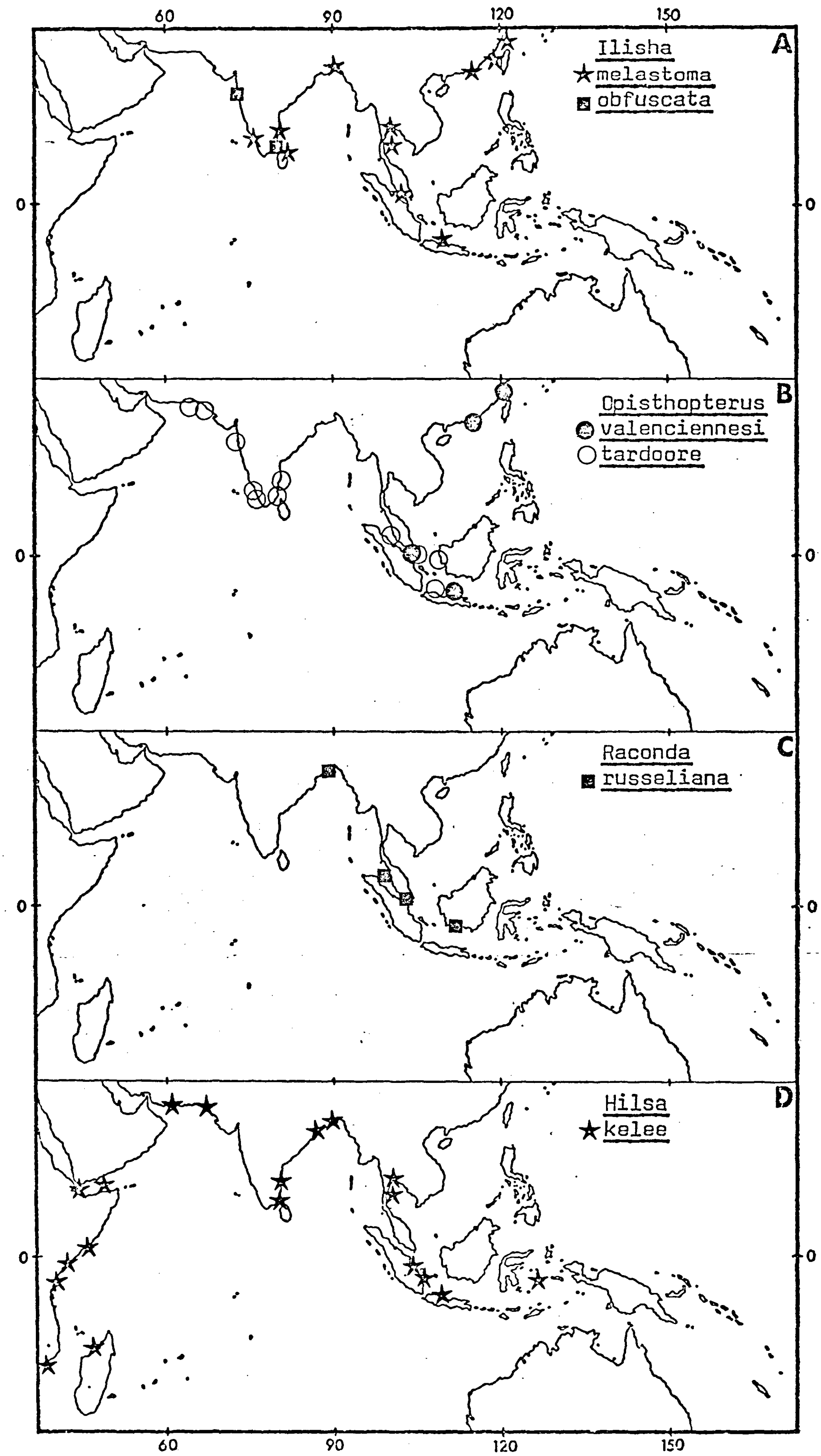


Figure 23 . Distribution of the species of Ilisha , Opisthopterus , Raconda and Hilsa.

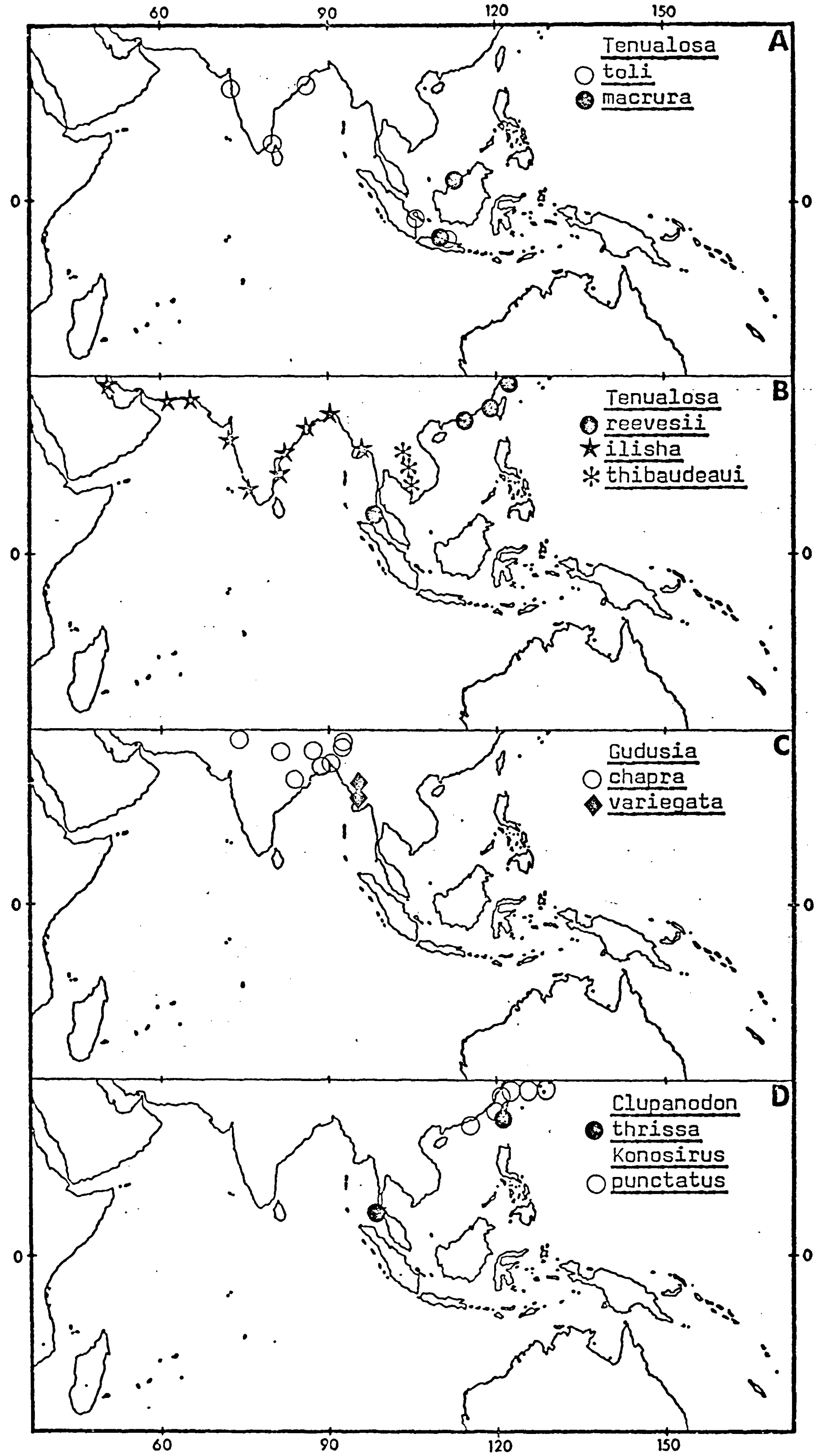


Figure 24 . Distribution of the species of Tenualosa , Gudusia , Clupanodon and Konosirus.

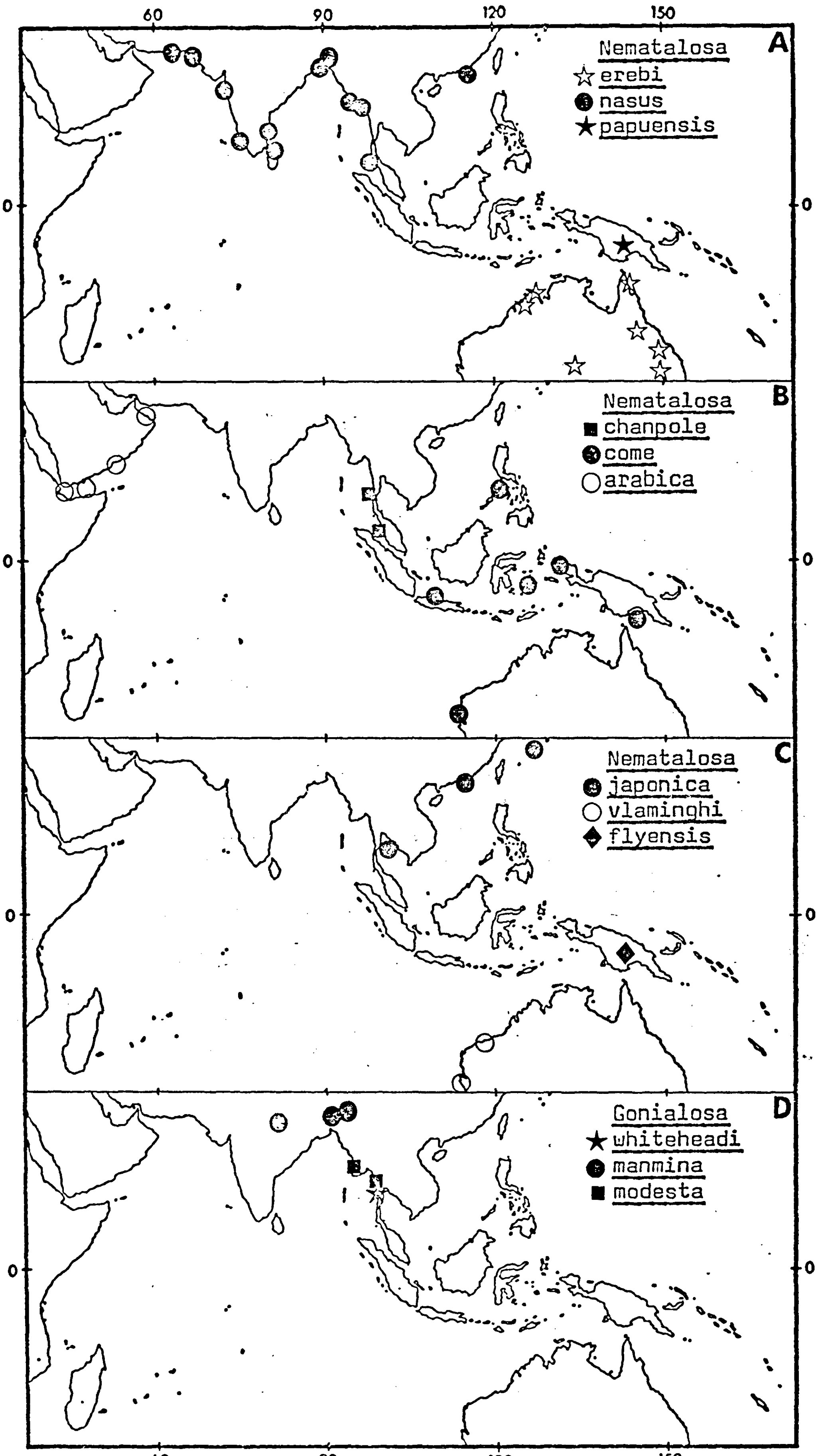


Figure 25 . Distribution of the species of Nematalosa and Gonialosa.

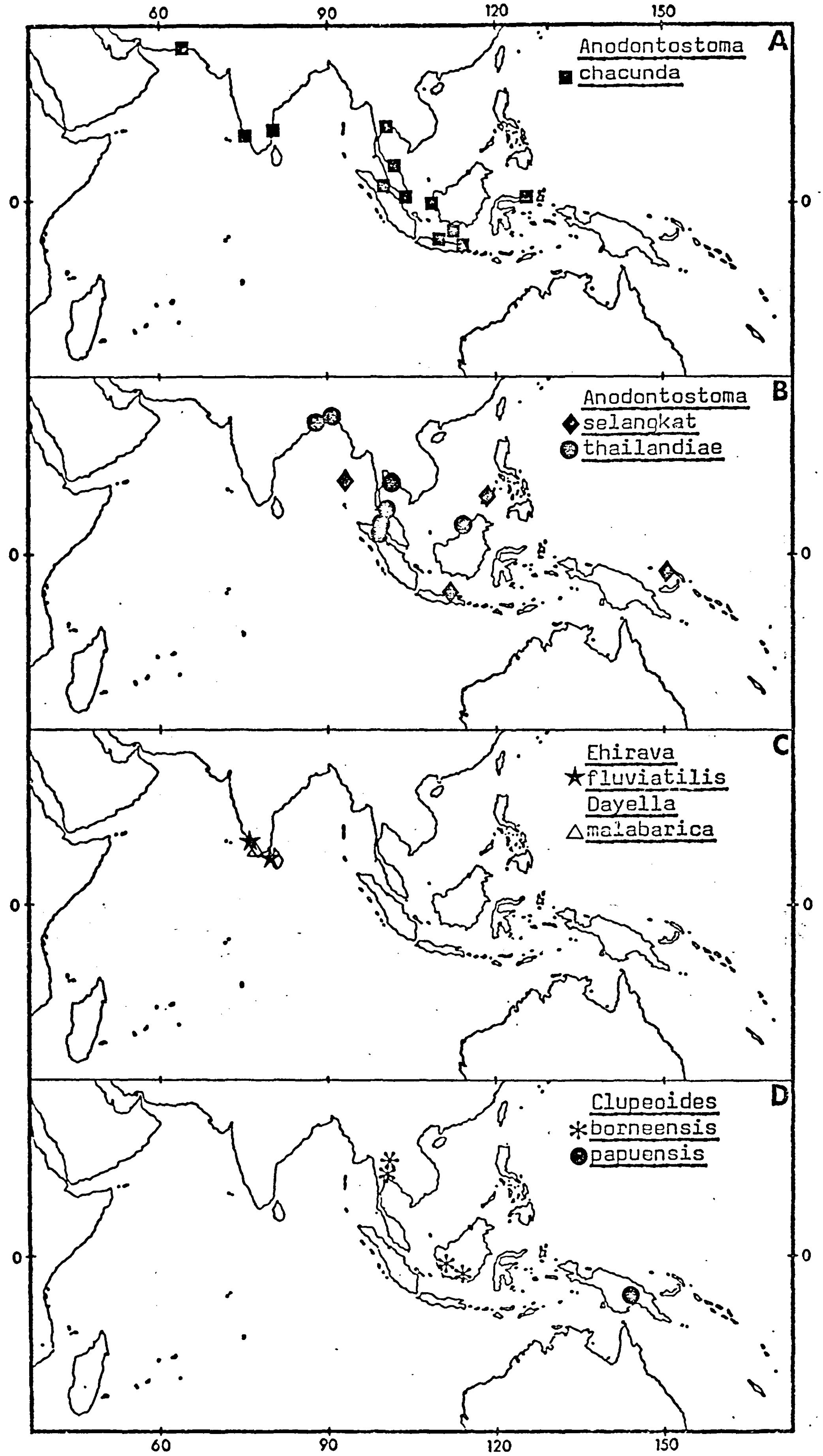


Figure 26 . Distribution of the species of Anodontostoma , Ehirava , Dayella and Clupeoides.

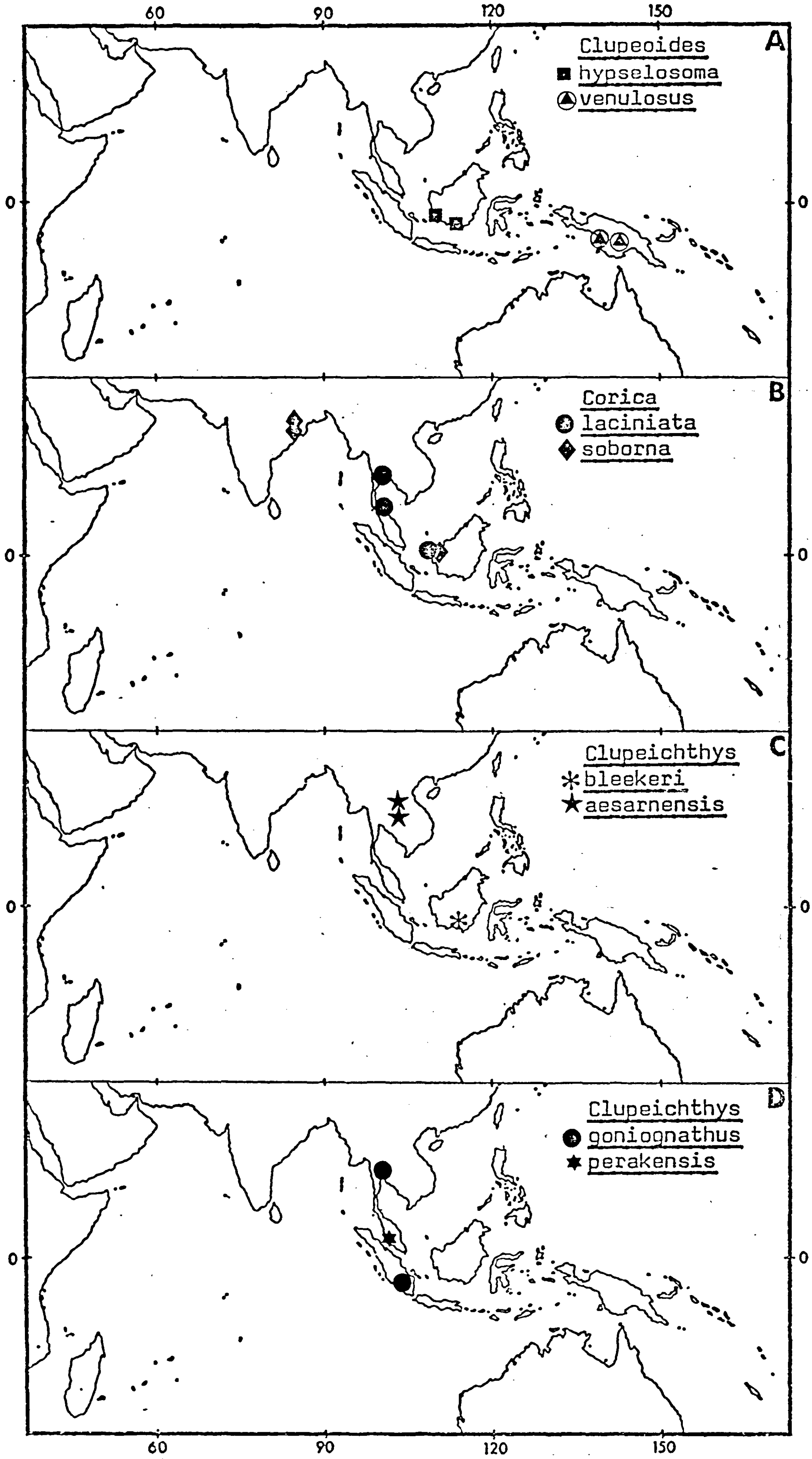


Figure 27 . Distribution of the species of *Clupeoides* , *Corica* and *Clupeichthys*.

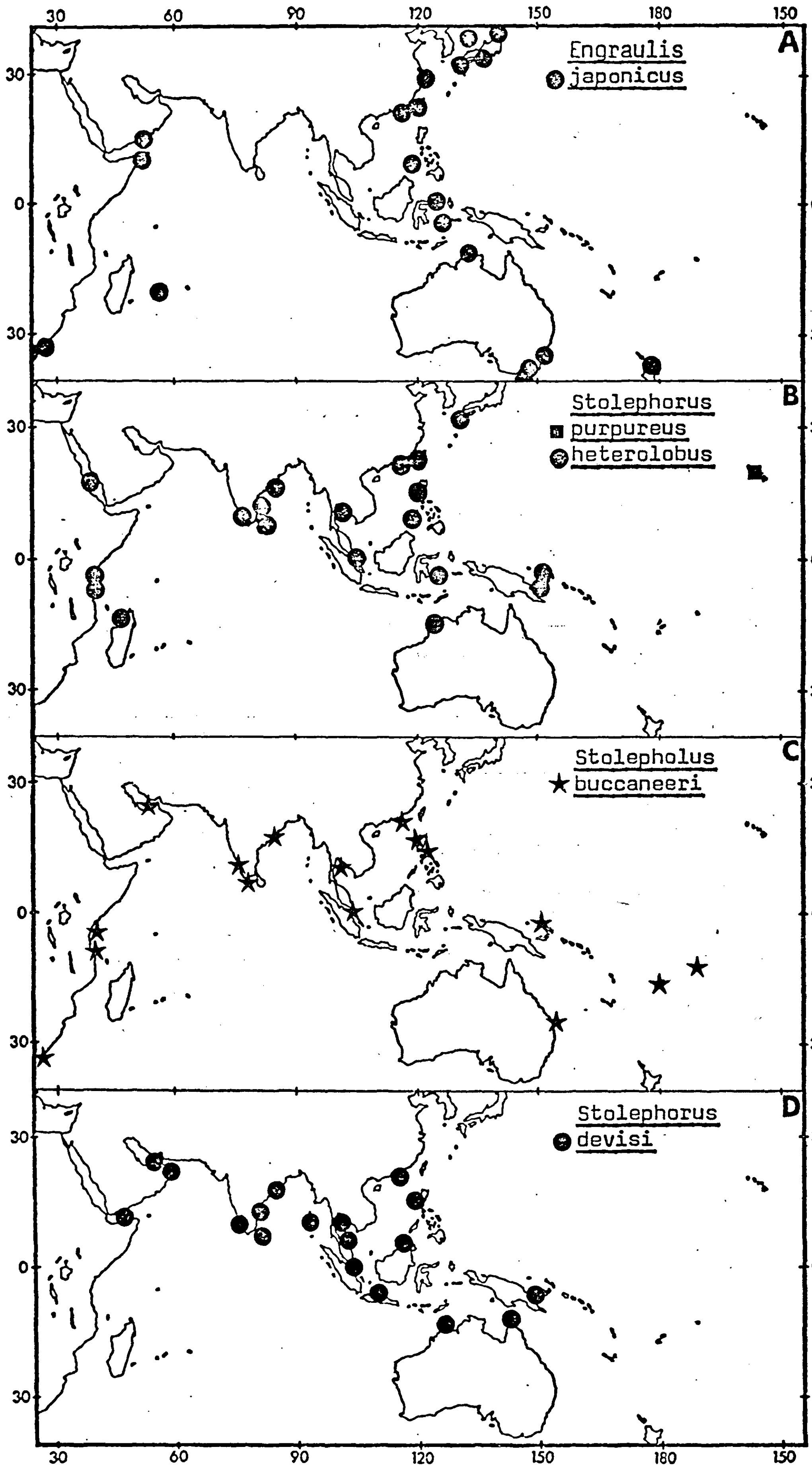


Figure 28 . Distribution of the species of Engraulis and Stolephorus.

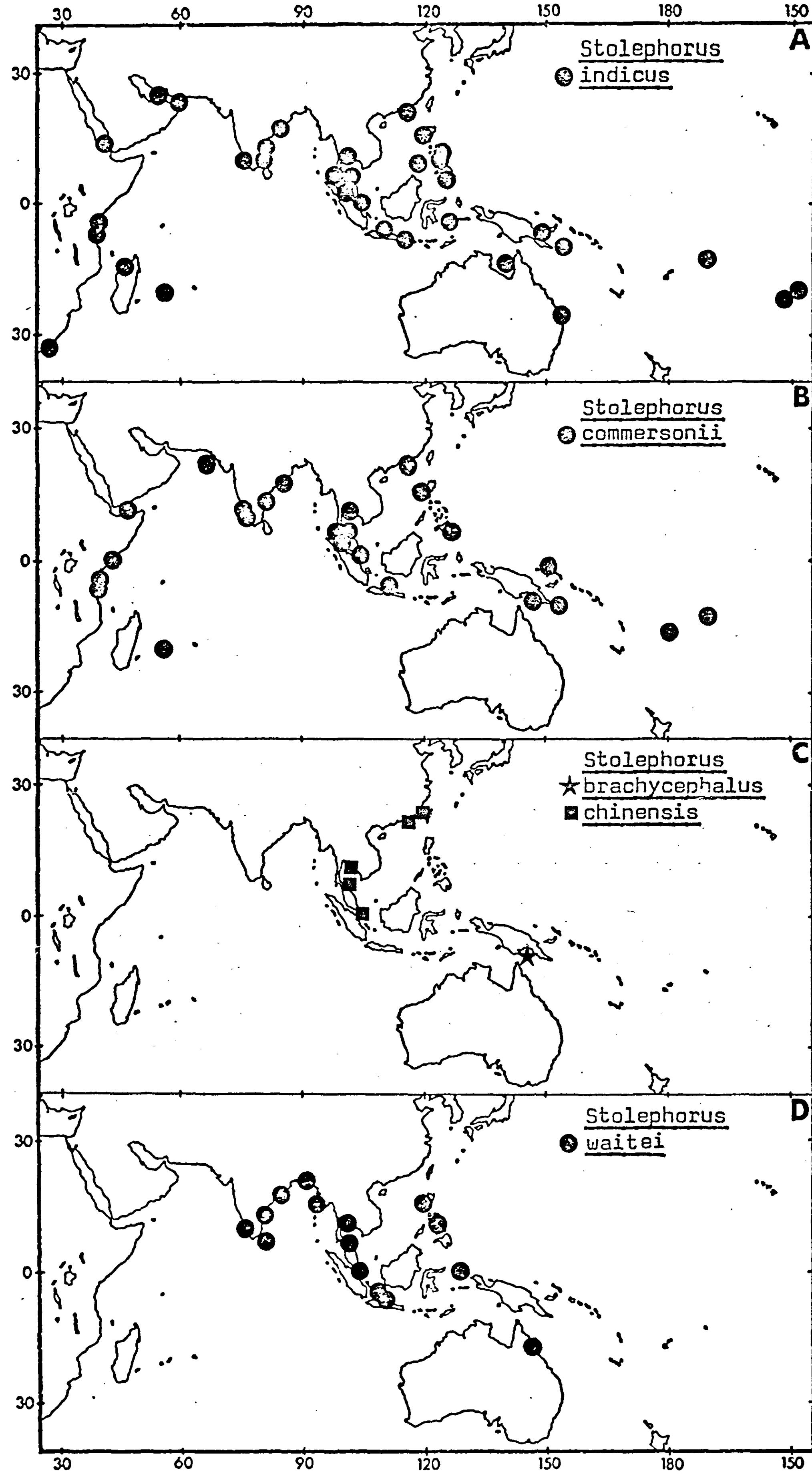


Figure 29 . Distribution of the species of Stolephorus.

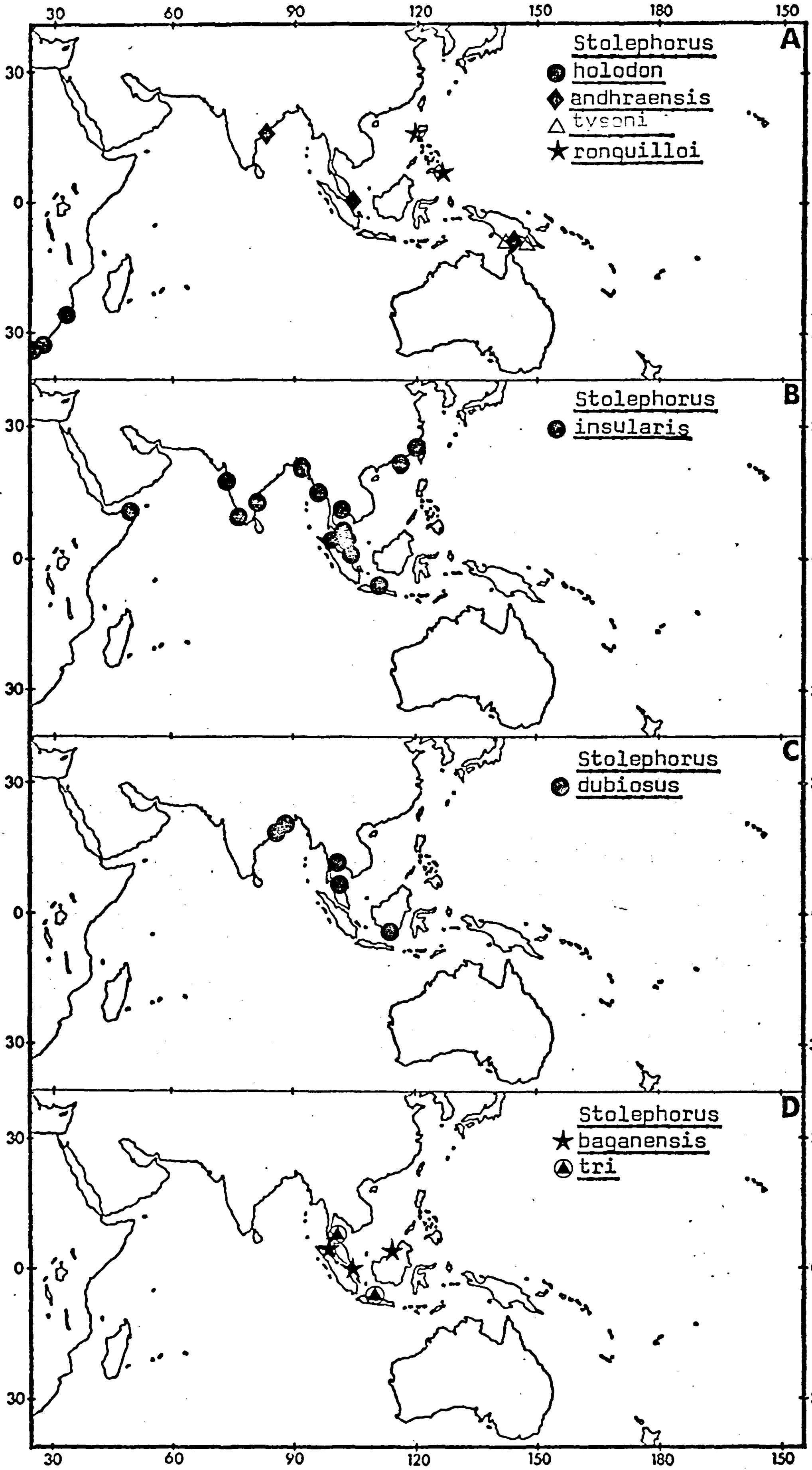


Figure 30 . Distribution of the species of Stolephorus.

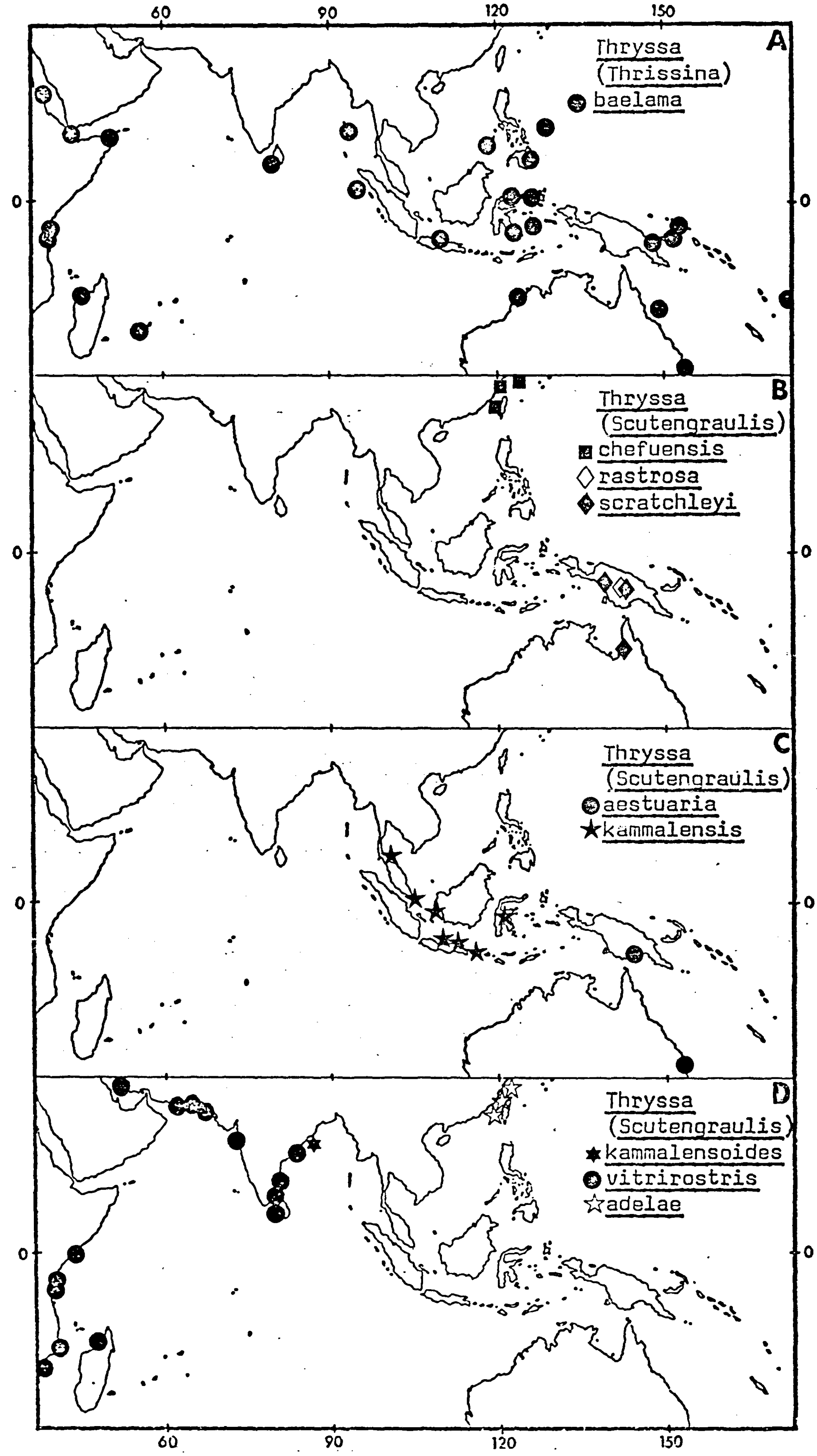


Figure 31 . Distribution of the species of *Thryssa* (*Thrissina*) and *Thryssa* (*Scutengraulis*).

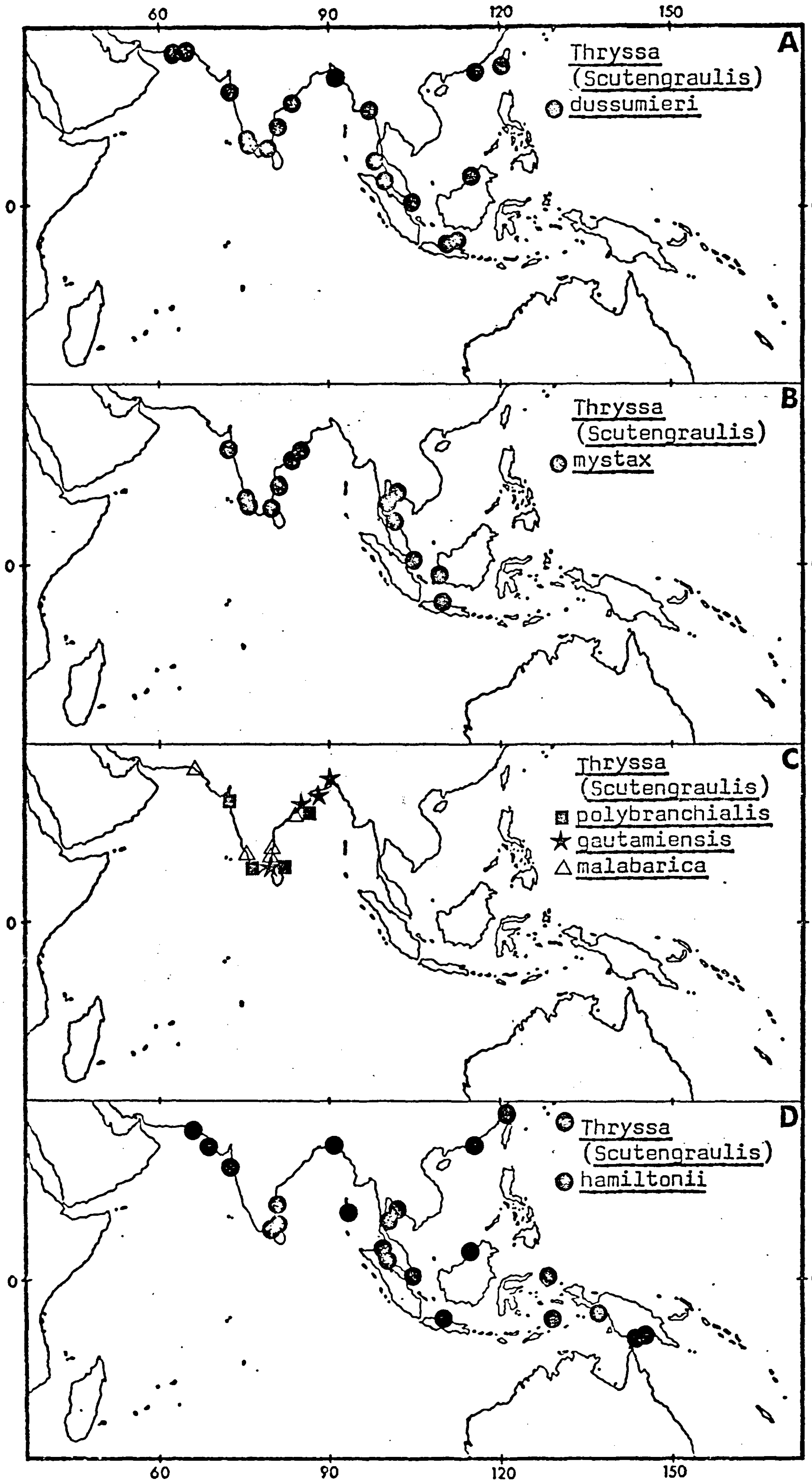


Figure 32 . Distribution of the species of Thryssa (Scutengraulis).

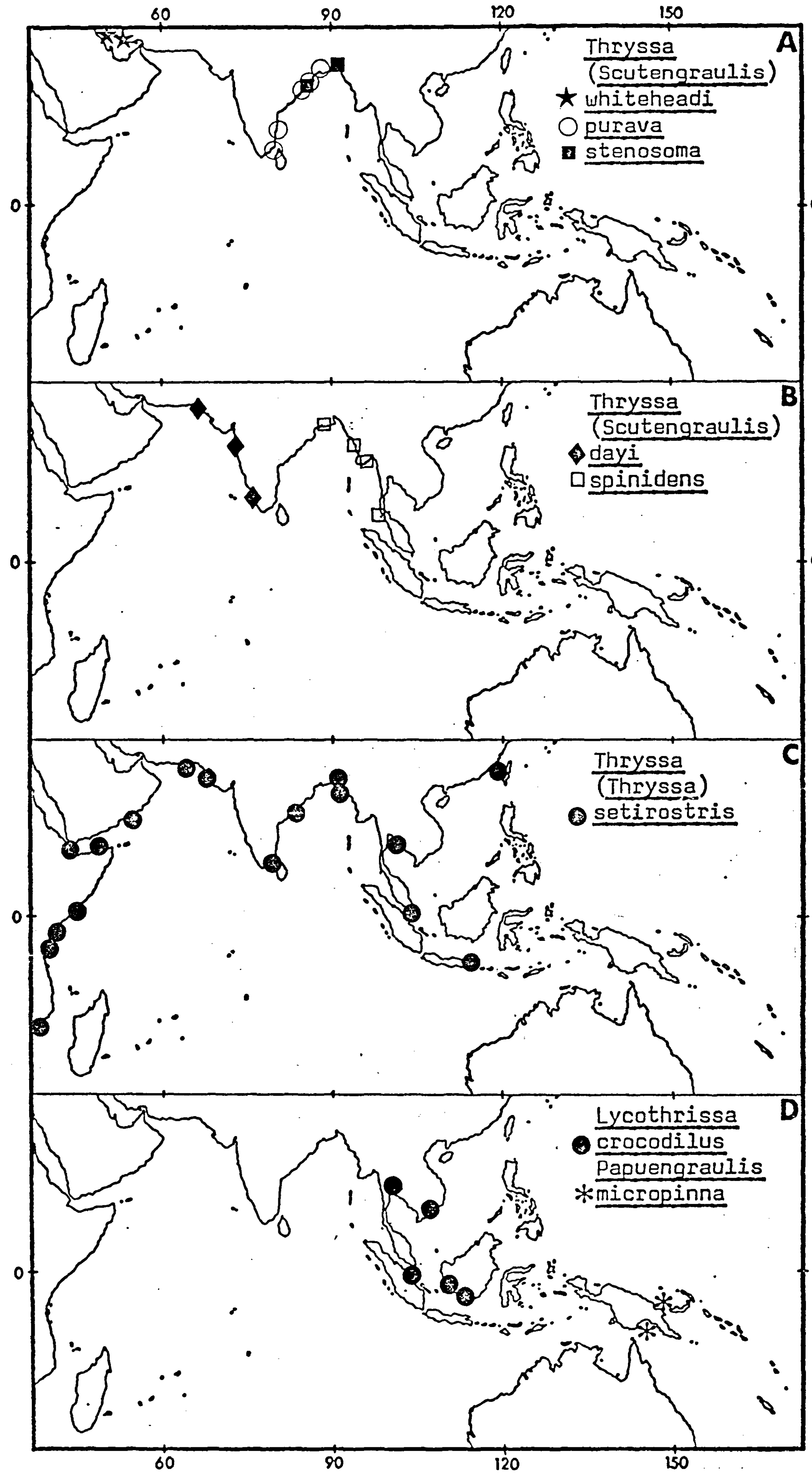


Figure 33 . Distribution of the species of Thryssa (Scutengraulis), Thryssa (Thryssa), Lycothrissa and Papuengraulis.

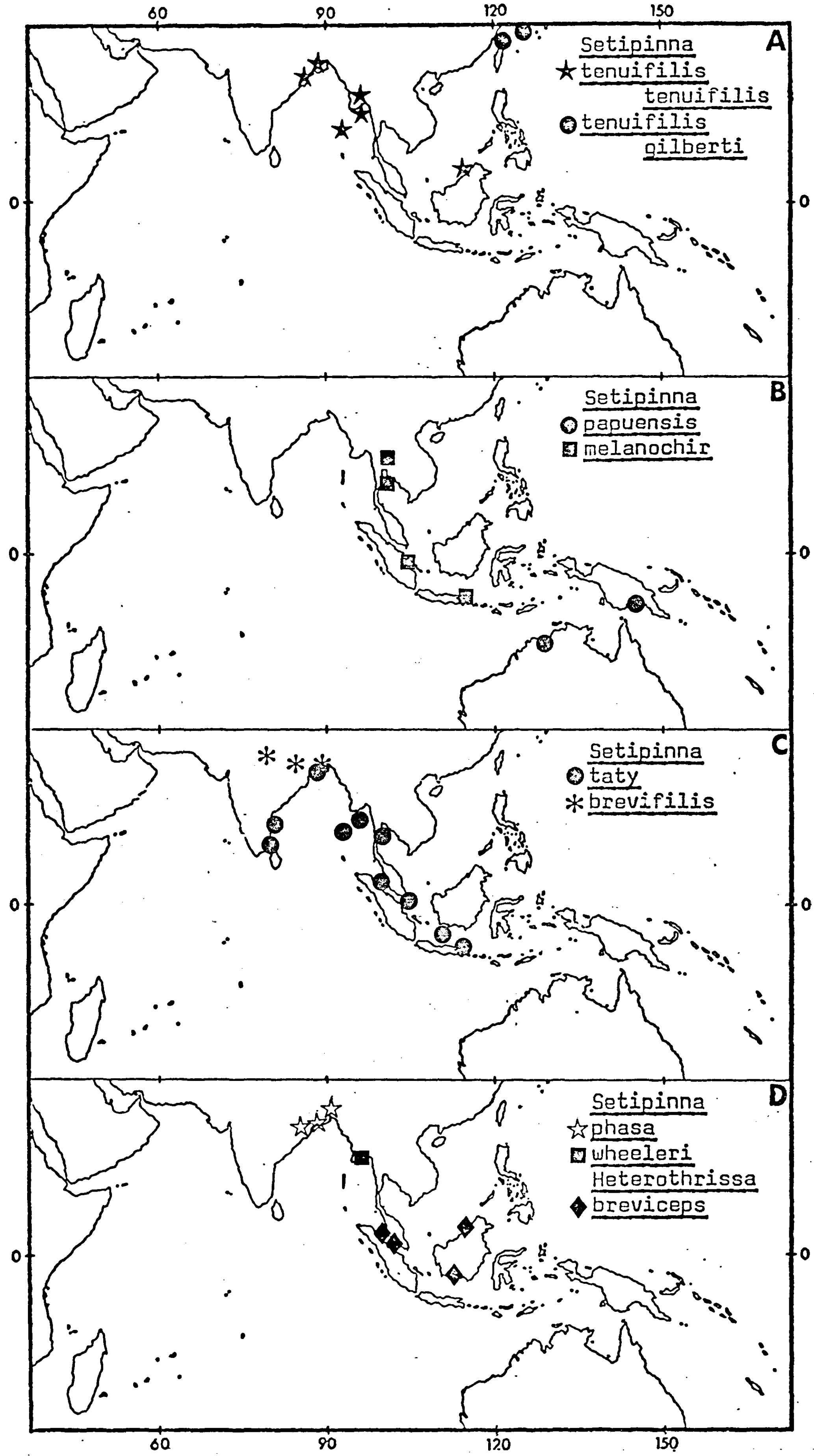


Figure 34 . Distribution of the species of Setipinna and Heterithrissa.

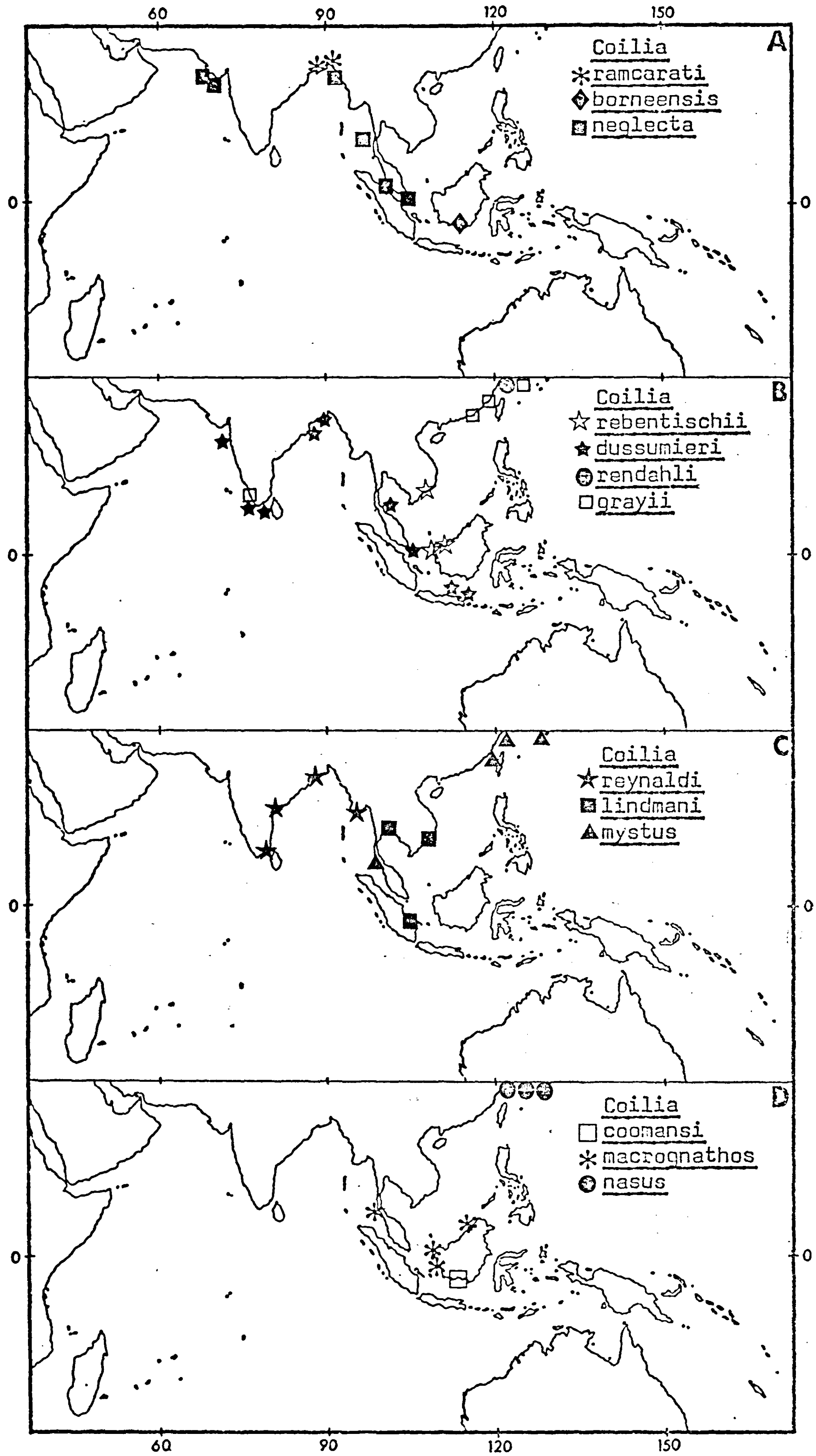


Figure 35 . Distribution of the species of *Coilia*.

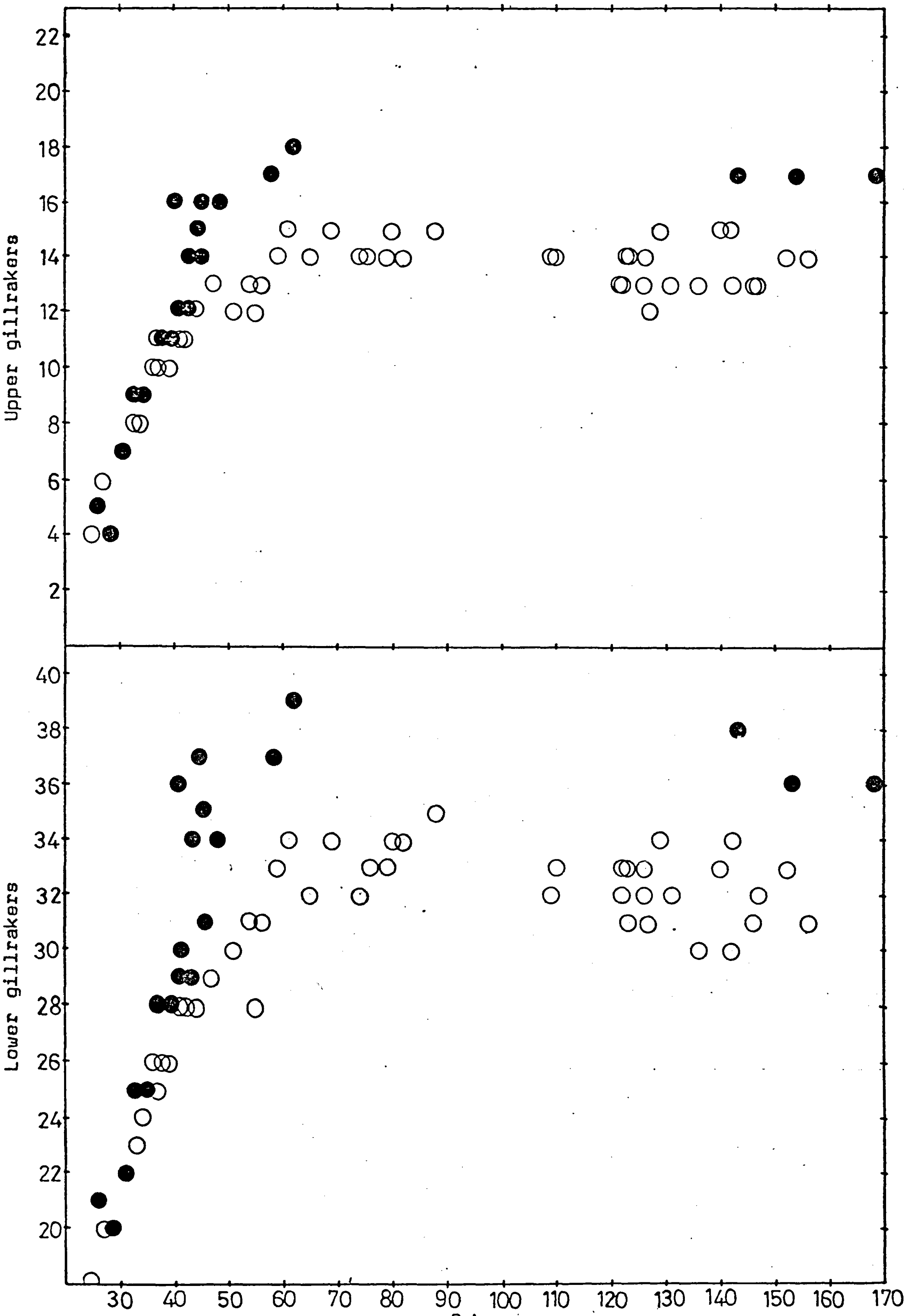


Figure 36 . Relation of number of gillrakers to standard length (mm) for Etrumeus teres (○) and E.whiteheadi (●).

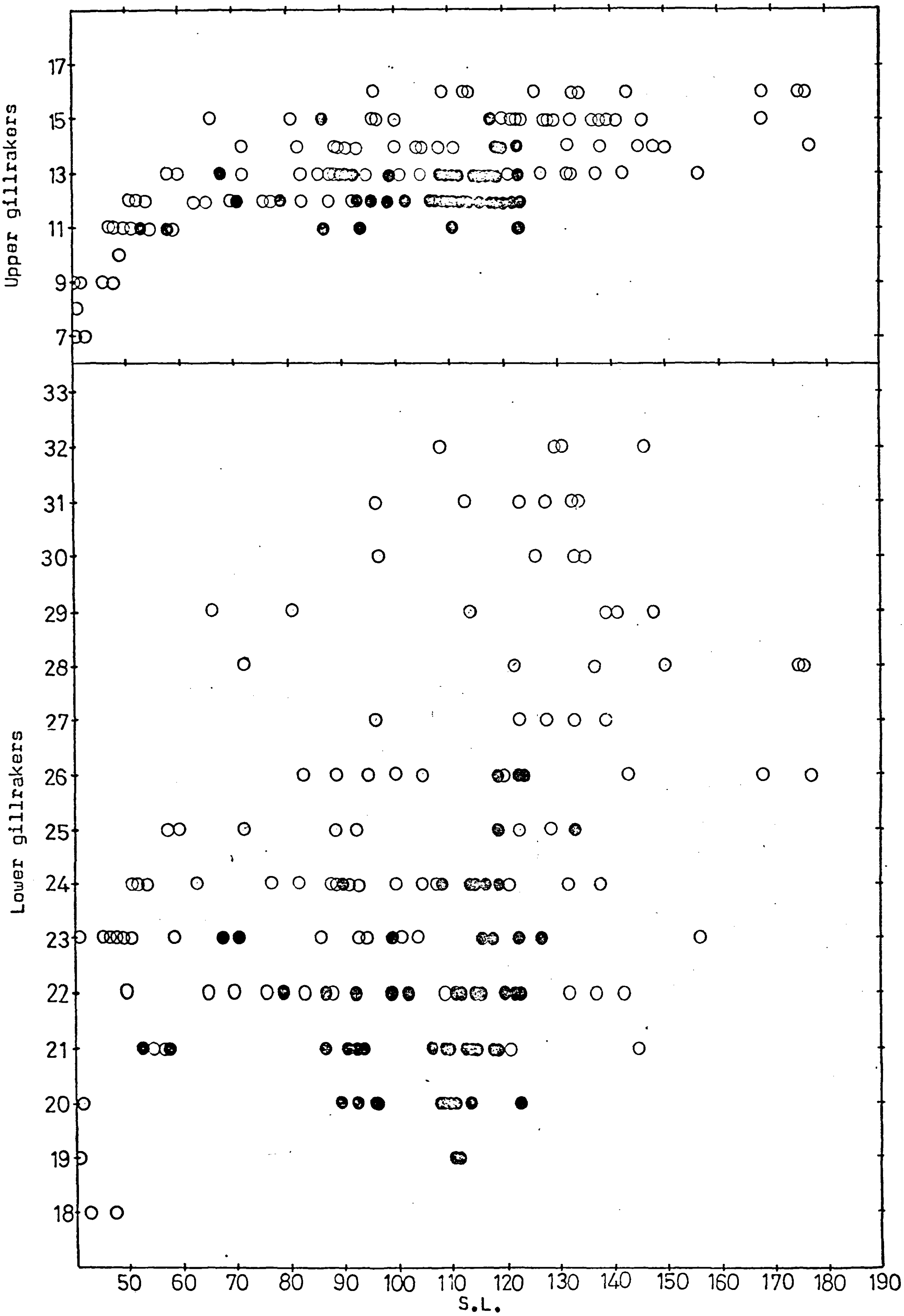


Figure 37 . Relation of number of gillrakers to standard length (mm) for <u>Dussumieria elopsoides</u> (○) and <u>D.acuta</u> (●).

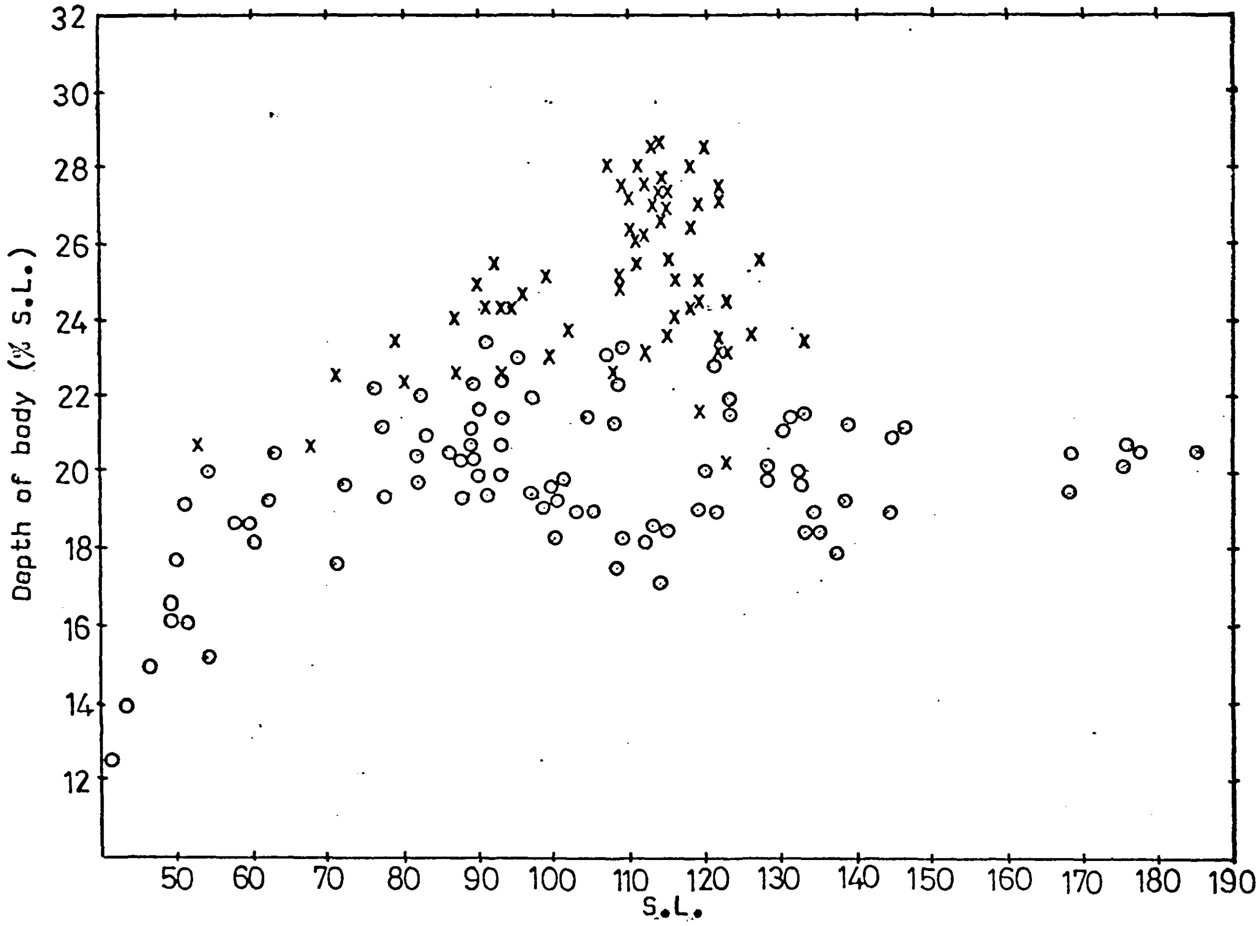


Figure 38 . Relation of depth of body as percent of standard length to standard length (mm) for <u>Dussumieria elopsoides</u> (⊙) and <u>D. acuta</u> (X).

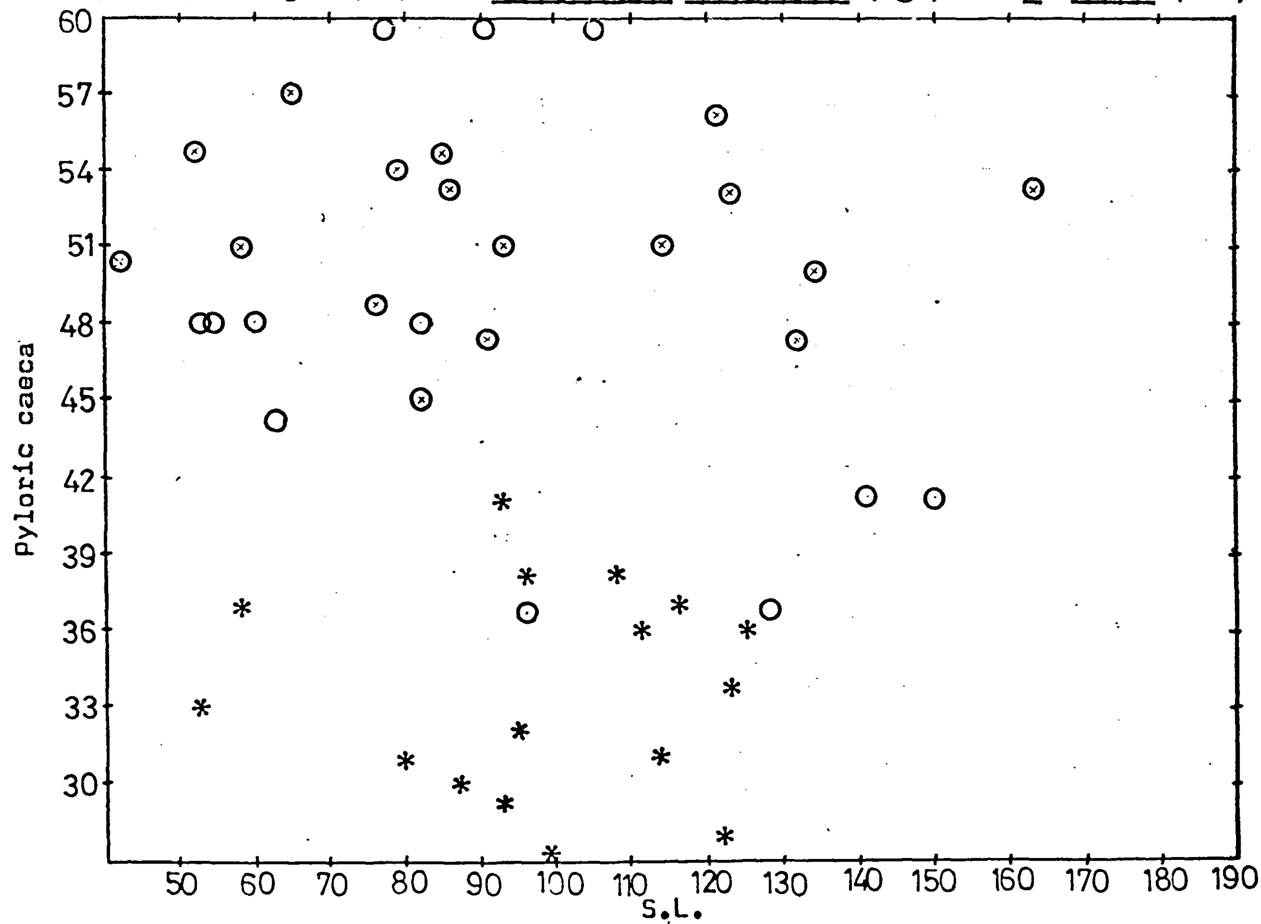


Figure 39 . Relation of number of pyloric caeca to standard length (mm) for <u>Dussumieria elopsoides</u> (O) and <u>D. acuta</u> (*).

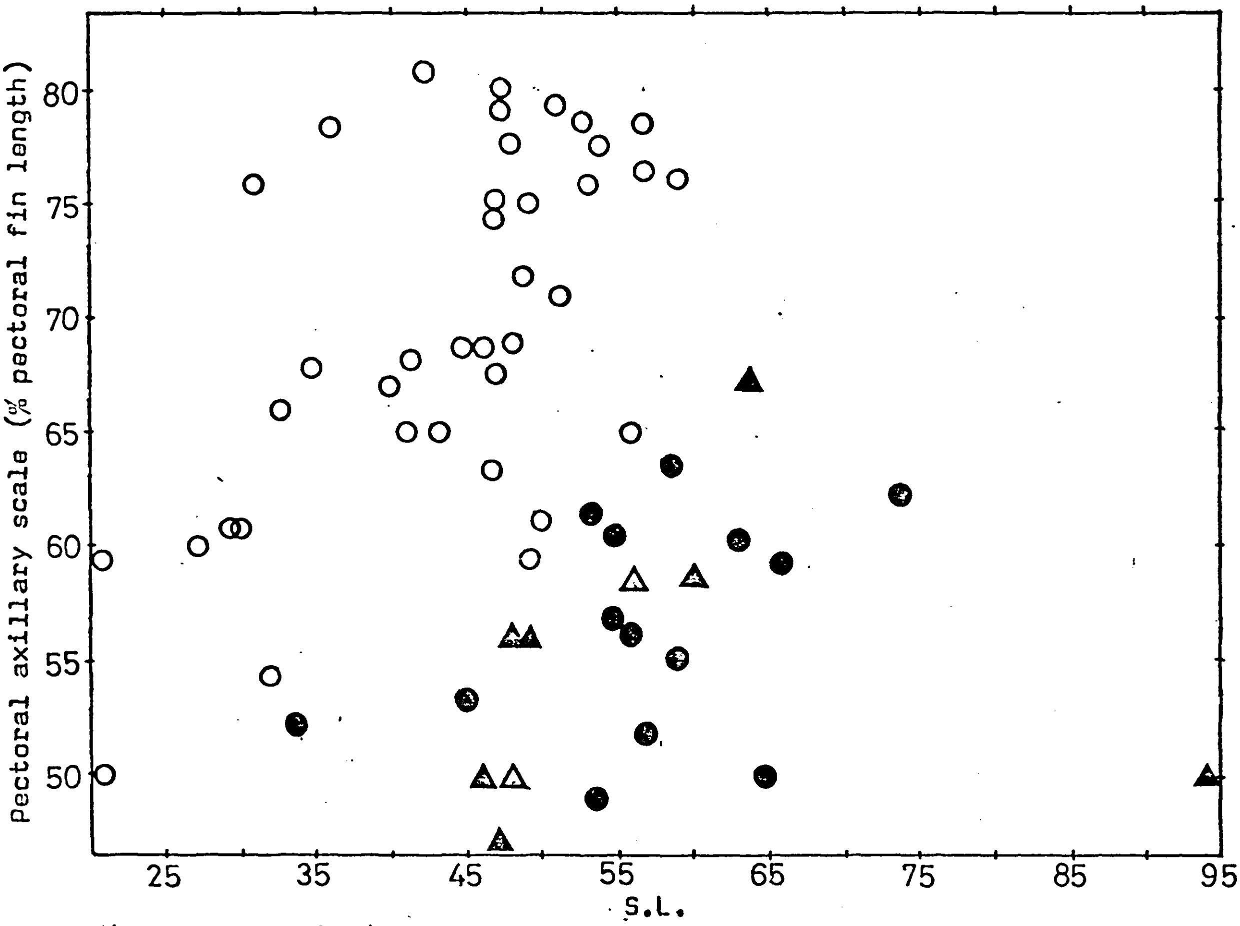


Figure 40 . Relation of length of pectoral axillary scale as percent of pectoral fin length to standard length (mm) for Spratelloides gracilis (▲), S.lewisi (△), S.delicatulus (○) and S.robustus (●).

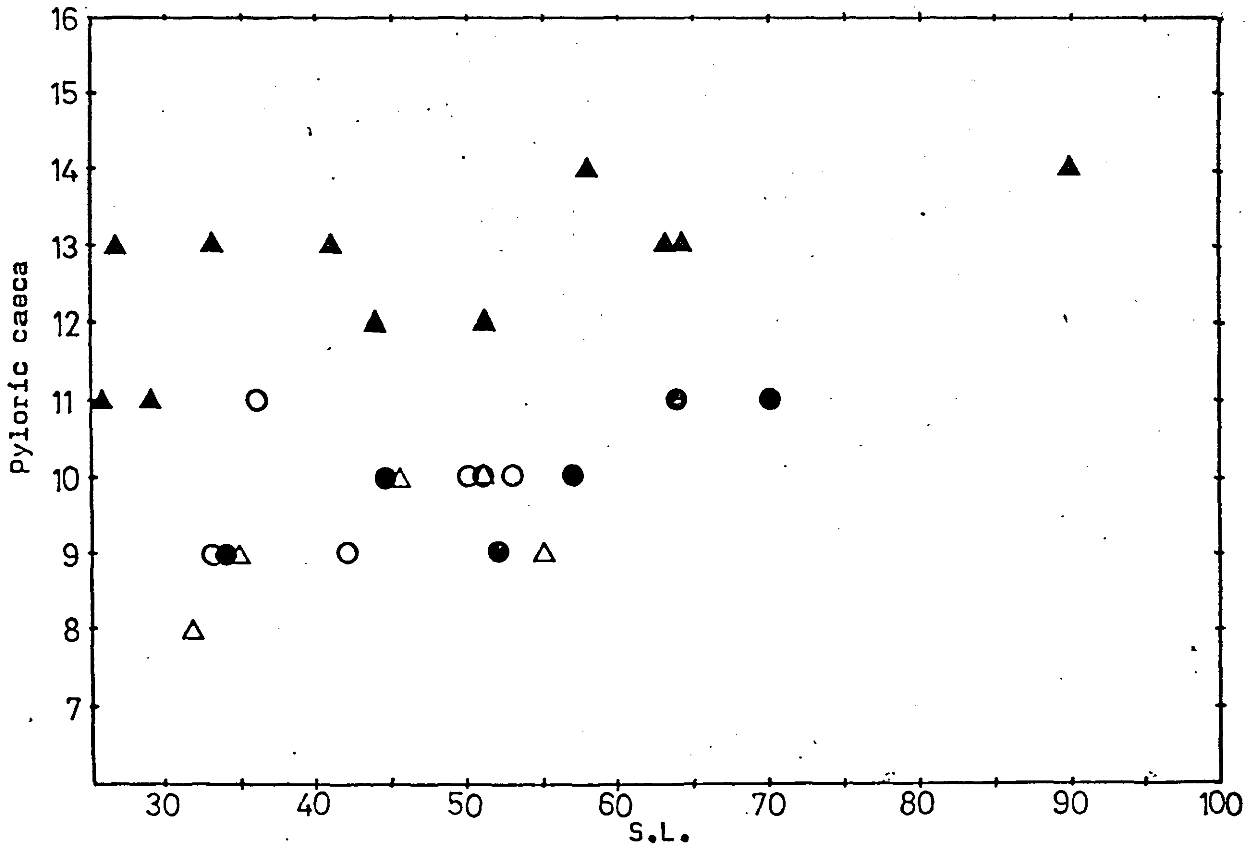


Figure 41 . Relation of number of pyloric caeca to standard length (mm) for Spratelloides gracilis (▲), S.lewisi (△), S.delicatulus (○) and S.robustus (●).

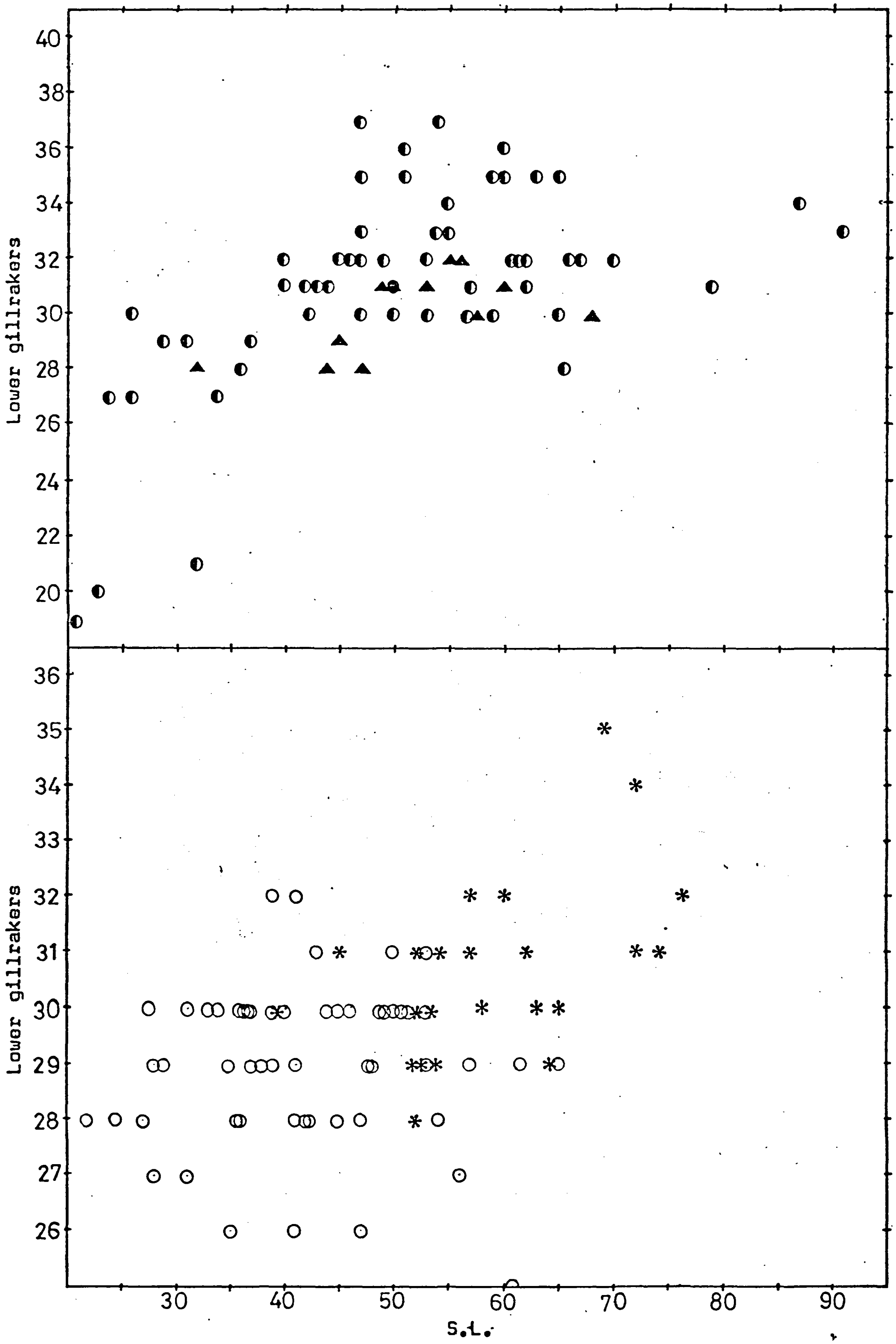


Figure 42 . Relation of number of lower gillrakers to standard length (mm) for Spratelloides gracilis (◐), S.lewisi (▲), S.delicatulus (○) and S.robustus (*).

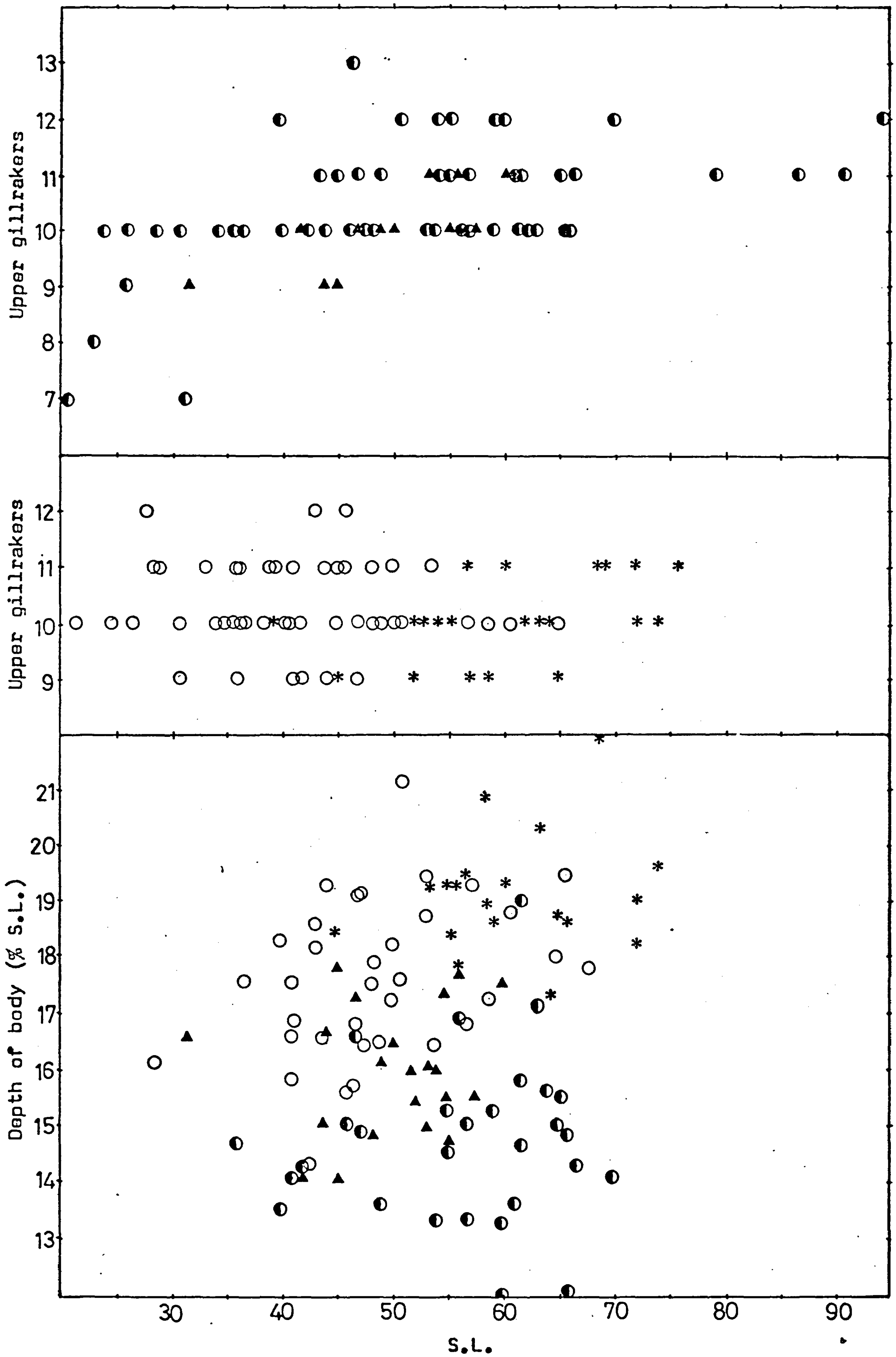


Figure 43 . Relation of number of upper gillrakers and depth of body as percent of standard length to standard length (mm) for <u>Spratelloides gracilis</u> (◐), <u>S. lewisi</u> (▲), <u>S. delicatulus</u> (○) and <u>S. robustus</u> (✻).

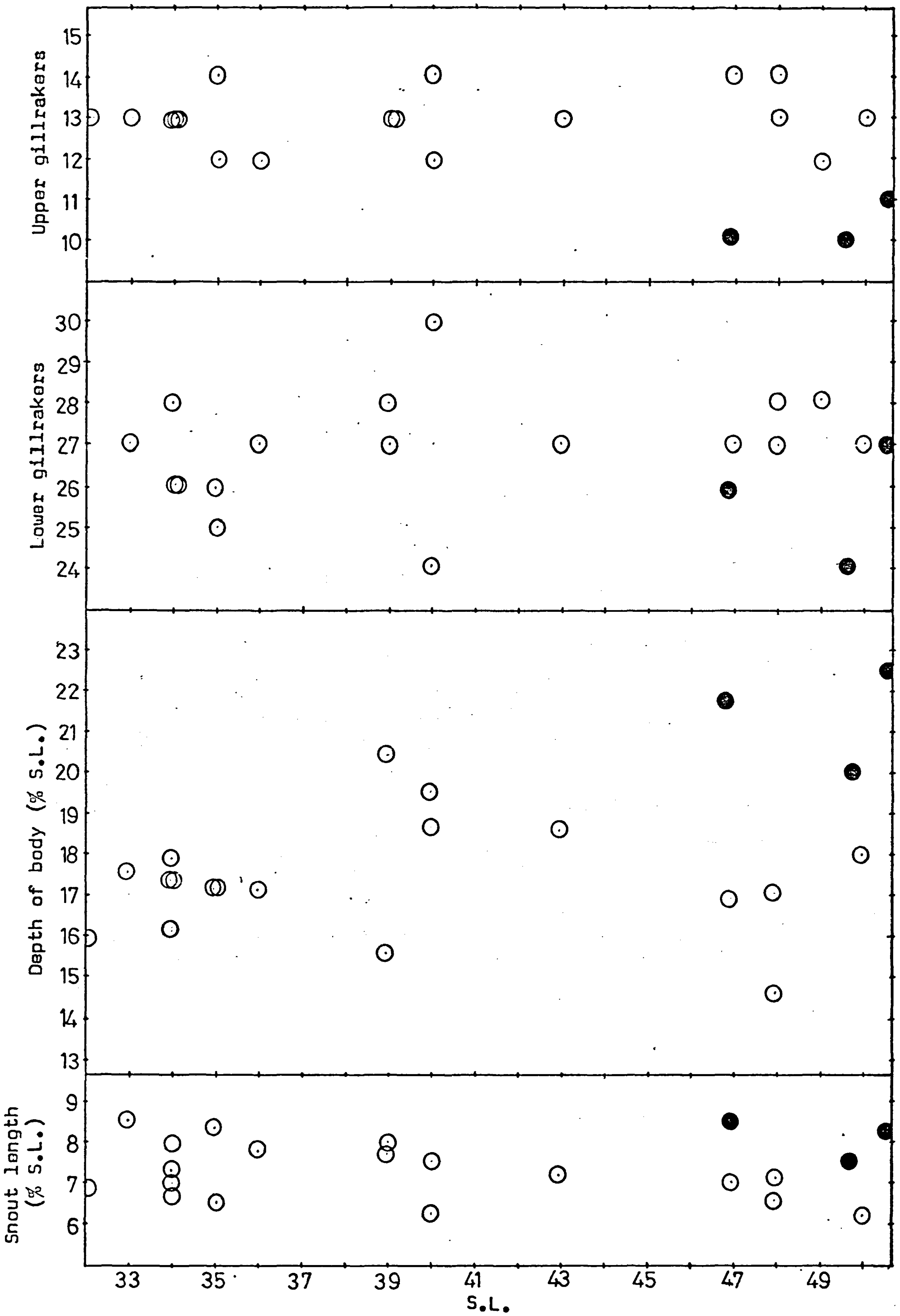


Figure 44 . Relation of number of gillrakers, depth of body and snout length as percent of standard length to standard length (mm) for *Ehirava fluviatilis* (○) and *Dayella malabarica* (●). Counts and proportions of lectotype (ZSI. 2246) and paralectotype (RMNH. 2726) of *Spratelloides malabaricus* have been taken from Talwar & Whitehead (1971).

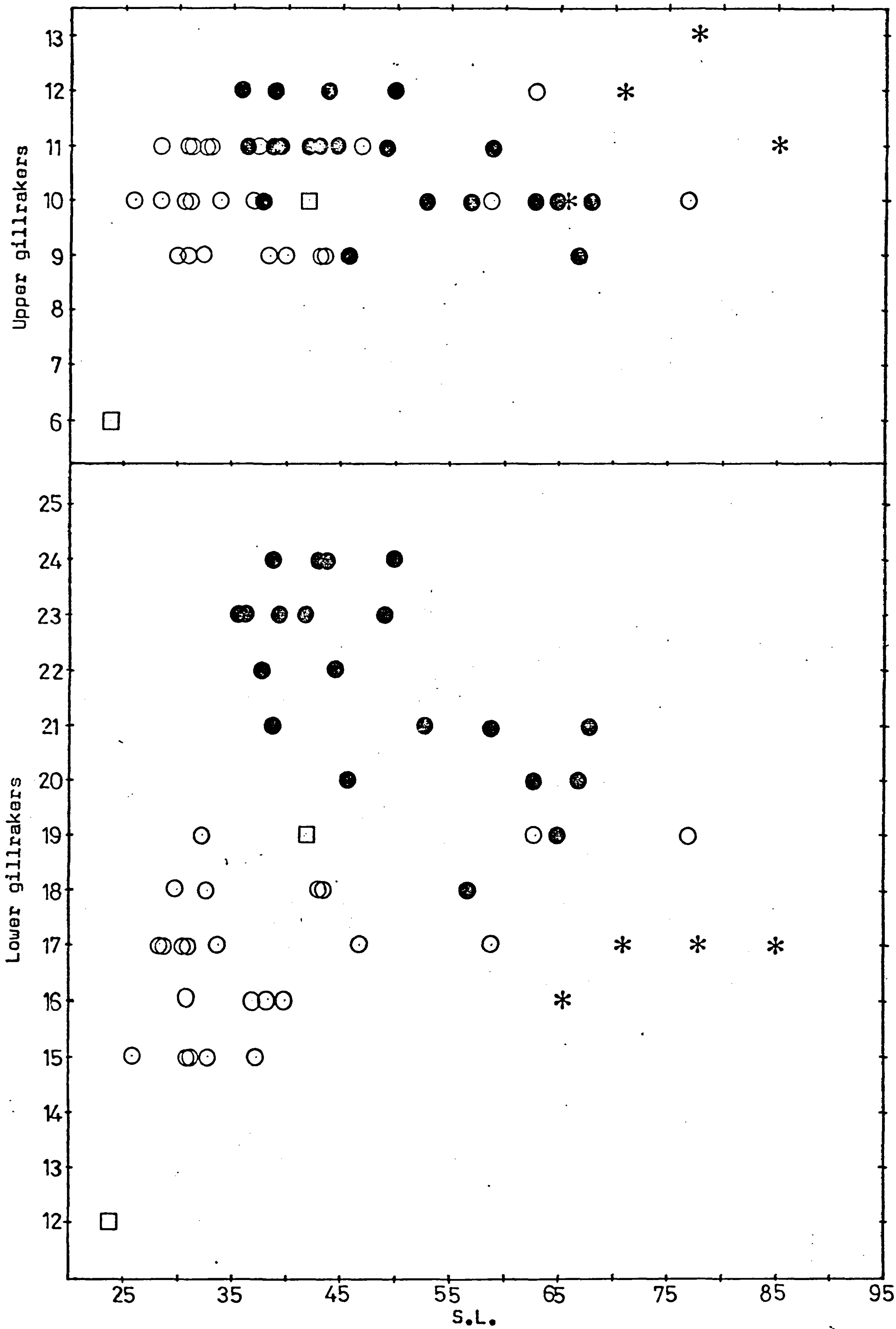


Figure 45 . Relation of number of gillrakers to standard length (mm) for Clupeoides borneensis (●), C. hypselosoma (□), C. papuensis (○) and C. venulosus (*).

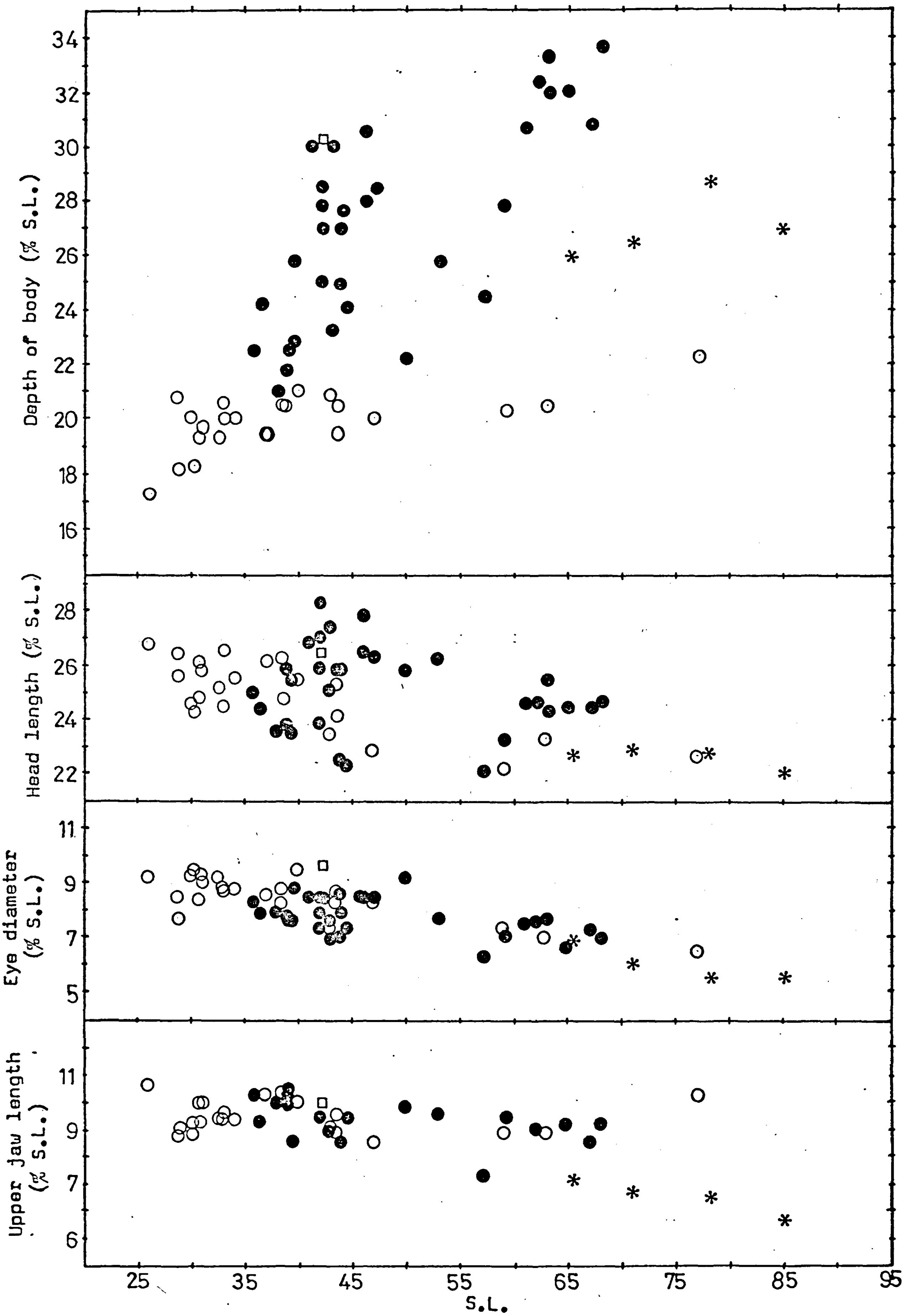


Figure 46 . Relation of depth of body, head length, eye diameter and upper jaw length as percent of standard length to standard length (mm) for Clupeoides borneensis (●), C. hypselosoma (□), C. papuensis (○) and C. venulosus (*).

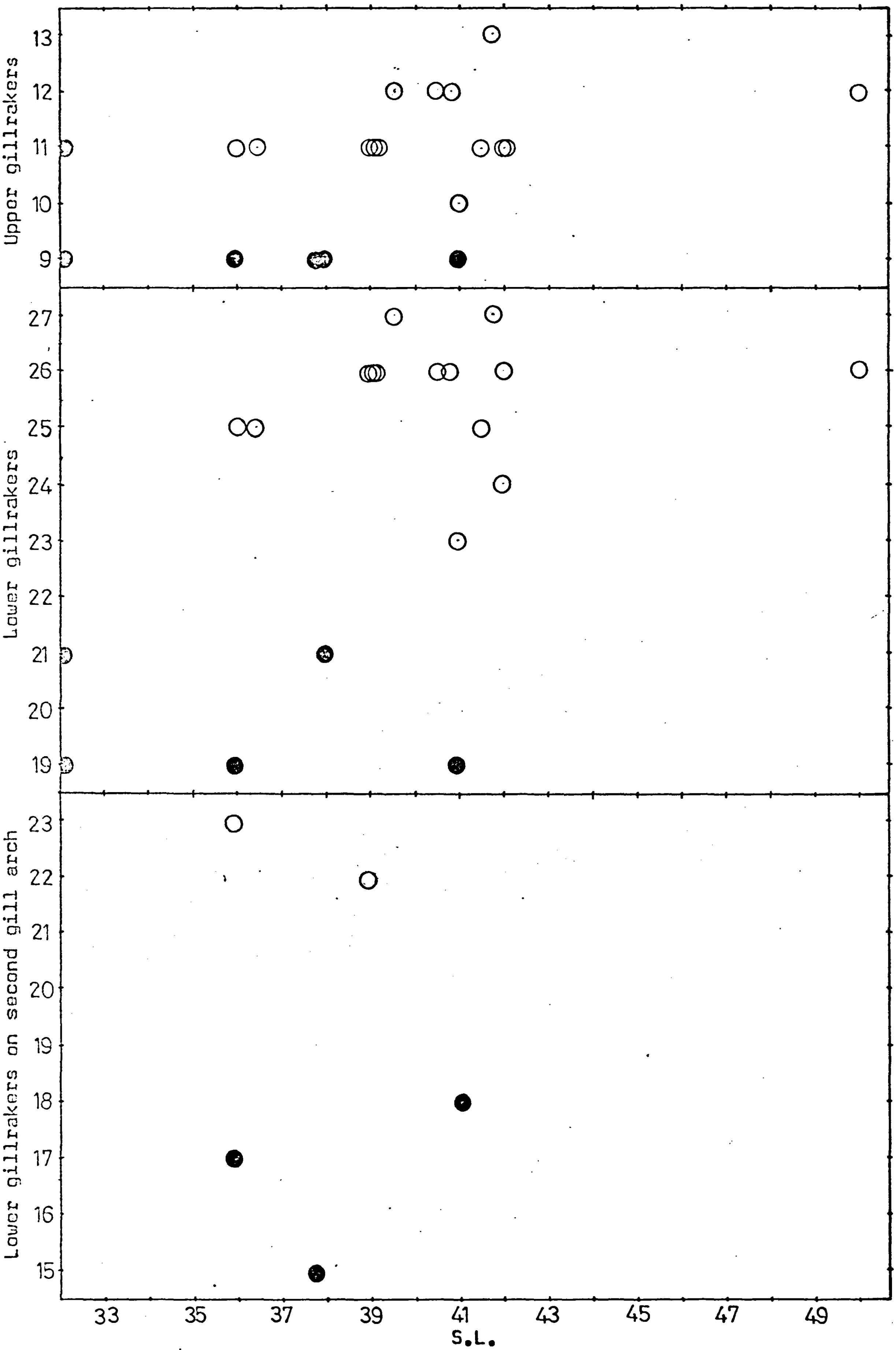


Figure 47 . Relation of number of gillrakers to standard length (mm) for Corica laciniata (○) and C. soborna (●).

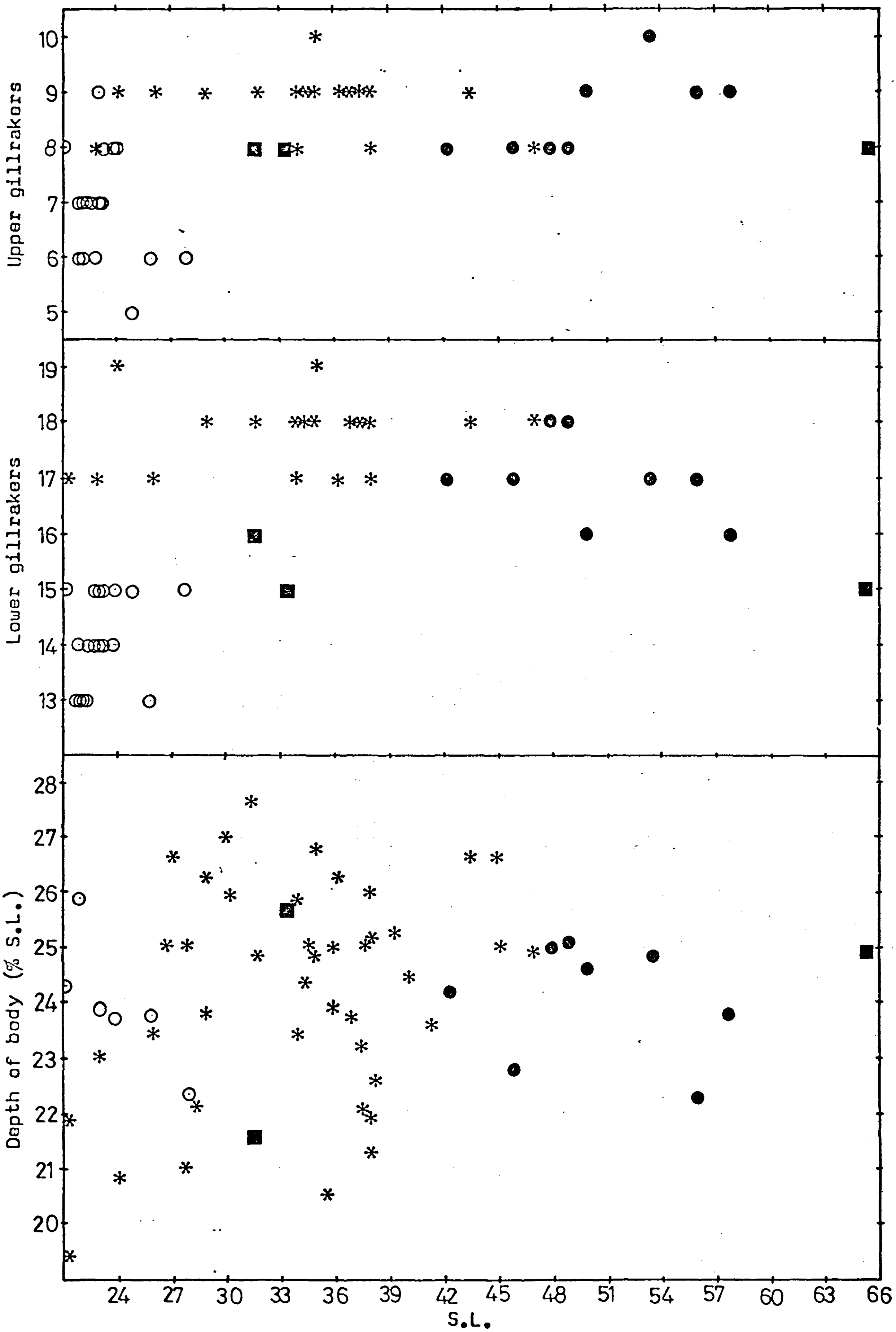


Figure 48 . Relation of number of gillrakers and depth of body as percent of standard length to standard length (mm) for Clupeichthys bleekeri (●), C. aesarnensis (*), C. goniognathus (■) and C. perakensis (○).

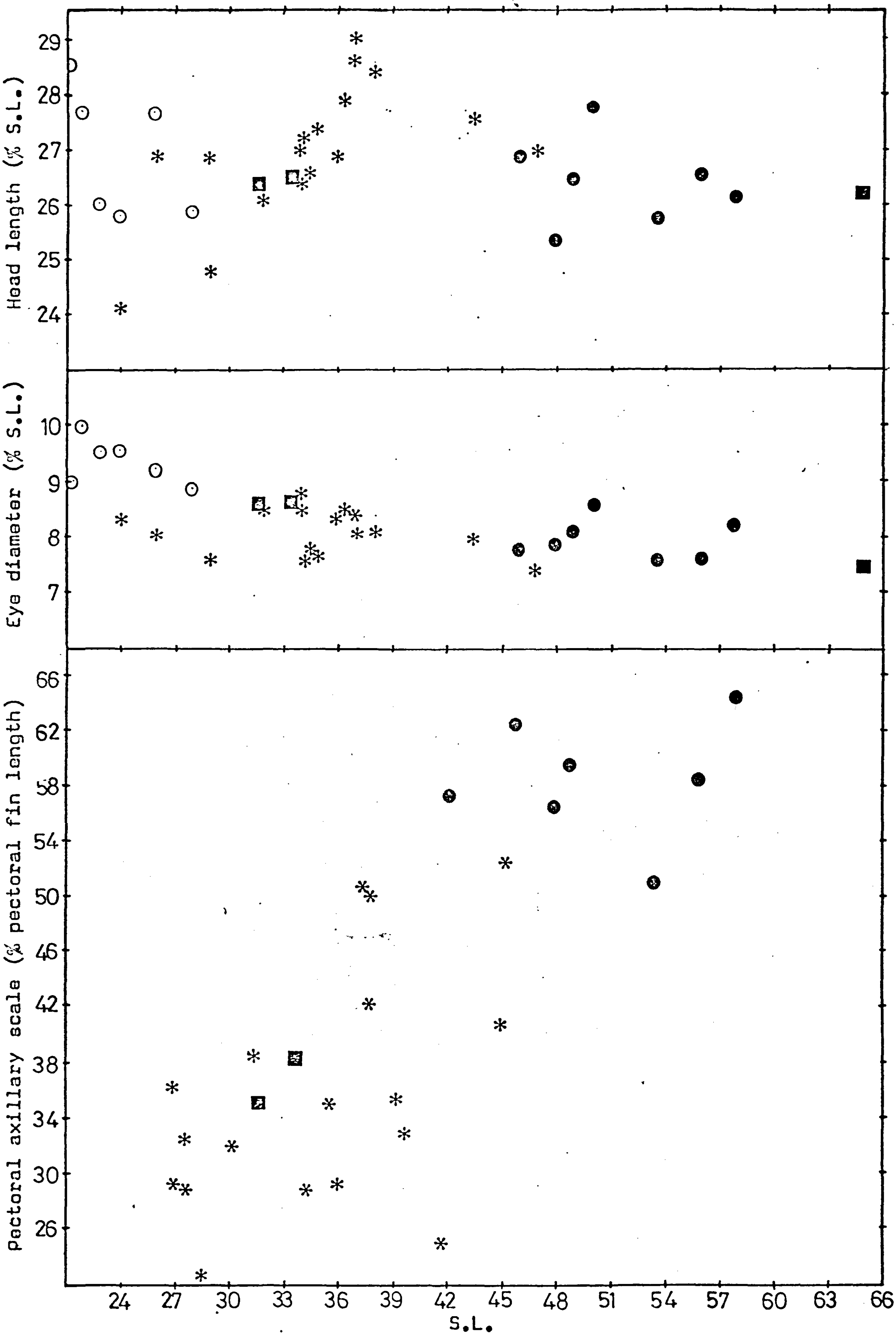


Figure 49 . Relation of head length and eye diameter as percent of standard length and length of pectoral axillary scale as percent of pectoral fin length all to standard length (mm) for <u>Clupeichthys bleekeri</u> (●), <u>C.</u> <u>aesarnensis</u> (*), <u>C.</u> <u>goniognathus</u> (■) and <u>C.</u> <u>perakensis</u> (○). Pectoral axillary scales of the last species are too small, thus their measurements have been omitted.

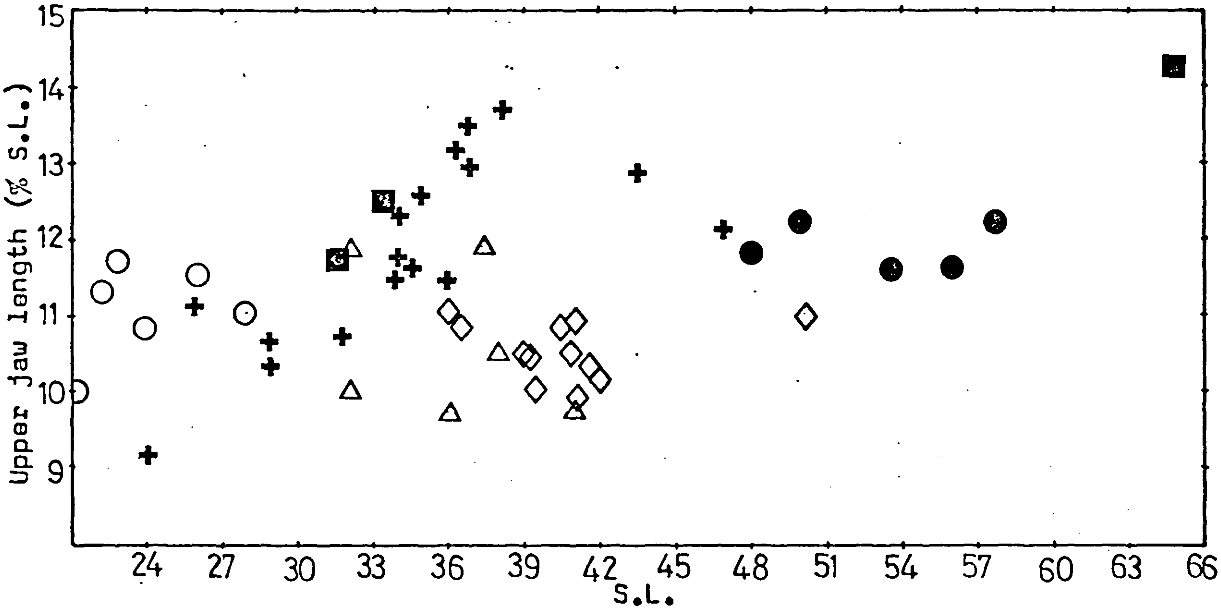


Figure 50 . Relation of upper jaw length as percent of standard length to standard length (mm) for Corica laciniata (◇), C. soborna (△), Clupeichthys bleekeri (●), C. aesarnensis (+), C. goniognathus (■) and C. perakensis (○).

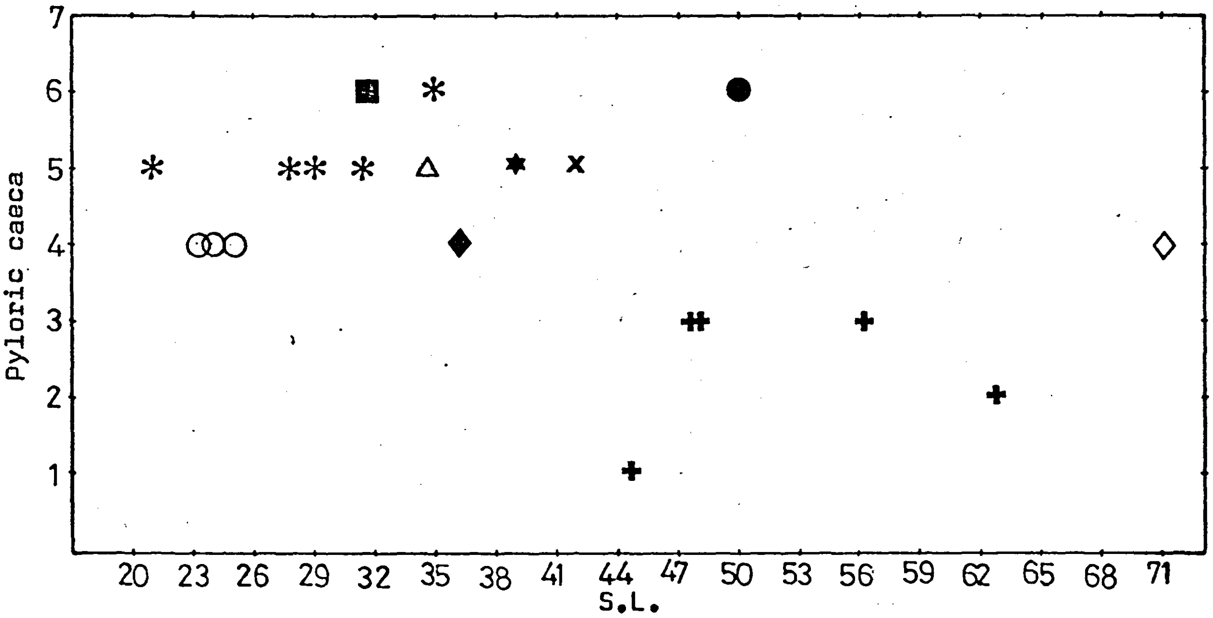


Figure 51 . Relation of number of pyloric caeca to standard length (mm) for Ehirava fluviatilis (✱), Clupeoides borneensis (+), C. papuaensis (X), C. venulosus (◇), Corica laciniata (◆), C. soborna (△), Clupeichthys bleekeri (●), C. aesarnensis (✳), C. goniognathus (■) and C. perakensis (○).

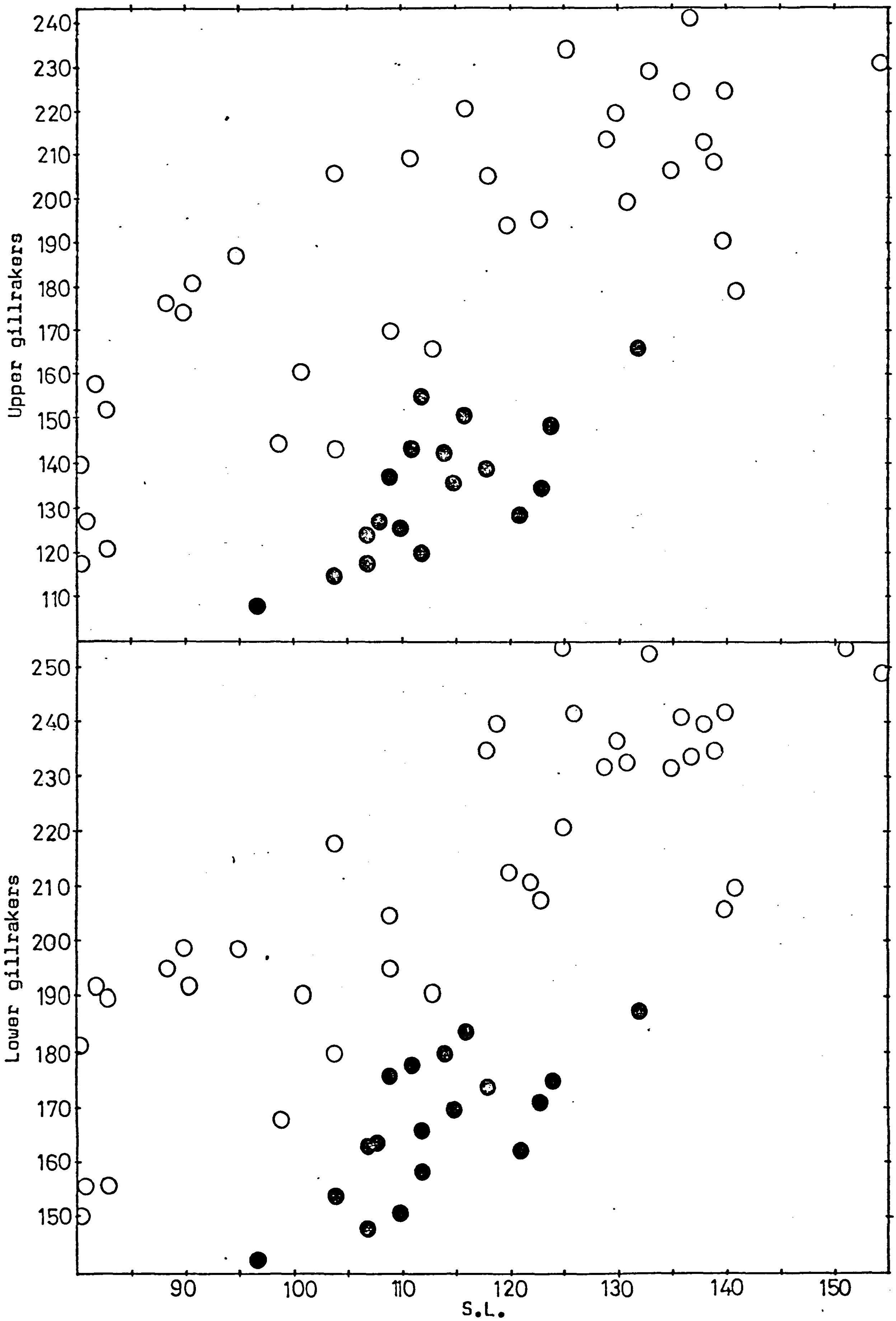


Figure 52 . Relation of number of gillrakers to standard length (mm) for Sardinella (Sardinella) longiceps (○) and S. (S.) neglecta (●).

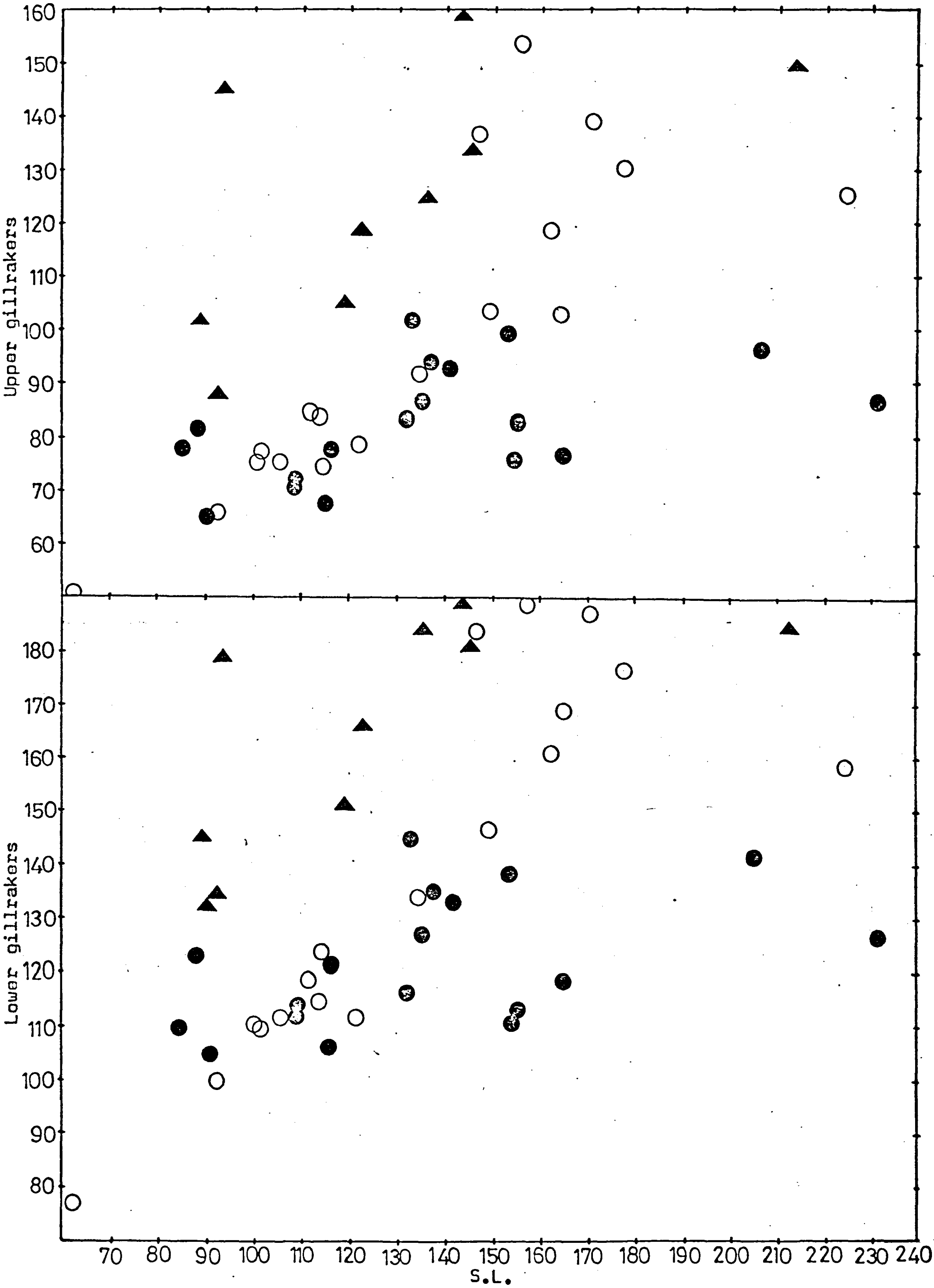


Figure 53 . Relation of number of gillrakers to standard length (mm) for Sardinella (Sardinella) lemuru (○), S. (S.) aurita (● = Form A.) and S. (S.) aurita (▲ = Form B.).

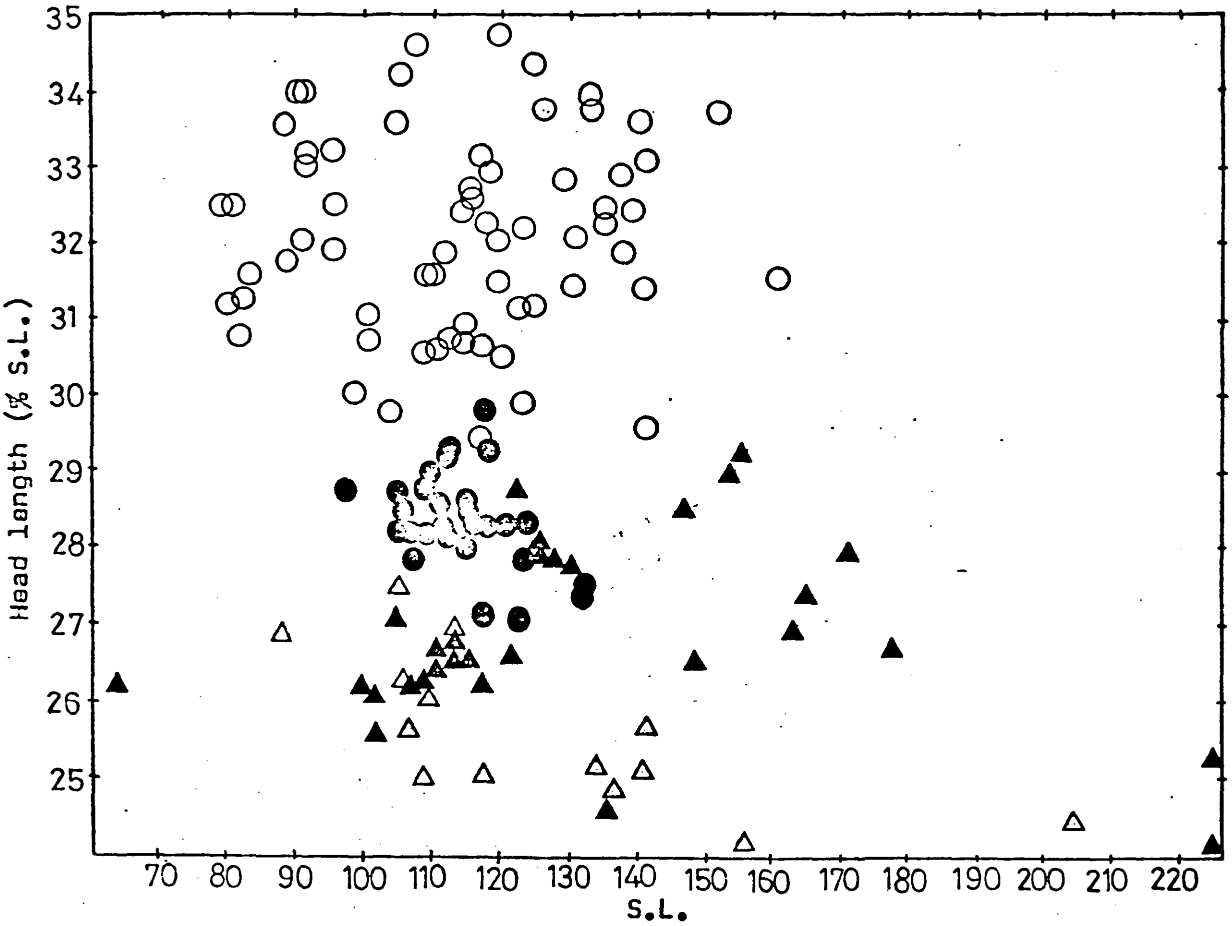


Figure 54 . Relation of head length as percent of standard length to standard length (mm) for Sardinella (Sardinella) longiceps (○), S. (S.) neglecta (●), S. (S.) lemuru (▲) and S. (S.) aurita (△).

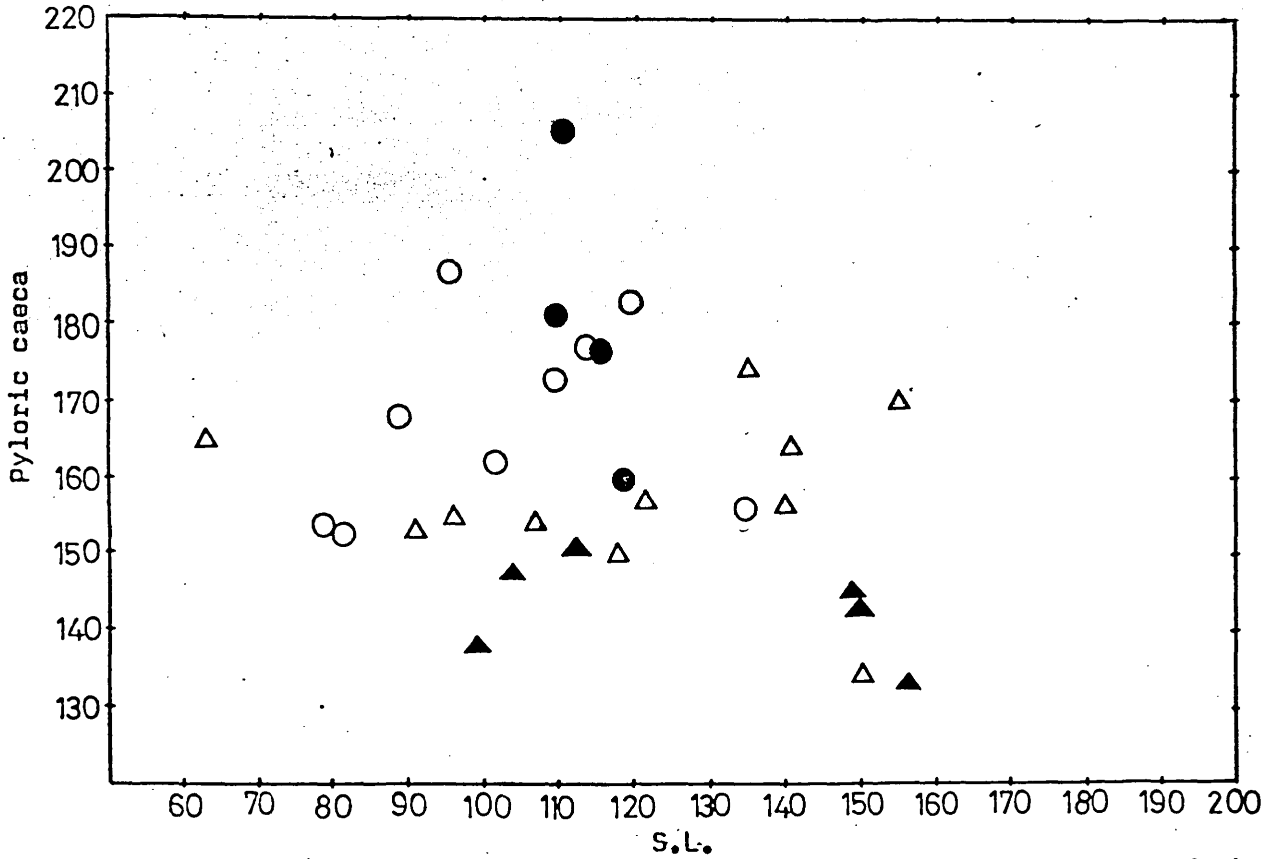


Figure 55 . Relation of number of pyloric caeca to standard length (mm) for Sardinella (Sardinella) longiceps (○), S. (S.) neglecta (●), S. (S.) lemuru (▲) and S. (S.) aurita (△).

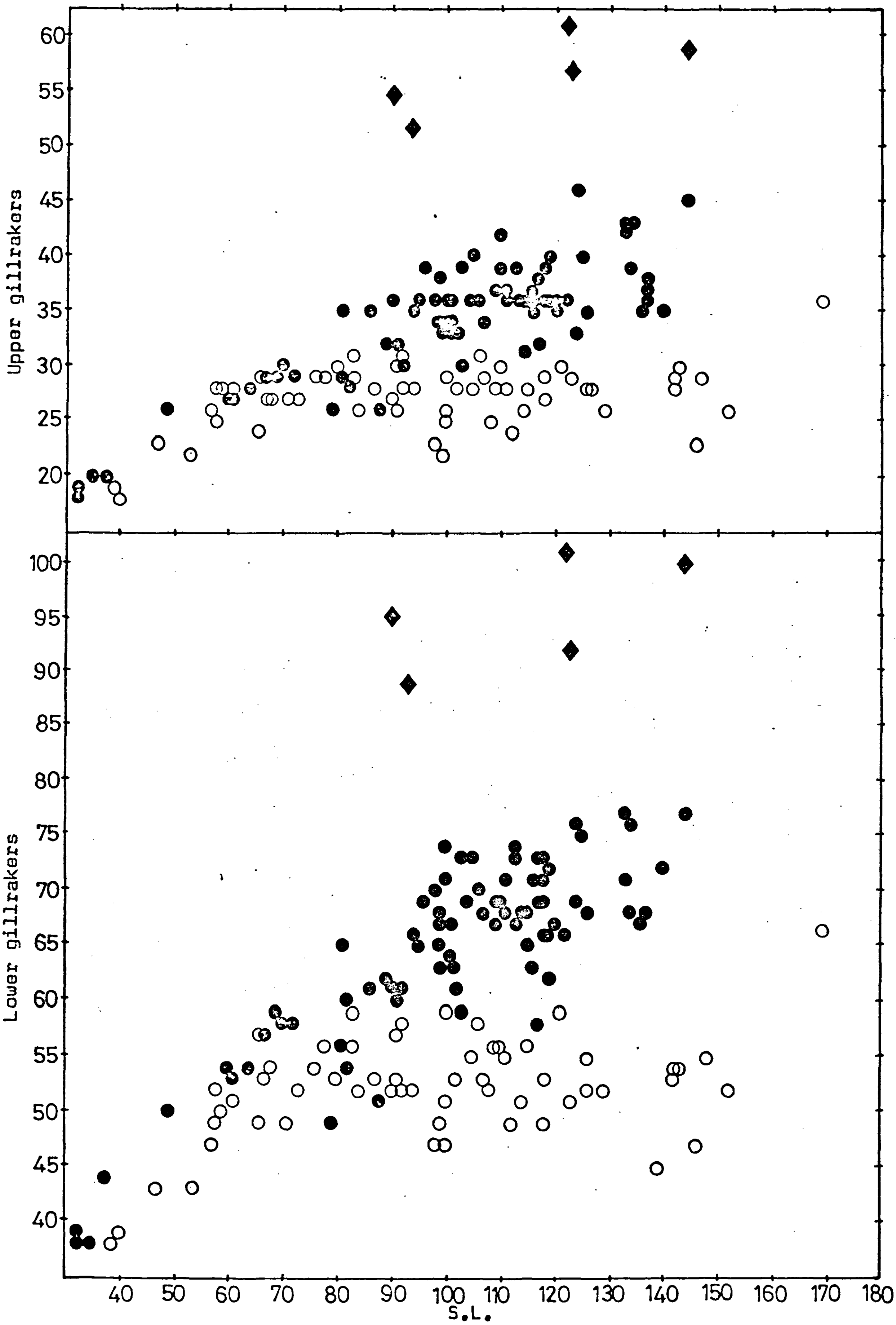


Figure 56. Relation of number of gillrakers to standard length (mm) for Sardinella (Clupeonia) jussieui (♦), S. (C.) sindensis (●) and S. (C.) gibbosa (○). Gillraker counts of lectotype (ZSI.2630) and paralectotype (ZSI.2614) of Clupea sindensis have been taken from Talwar and Whitehead (1971).

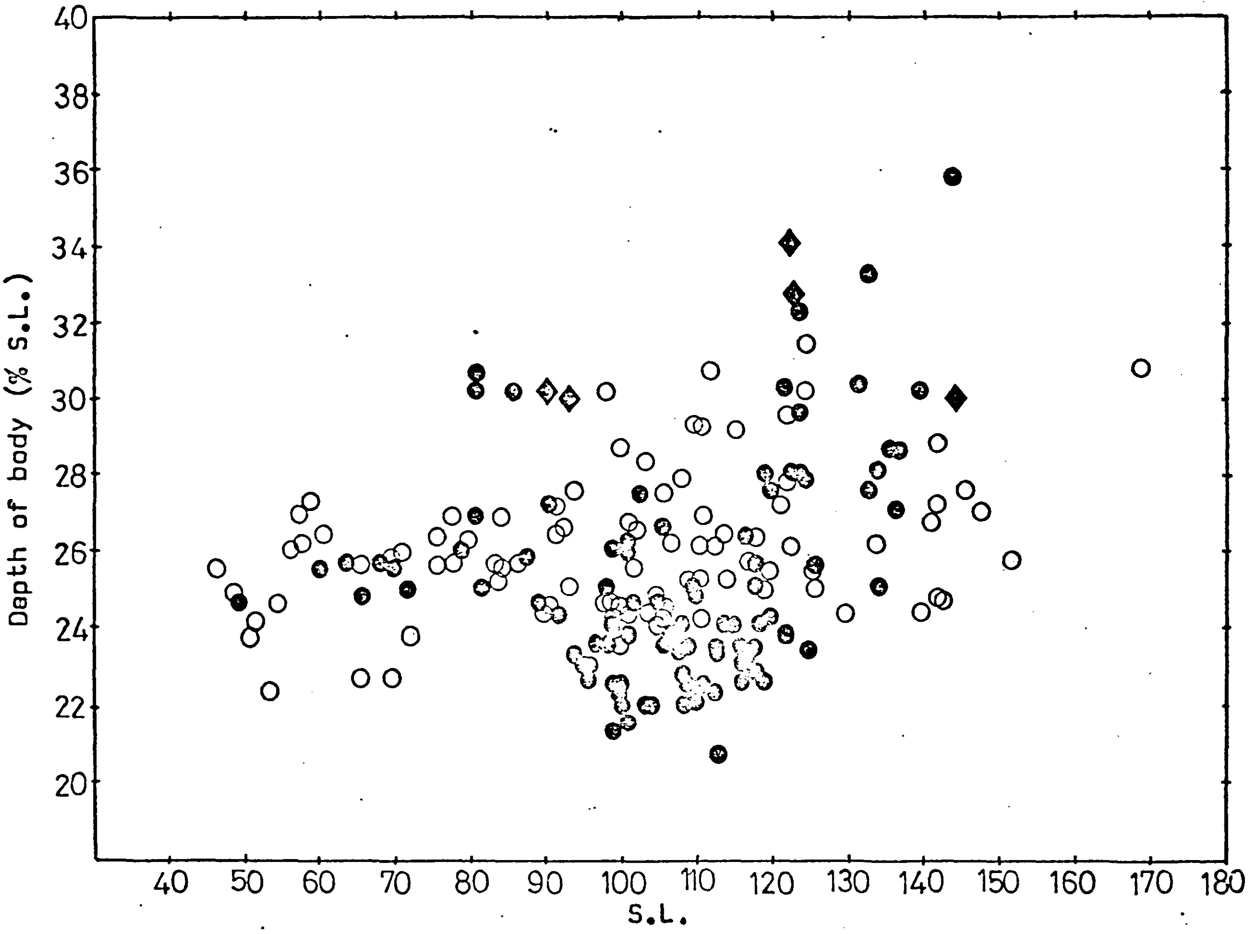


Figure 57 . Relation of depth of body as percent of standard length to standard length (mm) for Sardinella (Clupeonia) jussieui (◆), S. (C.) sindensis (●) and S. (C.) gibbosa (○).

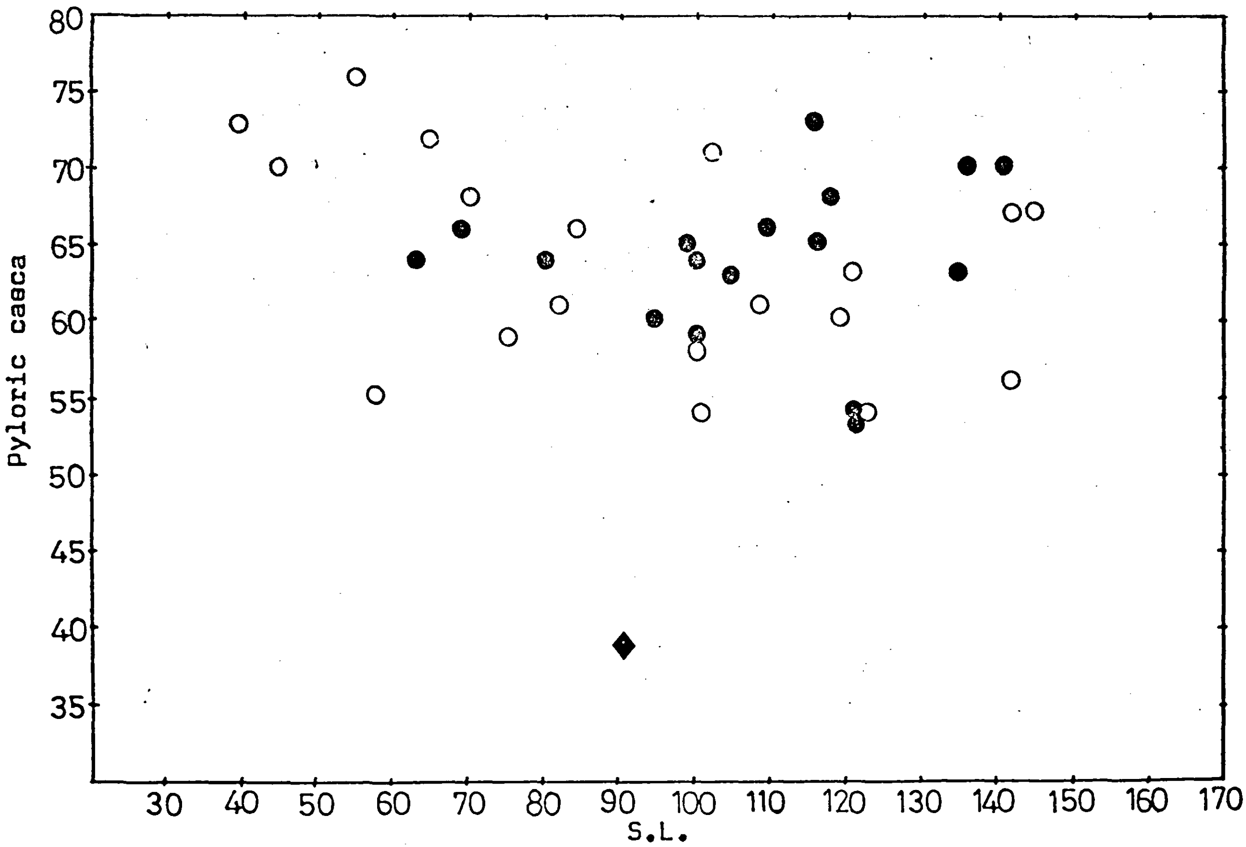


Figure 58 . Relation of number of pyloric caeca to standard length (mm) for Sardinella (Clupeonia) jussieui (◆), S. (C.) sindensis (●) and S. (C.) gibbosa (○).

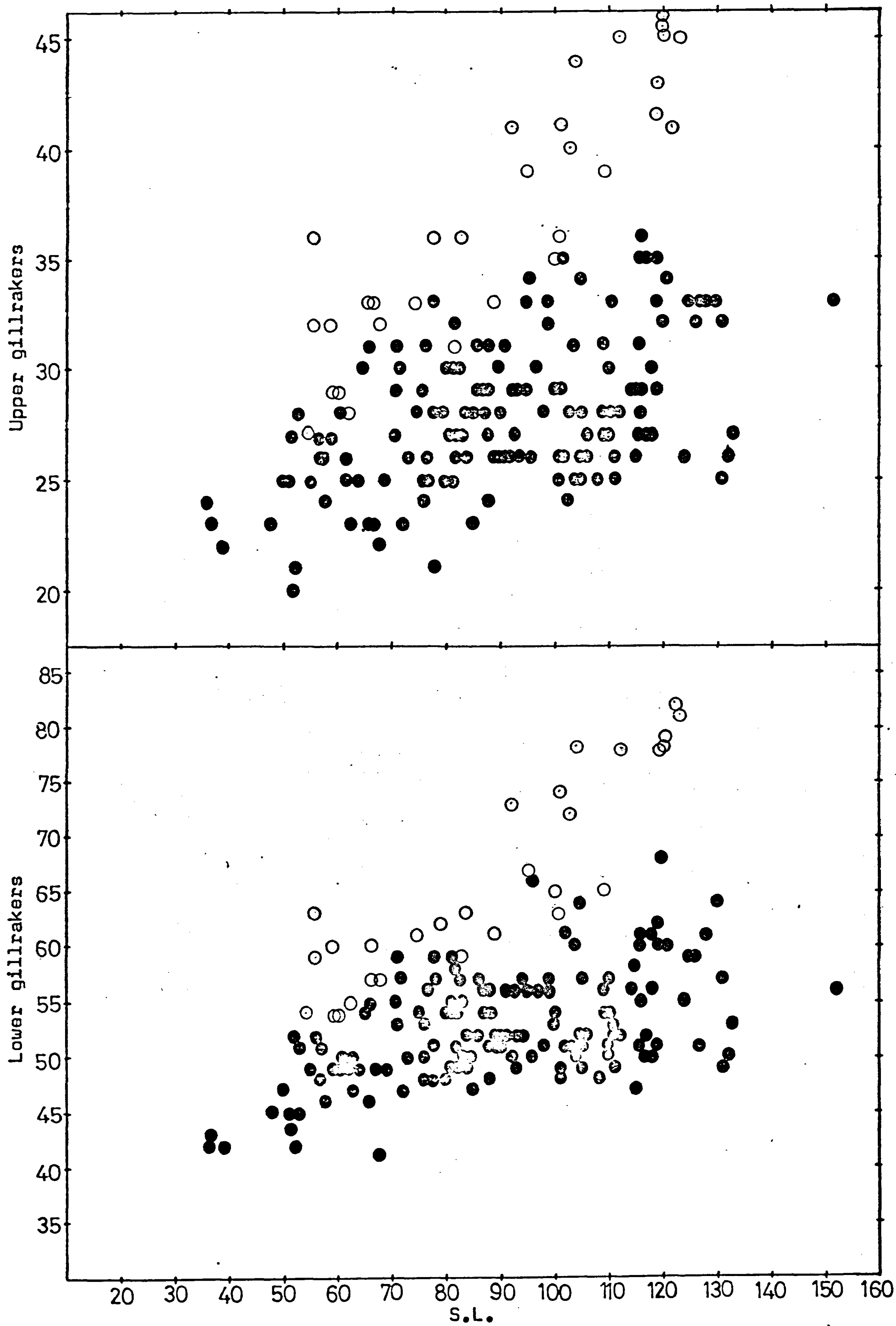


Figure 59 . Relation of number of gillrakers to standard length (mm) for *Sardinella* (*Clupeonia*) *fimbriata* (○) and *S.* (*C.*) *albella* (●).

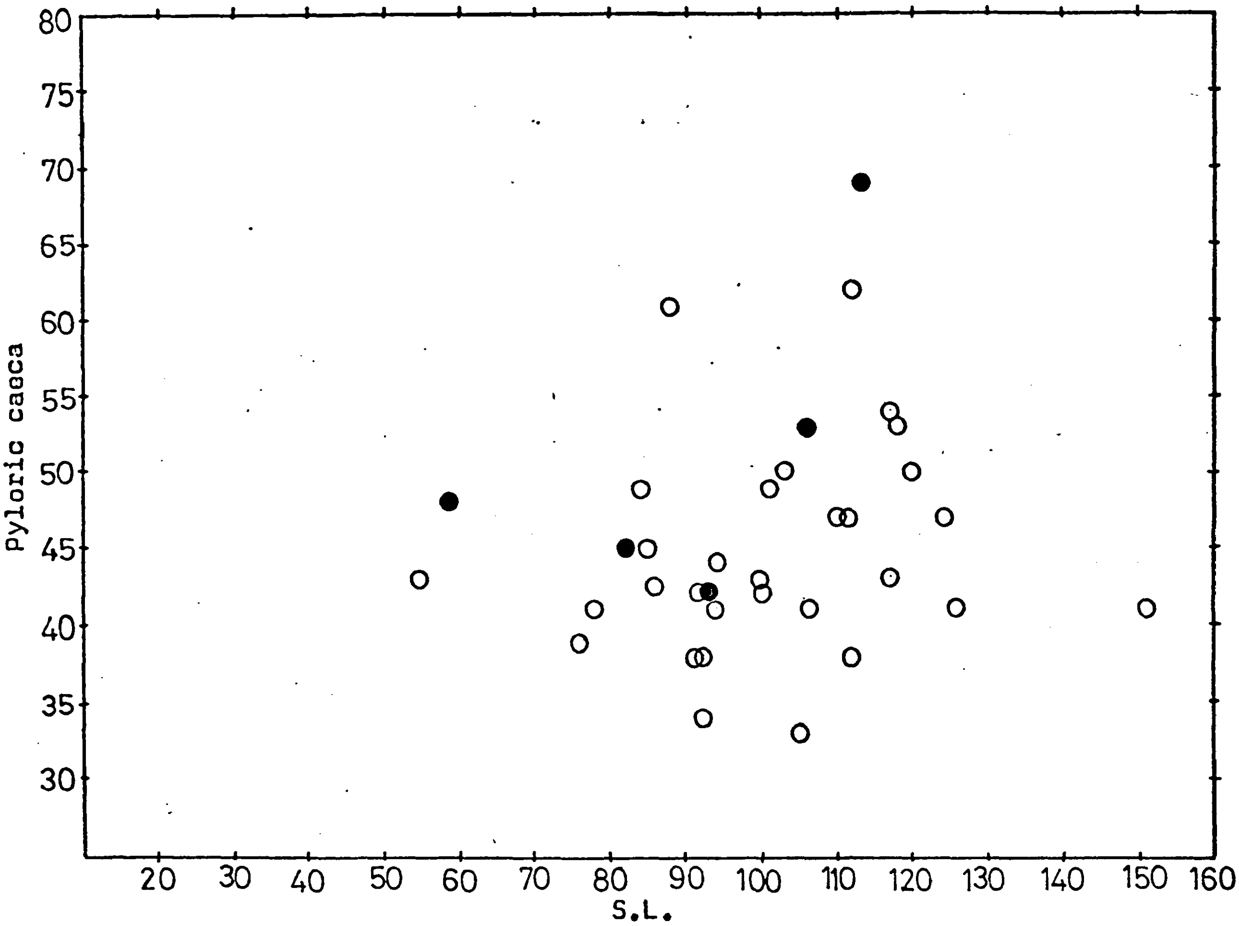


Figure 60 . Relation of number of pyloric caeca to standard length (mm) for Sardinella (Clupeonia) fimbriata (●) and S. (C.) albella (○).

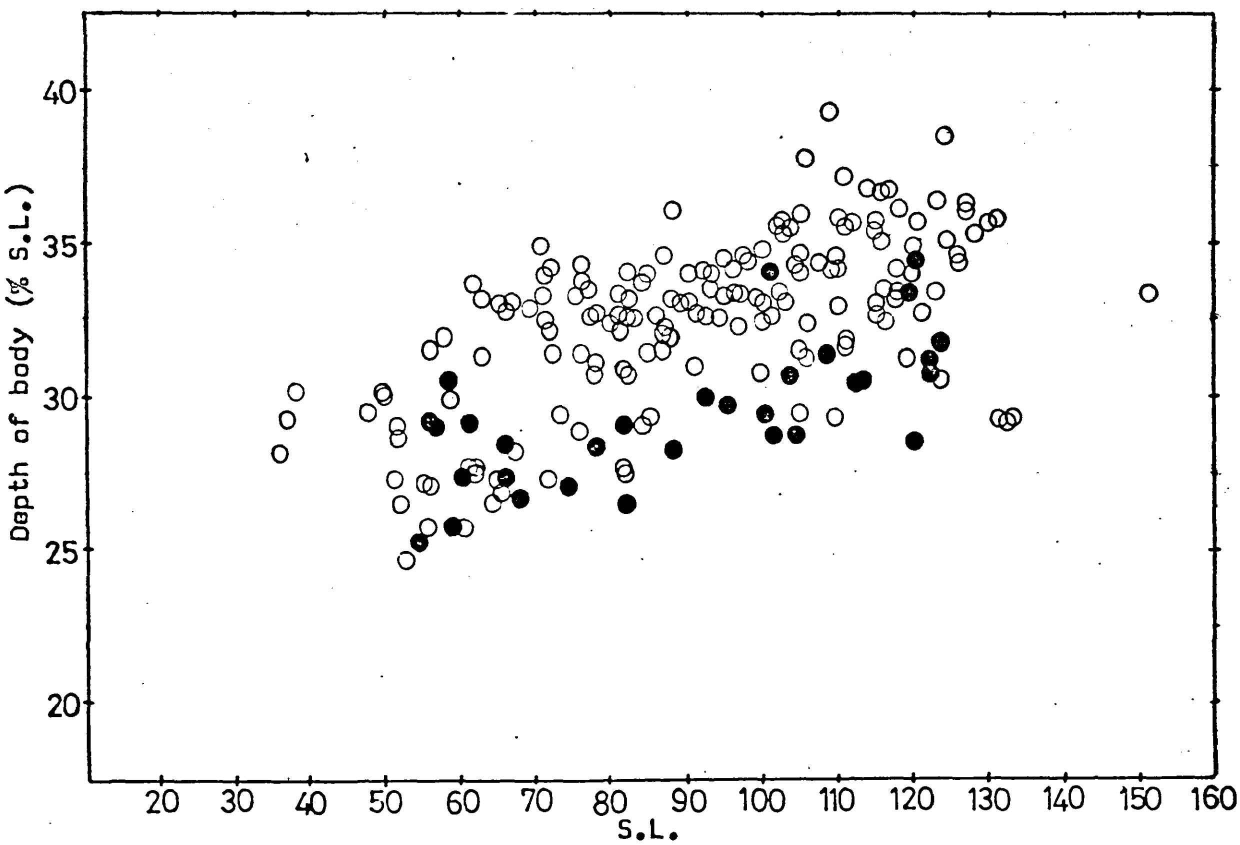


Figure 61 . Relation of depth of body as percent of standard length to standard length (mm) for Sardinella (Clupeonia) fimbriata (●) and S. (C.) albella (○).

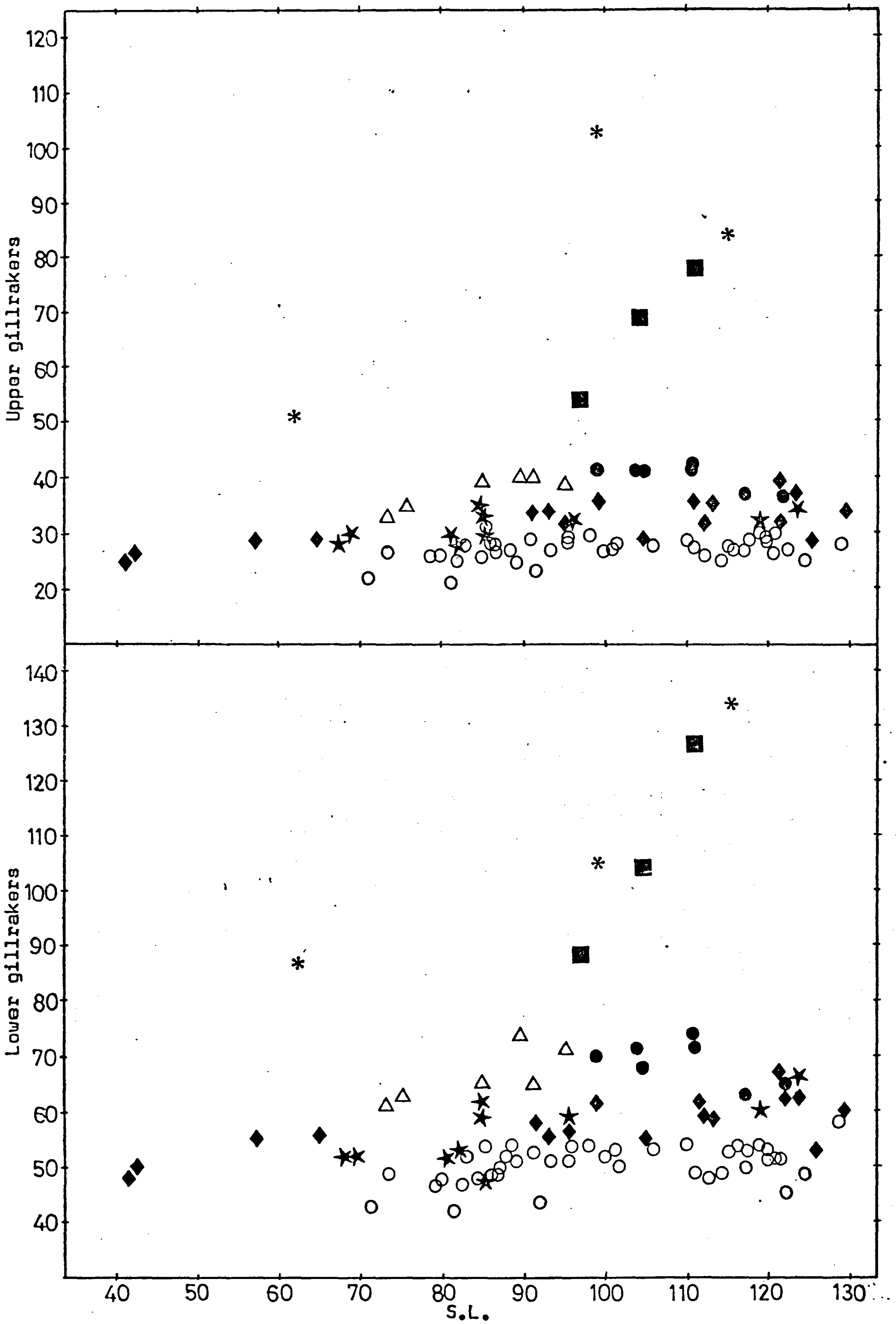


Figure 62 . Relation of number of gillrakers to standard length (mm) for <u>Sardinella</u> (<u>Clupeonia</u>) <u>fijiense</u> (*), <u>S.</u> (<u>C.</u>) <u>tawilis</u> (△), <u>S.</u> (<u>C.</u>)<u>richardsoni</u> (●), <u>S.</u> (<u>C.</u>) <u>zunasi</u> (○), <u>S.</u> (<u>C.</u>) <u>dayi</u> (■), <u>S.</u> (<u>C.</u>) <u>hualiensis</u> (★) and <u>S.</u> (<u>C.</u>) <u>brachysoma</u> (◆).

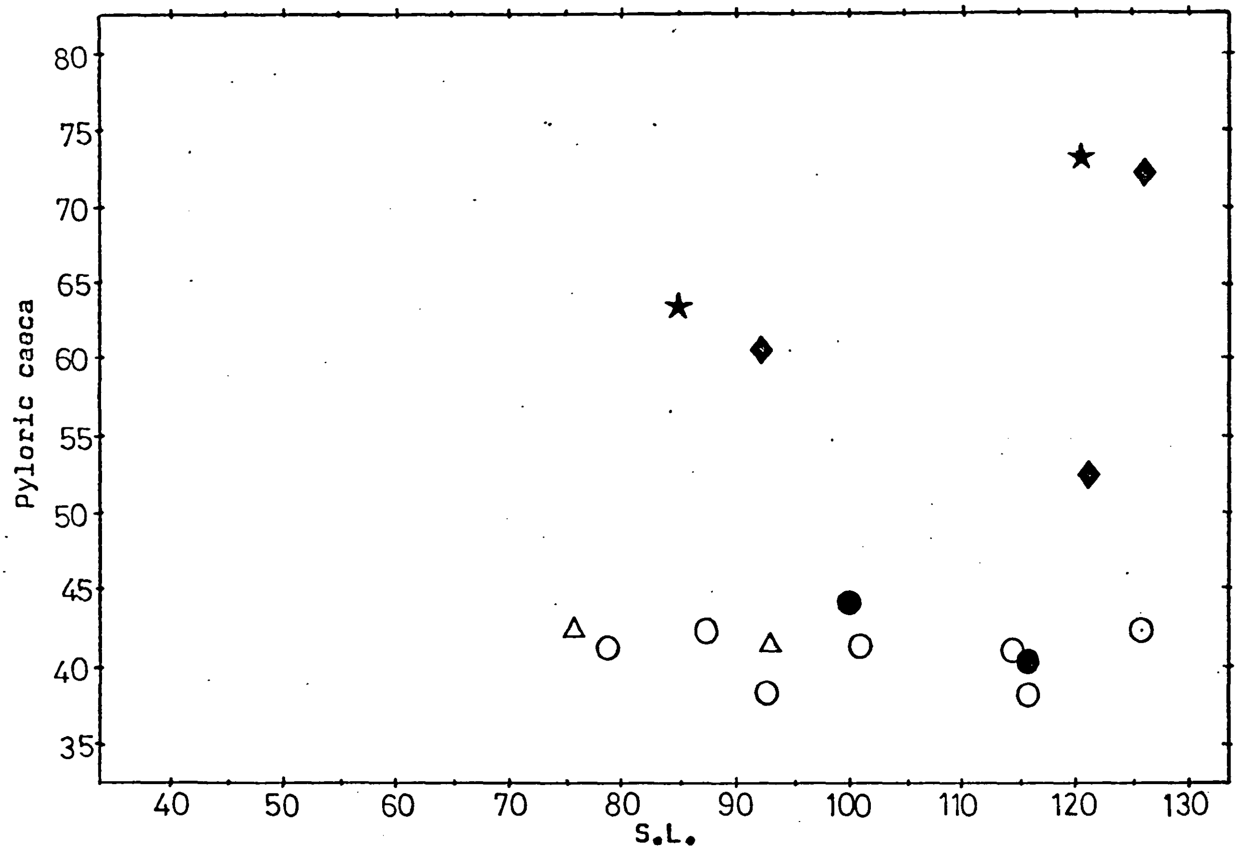


Figure 63 .Relation of number of pyloric caeca to standard length (mm) for Sardinella (Clupeonia) tawilis (△), S. (C.) richardsoni (●), S. (C.) zunasi (○), S. (C.) hualiensis (★) and S. (C.) brachysoma (◆).

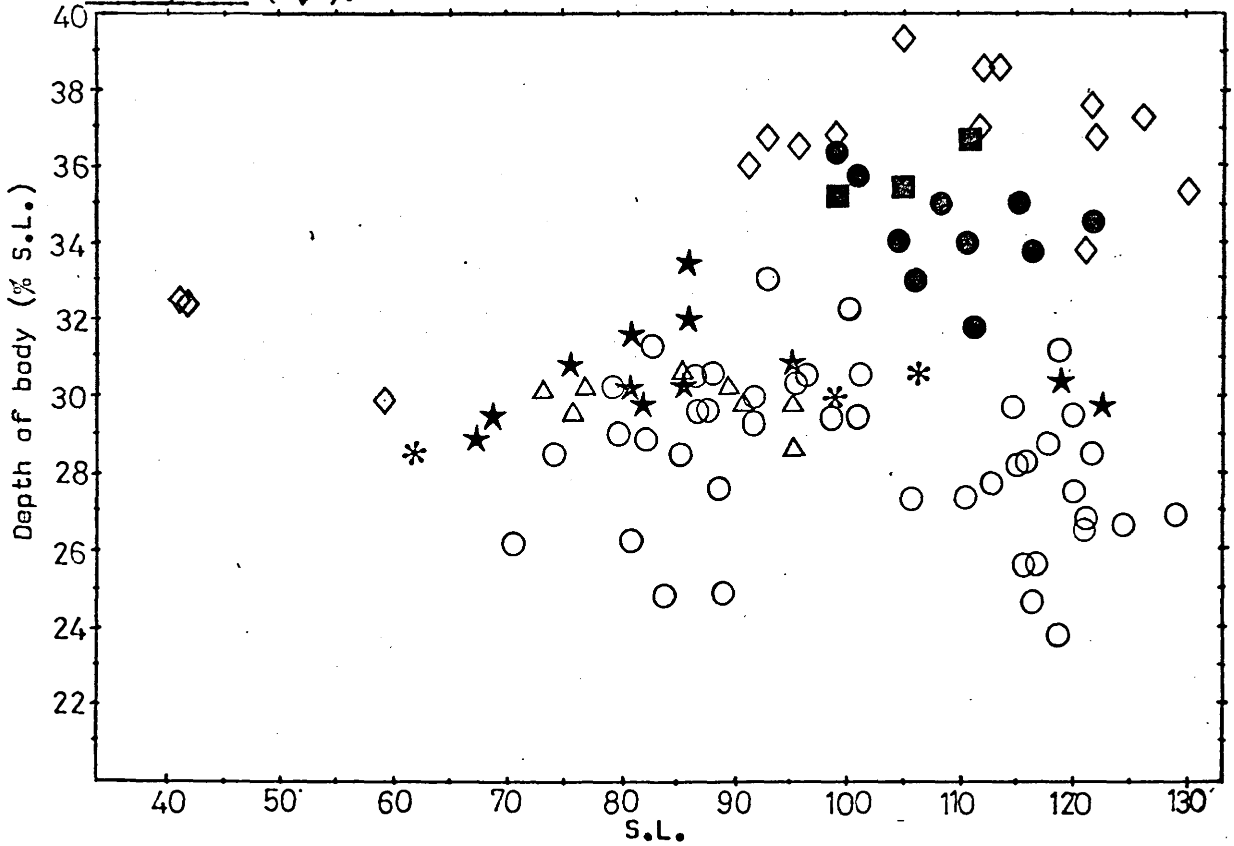


Figure 64 . Relation of depth of body as percent of standard length to standard length (mm) for Sardinella (Clupeonia) fijiense (✱), S. (C.)tawilis (△), S. (C.) richardsoni (●), S. (C.) zunasi (○), S. (C.) dayi (■), S. (C.) hualiensis (★) and S. (C.) brachysoma (◇).

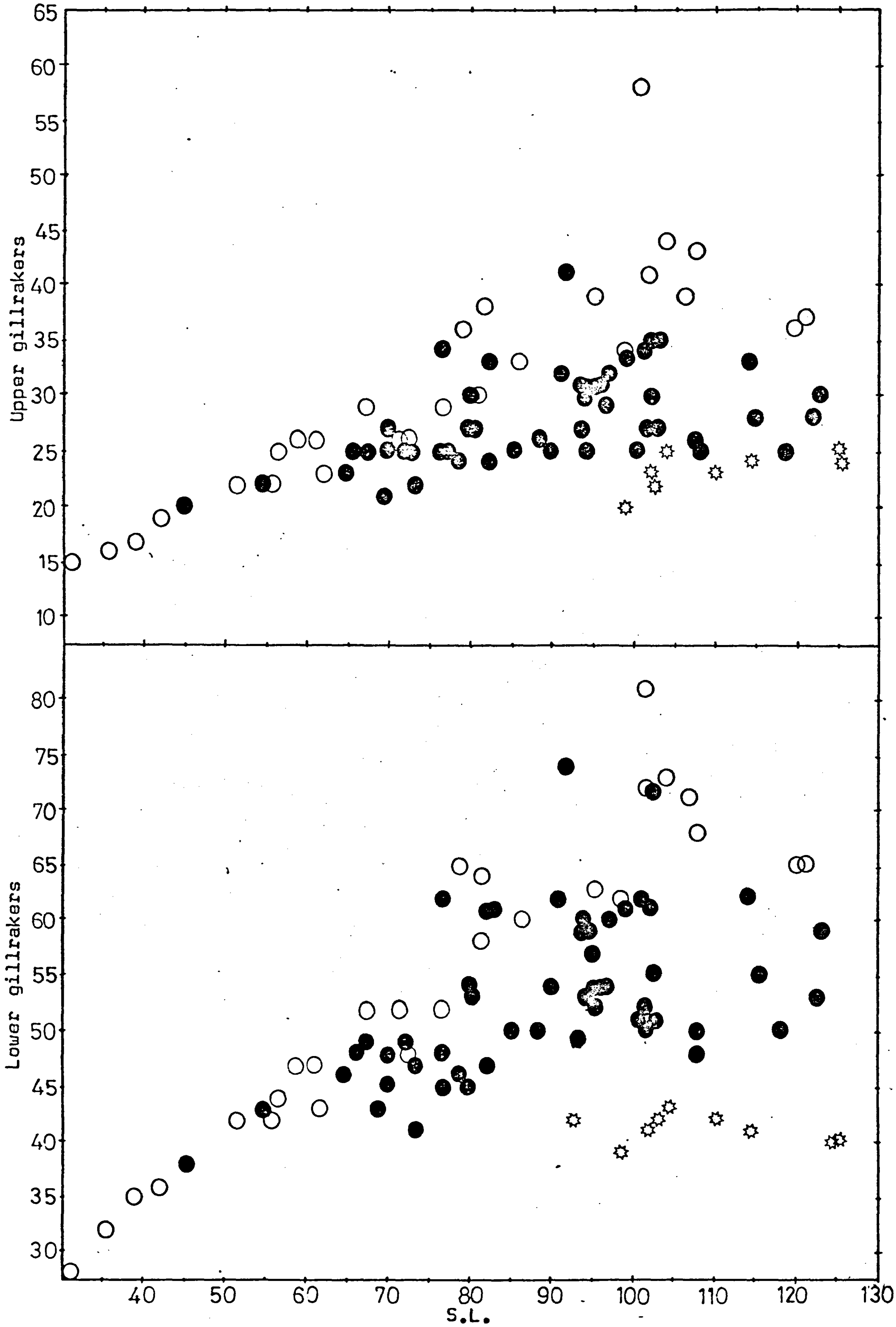


Figure 65 . Relation of number of gillrakers to standard length (mm) for Sardinella (Clupeonia) atricauda (✡), S. (C.) marquesensis (○) and S. (C.) melanura (●).

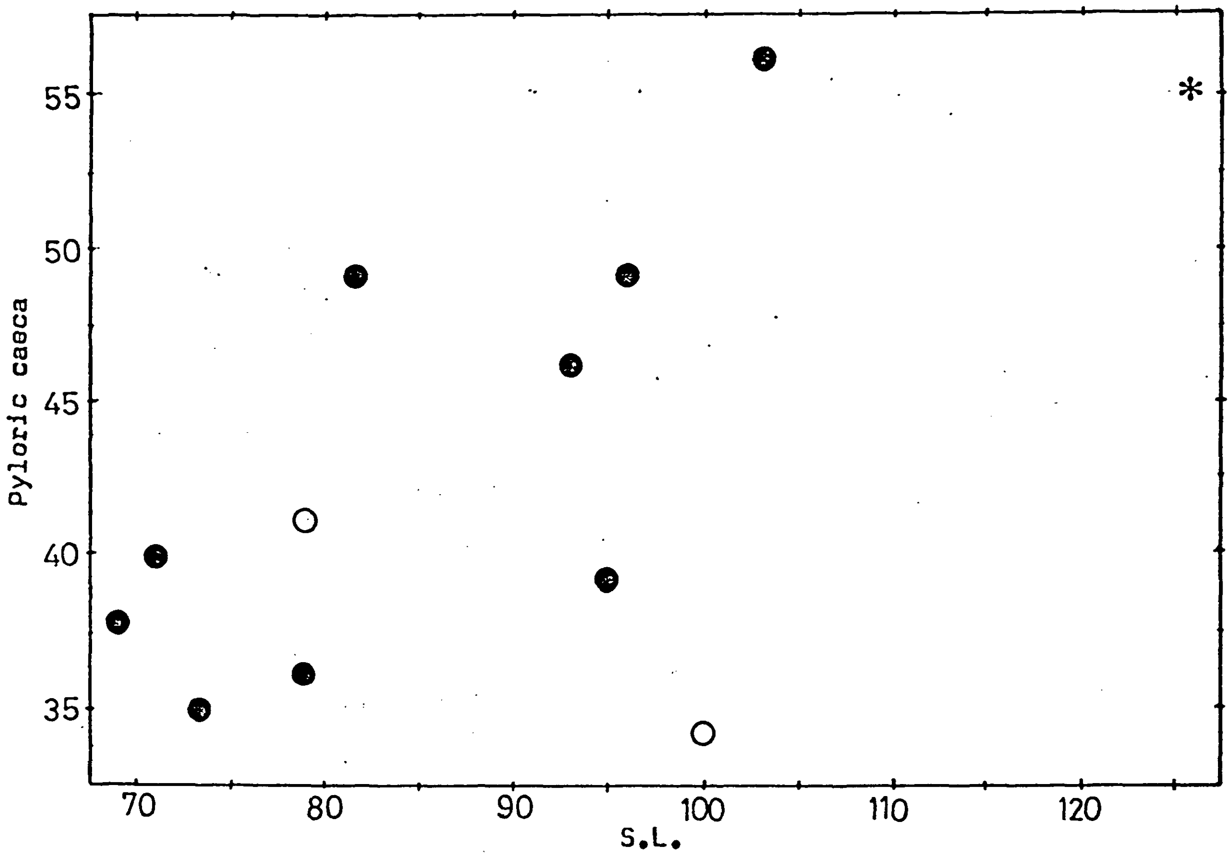


Figure 66 . Relation of number of pyloric caeca to standard length (mm) for *Sardinella* (*Clupeonia*) *atricauda* (*), *S.* (*C.*) *marquesensis* (○) and *S.* (*C.*) *melanura* (●).

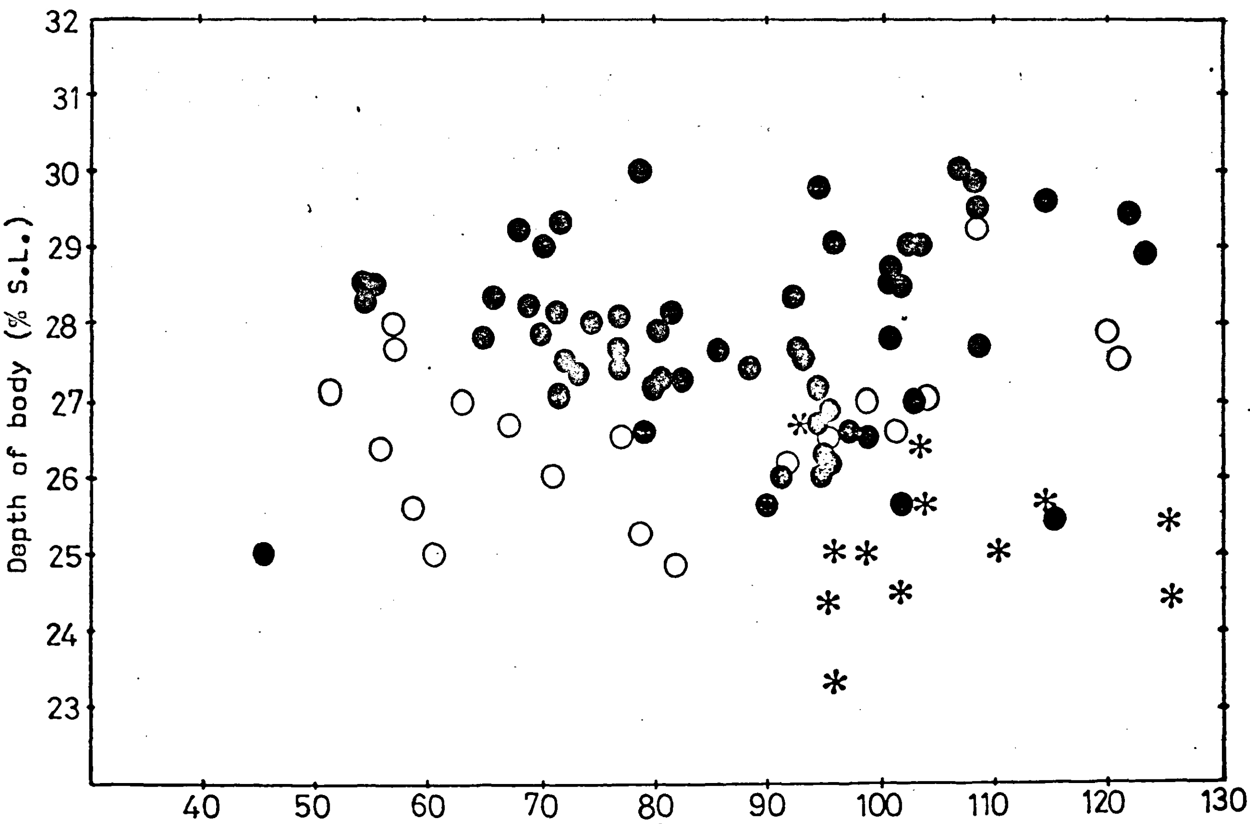


Figure 67 . Relation of depth of body as percent of standard length to standard length (mm) for *Sardinella* (*Clupeonia*) *atricauda* (*), *S.* (*C.*) *marquesensis* (○) and *S.* (*C.*) *melanura* (●).

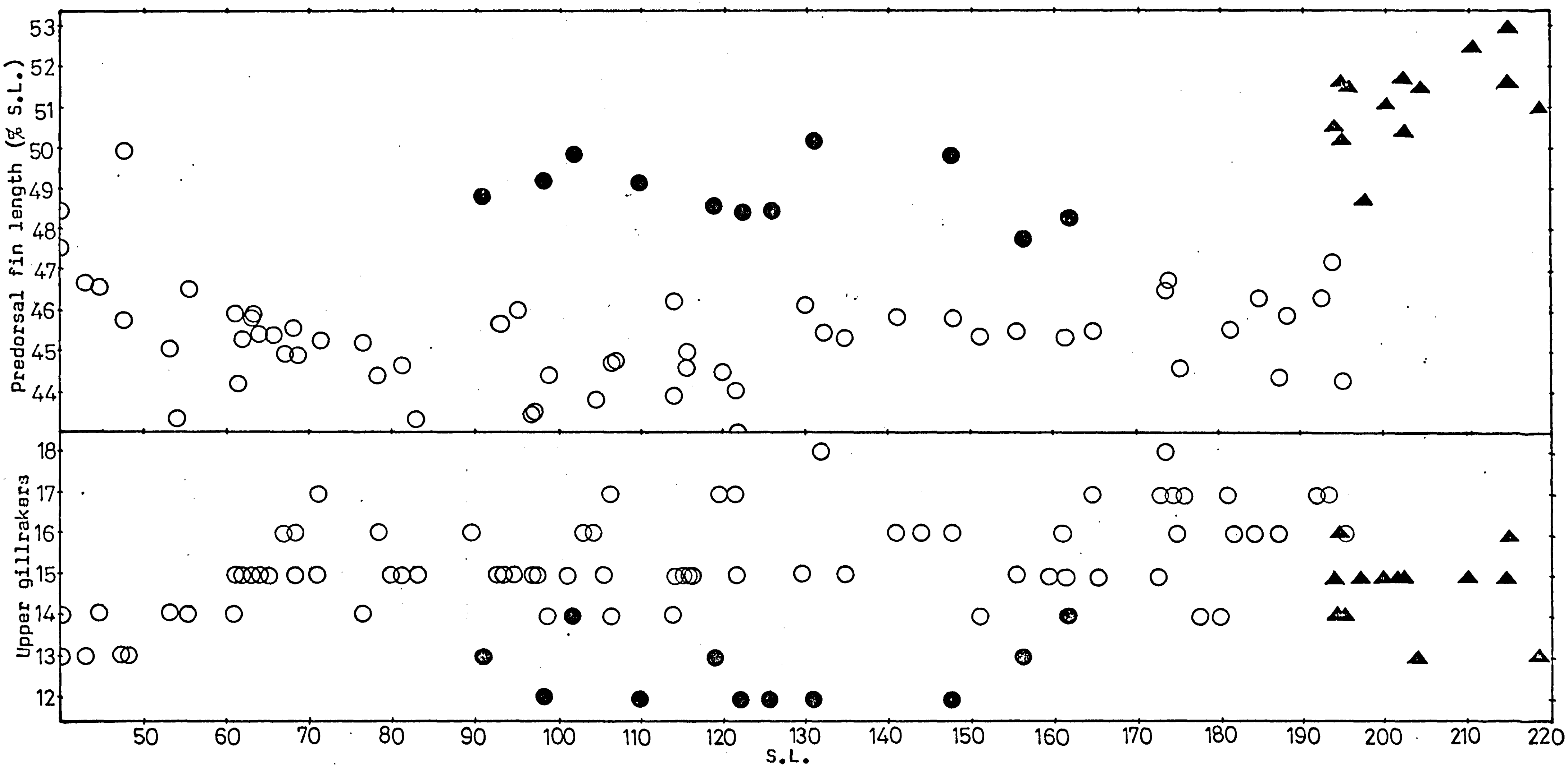


Figure 68 . Relation of predorsal fin length as percent of standard length and number of upper gillrakers to standard length (mm) for *Amblygaster sirm* (○), *A. clupeoides* (●) and *A. leiogaster* (▲).

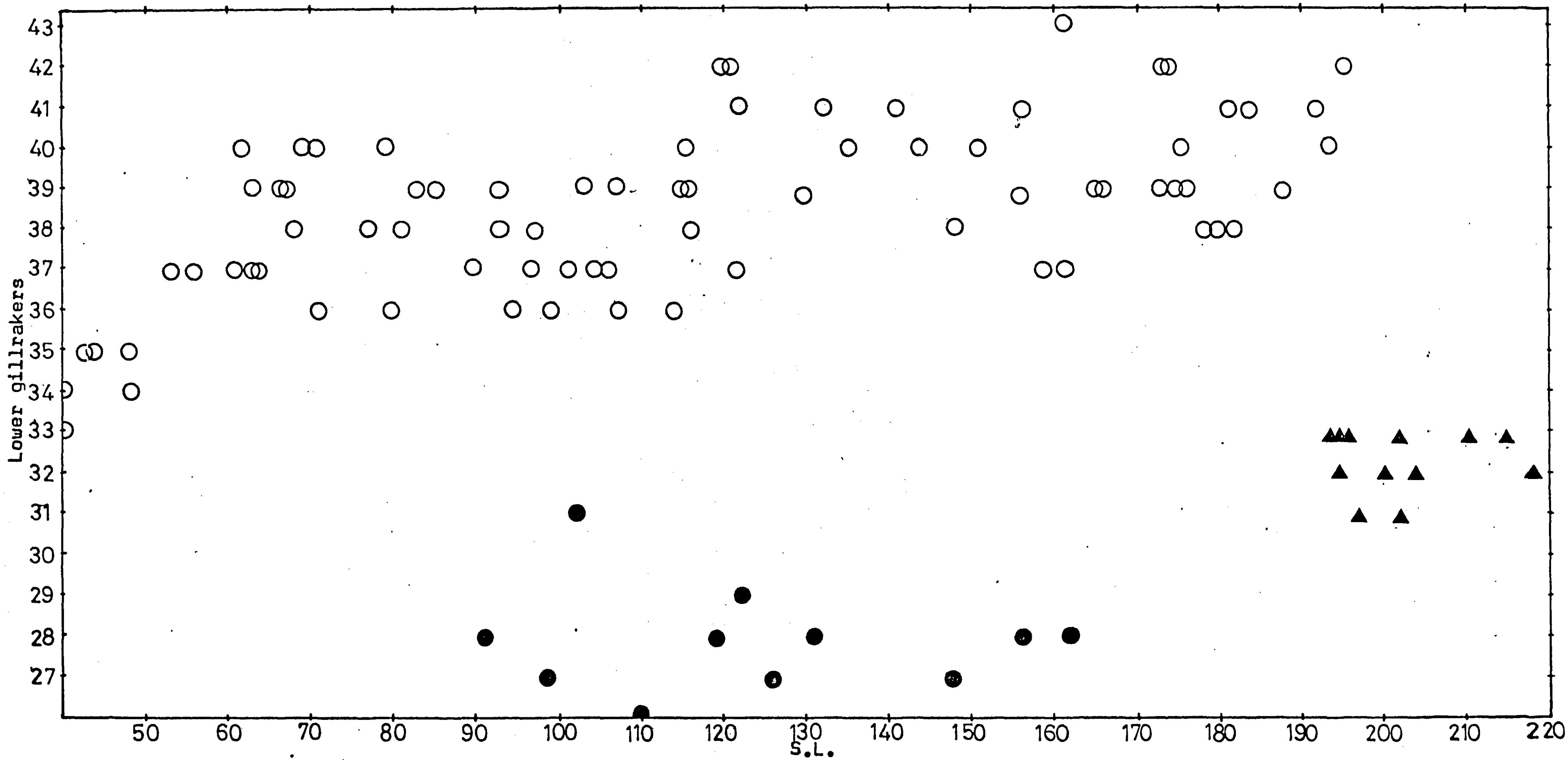


Figure 69 . Relation of number of lower gillrakers to standard length (mm) for Amblygaster sirm (○), A. clupeoides (●) and A. leiogaster (▲).

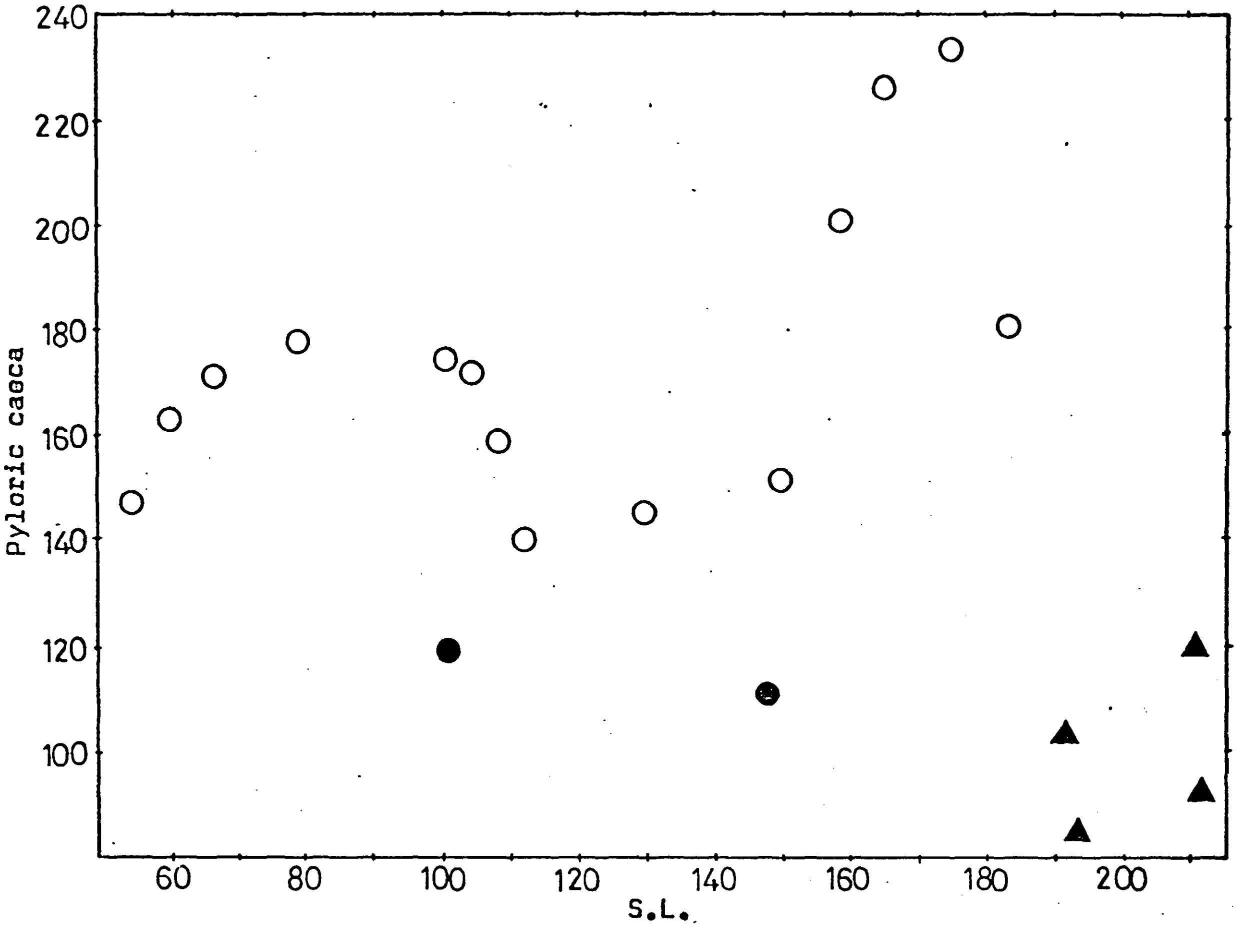


Figure 70 . Relation of number of pyloric caeca to standard length (mm) for Amblygaster sirm (○), A. clupeoides (●) and A. leiogaster (▲).

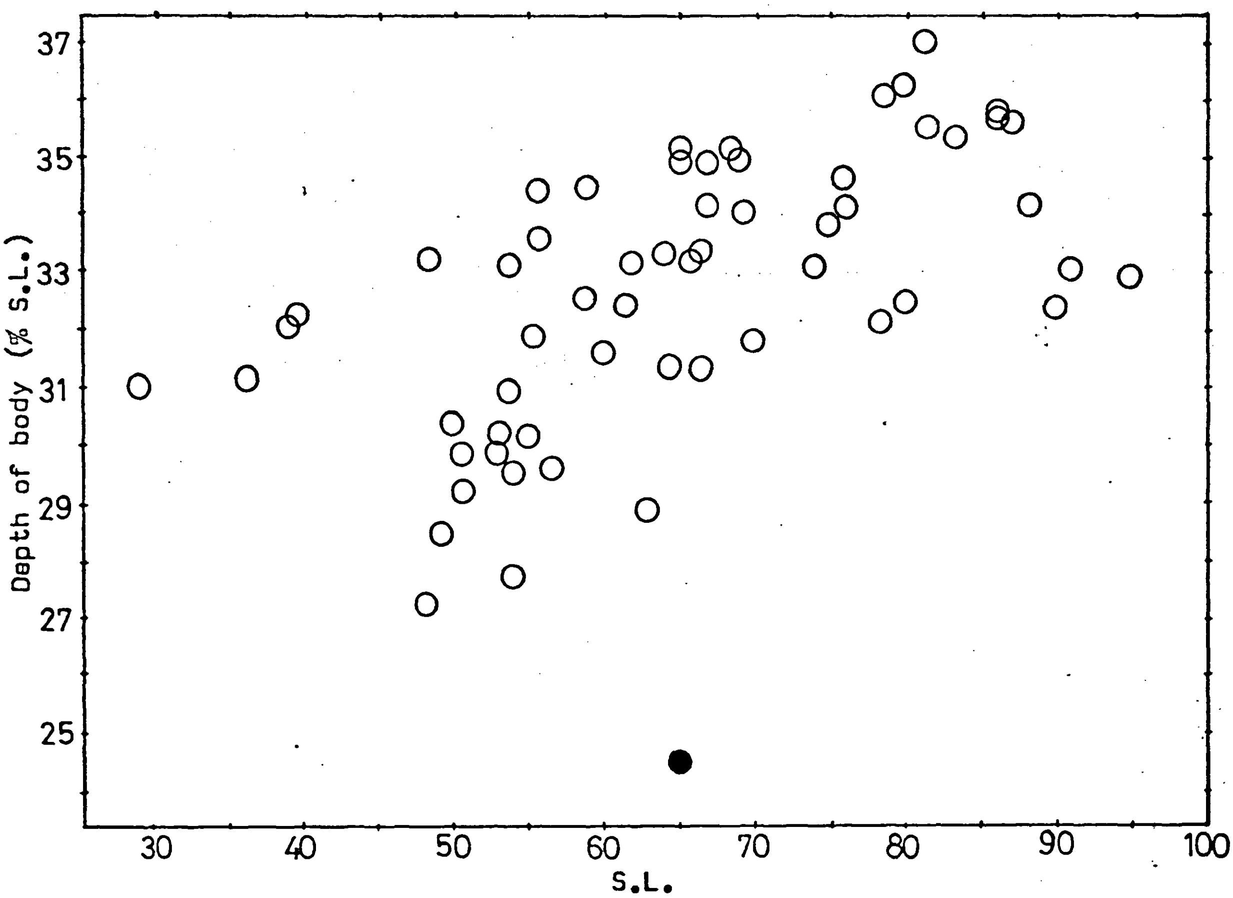


Figure 71 . Relation of depth of body as percent of standard length to standard length (mm) for Escualosa elongata (●) and E. thoracata (○).

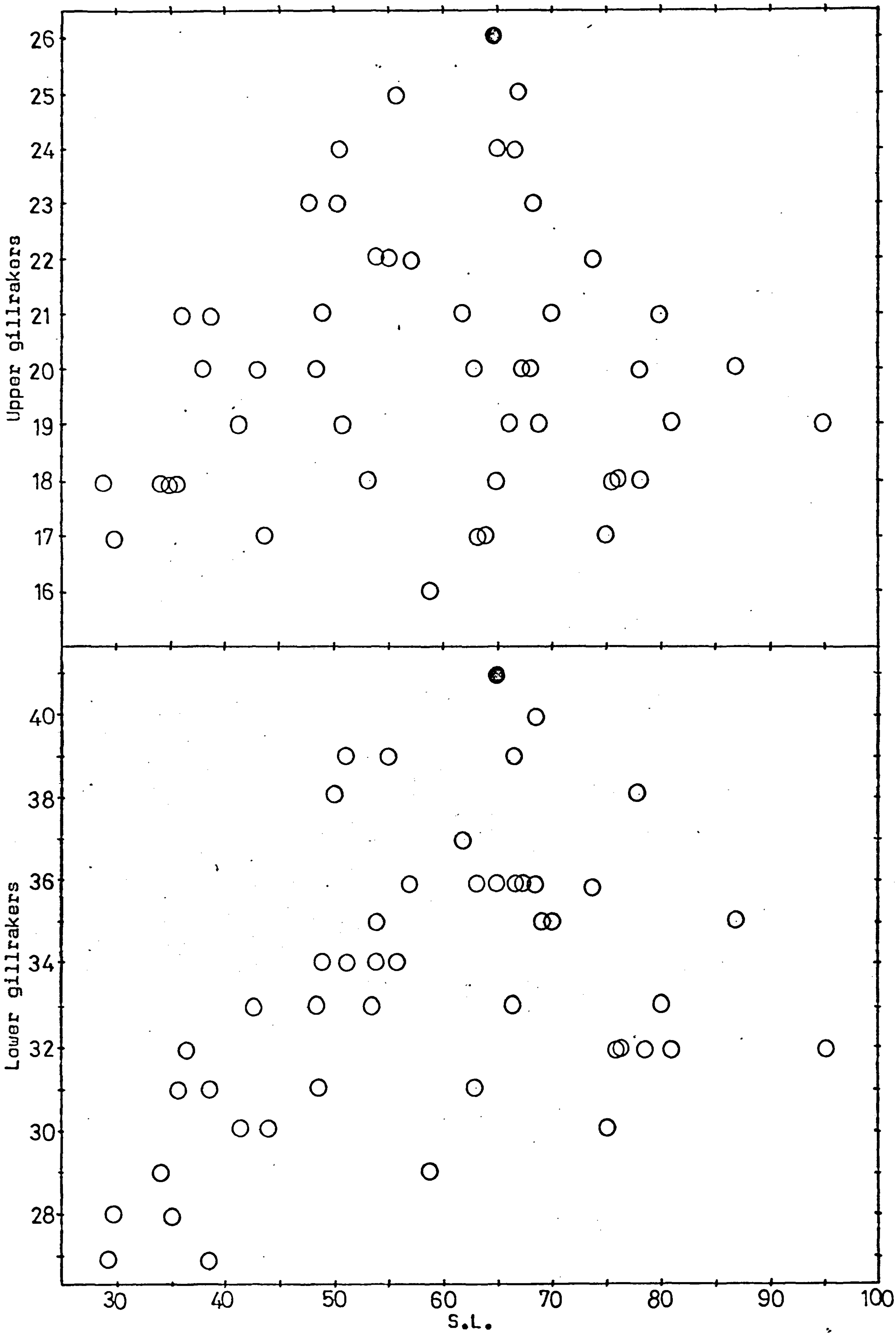


Figure 72 . Relation of number of gillrakers to standard length (mm) for *Escualosa elongata* (●) and *E. thoracata* (○).

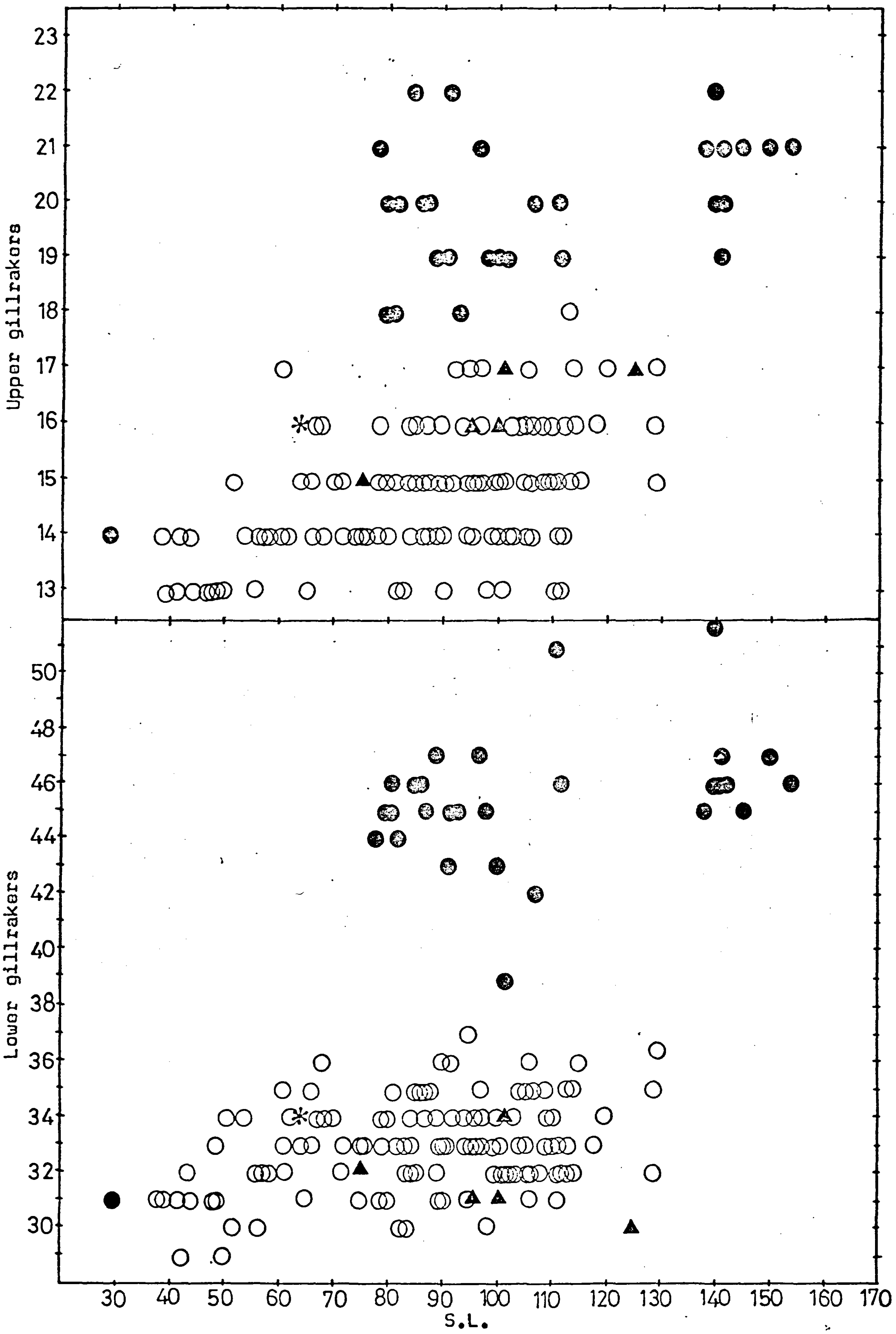


Figure 73 . Relation of number of gillrakers to standard length (mm) for Herklotsichthys quadrimaculatus (○), H. koningsbergeri (▲), H. castelnaui (●) and H. gotoi (*).

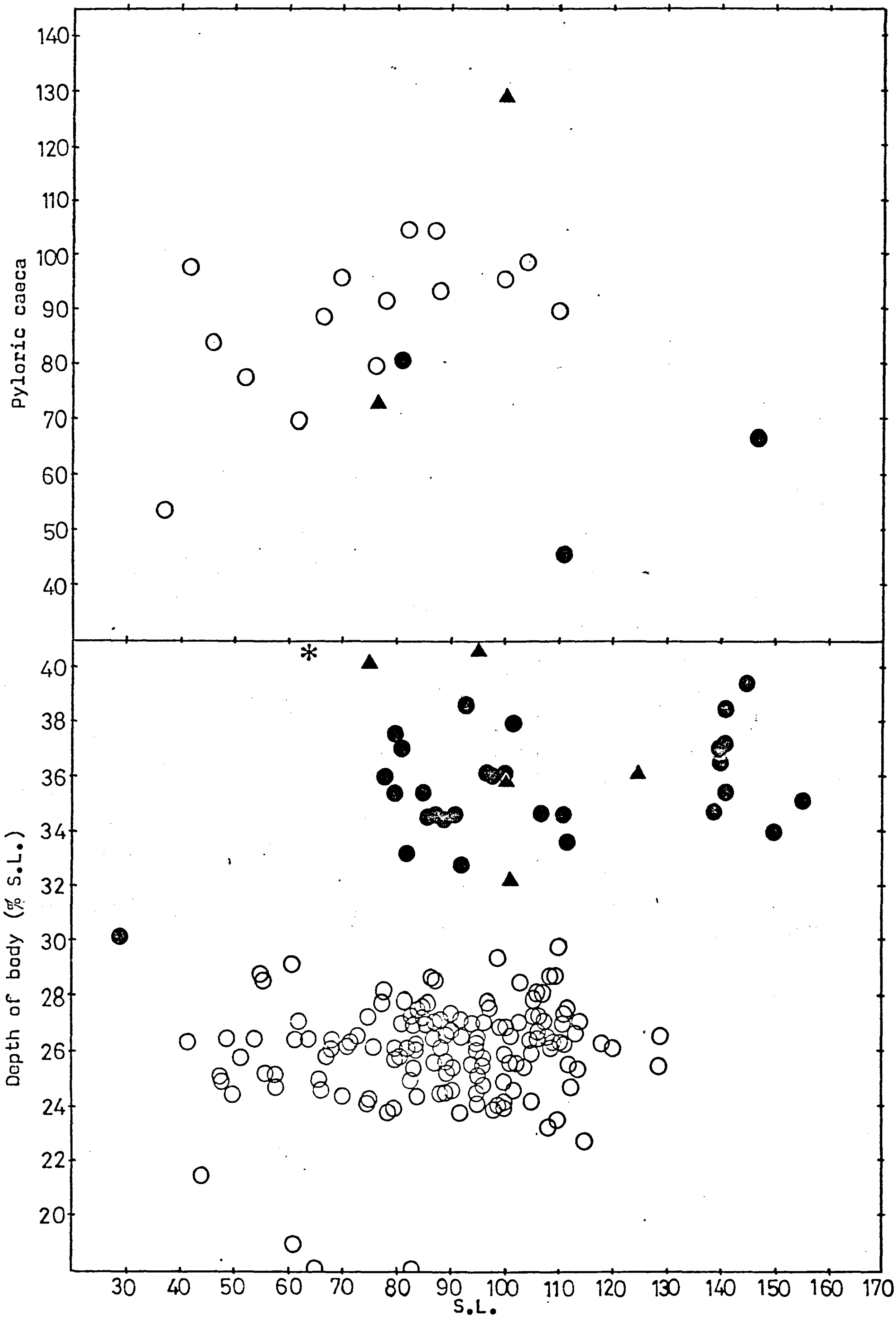


Figure 74 . Relation of number of pyloric caeca and depth of body as percent of standard length to standard length (mm) for <u>Herklotsichthys quadrimaculatus</u> (○), <u>H.</u> <u>koningsbergeri</u> (▲), <u>H.</u> <u>castelnaui</u> (●) and <u>H.</u> <u>gotoi</u> (*).

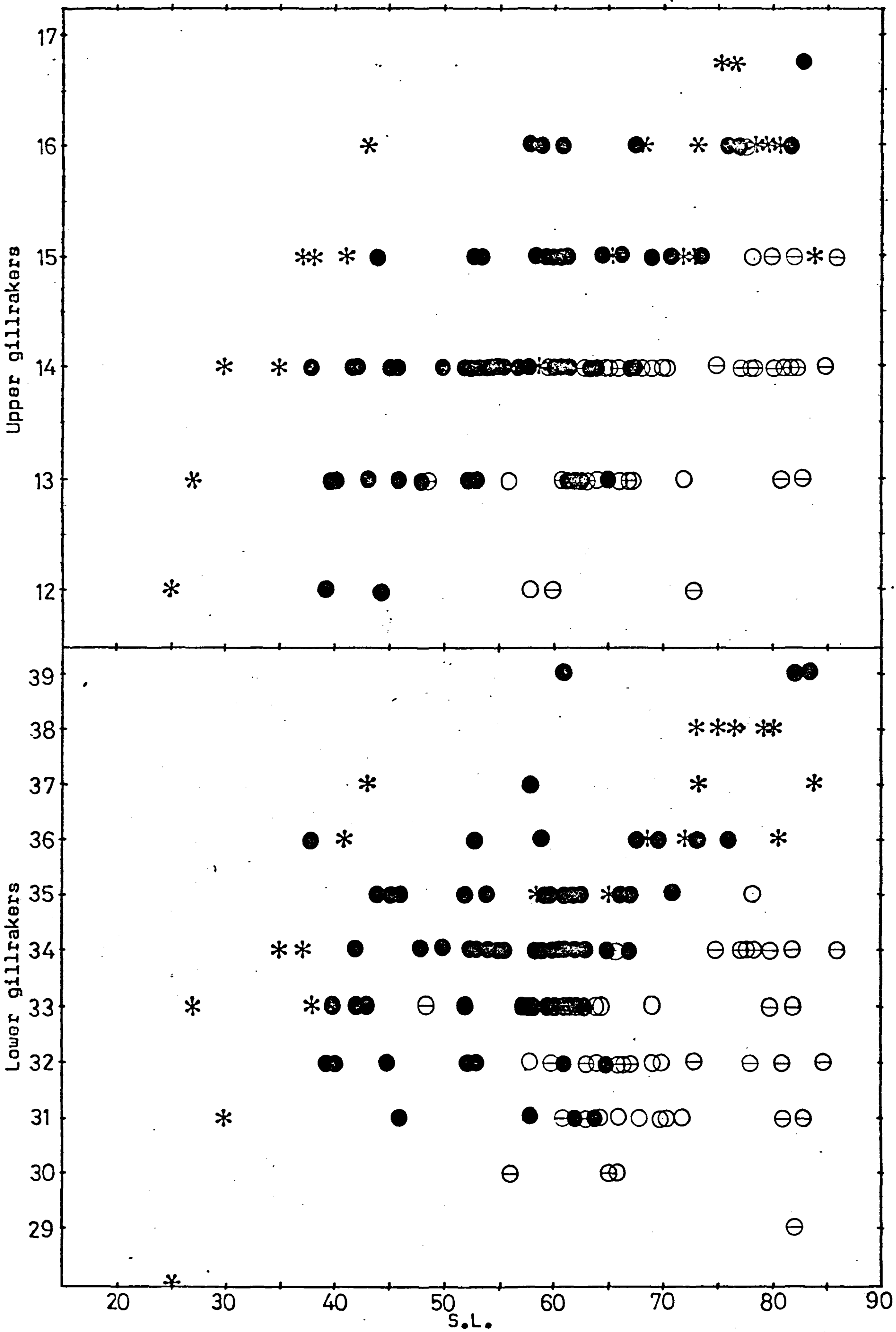


Figure 75 . Relation of number of gillrakers to standard length (mm) for <u>Herklotsichthys lossei</u> (○), <u>H. spilura</u> (⊖), <u>H. punctata</u> (●) and <u>H. dispilonotus</u> (✻).

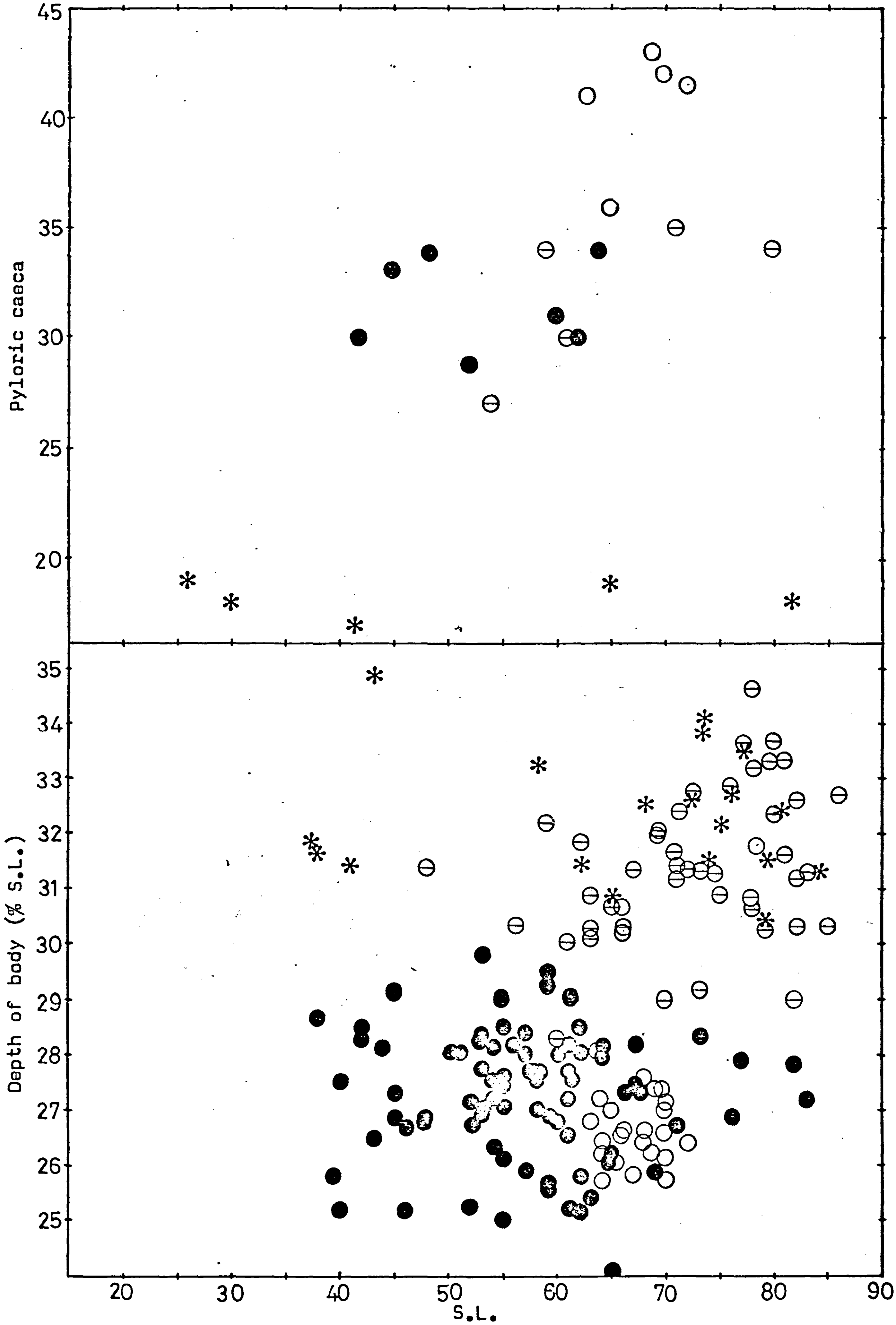


Figure 76 . Relation of number of pyloric caeca and depth of body as percent of standard length to standard length (mm) for Herklotsichthys lossei (○), H. spilura (⊖), H. punctatus (●) and H. dispilonotus (*).

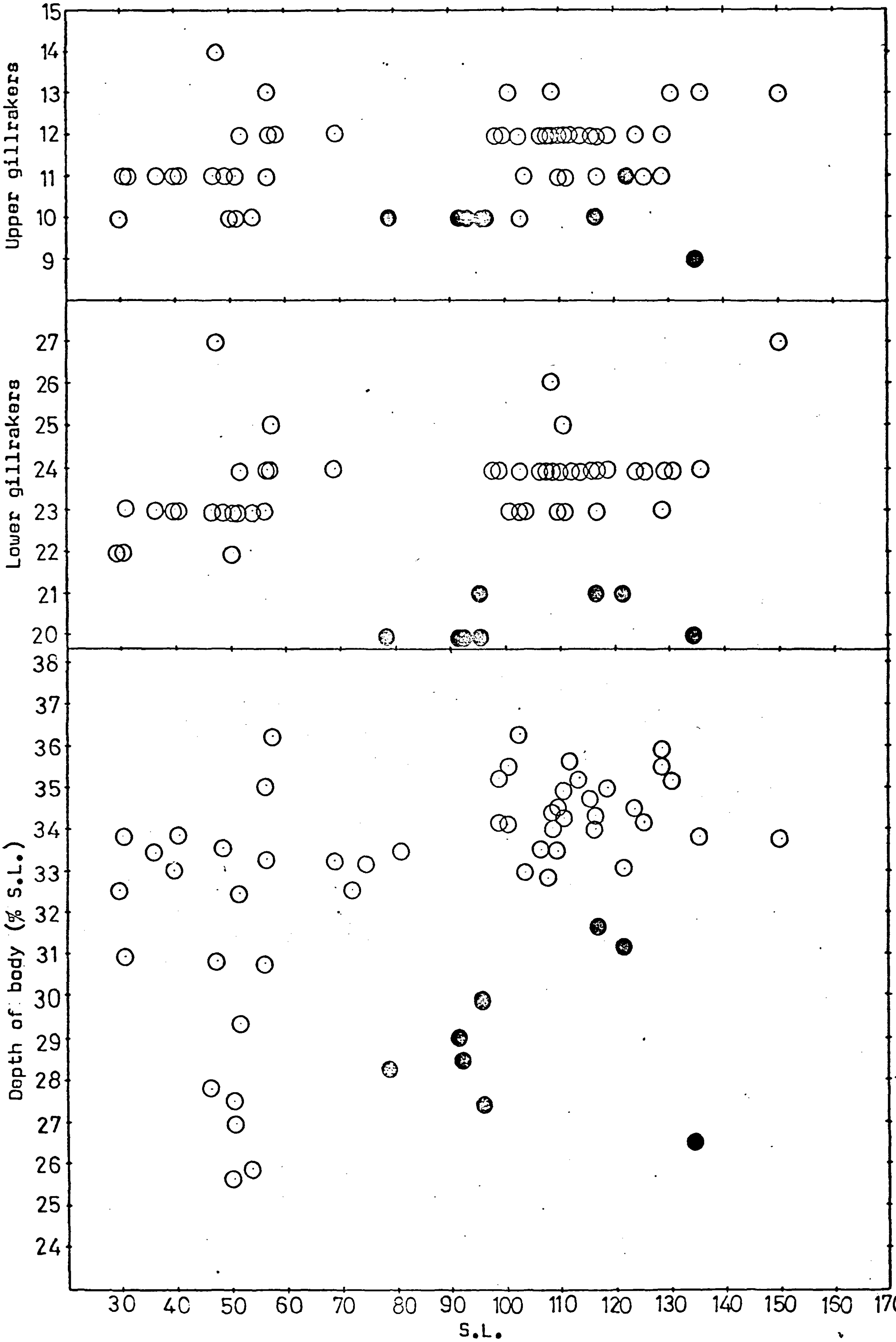


Figure 77. Relation of number of gillrakers and depth of body as percent of standard length to standard length (mm) for Pellona ditchela (O) and P. dayi (●).

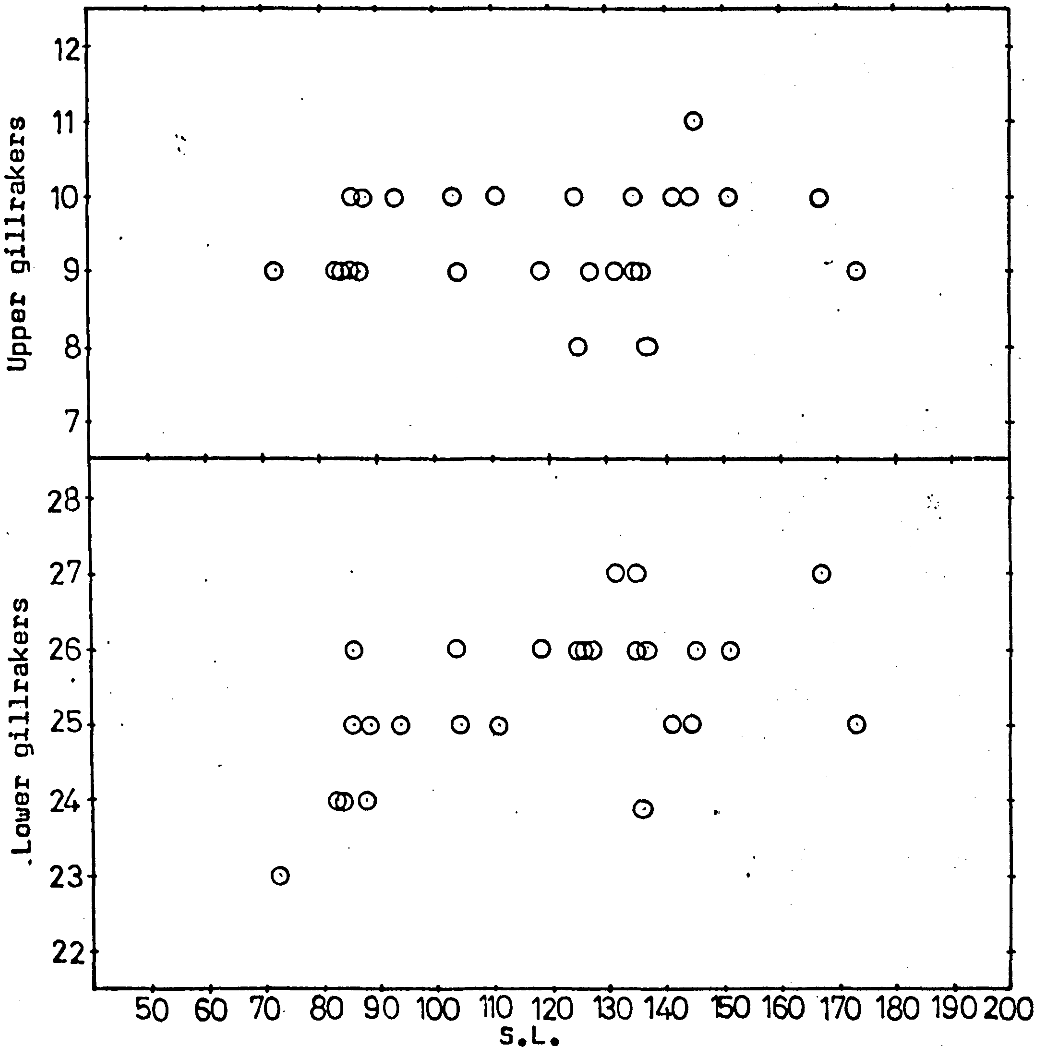


Figure 79 . Relation of number of gillrakers to standard length (mm) for Raconda russeliana (O).

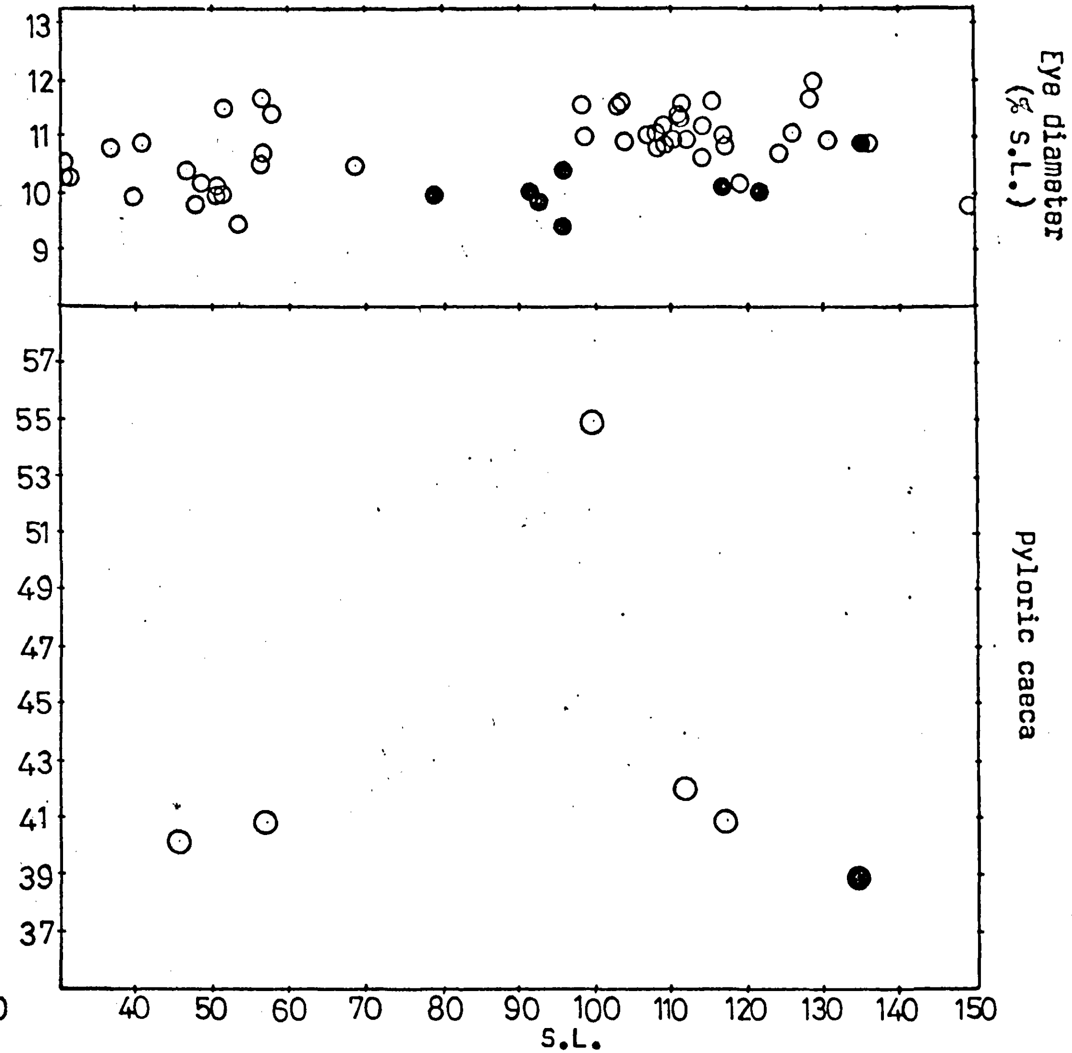


Figure 78 . Relation of eye diameter as percent of standard length and number of pyloric caeca to standard length (mm) for Pellona ditchela (O) and P. dayi (●).

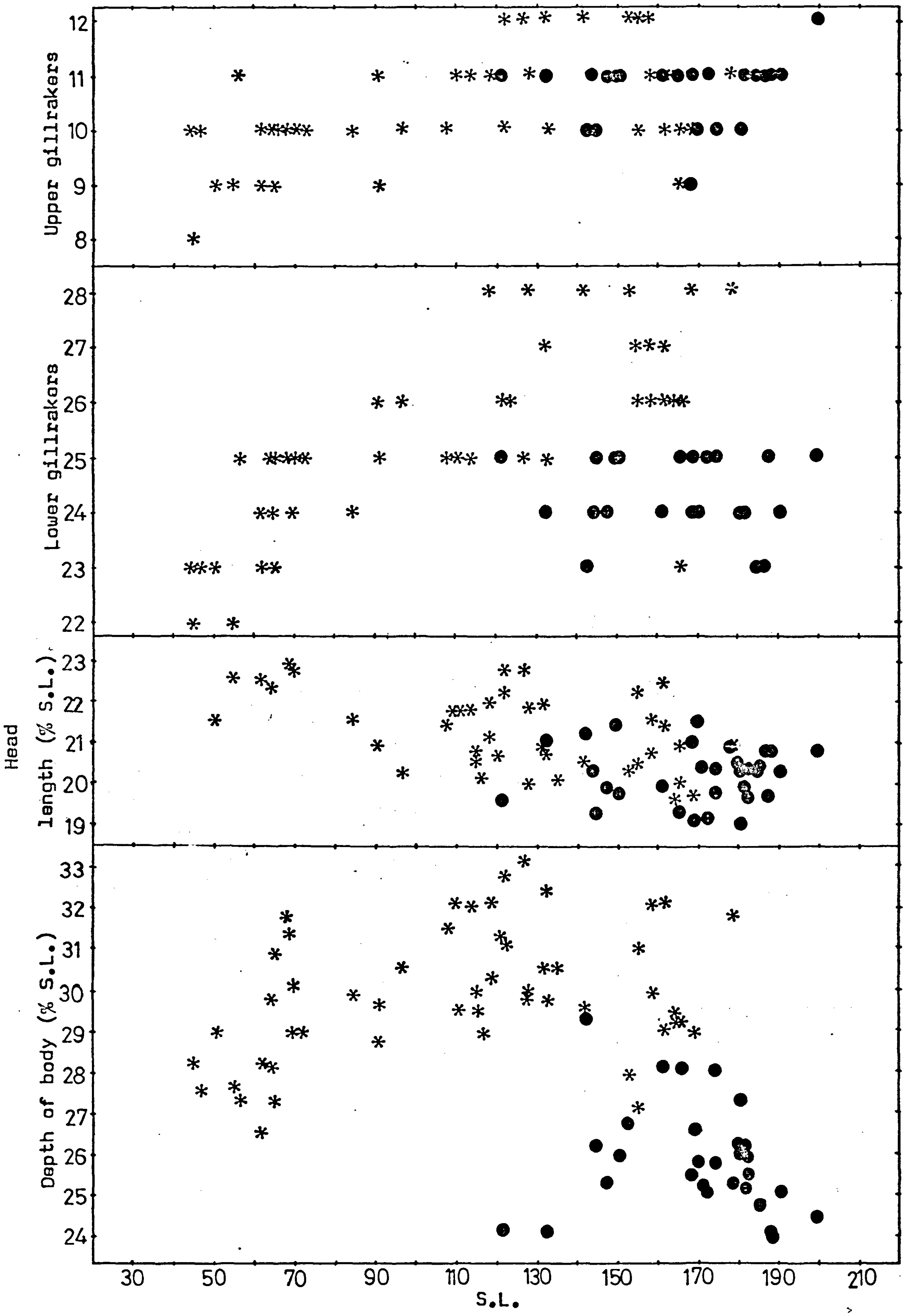


Figure 80 . Relation of number of gillrakers, head length and depth of body as percent of standard length to standard length (mm) for <u>Opisthopterus tardoore</u> (*) and <u>O. valenciennesi</u> (●).

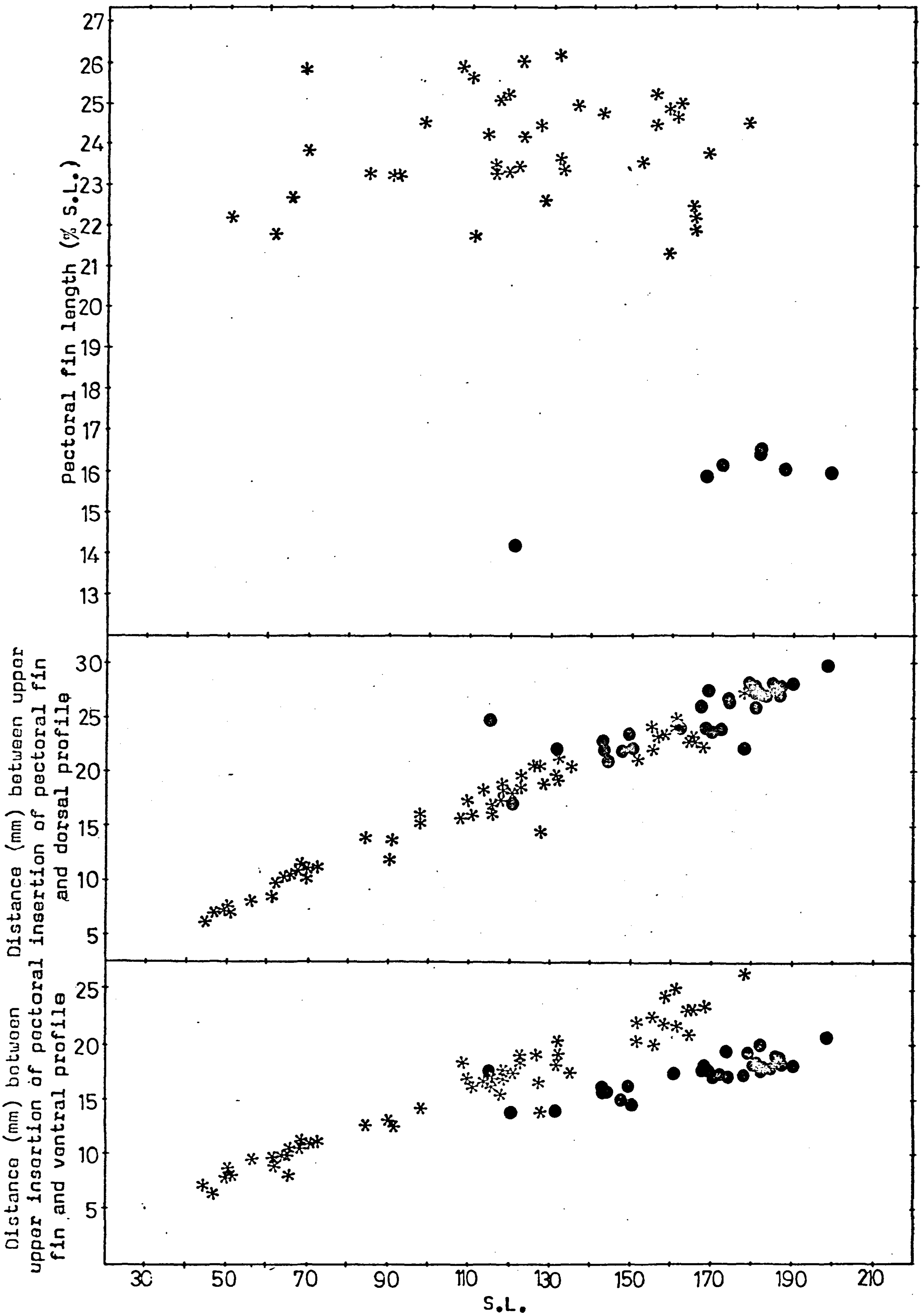


Figure 81 . Relation of pectoral fin length as percent of standard length and distance (mm) between upper insertion of pectoral fin and dorsal and ventral profiles to standard length (mm) for Opisthopterus tardoore (*) and O. valenciennesi (●).

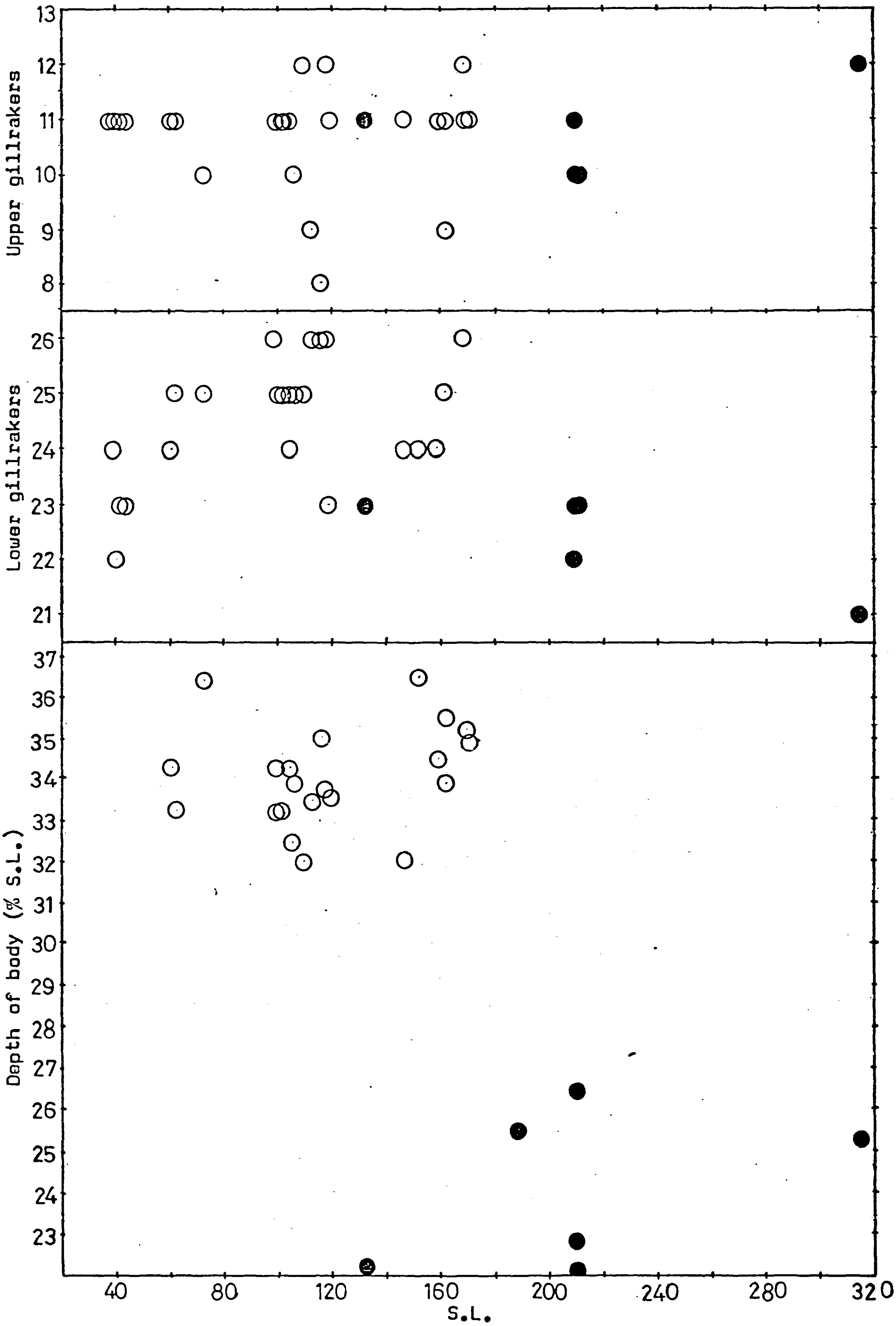


Figure 82 . Relation of number of gillrakers and depth of body as percent of standard length to standard length (mm) for Ilisha sirishai (O) and I. novacula (⊖). Gillraker counts and depth measurements of lectotype (ZSI.2672) and ?paralectotype (ZSI.298) of Pellona sladeni (= I. novacula) have been taken from Talwar and Whitehead (1971).

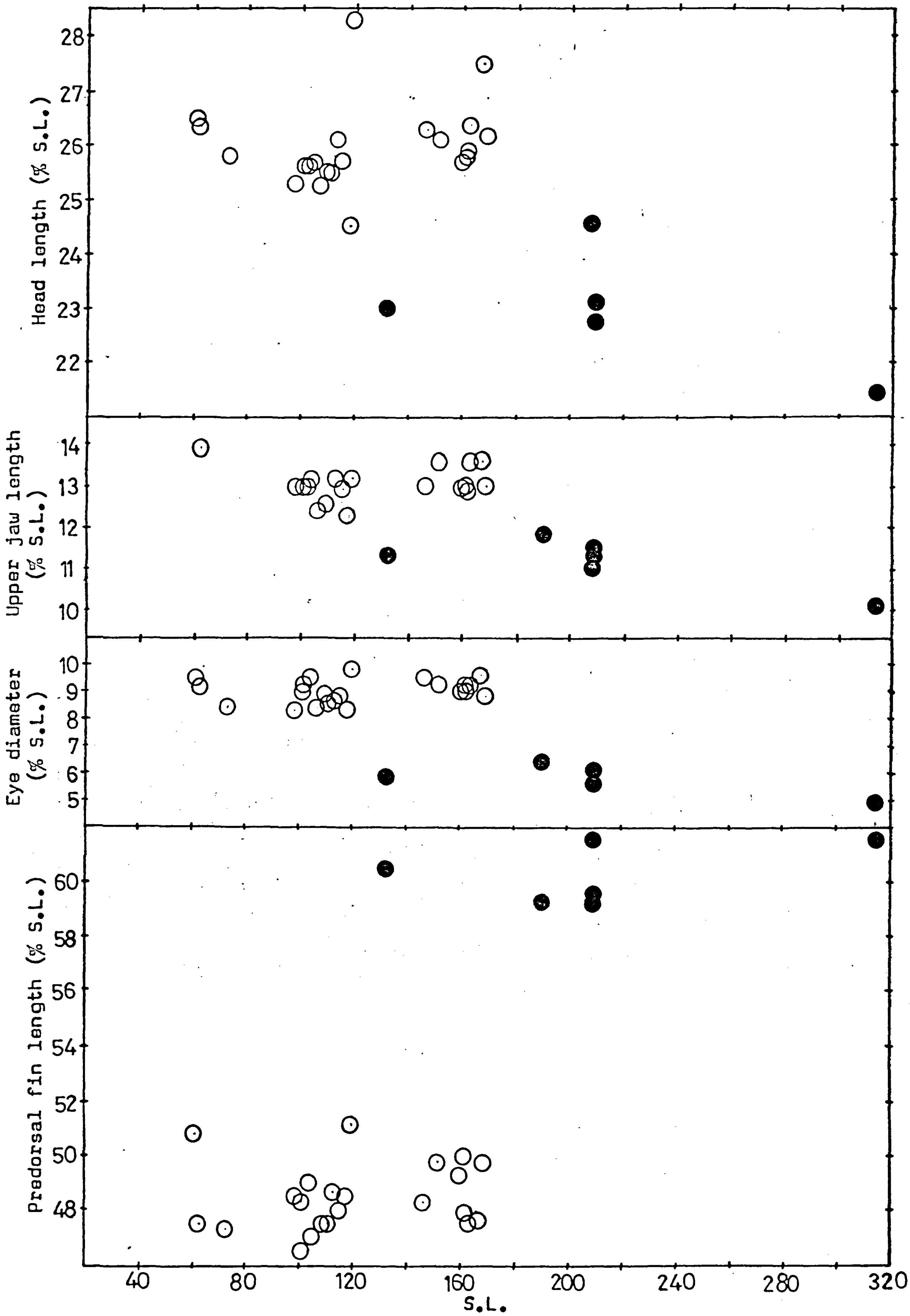


Figure 83 . Relation of head length, upper jaw length, eye diameter and predorsal fin length as percent of standard length to standard length (mm) for Ilisha sirishai (○) and I. novacula (●). Measurements of lectotype (ZSI.2672) and ?paralectotype (ZSI.298) of Pellona sladeni (= I. novacula)have been taken from Talwar and Whitehead (1971).

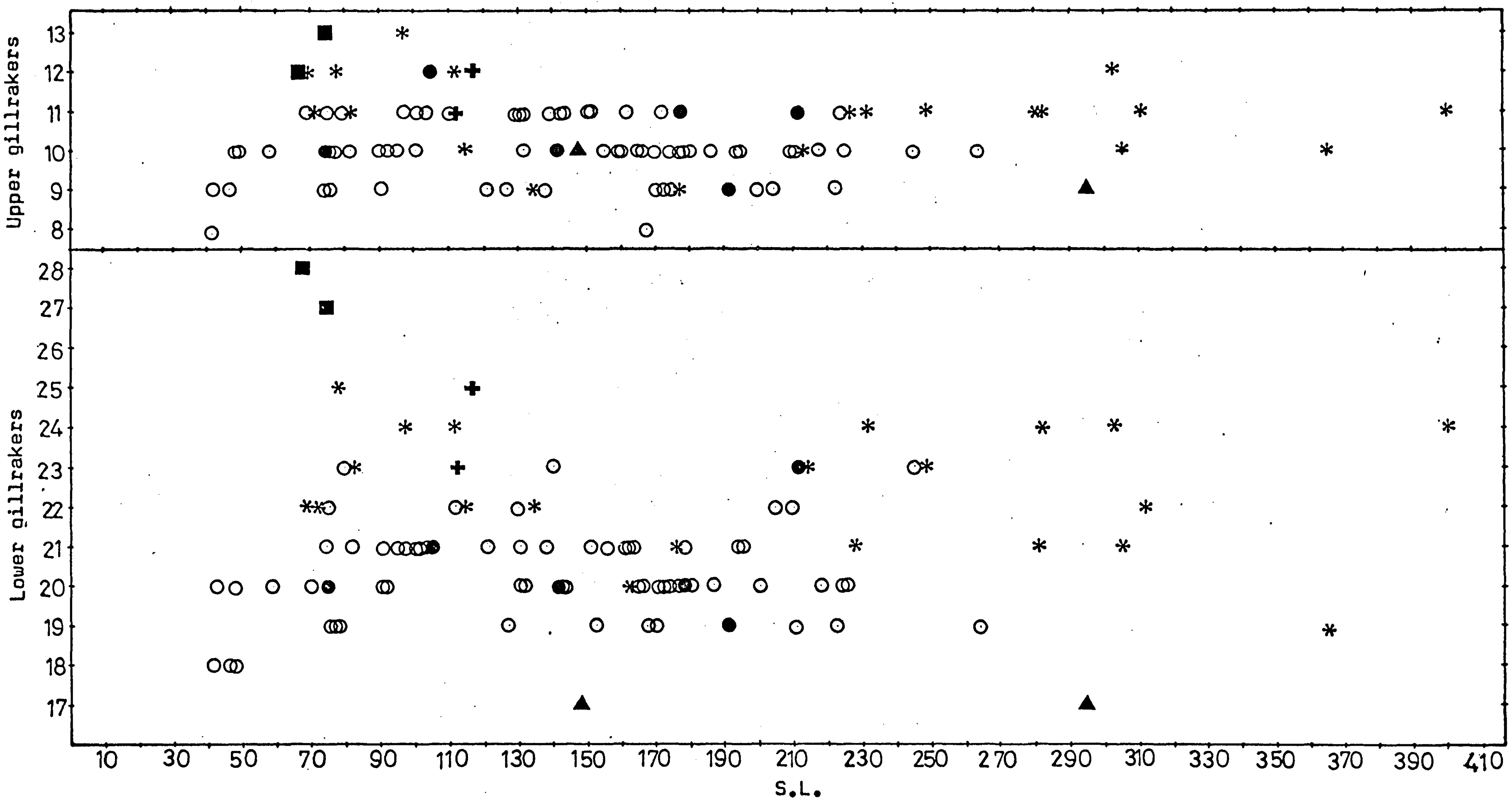


Figure 84 . Relation of number of gillrakers to standard length (mm) for Ilisha obfuscata (■), I. megaloptera (○), I. filigera(●), I. elongata (*), I. macrogaster (+) and I. pristigastroides (▲).

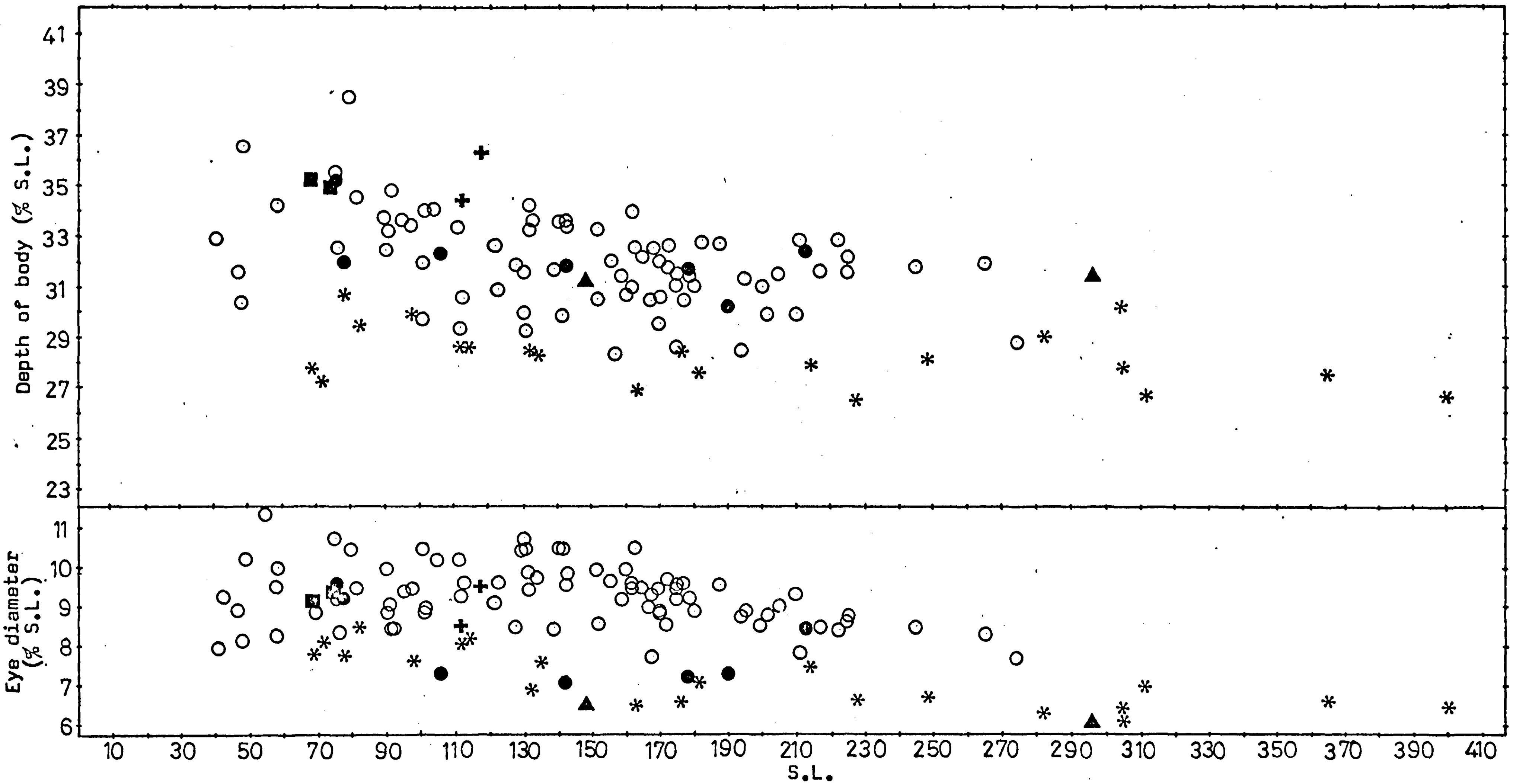


Figure 85 . Relation of depth of body and eye diameter as percent of standard length to standard length (mm) for Ilisha obfuscata (■), I. megaloptera (○), I. filigera(●), I. elongata (*), I. macrogaster (+) and I. pristigastroides (▲).

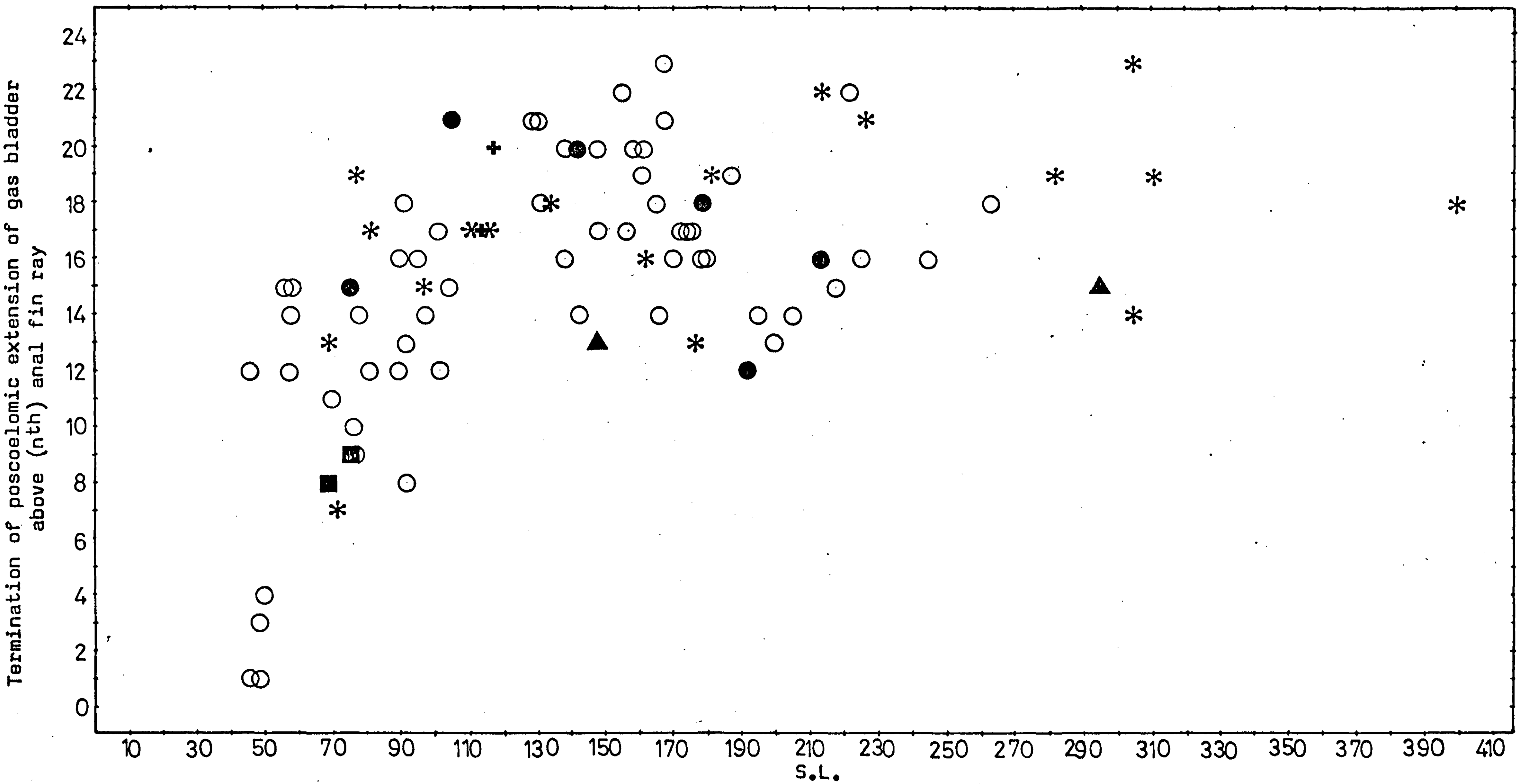


Figure 86 . Relation of termination of postcoelomic extension of gas bladder above (n^{th}) anal fin ray (including unbranched fin rays) to standard length (mm) for Ilisha obfuscata(■), I. megaloptera (○), I. filigera(●), I. elongata (*), I. macrogaster (✚) and I. pristigastroides (▲).

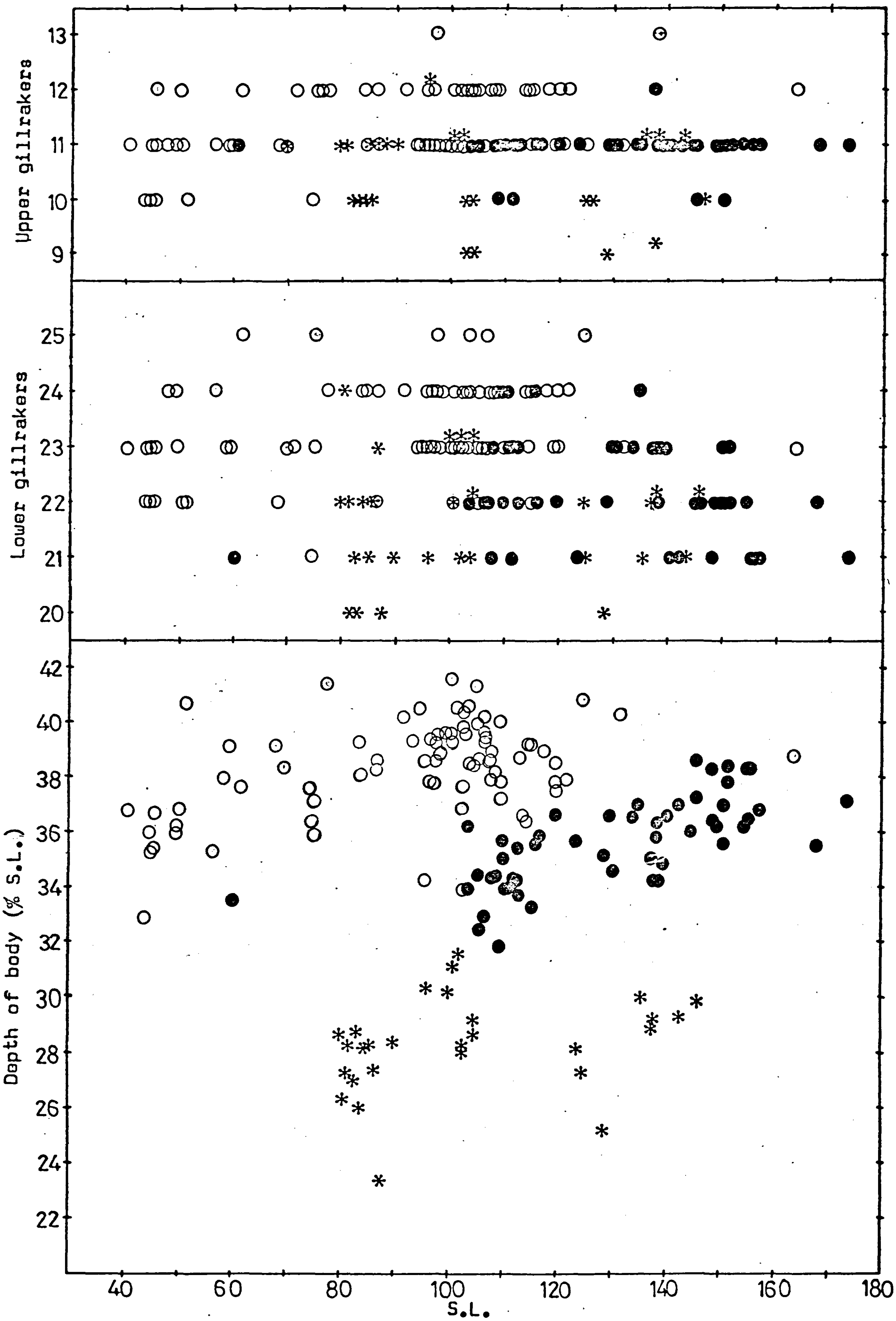


Figure 87. Relation of number of gillrakers and depth of body as percent of standard length to standard length (mm) for Ilisha melastoma(○), I. striatula(●) and I. kampeni (*).

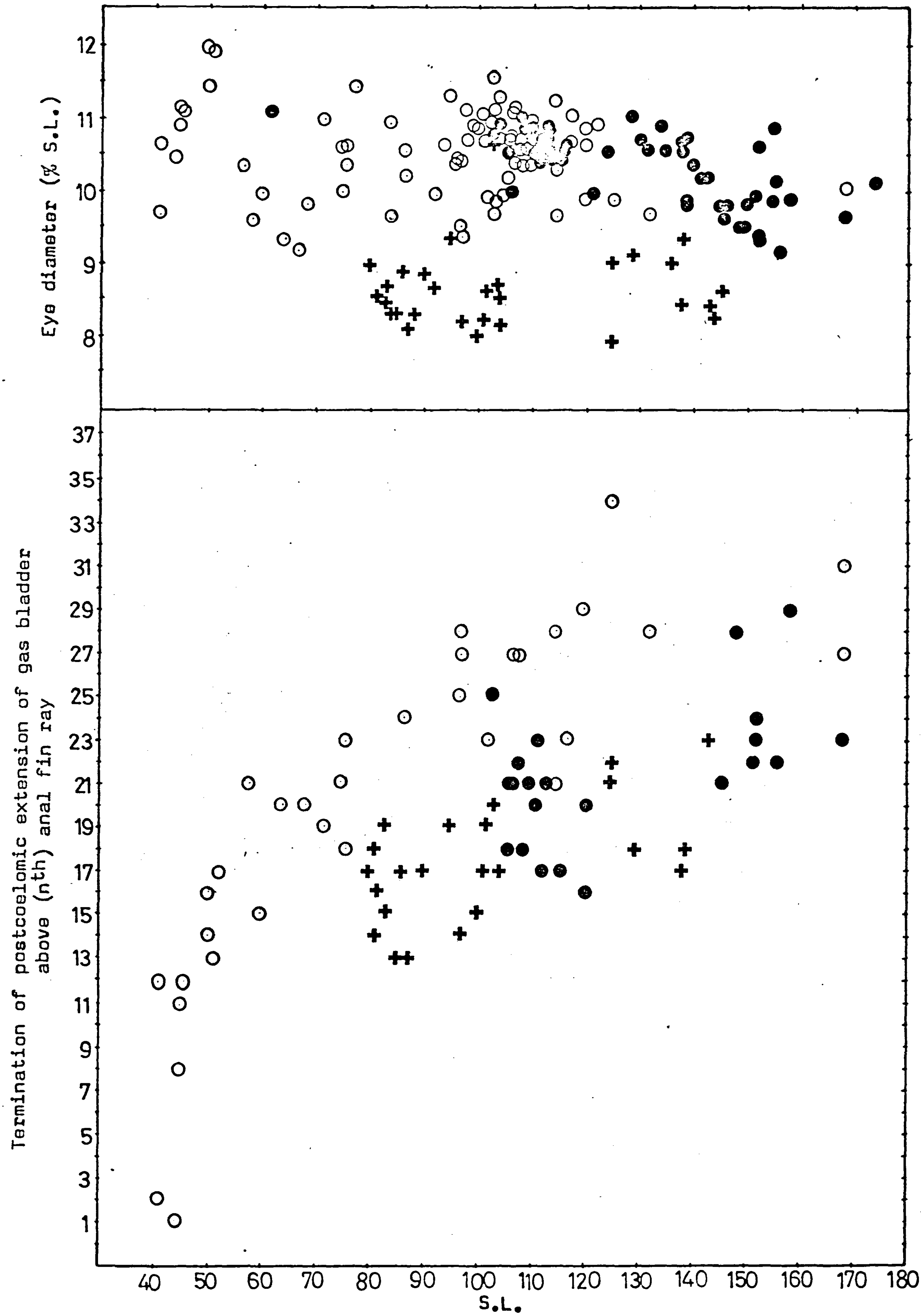


Figure 88 . Relation of eye diameter as percent of standard length and termination of right postcoelomic extension of gas bladder above (n^{th}) anal fin ray (including unbranched fin rays) to standard length (mm) for Ilisha melastoma(○), I. striatula(●) and I. kampeni (+).

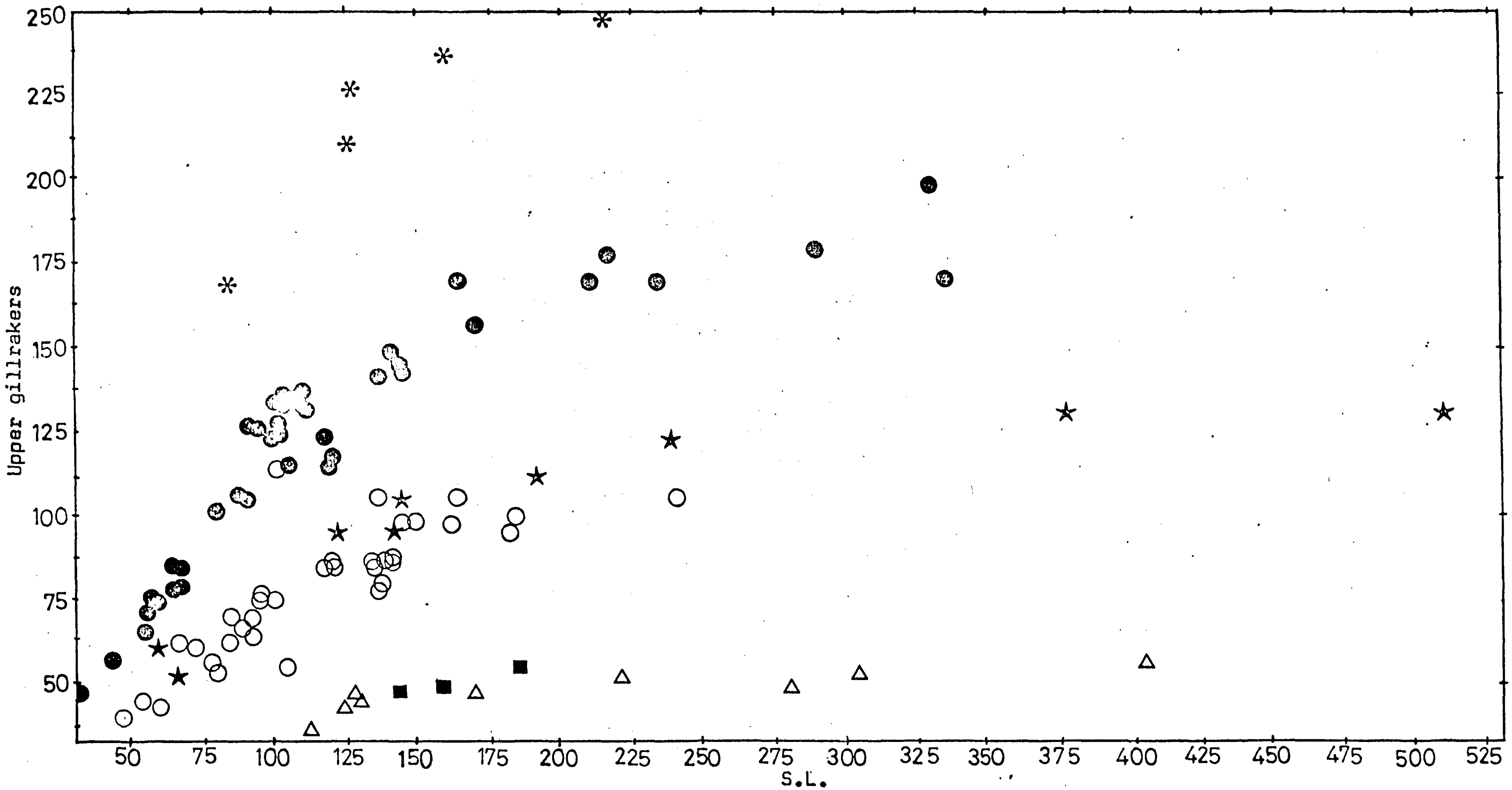


Figure 89 . Relation of number of upper gillrakers to standard length (mm) for Hilsa kelee (○), Tenualosa toli (△), T. macrura (■), T. reevesii (★), T. ilisha (●) and T. thibaudeaui (✻).

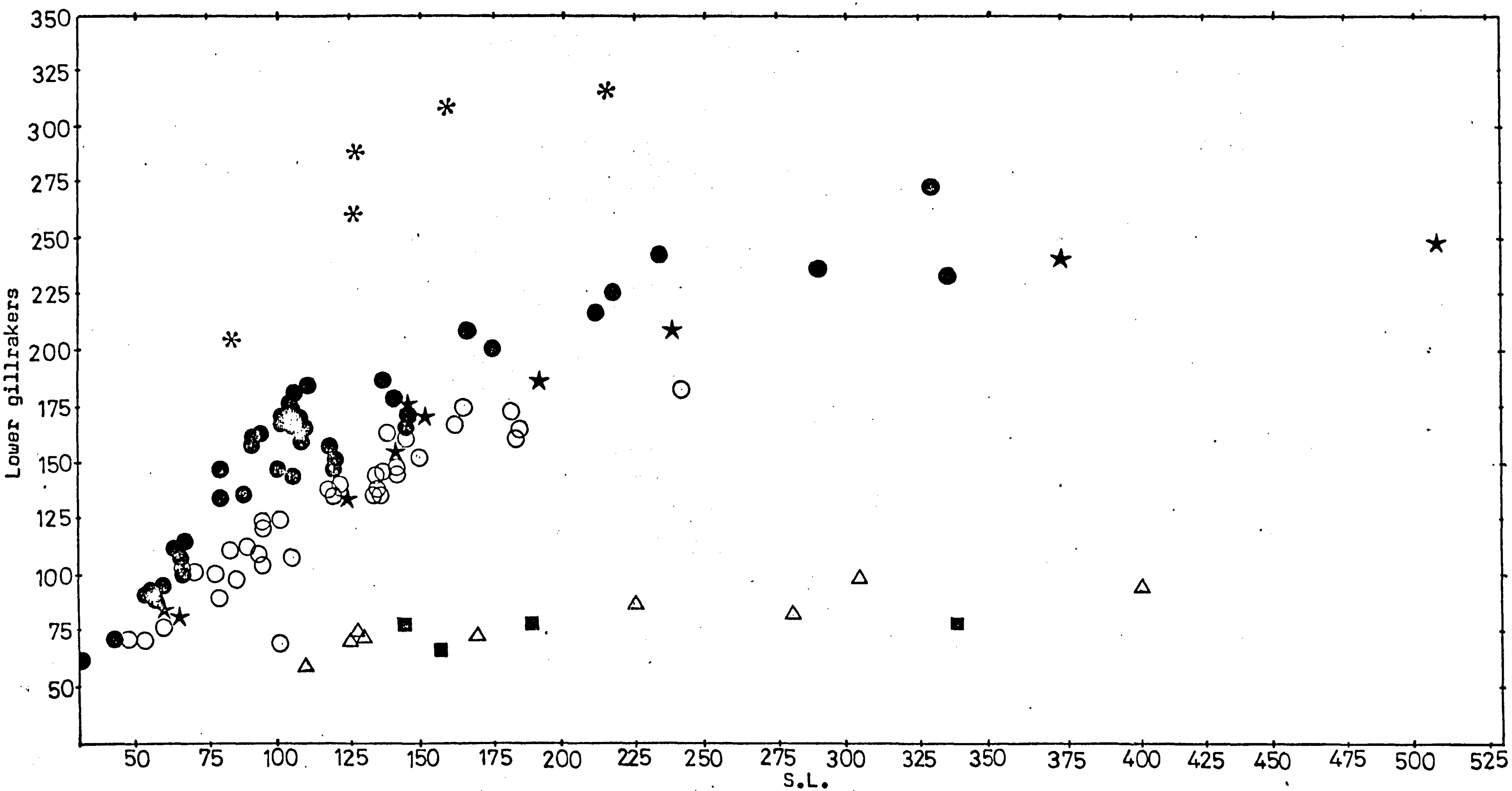


Figure 90 . Relation of number of lower gillrakers to standard length (mm) for Hilsa kelee (○), Tenualosa toli (△), T. macrura (■), T. reevesii (★), T. ilisha (●) and T. thibaudeaui (✱).

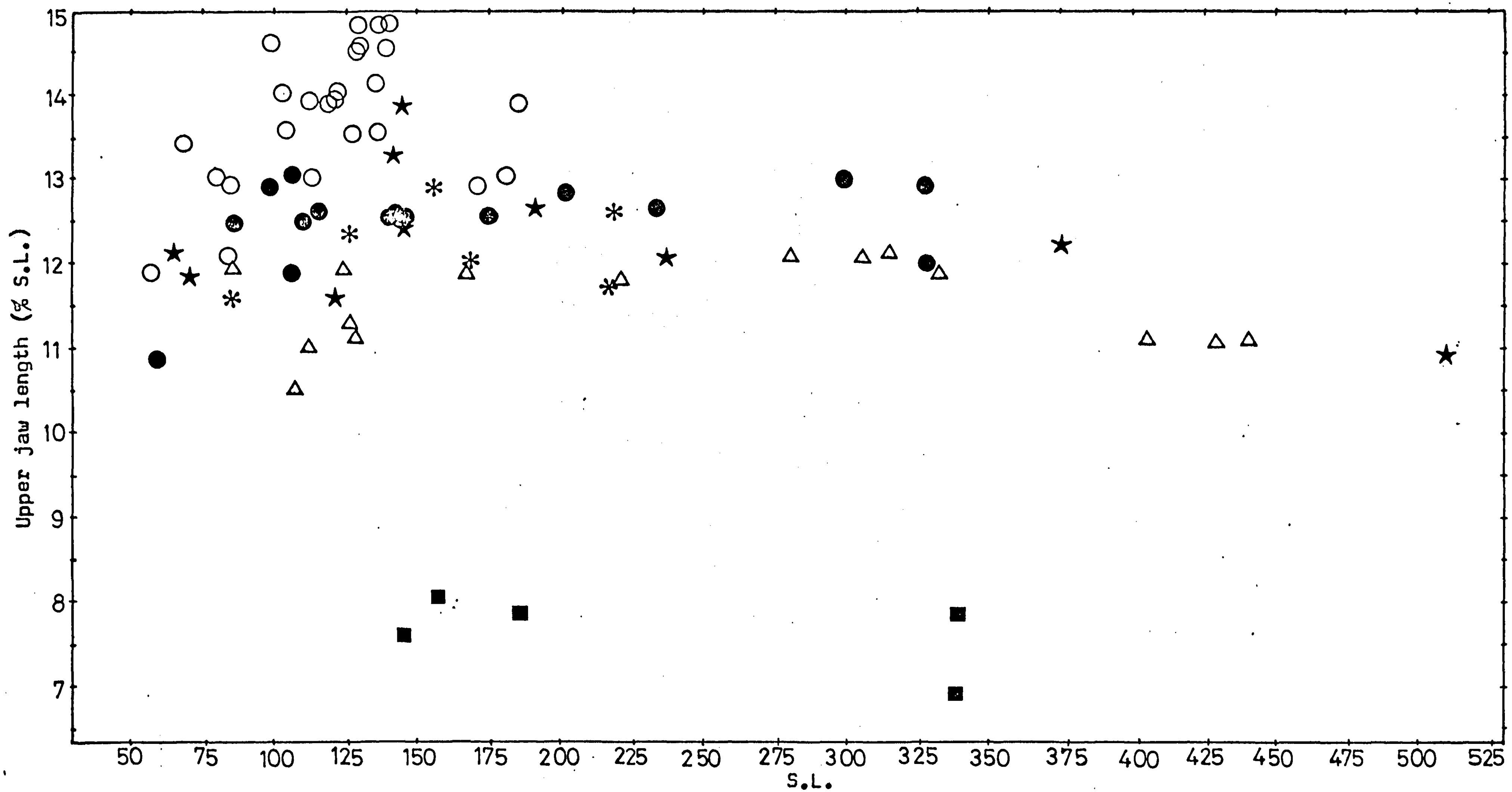


Figure 91 . Relation of upper jaw length as percent of standard length to standard length (mm) for Hilsa kelee (○), Tenualosa toli (△), T. macrura (■), T. reevesii (★), T. ilisha (●) and T. thibaudeaui (✻).

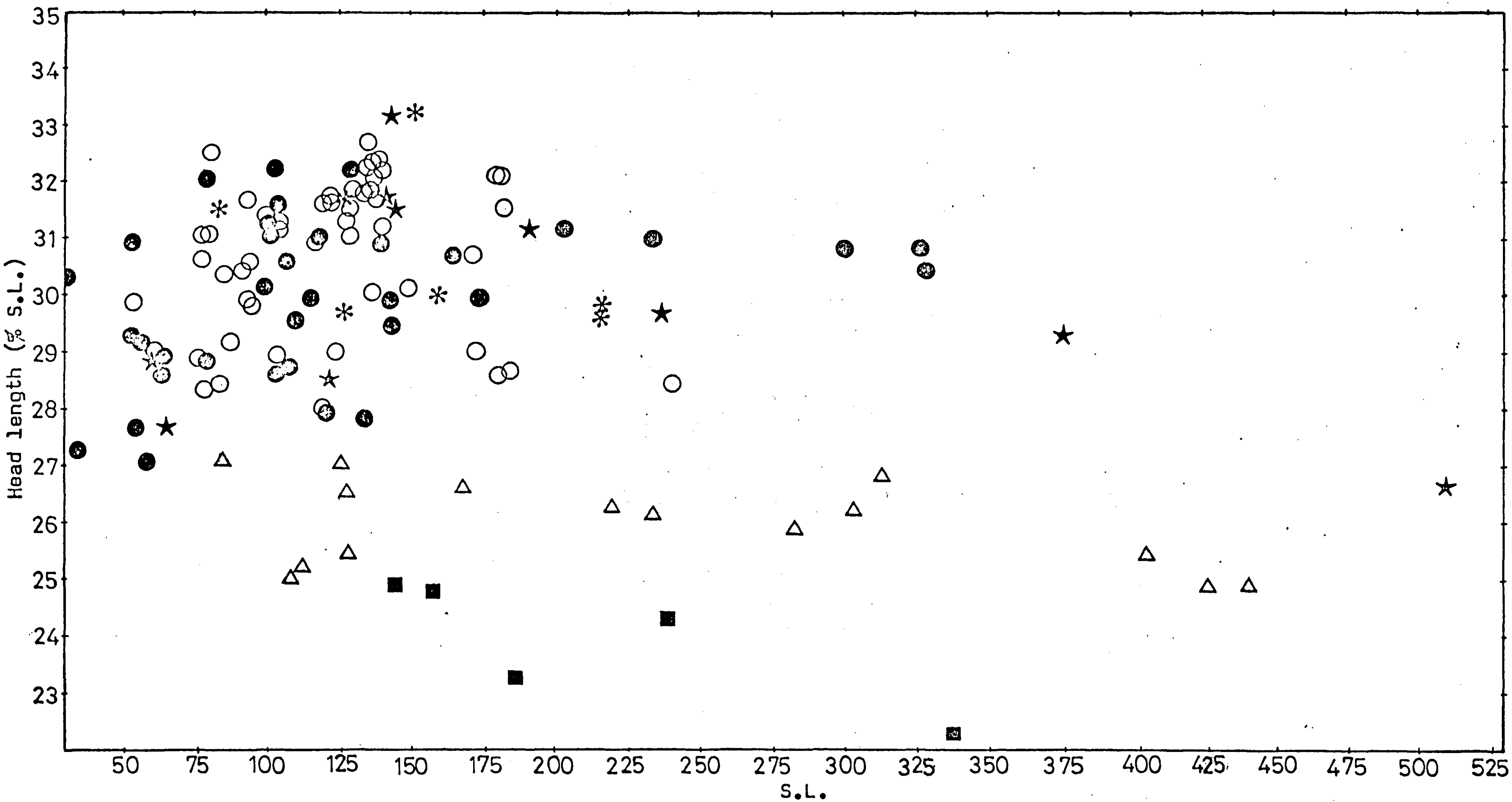


Figure 92 . Relation of head length as percent of standard length to standard length (mm) for Hilsa kelee (○), Tenualosa toli (△), T. macrura (■), T.reevesii (★), T.ilisha (●) and T. thibaudeaui (✳).

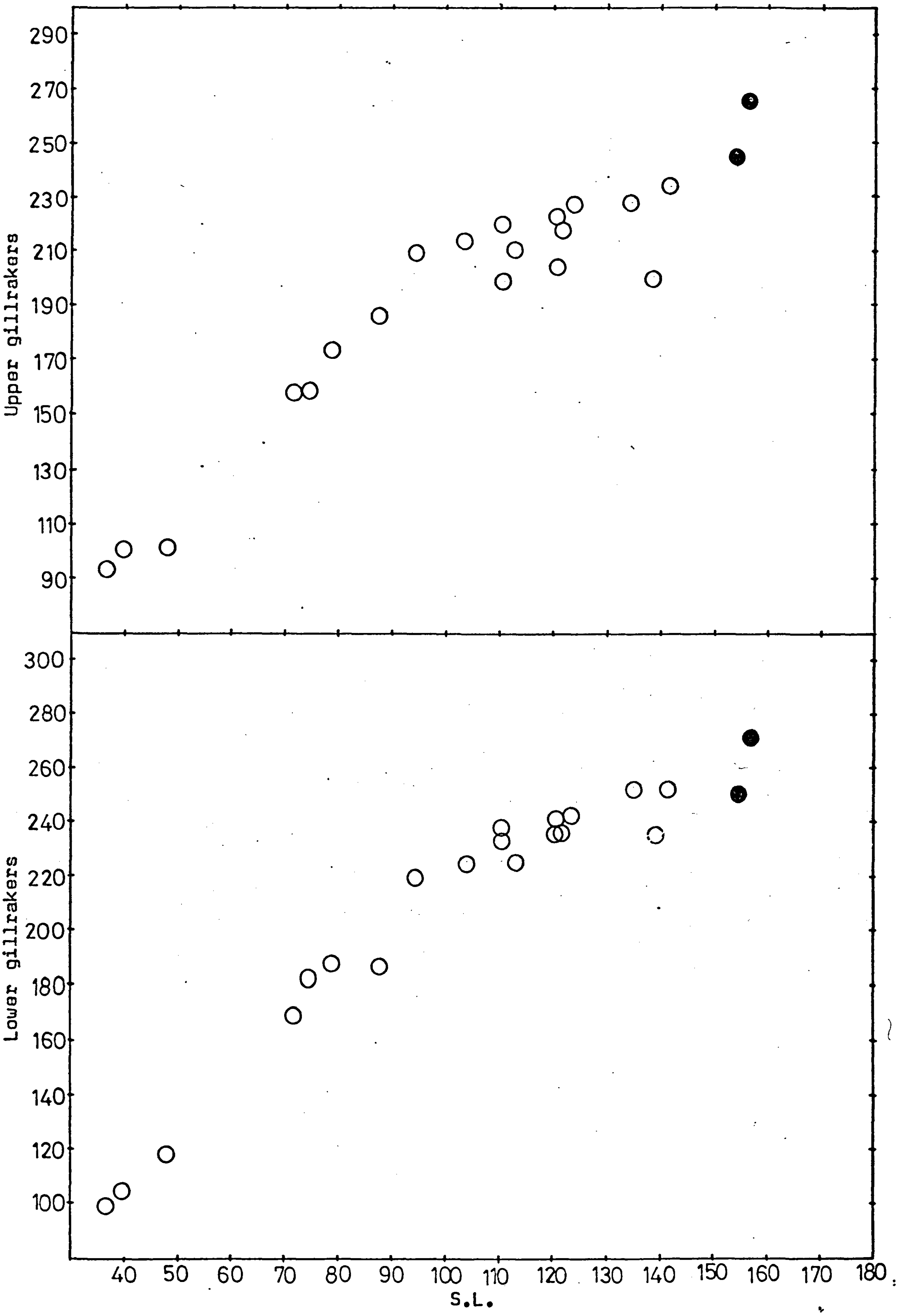


Figure 93 . Relation of number of gillrakers to standard length (mm) for *Gudusia variegata* (●) and *G. chapra* (○).

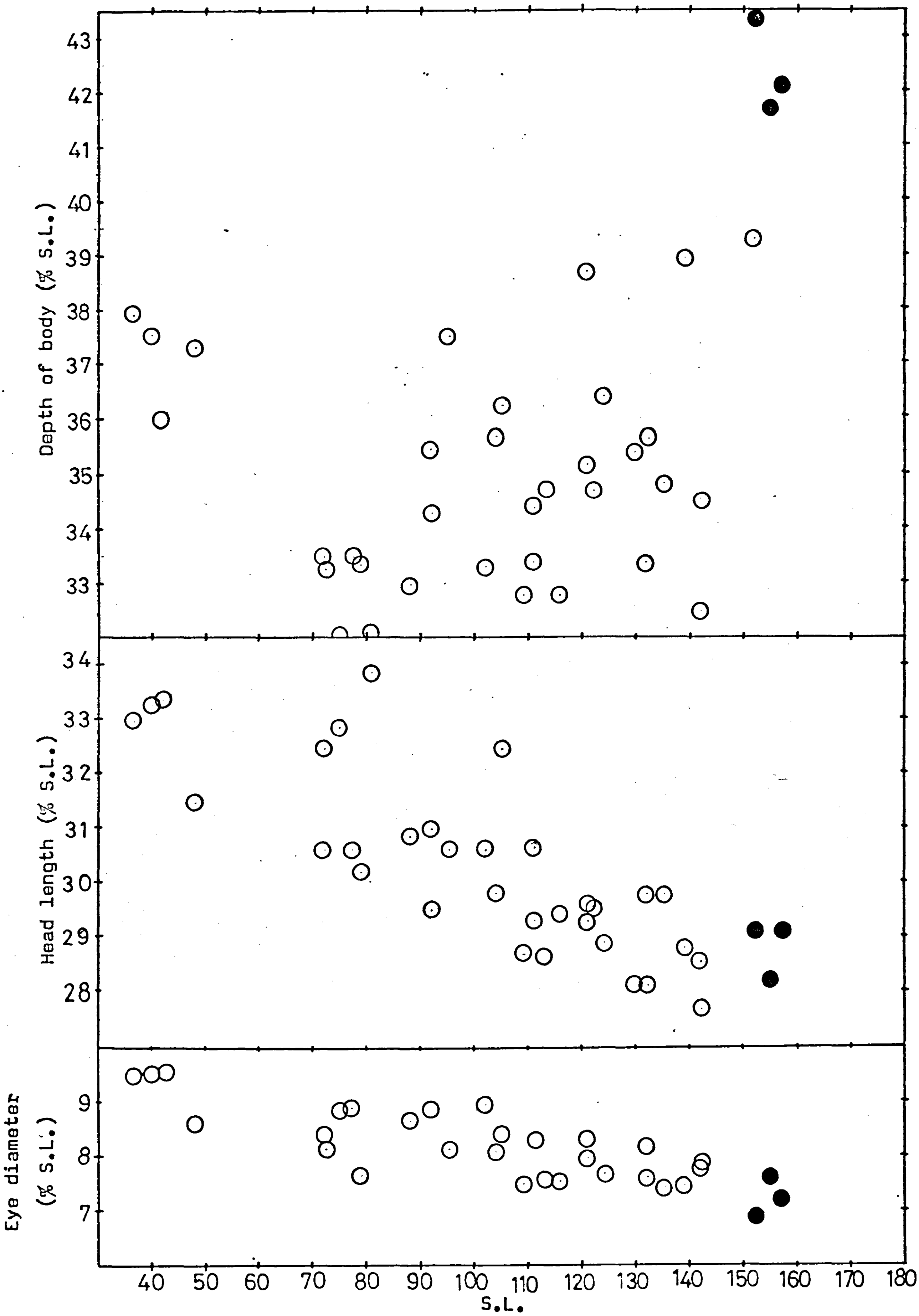


Figure 94 . Relation of depth of body, head length and eye diameter as percent of standard length to standard length (mm) for Gudusia variegata (●) and G. chapra (○).

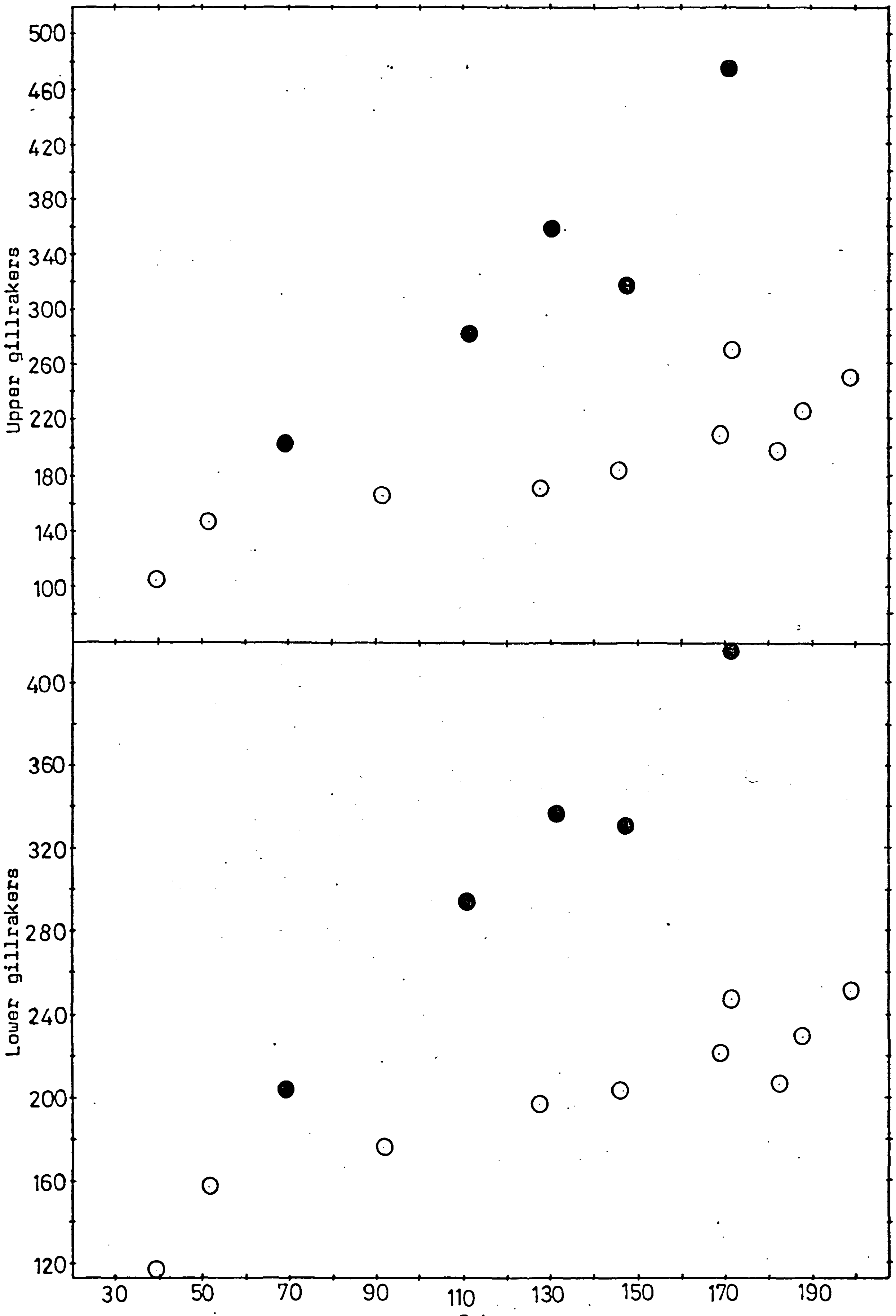


Figure 95 . Relation of number of gillrakers to standard length (mm) for <u>Clupanodon thrissa</u> (●) and <u>Konosirus punctatus</u> (○).

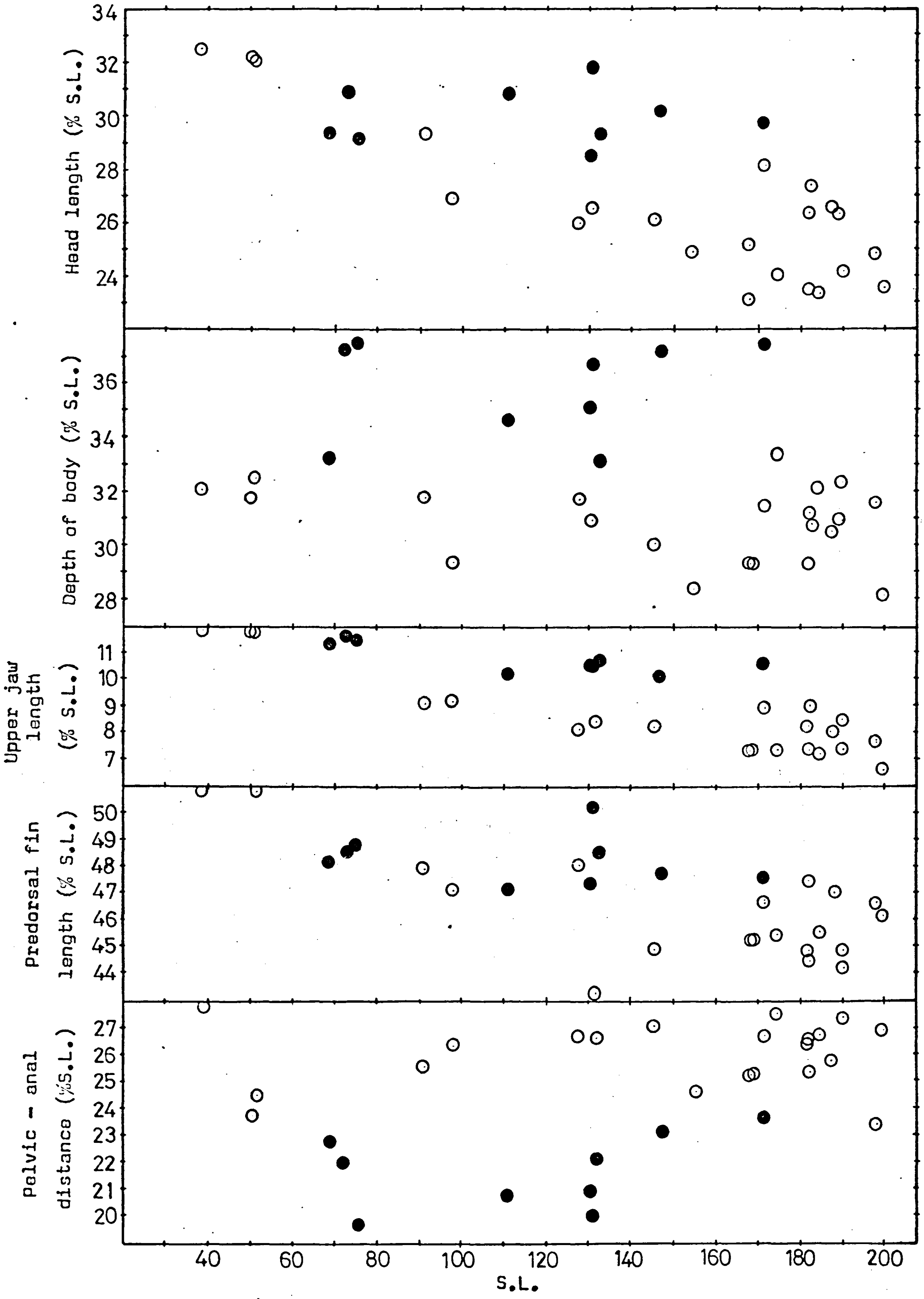


Figure 96 . Relation of head length, depth of body, upper jaw length, predorsal fin length and pelvic - anal distance as percent of standard length to standard length (mm) for <u>Clupanodon thrissa</u> (●) and <u>Konosirus punctatus</u> (O).

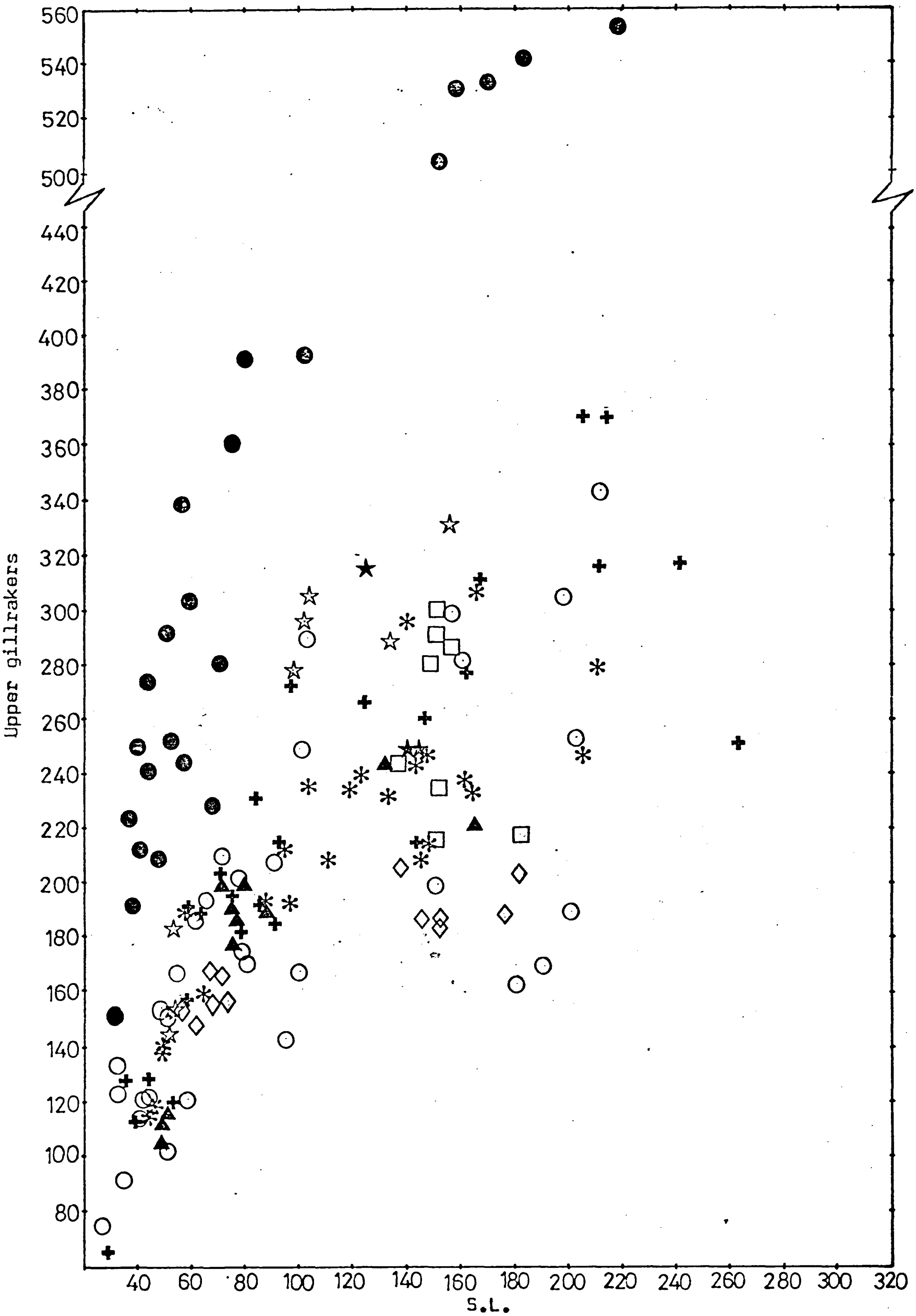


Figure 97 . Relation of number of upper gillrakers to standard length (mm) for Nematalosa erebi (✚), N. chanpole (★), N. come (▲), N. arabica (☆), N. nasus (✱), N. japonica (◇), N. vlaminghi (□), N. papuensis (○) and N. flyensis (●).

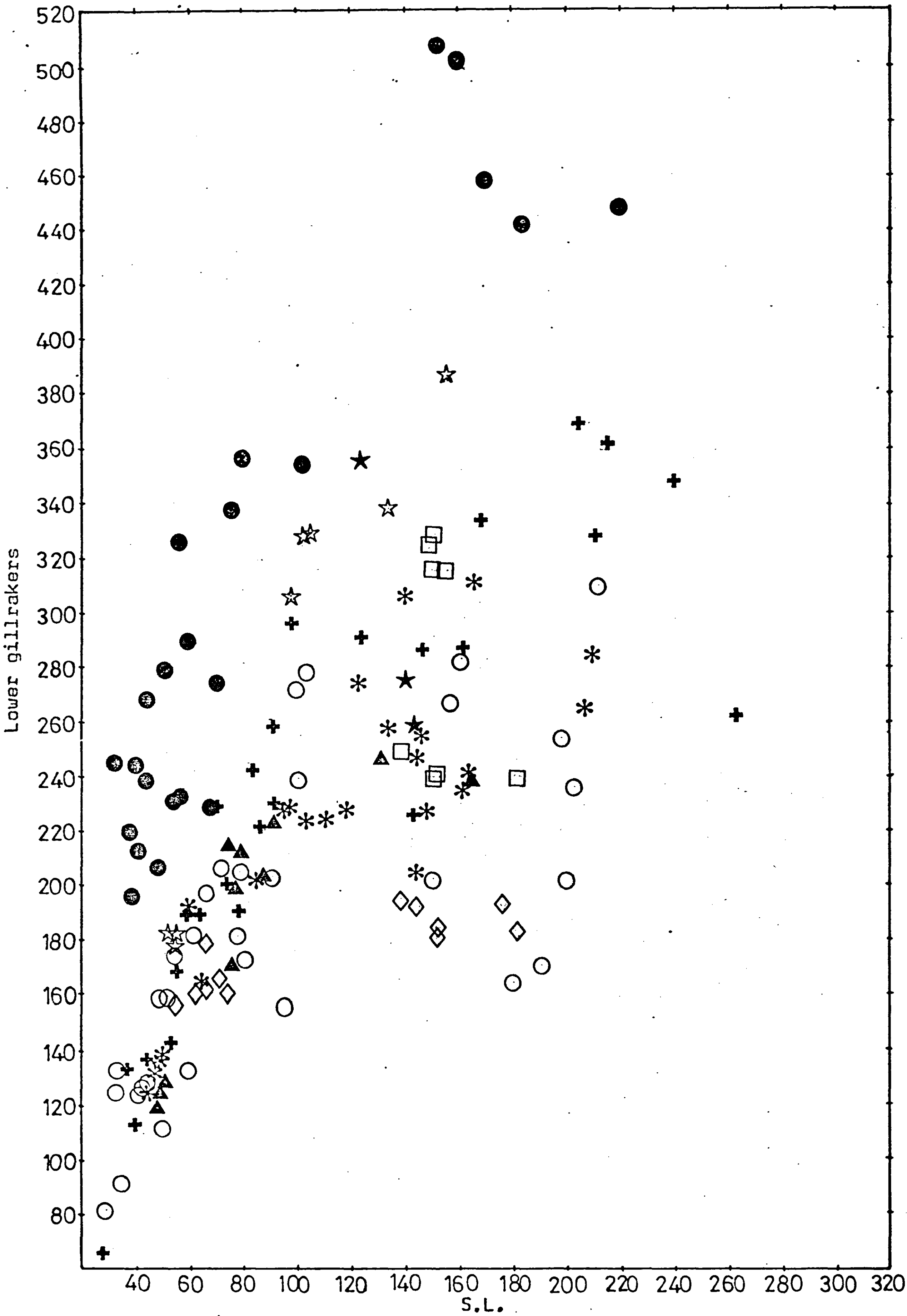


Figure 98. Relation of number of lower gillrakers to standard length (mm) for Nematalosa erebi (✚), N. chanpole (★), N. come (▲), N. arabica (☆), N. nasus (✳), N. japonica (◇), N. vlaminghi (□), N. papuensis (○) and N. flyensis (●).

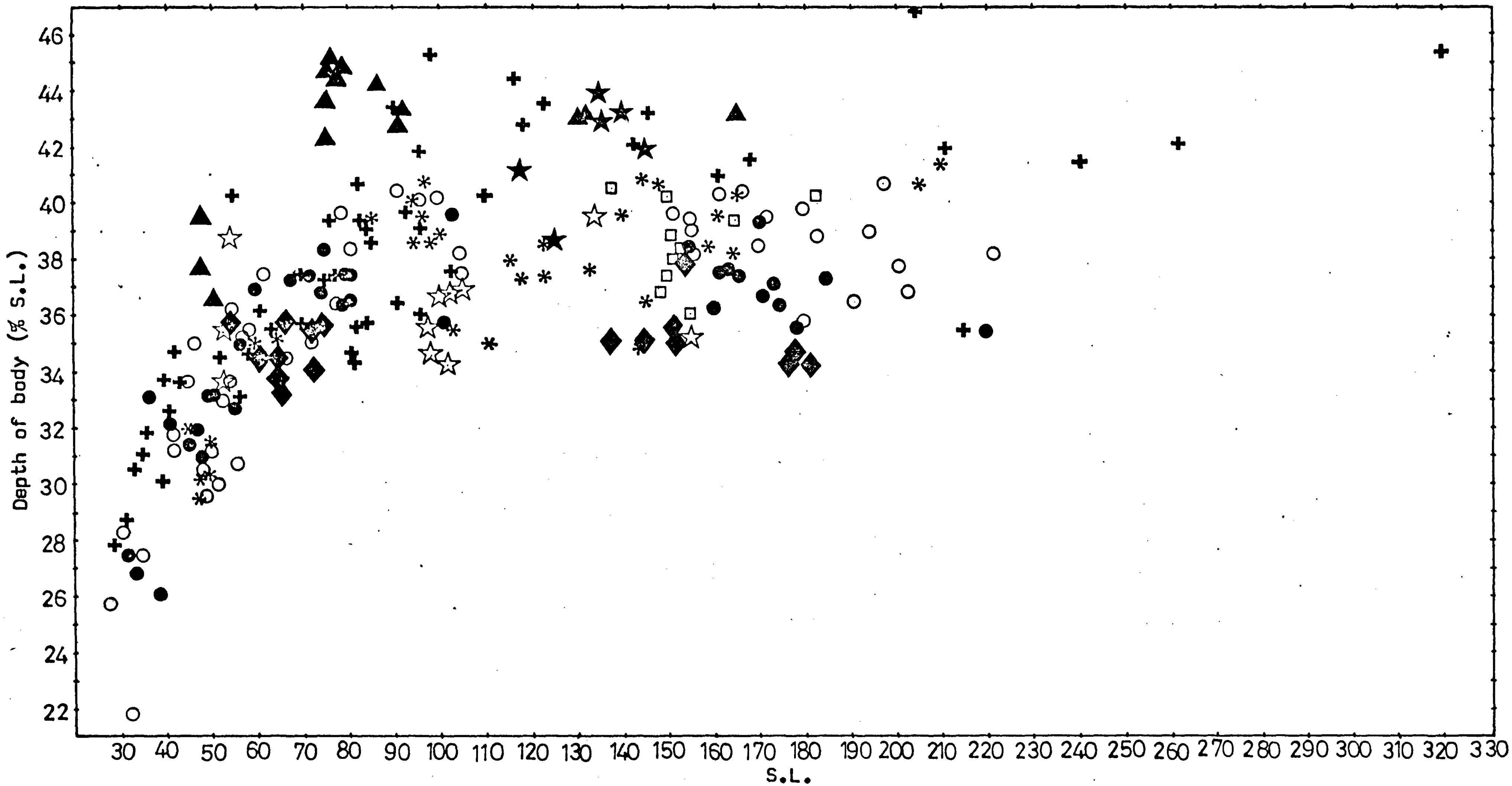


Figure 99 . Relation of depth of body as percent of standard length to standard length (mm) for Nematalosa erebi (✚), N. chanpole (★), N. come (▲), N. arabica (☆), N. nasus (✱), N. japonica (◆), N. vlaminghi (□), N. papuensis (○) and N. flyensis (●).

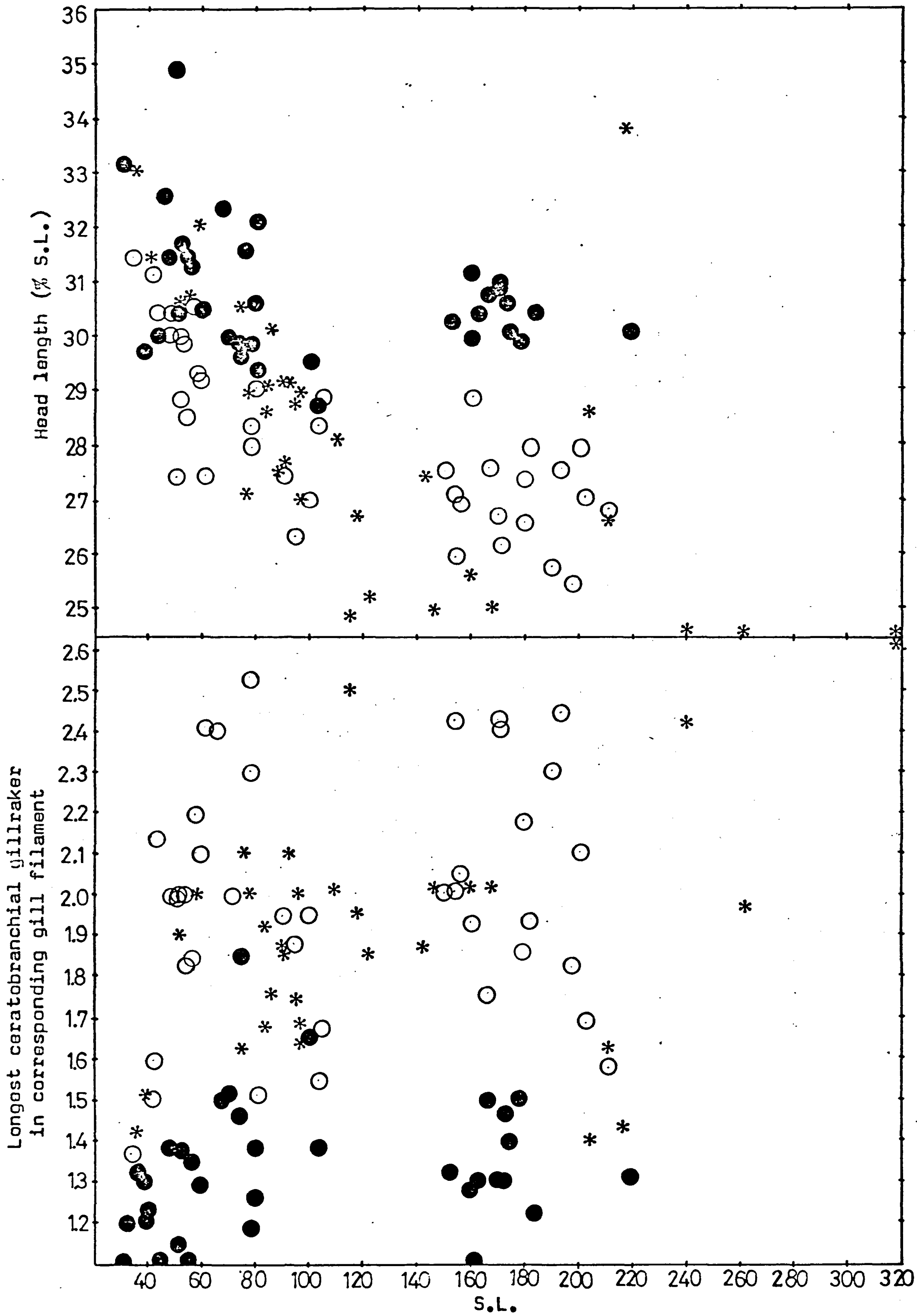


Figure 100. Relation of head length as percent of standard length and longest ceratobranchial gillraker in corresponding gill filament to standard length (mm) for *Nematalosa erebi* (*), *N. papuensis* (○) and *N. flyensis* (●).

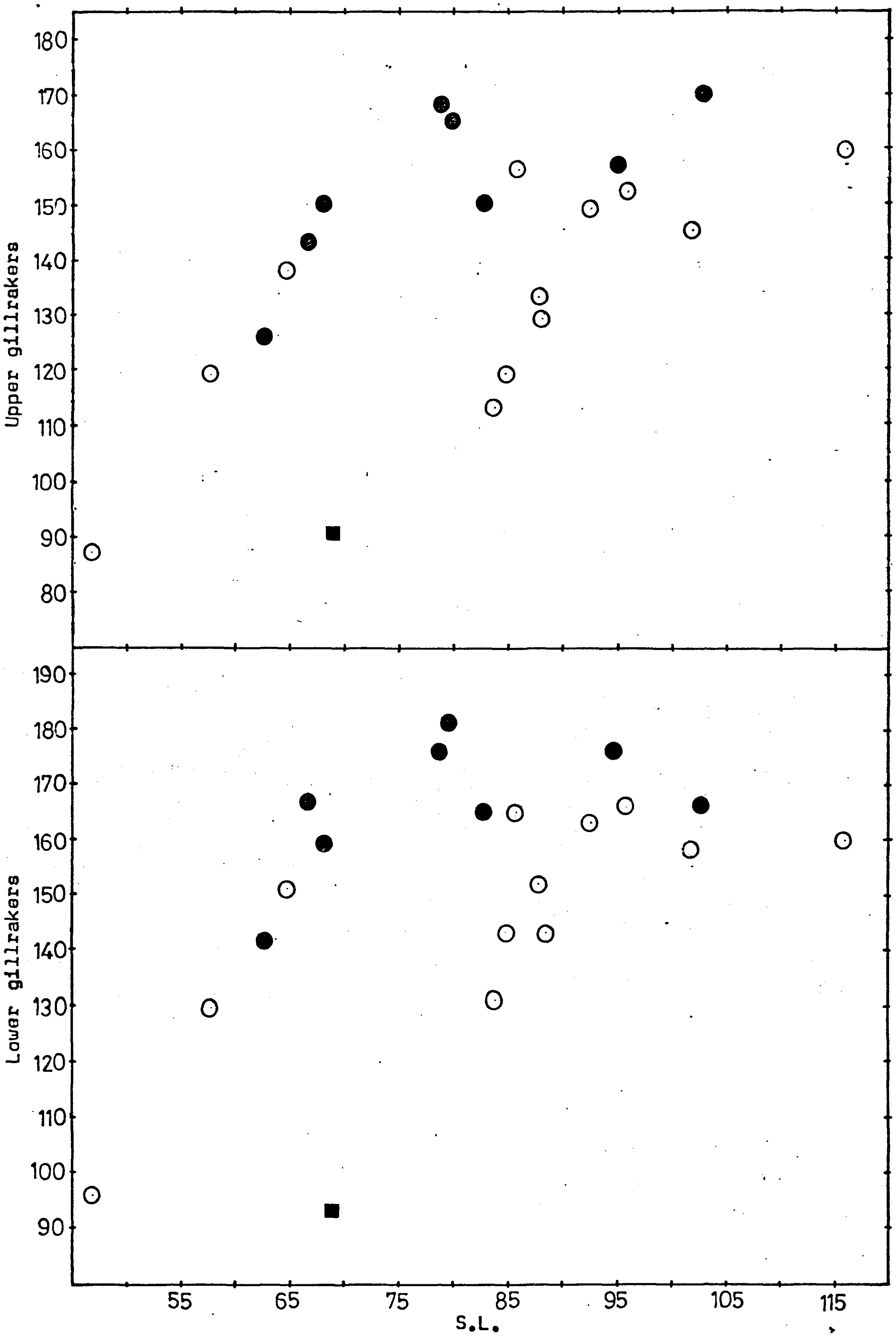


Figure 101 .Relation of number of gillrakers to standard length (mm) for <u>Gonialosa</u> <u>modesta</u> (●), <u>G. whiteheadi</u> (■) and <u>G. manmina</u> (○).

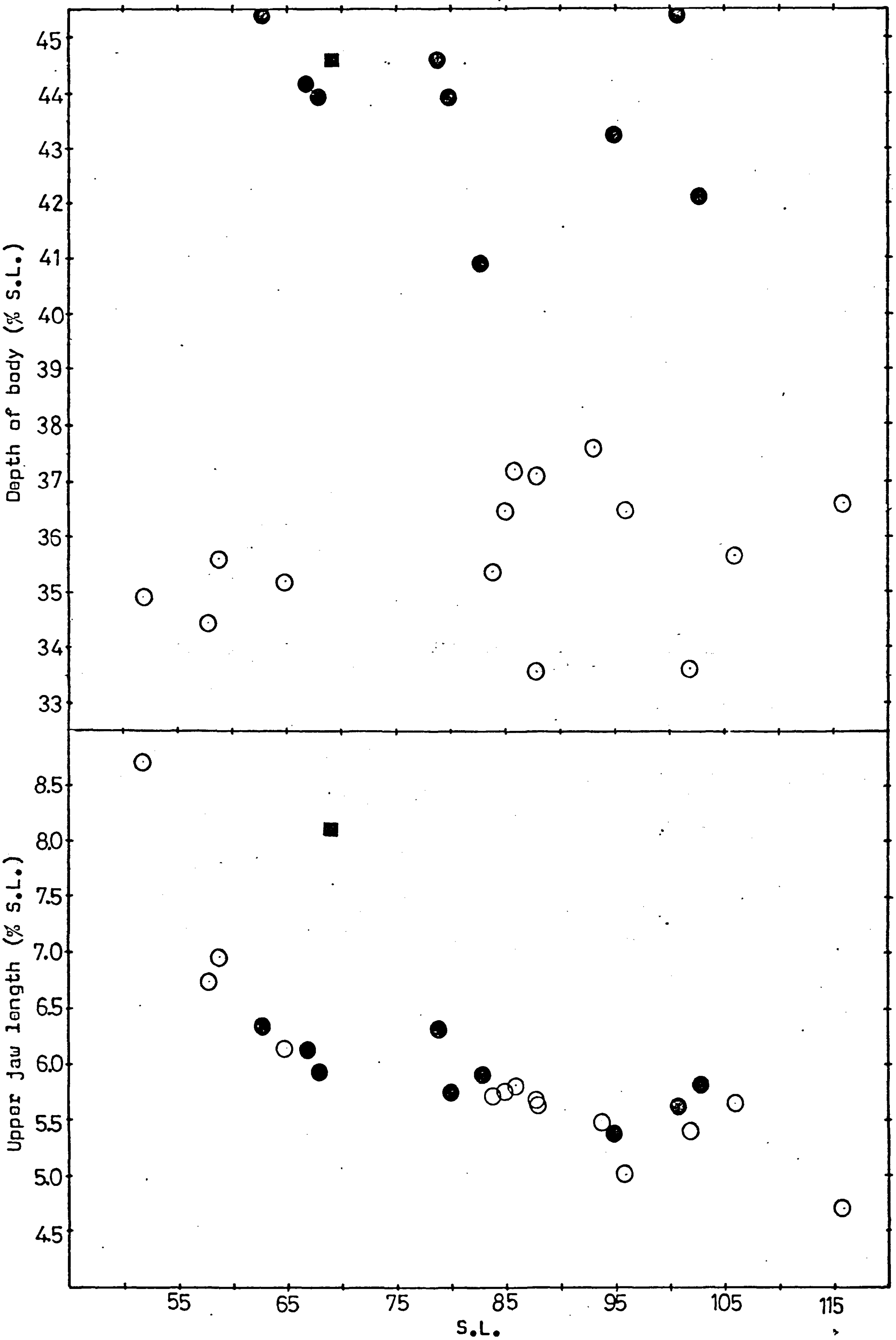


Figure 102. Relation of depth of body and upper jaw length as percent of standard length to standard length (mm) for Gonialosa modesta (●), G. whiteheadi (■) and G. manmina (○).

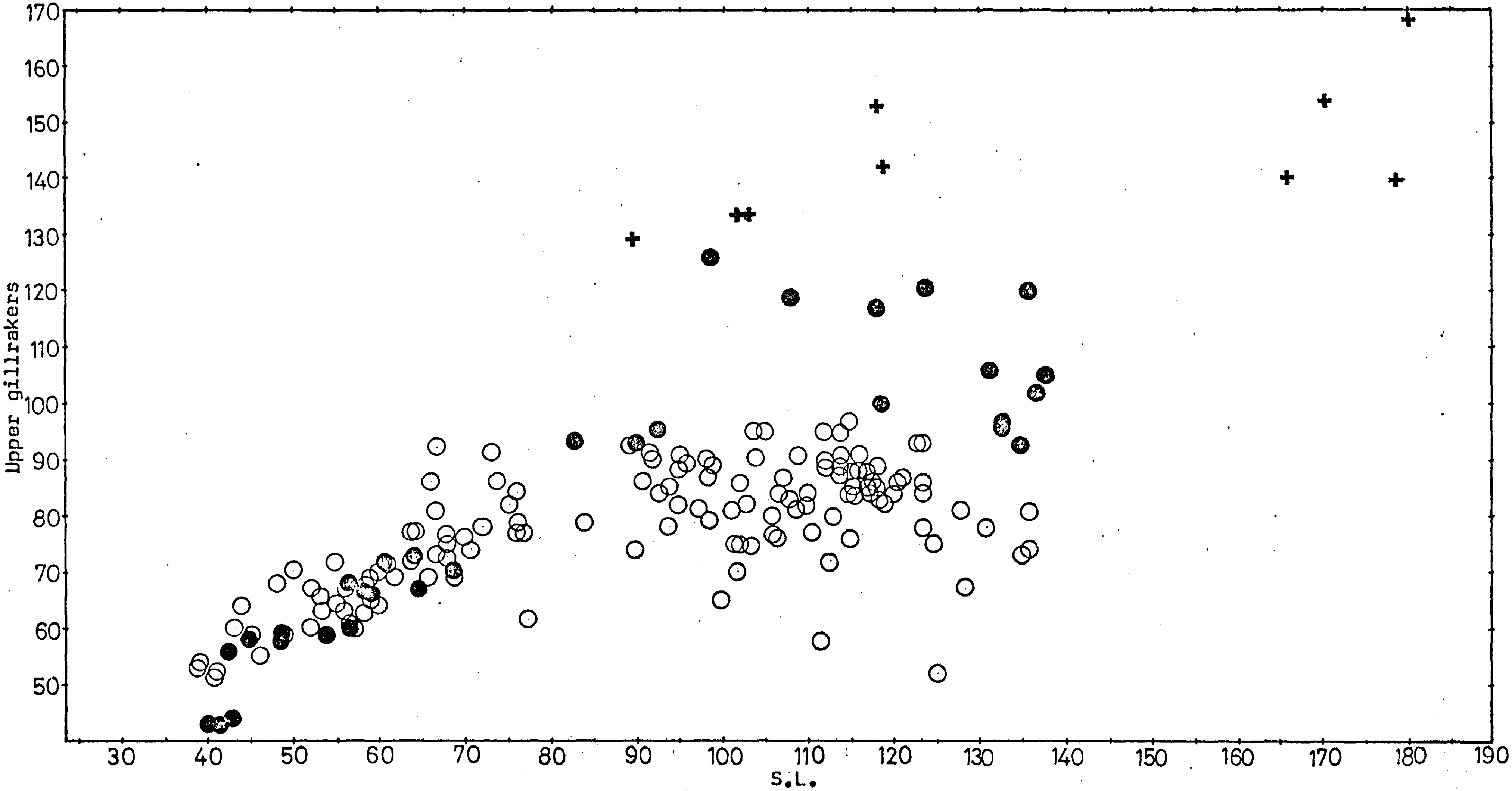


Figure 103. Relation of number of upper gillrakers to standard length (mm) for Anodontostoma selangkat (+), A. thailandiae (●) and A. chacunda (○).

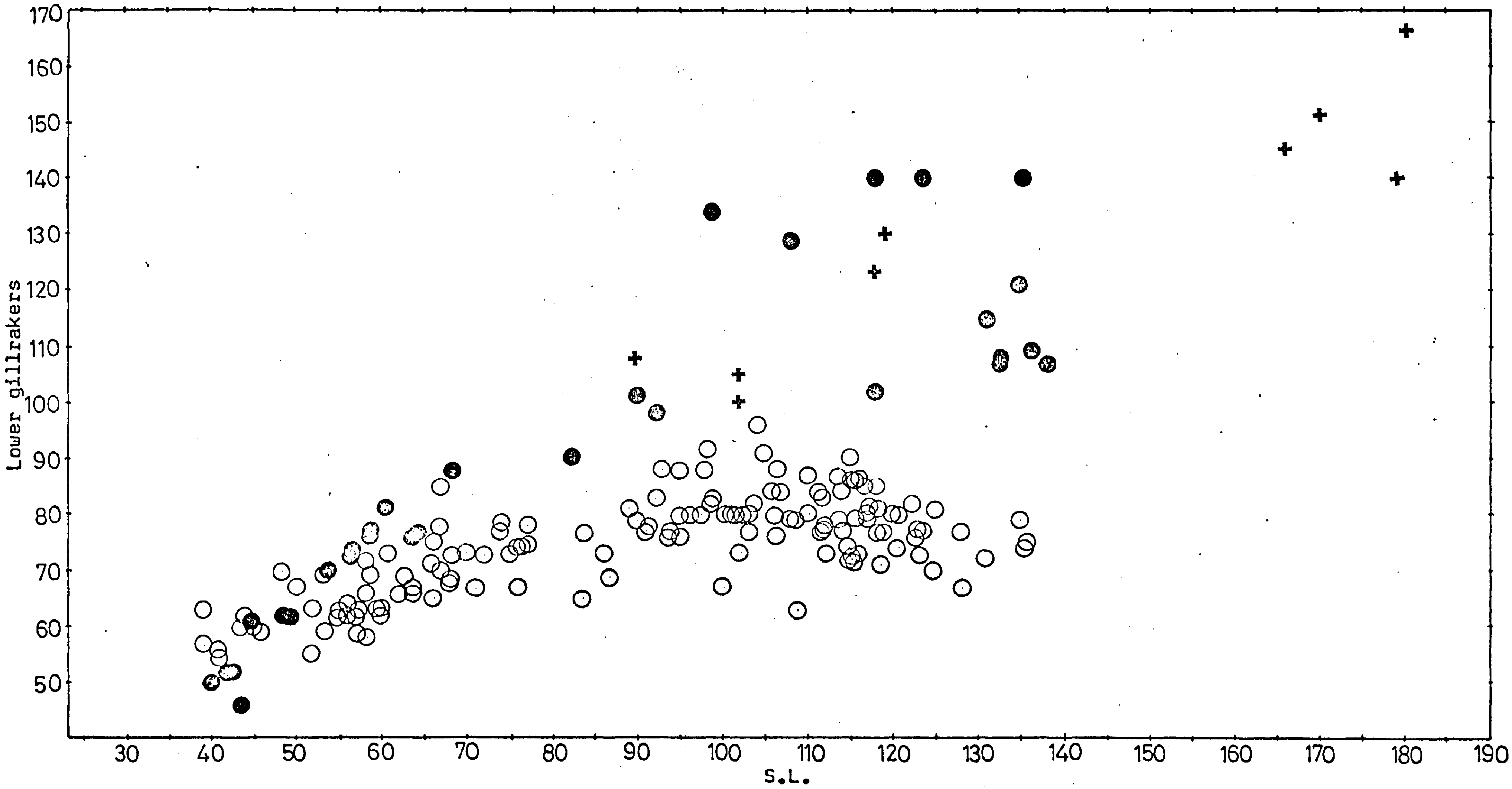


Figure 104. Relation of number of lower gillrakers to standard length (mm) for Anodontostoma selangkat (✚), A. thailandiae (●) and A. chacunda (○).

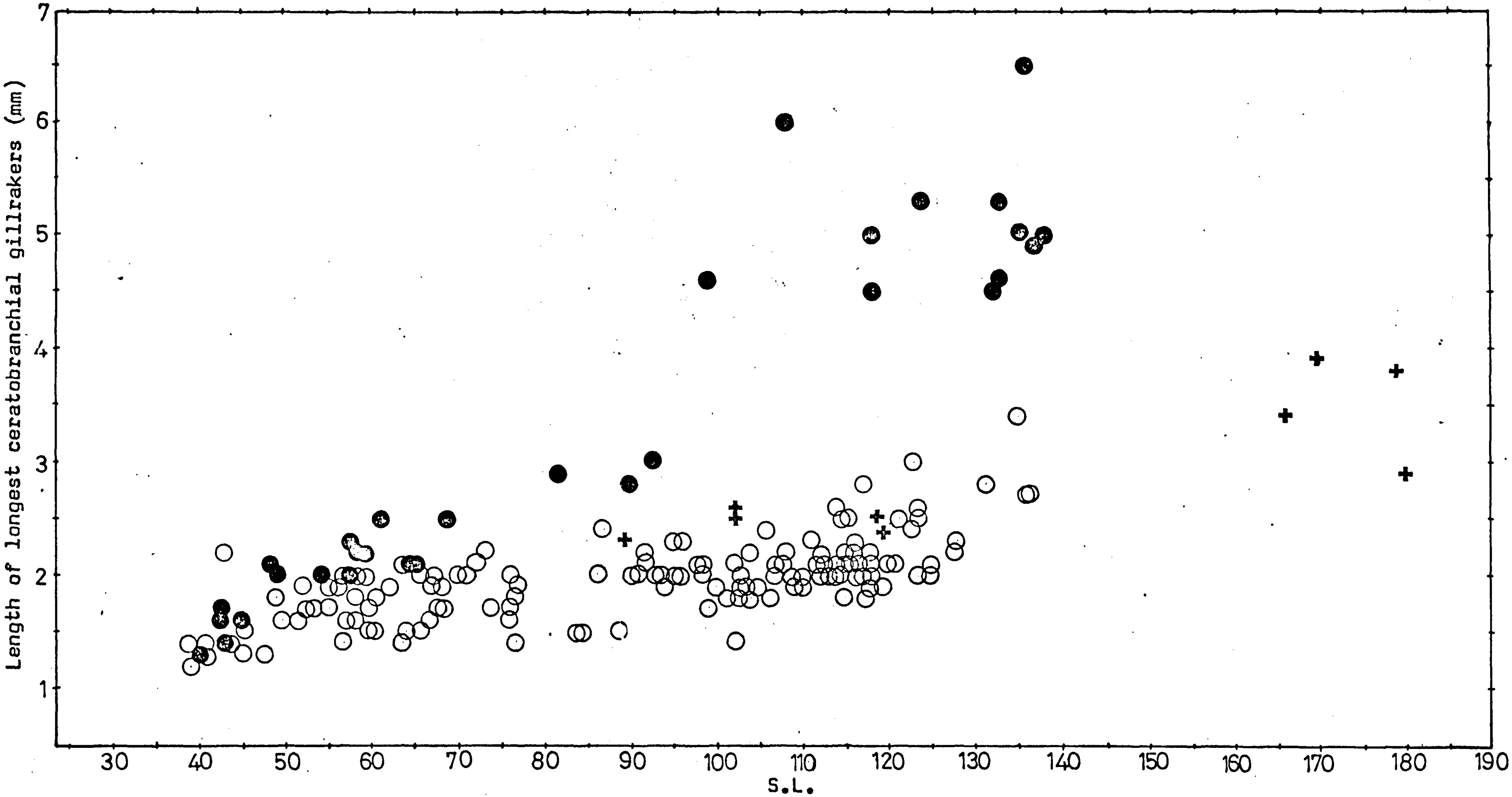


Figure 105. Relation of length of longest ceratobranchial gillrakers (mm) to standard length (mm) for Anodontostoma selangkat (✚), A. thailandiae (●) and A. chacunda (○).

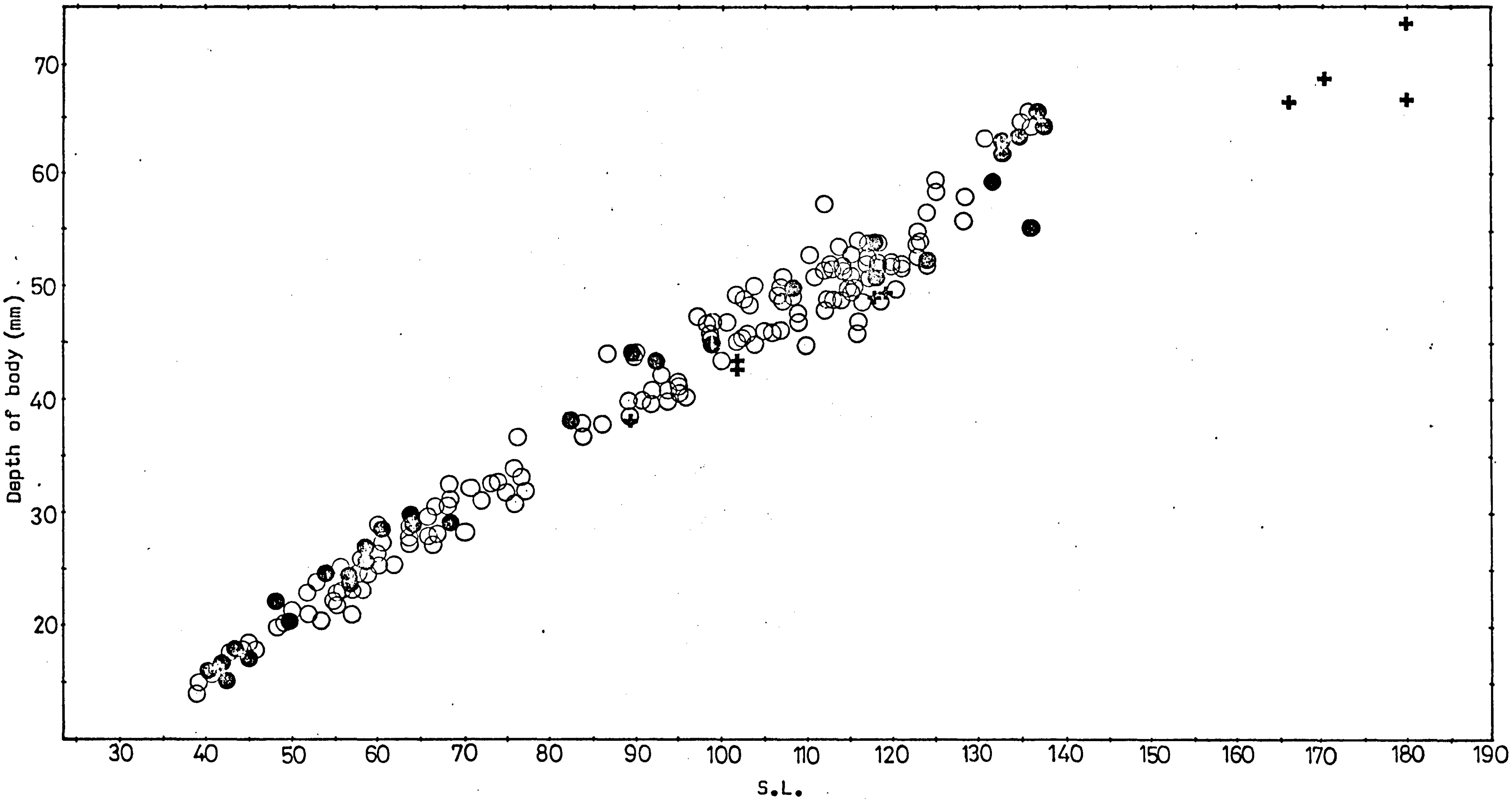


Figure 106. Relation of depth of body (mm) to standard length (mm) for *Anodontostoma selangkat* (✚), *A. thailandiae* (●) and *A. chacunda* (○).

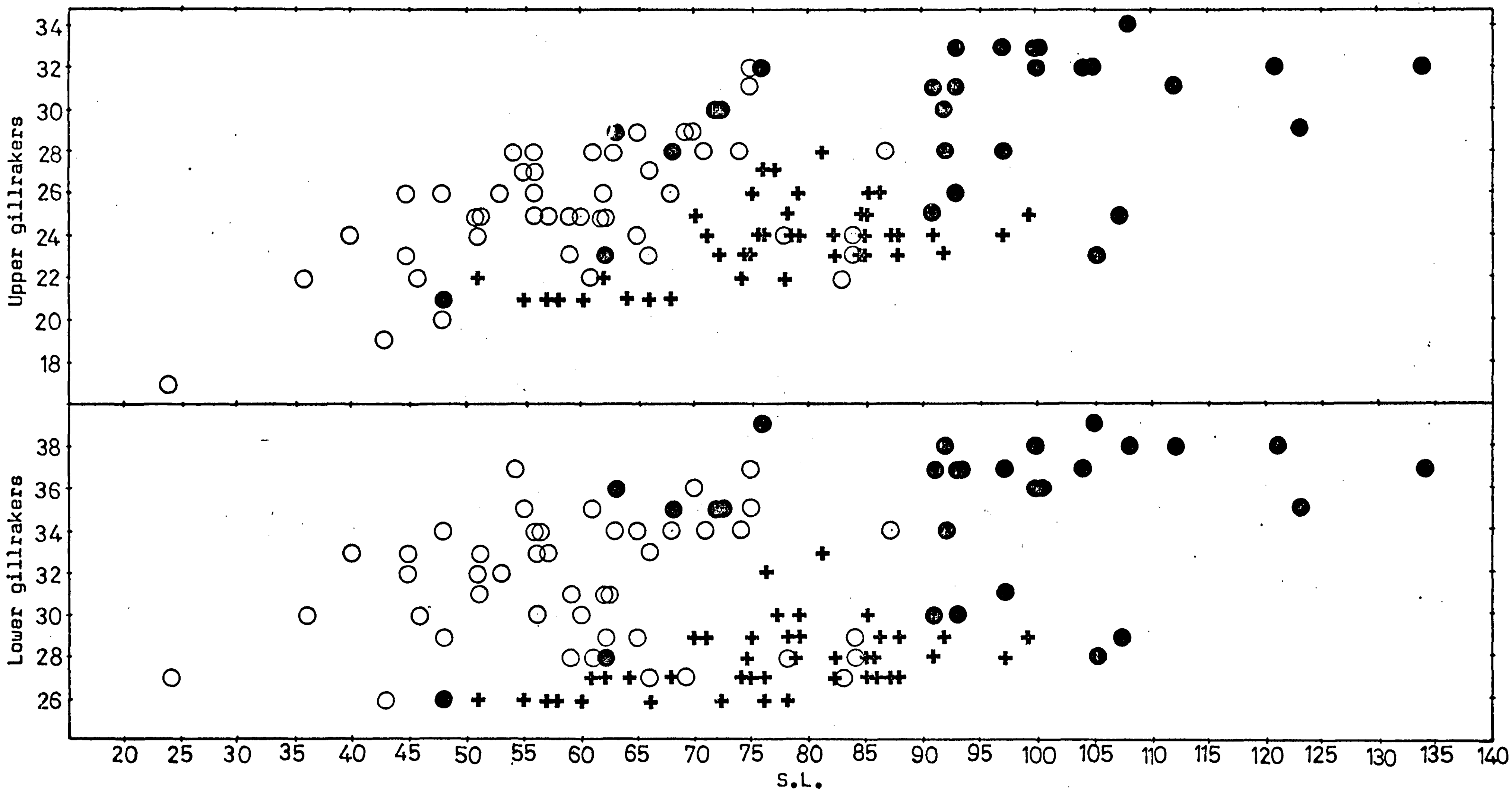


Figure 107 . Relation of number of gillrakers to standard length (mm) for Englaulis japonicus (● = cold water areas: South Africa, Australia, Tasmania, China and Japan; ○ = subtropical area: Hongkong; and + = tropical areas).

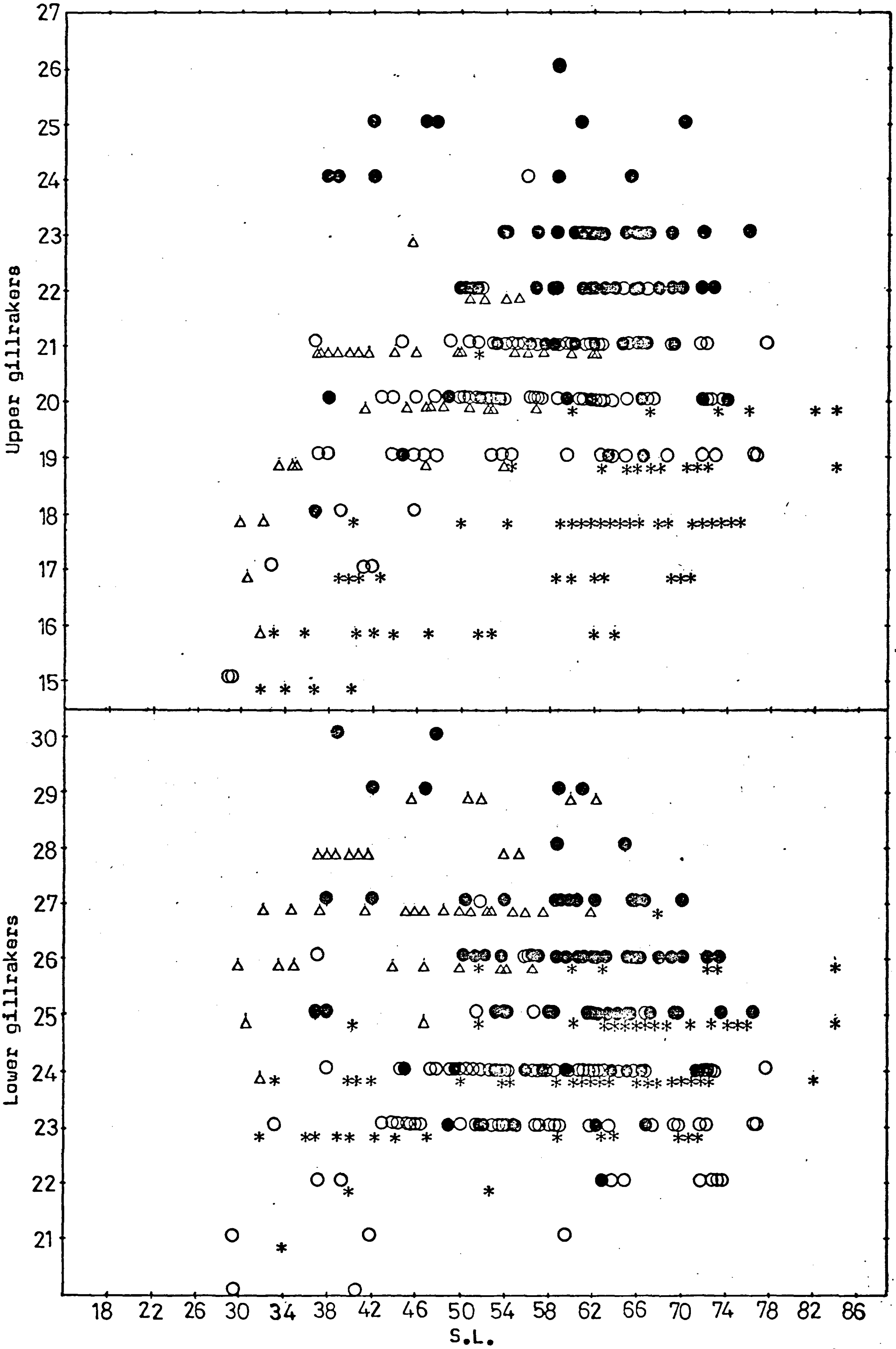


Figure 108. Relation of number of gillrakers to standard length (mm) for Stolephorus purpureus (△), S. buccaneeri (*), S. heterolobus (●) and S. devisi (○).

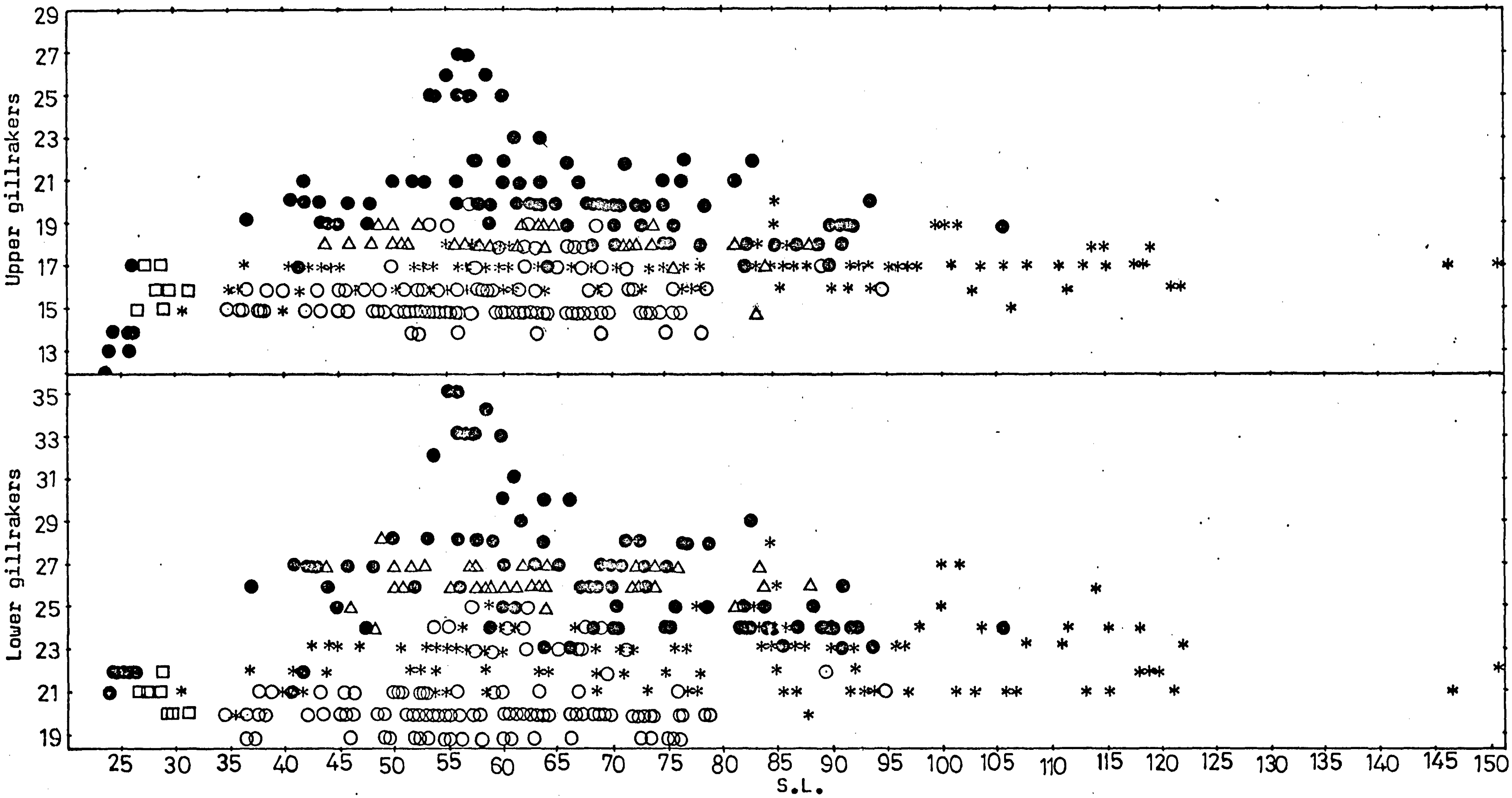


Figure 109. Relation of number of gillrakers to standard length (mm) for Stolephorus indicus (*), S. commersonii (●), S. waitei (○), S. brachycephalus (□) and S. chinensis (△).

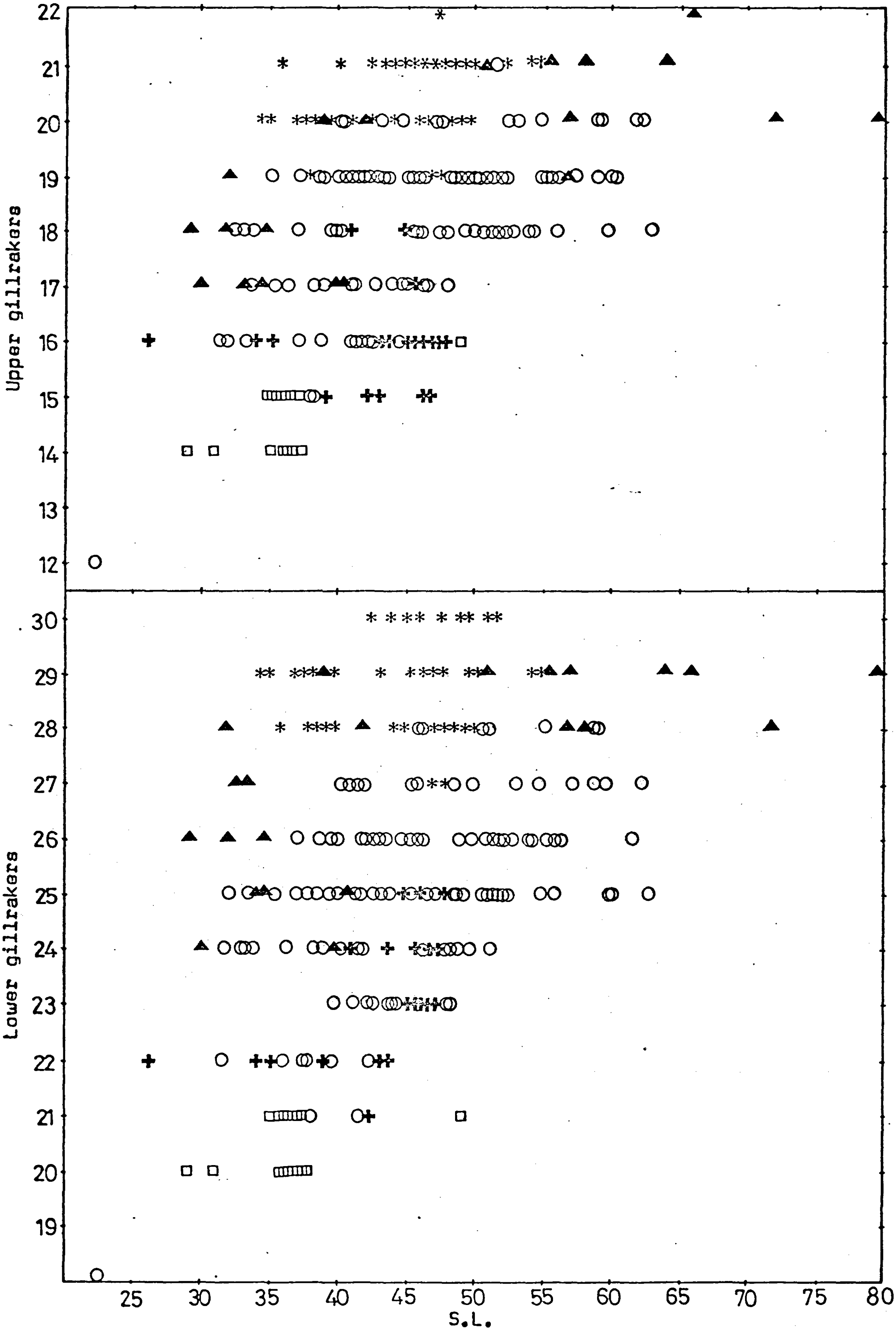


Figure 110. Relation of number of gillrakers to standard length (mm) for Stolephorus tysoni (+), S. holodon (▲), S. andhraensis (□), S. ronquilloi (*) and S. insularis (○).

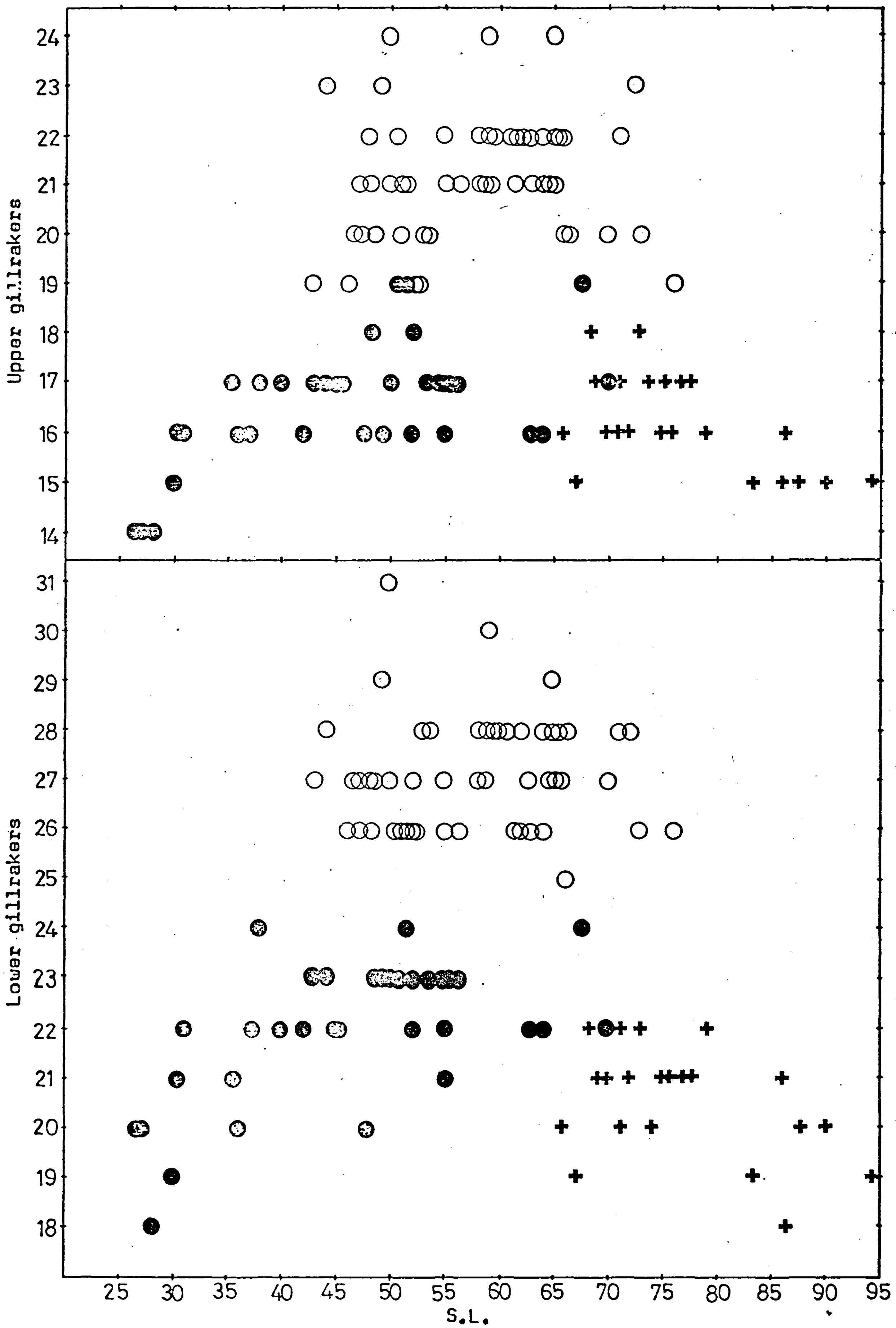


Figure 111. Relation of number of gillrakers to standard length (mm) for <u>Stolephorus dubiosus</u> (○), <u>S. baganensis</u> (●) and <u>S. tri</u> (+).

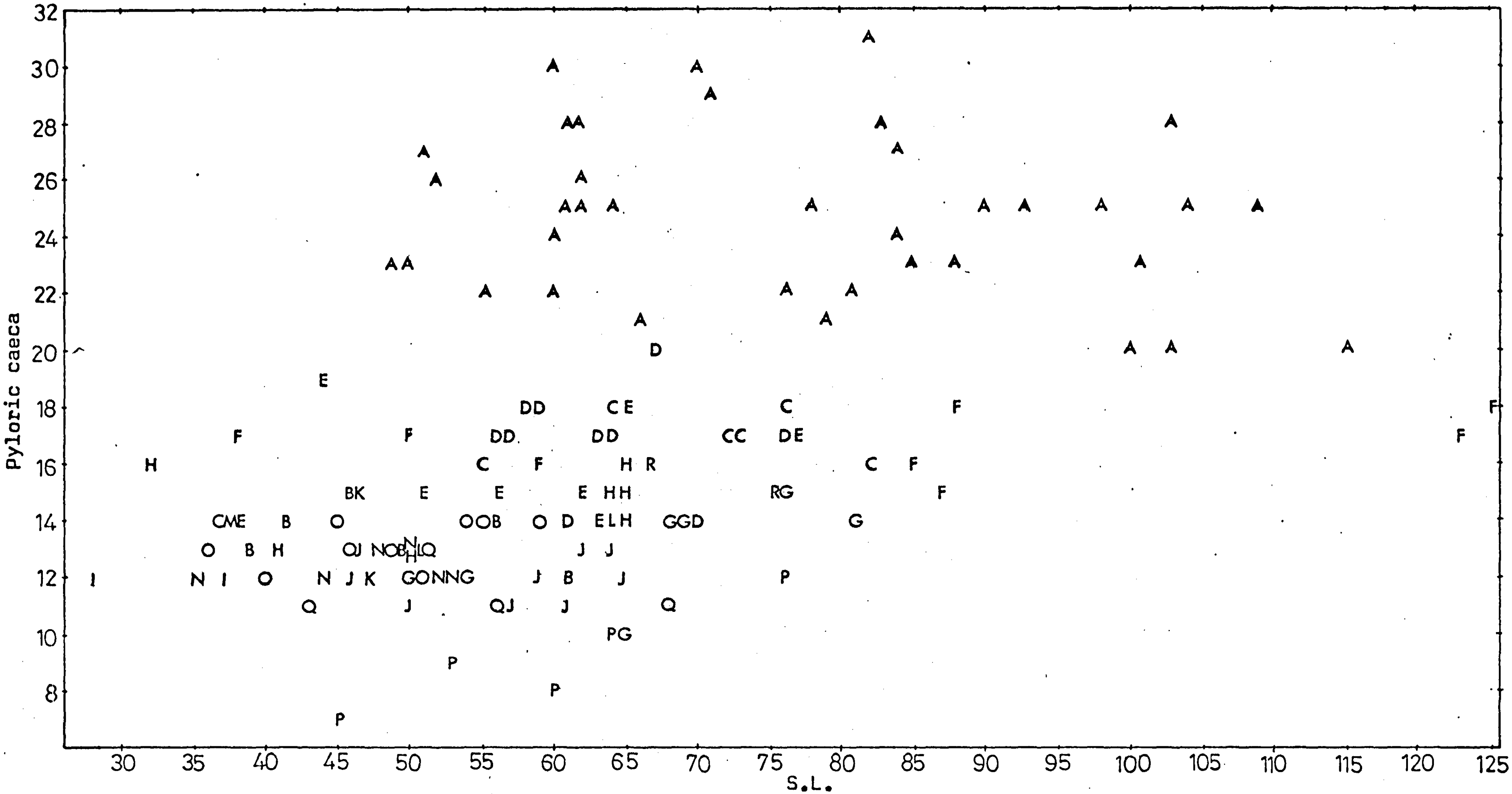


Figure 112. Relation of number of pyloric caeca to standard length (mm) for <u>Engraulis japonicus</u> (A), <u>Stolephorus purpureus</u> (B), <u>S. buccaneeri</u> (C), <u>S. heterolobus</u> (D), <u>S. devisi</u> (E), <u>S. indicus</u> (F), <u>S. commersonii</u> (G), <u>S. waitei</u> (H), <u>S. brachycephalus</u> (I), <u>S. chinensis</u> (J), <u>S. tysoni</u> (K), <u>S. holodon</u> (L), <u>S. andhraensis</u> (M), <u>S. ronquilloi</u> (N), <u>S. insularis</u> (O), <u>S. dubiosus</u> (P), <u>S. baganensis</u> (Q) and <u>S. tri</u> (R).

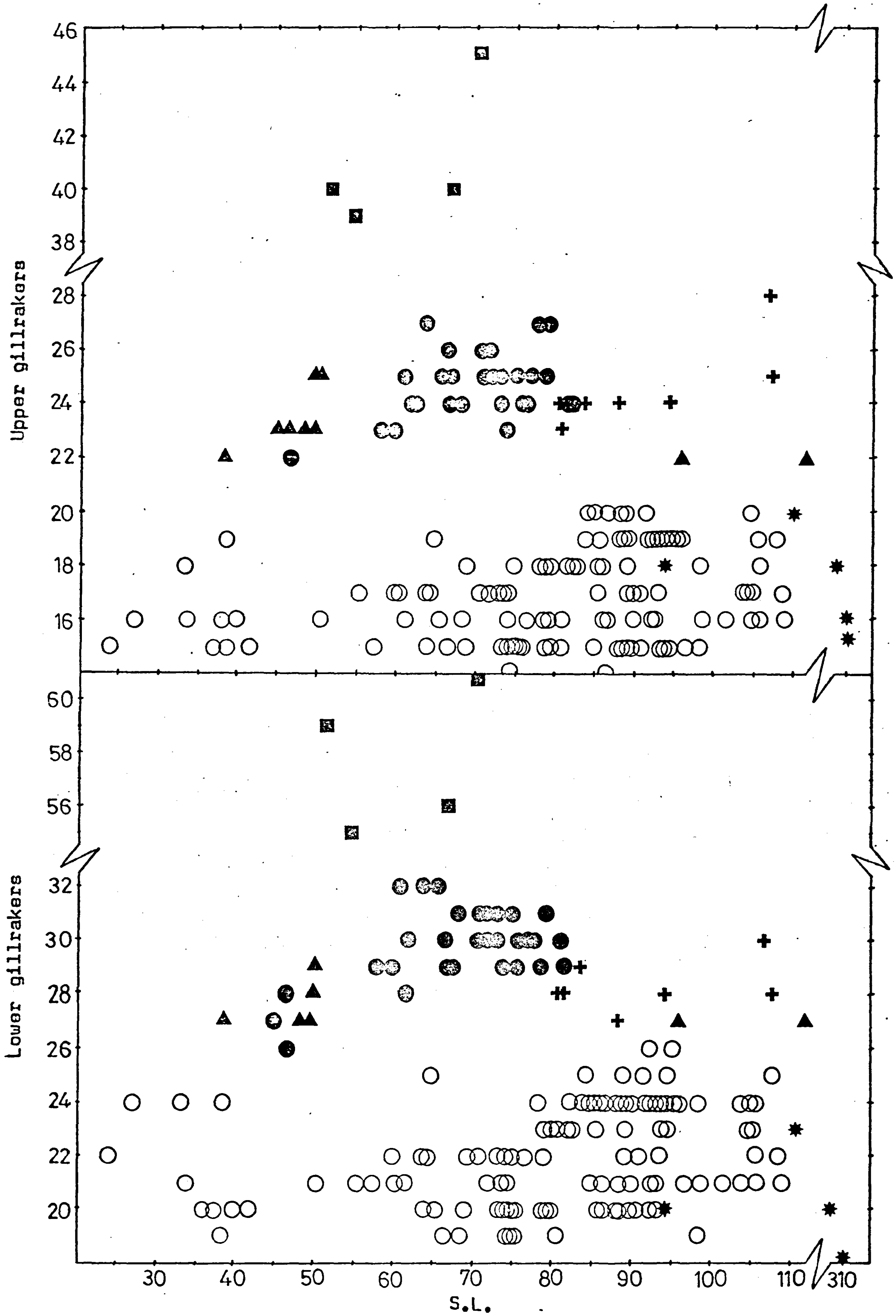


Figure 113. Relation of number of gillrakers to standard length (mm) for Thryssa (Thrissina) baelama (○), Thryssa (Scutengraulis) chefuensis (+), T. (S.) rastrosa (◻), T. (S.) aestuaria (▲), T. (S.) scratchleyi (✱) and T. (S.) kammalensis (◉).

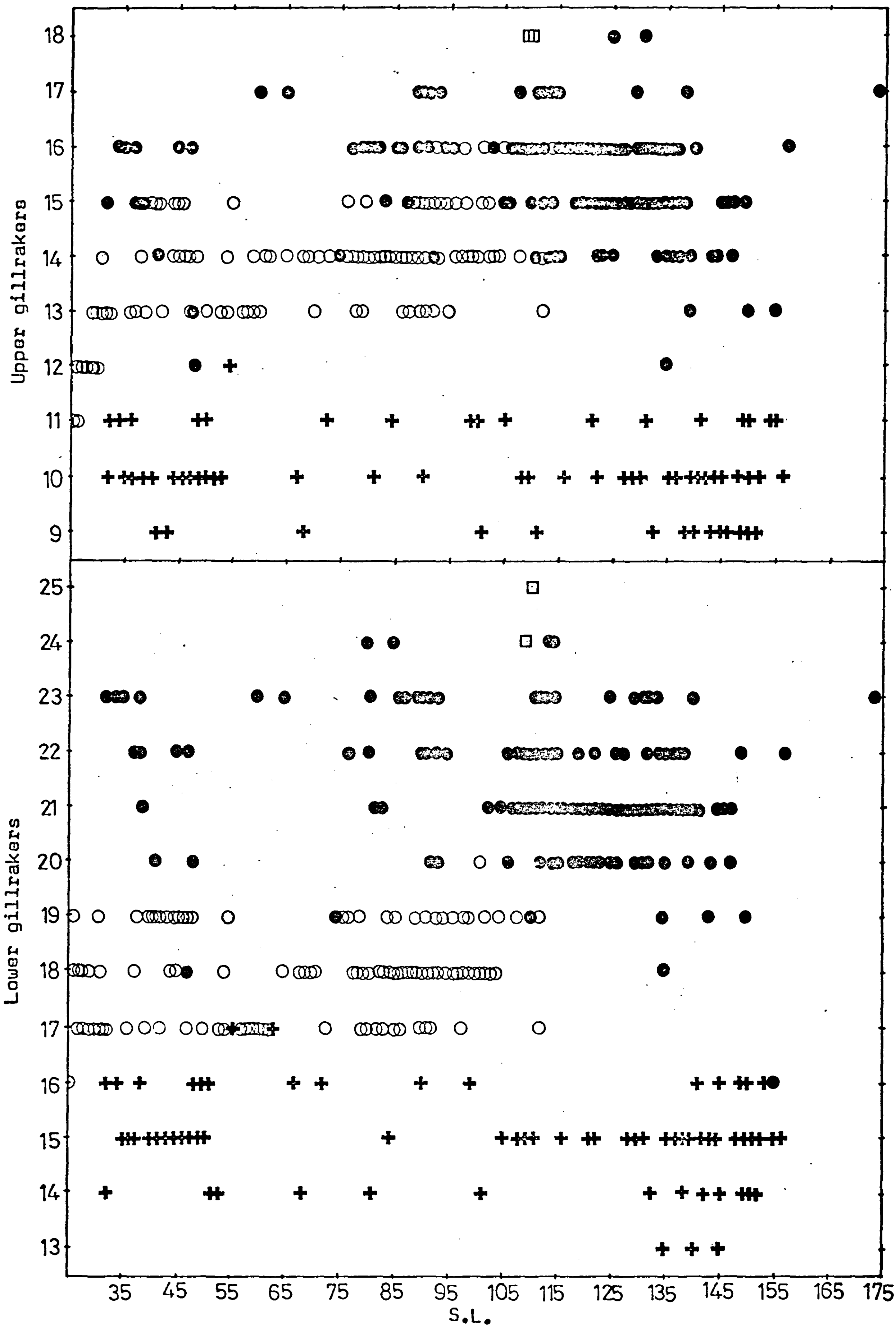


Figure 114. Relation of number of gillrakers to standard length (mm) for Thryssa (Scutengraulis) kammalensoides (□), T. (S.) dussumieri (○), T. (S.) vitrirostris (●) and T. (S.) mystax (+).

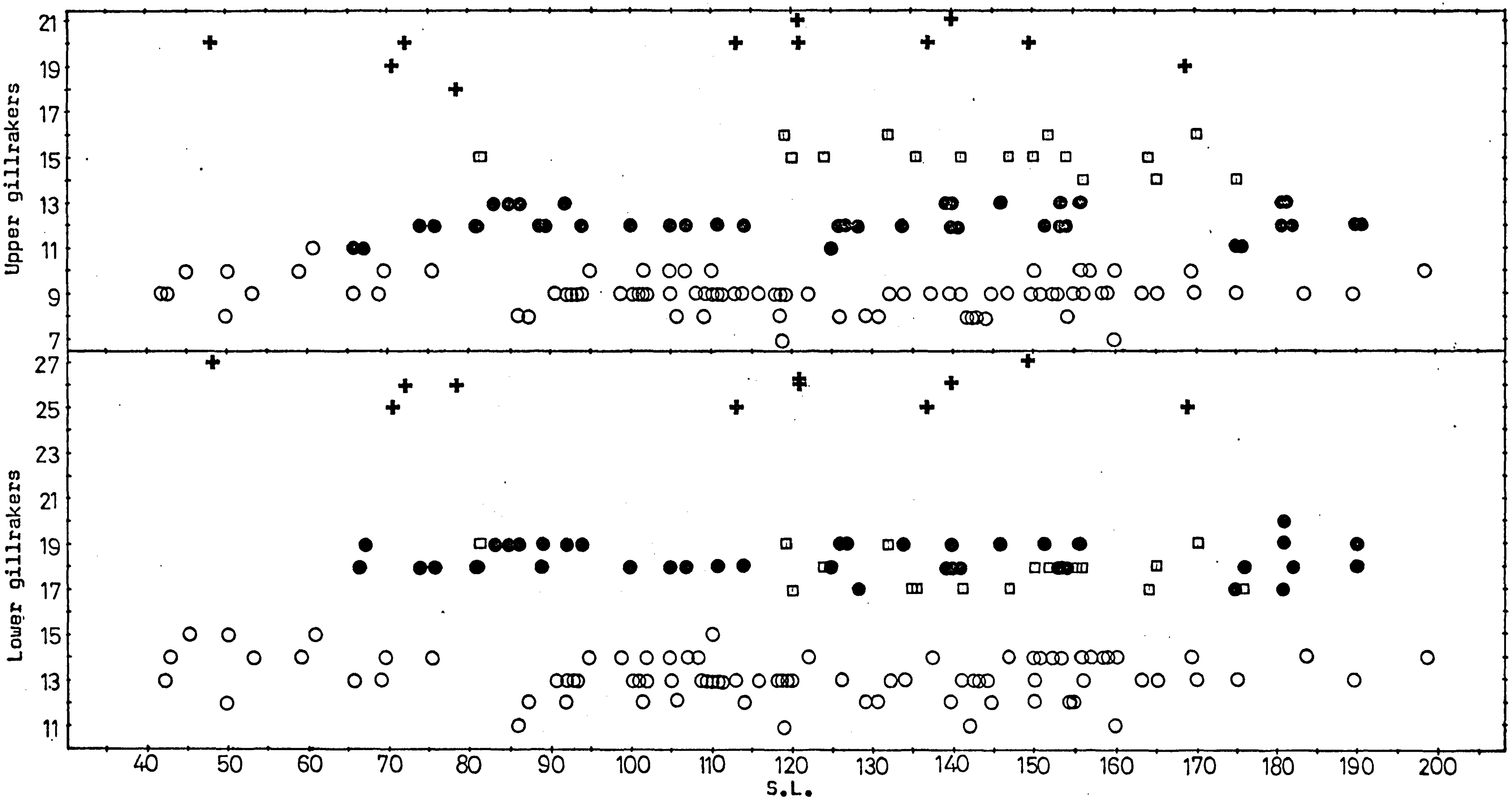


Figure 115. Relation of number of gillrakers to standard length (mm) for Thryssa (Scutengraulis) hamiltonii (○), T. (S.) gautamiensis (●), T. (S.) malabarica (□), and T. (S.) polybranchialis (+).

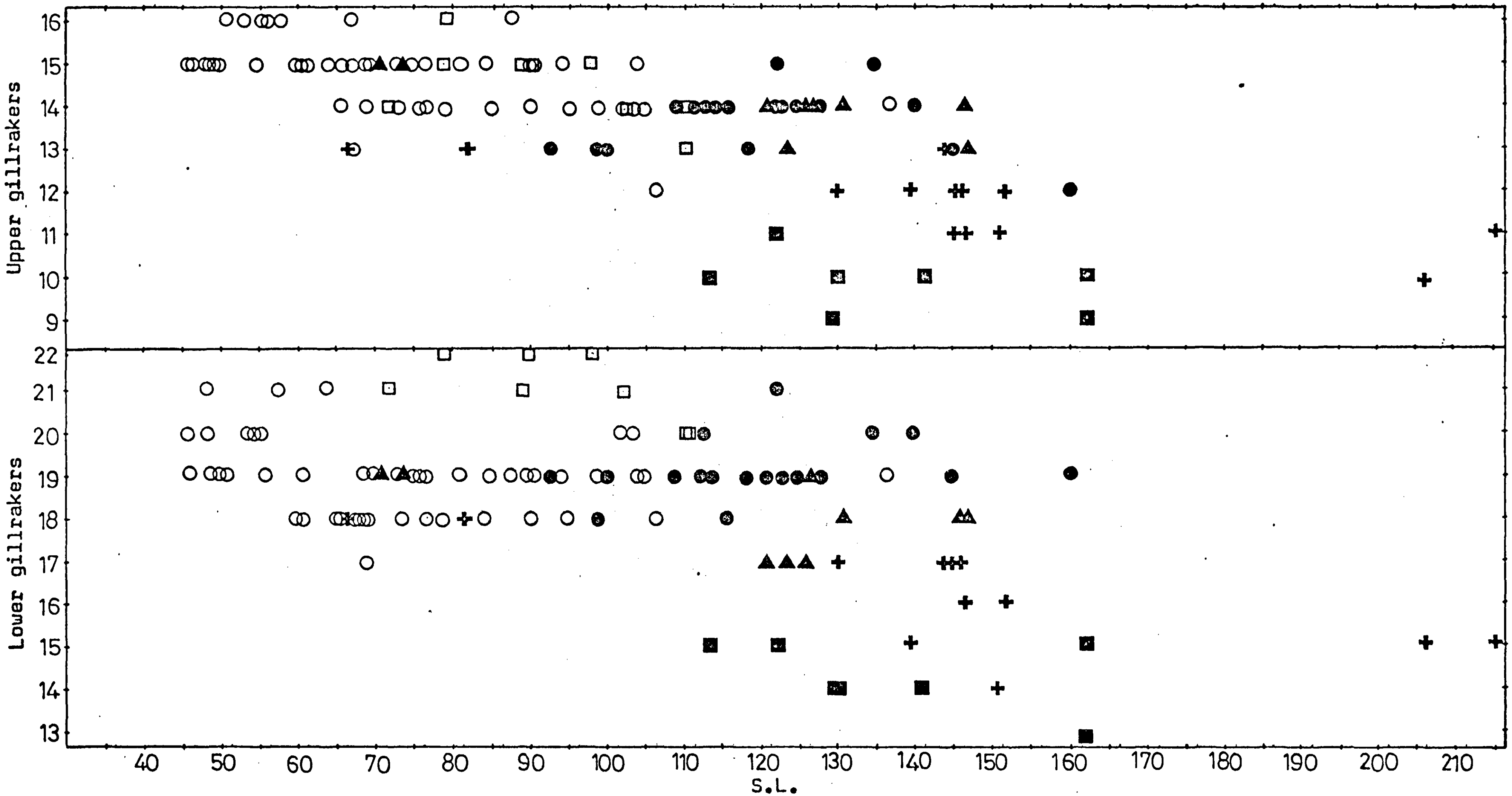


Figure 116. Relation of number of gillrakers to standard length (mm) for Thryssa (Scutengraulis) purava (○), T. (S.) adelae (□), T. (S.) spinidens (■), T. (S.) whiteheadi (●), T. (S.) stenosoma (▲) and T. (S.) dayi (+).

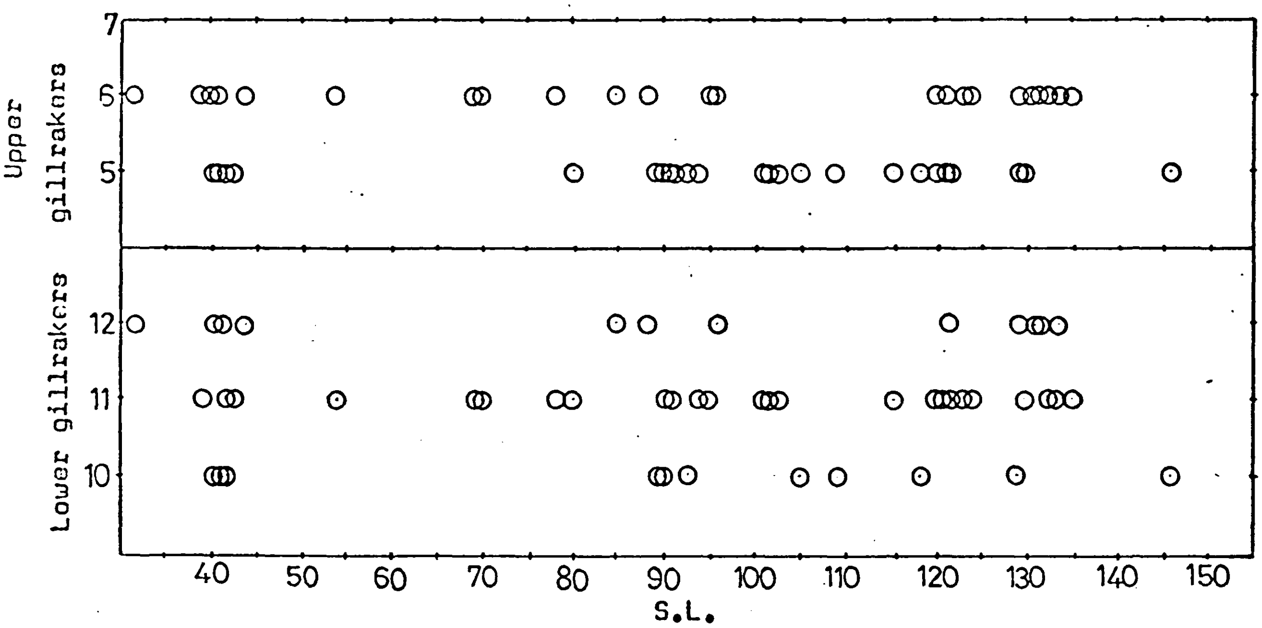


Figure 117. Relation of number of gillrakers to standard length (mm) for Thryssa (Thryssa) setirostris (O).

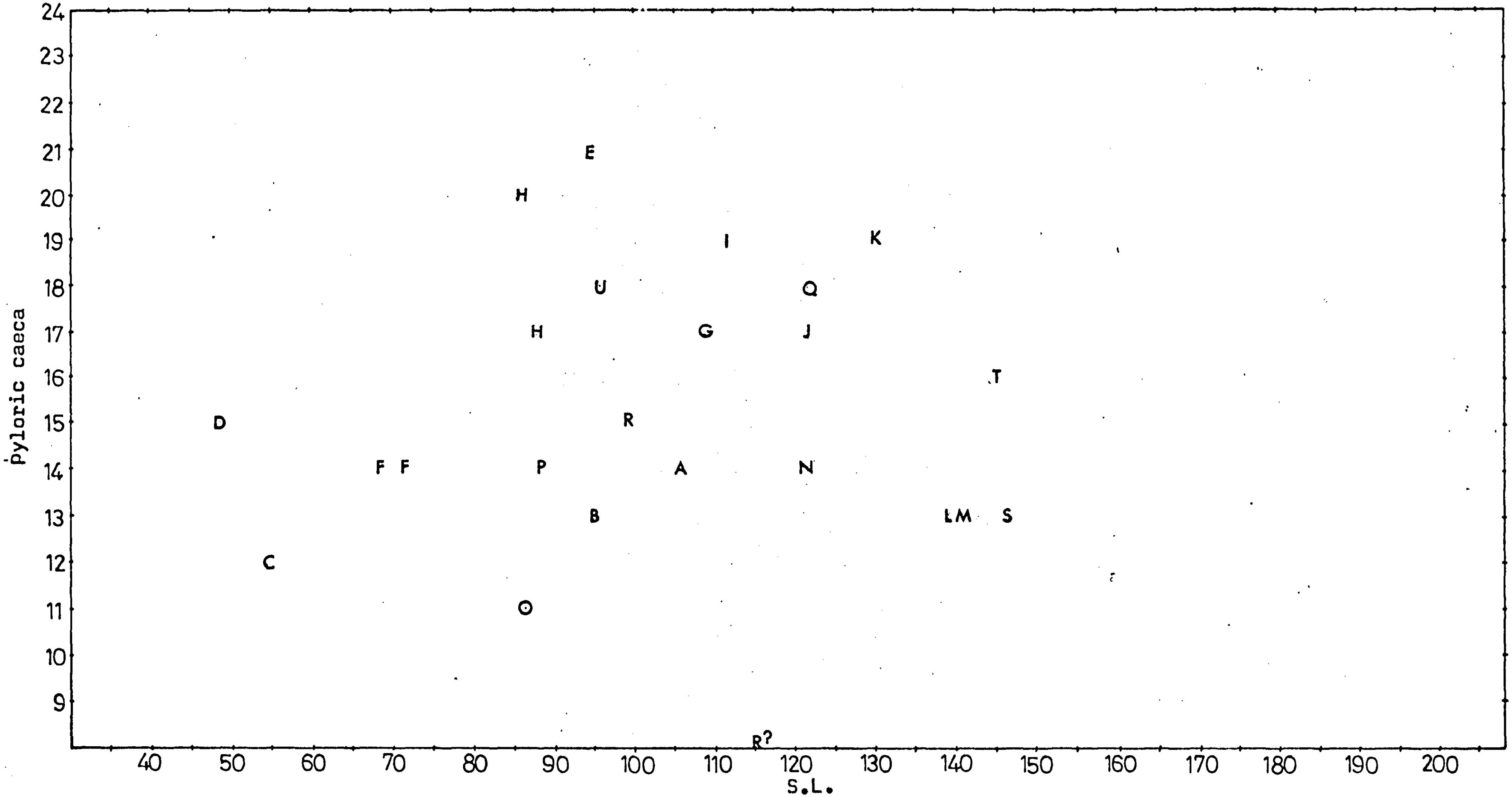


Figure 118. Relation of number of pyloric caeca to standard length (mm) for Thryssa (Thrissina) baelama (A), Thryssa (Scutengraulis) chefuensis (B), T. (S.) rastrosa (C), T. (S.) aestuaria (D), T. (S.)scratchleyi (E), T. (S.) kammalensis (F), T. (S.) kammalensoides (G), T. (S.) dussumieri (H), T. (S.) vitrirostris (I), T. (S.) mystax (J), T. (S.) hamiltonii (K), T. (S.) gautamiensis (L), T. (S.) malabarica (M), T. (S.) polybranchialis (N), T. (S.) purava (O), T. (S.) adelae (P), T. (S.) spinidens (Q), T. (S.) whiteheadi (R), T. (S.) stenosoma (S), T. (S.) dayi (T) and Thryssa (Thryssa) setirostris (U).

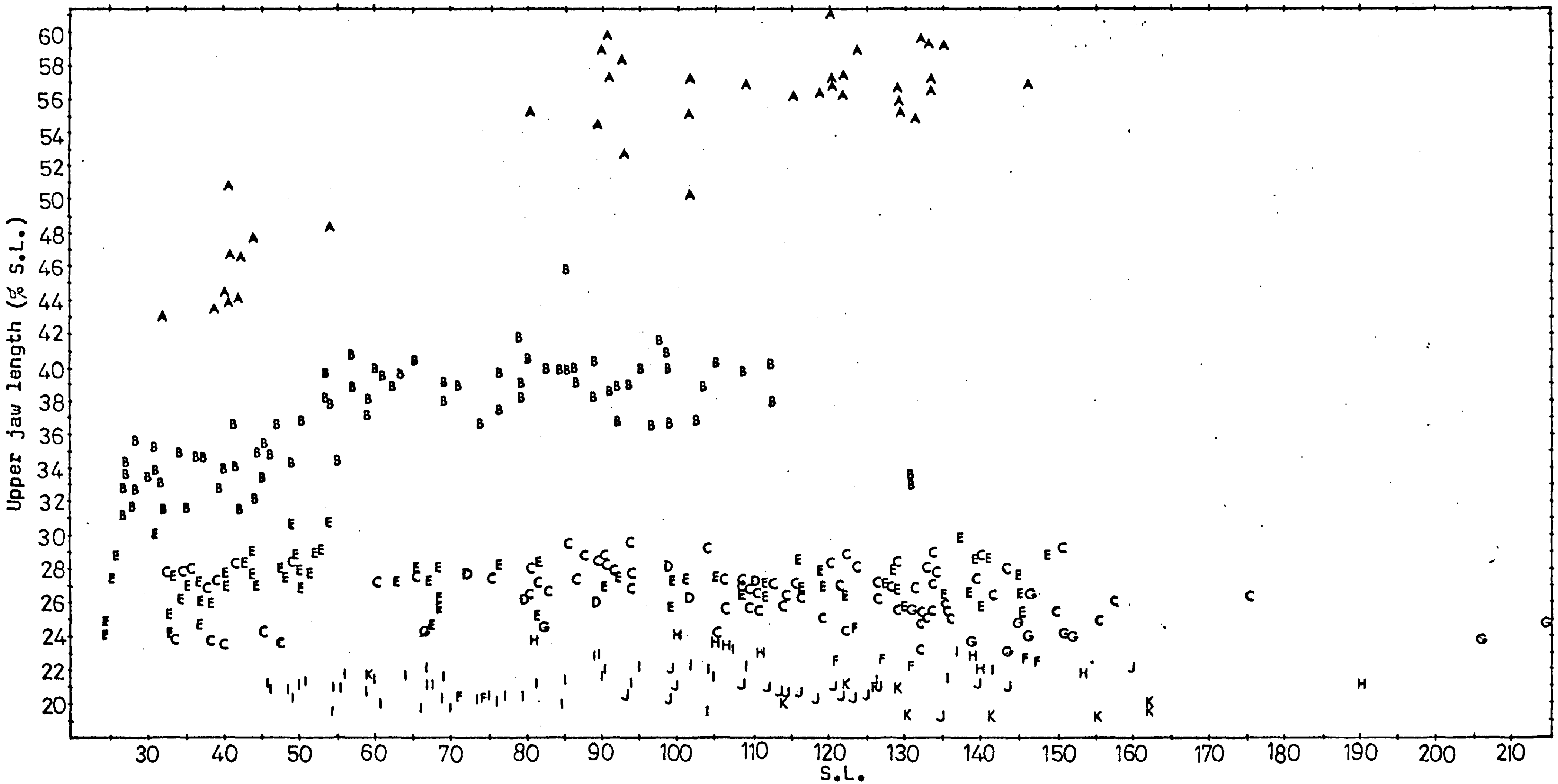


Figure 119. Relation of upper jaw length as percent of standard length to standard length (mm) for Thryssa (Thryssa) setirostris (A), Thryssa (Scutengraulis) dussumieri (B), T. (S.) vitrirostris (C), T. (S.) adelae (D), T. (S.) mystax (E), T. (S.) stenosoma (F), T. (S.) dayi (G), T. (S.) gautamiensis (H), T. (S.) purava (I), T. (S.) whiteheadi (J) and T. (S.) spinidens (K).

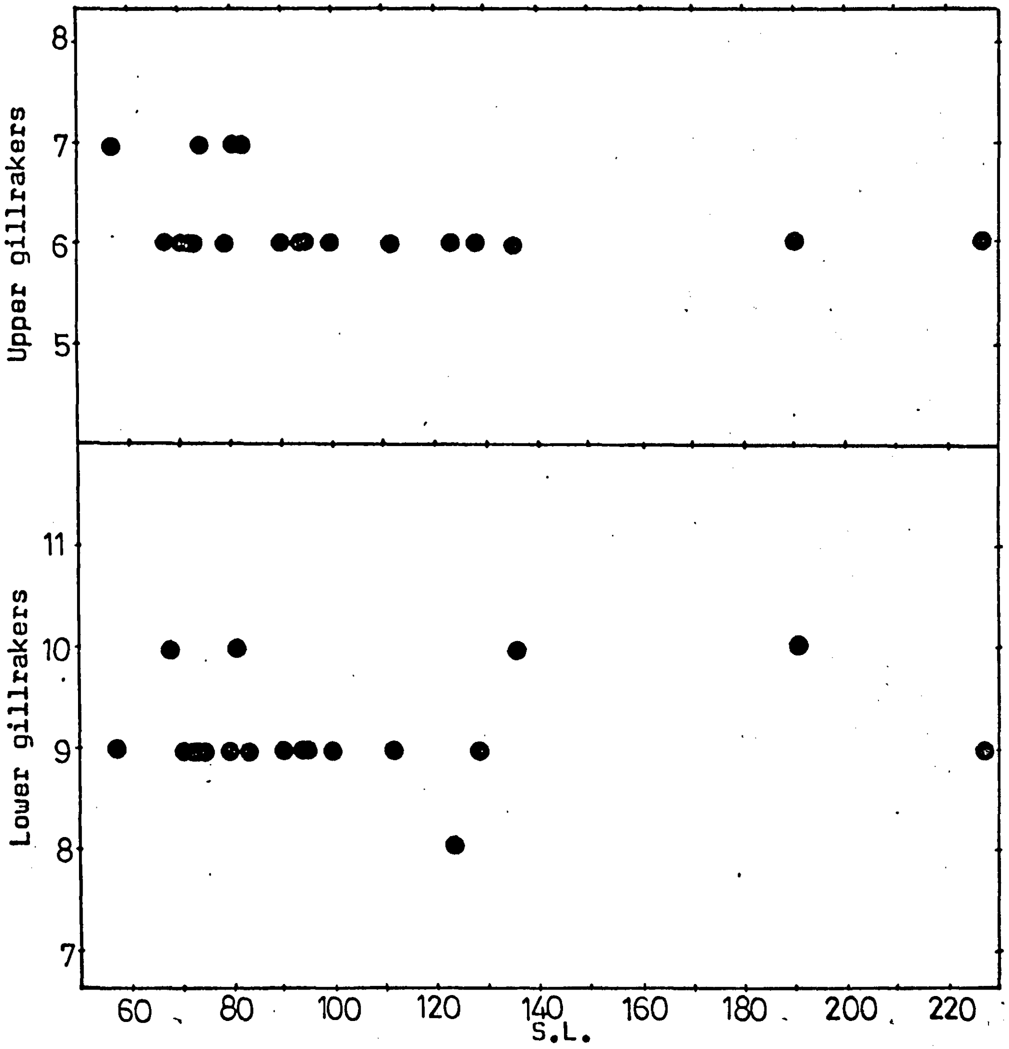


Figure 120. Relation of number of gillrakers to standard length (mm) for Lycothrissa crocodilus (●).

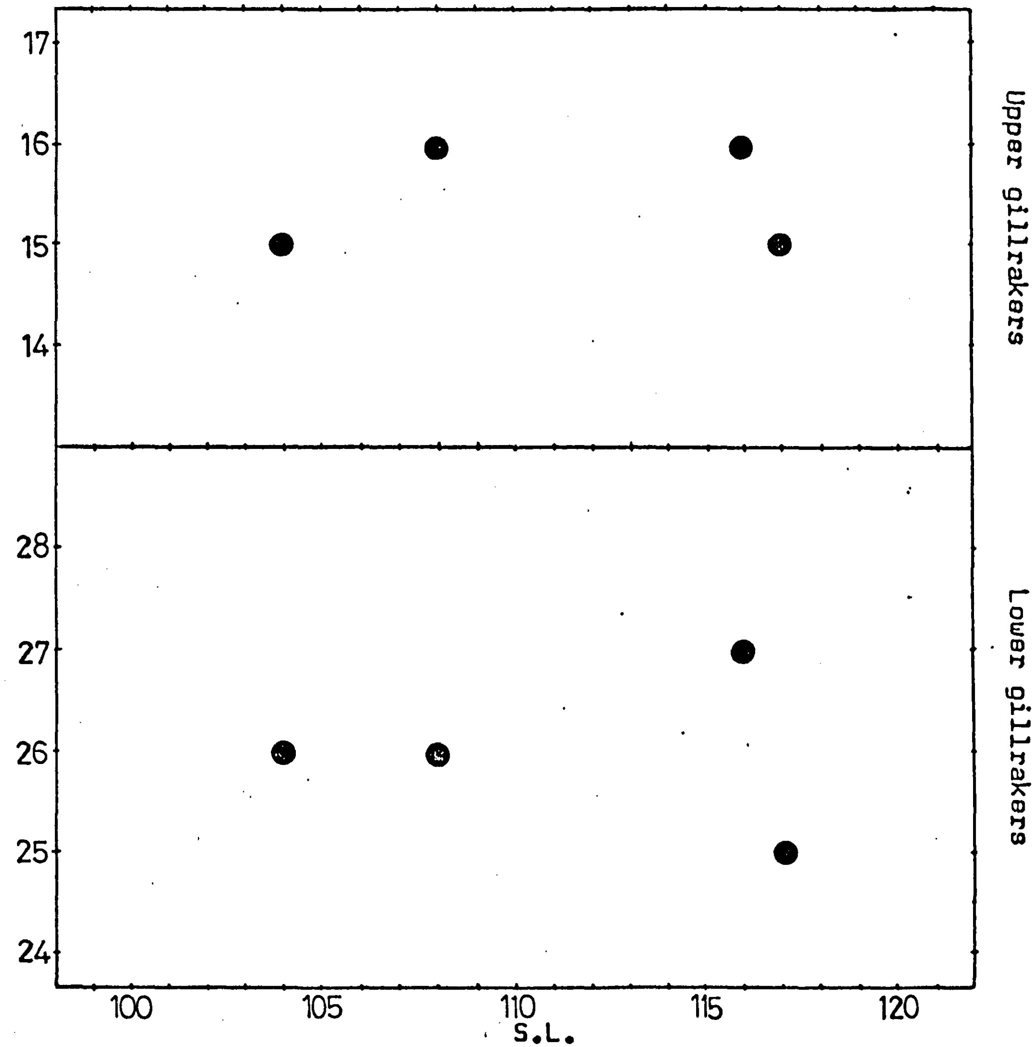


Figure 121. Relation of number of gillrakers to standard length (mm) for Papuengraulis micropinna (●).

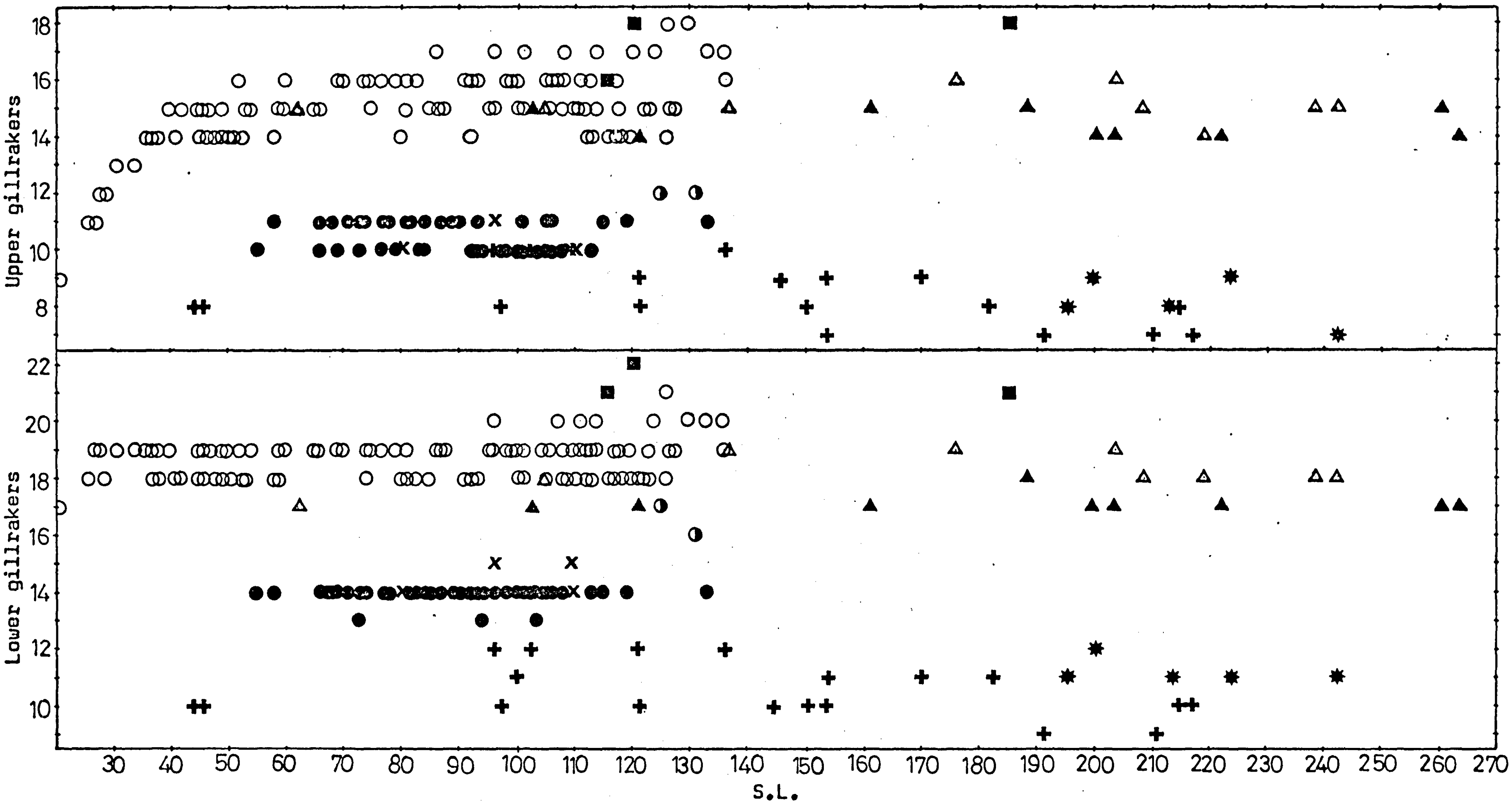


Figure 122. Relation of number of gillrakers to standard length (mm) for *Setipinna phasa* (△), *S. brevifilis* (▲), *S. wheeleri* (■), *S. melanochir* (✚), *S. tenuifilis tenuifilis* (●), *S. tenuifilis gilberti* (◐), *S. papuensis* (X), *S. taty* (○) and *Heterothrissa breviceps* (✱).

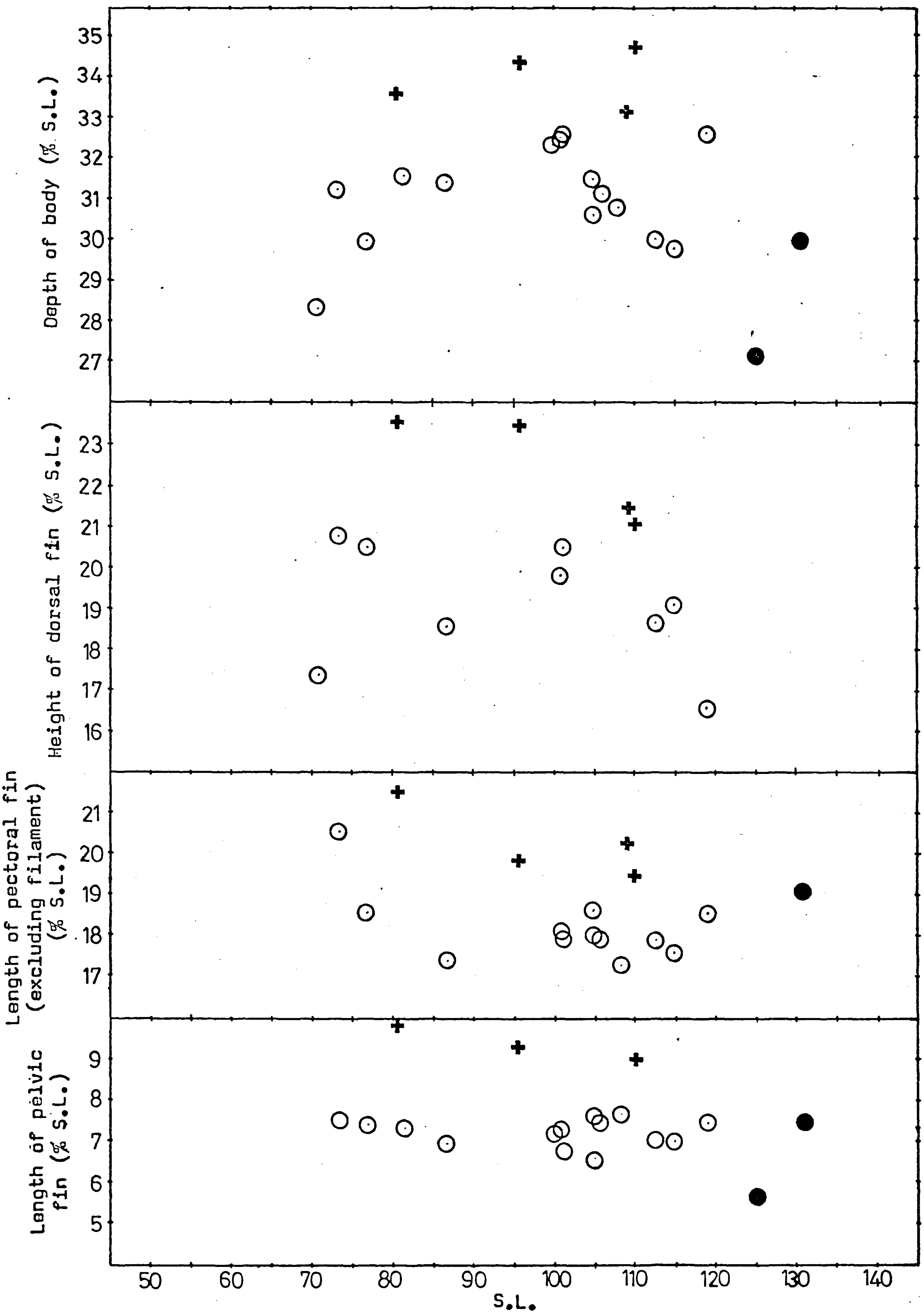


Figure 123. Relation of depth of body, height of dorsal fin, length of pectoral fin (excluding filament) and length of pelvic fin as percent of standard length (mm) for Setipinna tenuifilis tenuifilis (○), S. tenuifilis gilberti (●) and S. papuensis (✚).

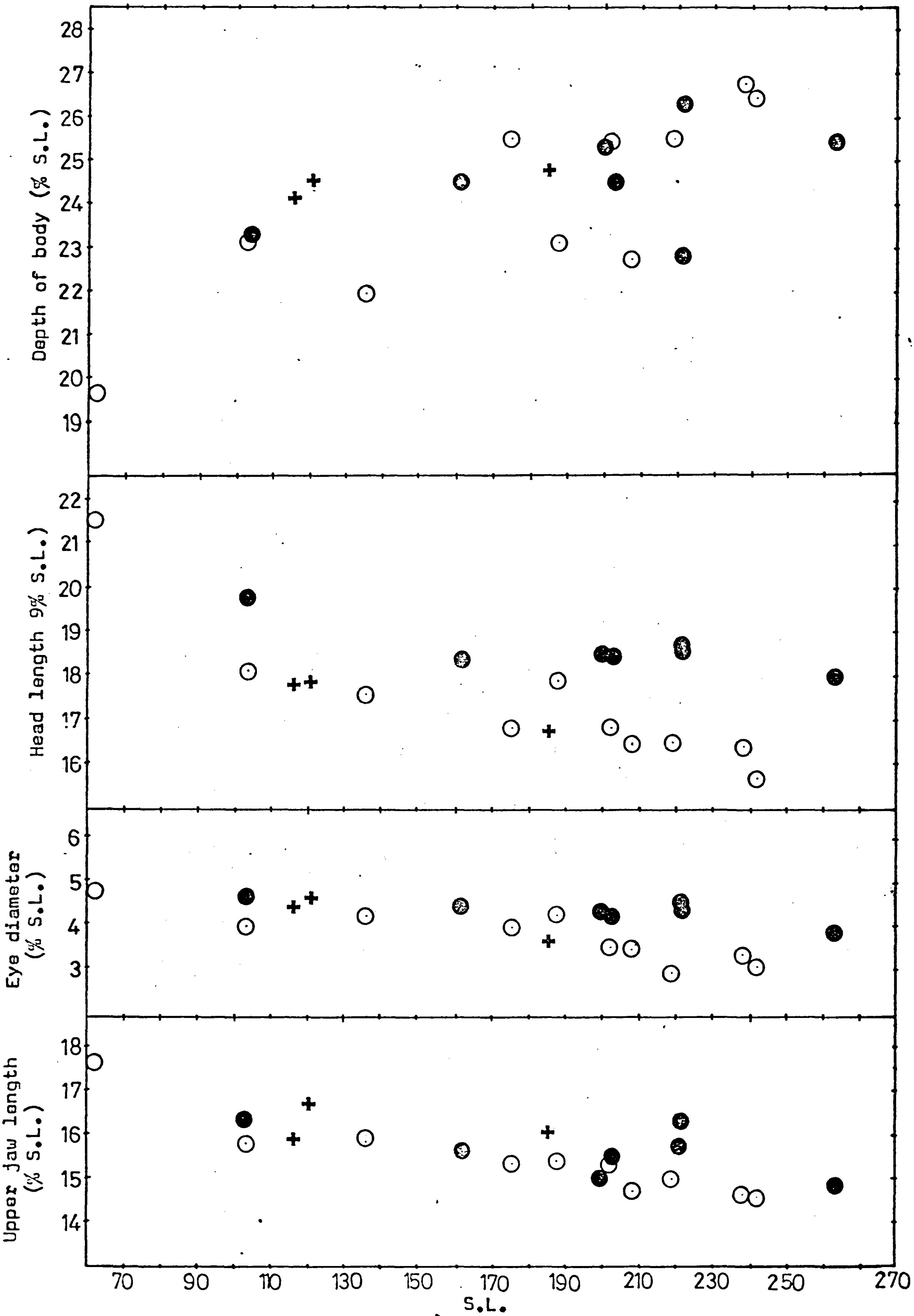


Figure 124. Relation of depth of body, head length, eye diameter and upper jaw length as percent of standard length to standard length (mm) for Setipinna phasa (○), S. brevifilis (●) and S. wheeleri (+).

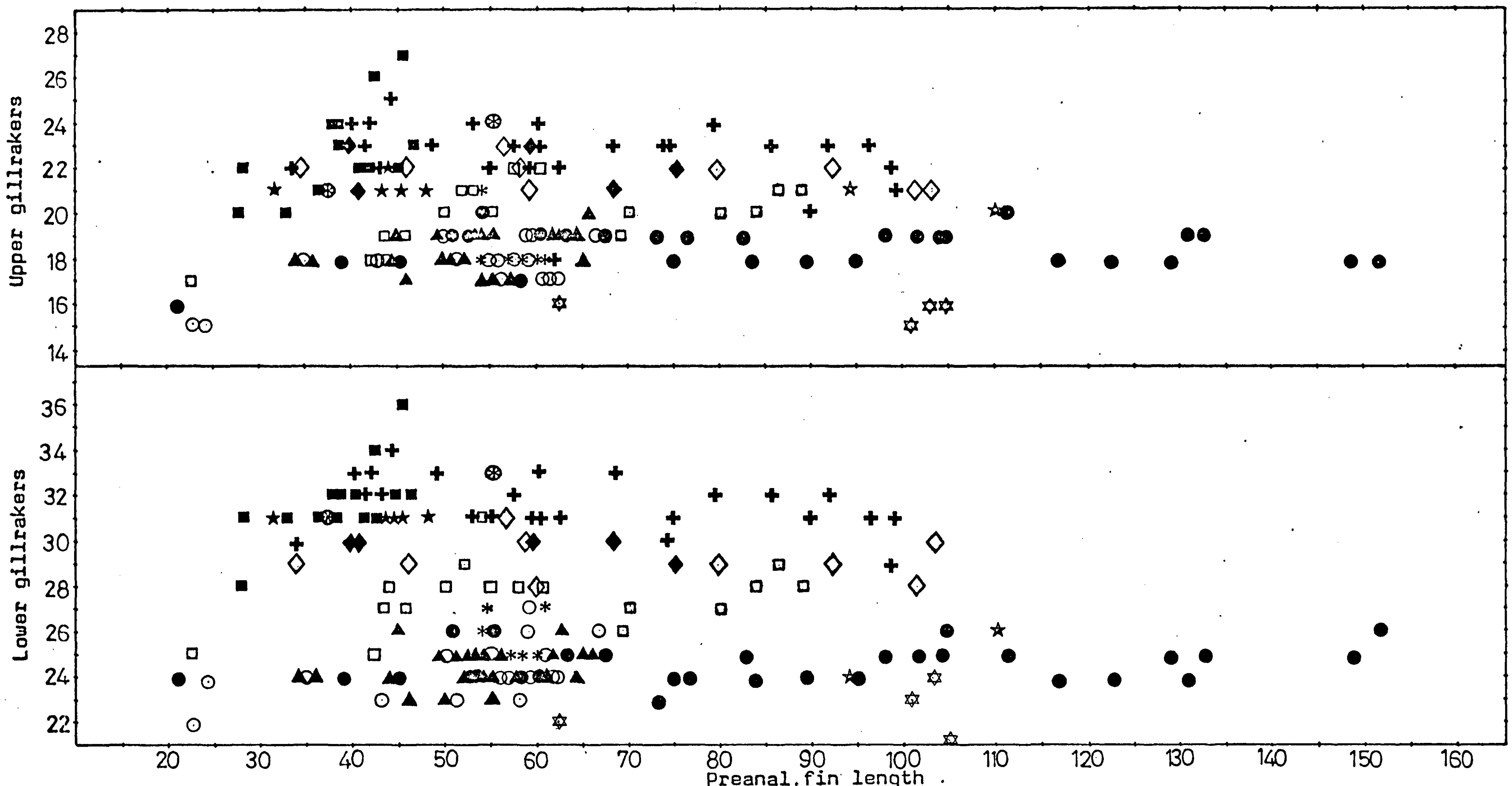


Figure 125. Relation of number of gillrakers to preanal fin length (mm) for Coilia ramcarati (◆), C. neglecta (○), C. dussumieri (▲), C. borneensis (★), C. reynaldi (■), C. coomansi (⊛), C. rebentischii (✳), C. rendahli (☆), C. lindmani (✚), C. grayii (◇), C. macrognathos (✡), C. mystus (□) and C. nasus (●).

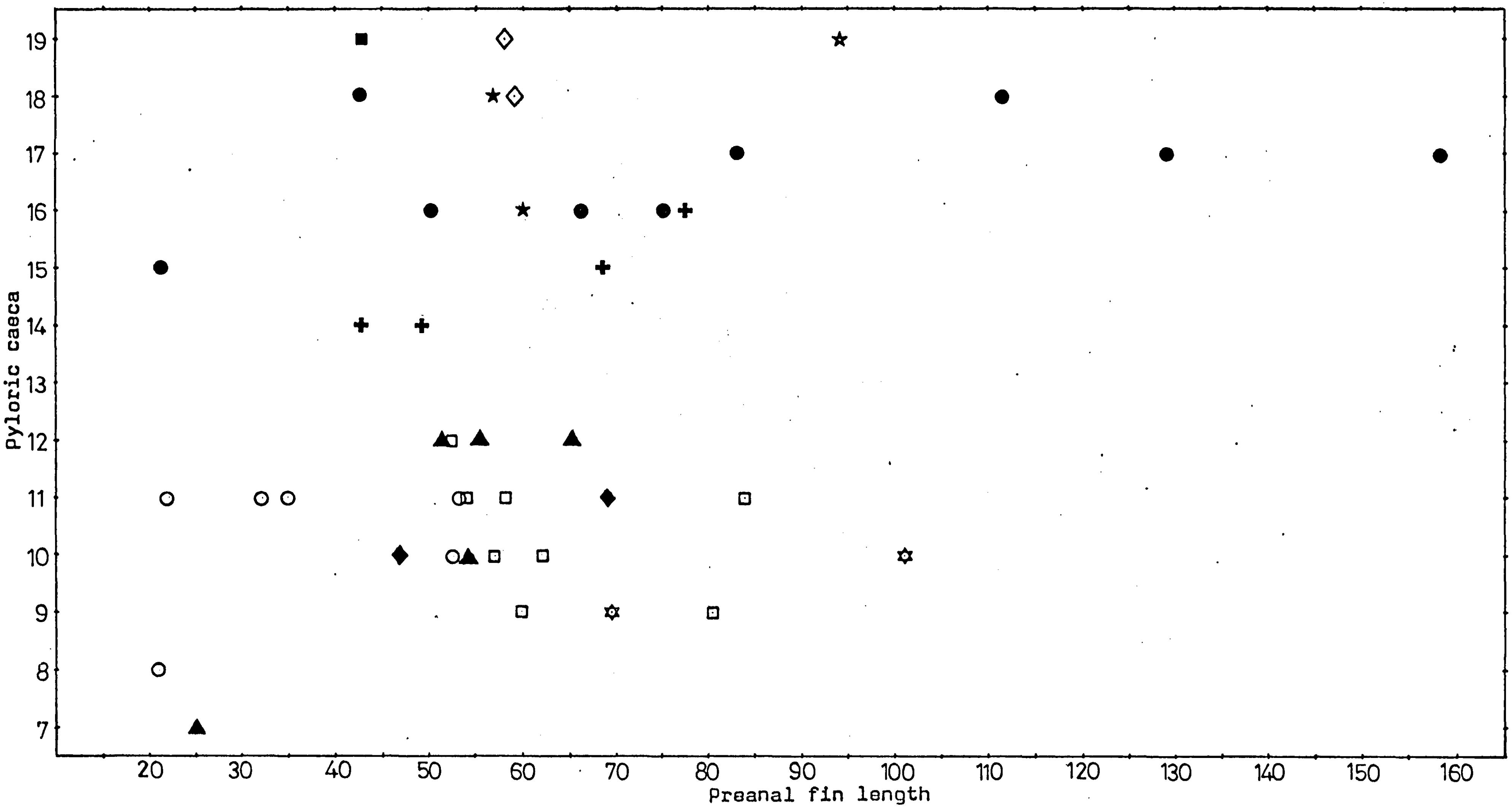


Figure 126. Relation of number of pyloric caeca to preanal fin length (mm) for Coilia ramcarati (◆), C. neglecta (○), C. dussumieri (▲), C. reynaldi (■), C. rebentischii (★), C. rendahli (☆), C. lindmani (✚), C. grayii (◇), C. macrognathos (✡), C. mystus (□) and C. nasus (●).

Table 2. Frequency distributions for certain meristic characters in Indo-Pacific species of *Etrumeus*, *Dussumieria* and *Spratelloides*.

	Unbranched and branched dorsal fin rays														Total dorsal fin rays											
	ii	iii	iv	v	9	10	11	12	13	14	15	16	17	18	11	12	13	14	-	18	19	20	21	22	23	n
Etrumeus																										
teres		4	36	10							2	12	34	2							2	15	24	9		50
whiteheadi			17	4						7	12	2								6	10	5				21
Dussumieria																										
elopsoides			82	7						2	25	44	16	2						1	25	44	15	3	1	89
acuta			36	19						1	7	28	19								7	19	22	7		55
Spratelloides																										
gracilis	42				4	23	14	1							2	25	14	1								42
lewisi	34				4	18	12								4	18	12									34
delicatulus	63				5	51	6	1							5	50	7	1								63
robustus	24					23	1									23	1									24

	Unbranched and branched anal fin rays												Total anal fin rays									
	ii	iii	iv	7	8	9	10	11	12	13	14	15	10	11	12	13	14	15	16	17	18	n
Etrumeus																						
teres		25	26	40	10	1							17	30	4							51
whiteheadi		15	4		3	10	6								10	9						19
Dussumieria																						
elopsoides		84	4					3	32	38	13	2					3	28	42	13	2	88
acuta		49	9					4	35	14	5						4	26	23	4	1	58
Spratelloides																						
gracilis	45					3	19	22	1					3	19	22	1					45
lewisi	12	23			19	9	5	2					3	18	12	2						35
delicatulus	67	2			65	4							64	5								69
robustus	24				23	1							23	1								24

	Total pectoral fin rays								Branchiostegal rays												
	11	12	13	14	15	16	17	n	6	7	8	-	11	12	13	14	15	16	17	18	n
Etrumeus																					
teres				2	11	35	5	53						2	6	16	10				34
whiteheadi				4	6	5		15					2	3	3	1					9
Dussumieria																					
elopsoides		5	36	47	3			91						3	14	22	37	33	14	3	126
acuta		5	30	20	2			57						7	17	34	16	1			75
Spratelloides																					
gracilis	3	14	24	10				51	3	25											28
lewisi		8	25	2				35		13											13
delicatulus	25	55	10					90	7	38	1										46
robustus	3	9	13	1				26	3	11											14

Table 2.1 Frequency distributions for certain meristic characters in Indo-Pacific species of Etrumeus, Dussumieria and Spratelloides.

Lateral scale series

	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	n
Etrumeus																														
teres																		1	8	2	7	7	4	2						31
whiteheadi														2	3	2	1													8
Dussumieria																														
elopsoides																				1	4	5	5	14	10	8	3	-	2	52
acuta																		1	6	10	7	6	1	2	2					35
Spratelloides																														
gracilis								7	7	7	4	3	2	1																31
lewisi					1	4	8	7	4																					24
delicatulus	1	27	12	23	10	5	1																							79
robustus								2	5	4	7	3																		21

Predorsal scales

	8	9	10	11	12	13	14	15	16	17	18	19	-	22	23	24	25	26	27	28	29	n
Etrumeus																						
teres								1	5	13	9	1										29
whiteheadi								3														3
Dussumieria																						
elopsoides																3	4	10	1	1	1	20
acuta														5	5	10	5	2	1	1		29
Spratelloides																						
gracilis						4	11	5	4	1												25
lewisi						6	15	3														24
delicatulus	1	-	14	33	19	5																72
robustus						6	14	3	1													24

Transverse scales

	6	7	8	9	-	11	12	13	14	15	n
Etrumeus											
teres							1	15	2	1	19
whiteheadi						2					2
Dussumieria											
elopsoides							8	7			15
acuta								3	4	1	8
Spratelloides											
gracilis		1	2								3
lewisi		4									4
delicatulus	29	4									33
robustus			42	9							51

Pseudobranchial filaments

	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	n
Etrumeus																		
teres									1	2	3	1	2	1	2	-	1	13
whiteheadi						3	2	1	1	-	-	-	-	1	1			9
Dussumieria																		
elopsoides					2	-	3	9	5	4	6	15	1	7	2			54
acuta							2	3	6	4	4	3	3					25
Spratelloides																		
gracilis	1	1	1	9	25	7	5	5	1									55
lewisi		1	6	7	5	2	1											22
delicatulus			1	12	20	14	3											50
robustus				4	12	14	8	3										41

Table 3. Frequency distributions for certain meristic characters in Indo-Pacific species of Ehirava, Deyella, Clupeoides, Corica and Clupeichthys.

	Unbranched and branched dorsal fin rays									Unbranched and branched anal fin rays																Total pectoral fin rays						
	iii	iv	10	11	12	13	14	15	n	ii	iii	iv	v	9	10	11	12	13	14	15	16	17	18	+ 2	n	10	11	12	13	14	15	n
Ehirava																																
fluviatilis	19			9	9	1			19	2	17				1	2	6	6	2	2					19		3	9	7			19
Deyella																																
malabarica	1			1					2	1										1					1				1	1		2
Clupeoides																																
borneensis	30	3			18	14	-	1	33		31	2					3	13	10	6	1				33		2	20	19			41
hypselosoma	2			1	1				2		2							1	-	1					2		2		2			4
papuensis	11	14	7	12	6				50		6	17	2						1	4	7	12	1		25		3	11	12	1		27
venulosus	2	2	1	3					8			4									2	1	1		4			3	3			6
Corica																																
laciniata	14				2	9	3	-	14		14				2	5	6	1						14	14				3	7	6	16
soborna	6				2	4			6		6					2	4							6	6			3	4	4		11
Clupeichthys																																
bleekeri	8			1	7				8		8							4	1	3				8	8		1	13				14
aesarnensis	55		2	40	13				55	17	39			1	3	19	19	12	1					56	56	17	51	8	1			77
goniognathus	3			1	2				3		3						2	-	1					3	3		1	5				6
perakensis	26		5	20	1				26	3	23					7	9	9	1					26	26	8	30	12				50

	Total pelvic fin rays			Lateral scale series											Predorsal scales											Transverse scales					
	7	8	n	33	34	35	36	37	38	39	40	41	42	n	10	11	12	13	14	15	16	17	18	19	n	8	9	10	11	12	n
Ehirava																															
fluviatilis		19	19				2	8	4	2	1			17			3	10	1						14	3	1				4
Deyella																															
malabarica		1	1					?						1				?							1		1				1
Clupeoides																															
borneensis		32	32			3	6	18	2	1				30			3	8	7						18			6	1		7
hypselosoma		2	2	1	-	1								2				1							1			1			1
papuensis		25	25							9	8	1	1	19								6	6	5	17				5	2	7
venulosus		4	4						1	2	-	1		4					3	1					4				3	2	5
Corica																															
laciniata		14	14				2	5	6	1				14					5	6	2				13			6			6
soborna		6	6			1	-	1	2	1	1			6			1	-	-	5					6			3			3
Clupeichthys																															
bleekeri		8	8			2	4	2						8						1	2	-	2		5			8			8
aesarnensis		7	7	5	9	8	6	6	4					38			2	8	8	3					21		5	13			18
goniognathus		3	3	1	2									3			1	1							2			1			1
perakensis	36		36			2	3	1						6	1	1									2				2		2

Table 3.1 Frequency distributions for certain meristic characters in Indo-Pacific species of Ehirava, Dayella, Clupeoides, Corica and Clupeichthys.

	Circumpeduncular scales				Branchiostegal rays					Pseudobranchial filaments													Prepelvic scutes									
	12	14	16	n	4	5	6	7	n	8	9	10	11	12	13	14	15	16	17	18	19	n	1	-	5	6	7	8	9	10	11	12
Ehirava																																
fluviatilis	5			5		3	15		18		1	2	8	3	2							16			1	5	7	1				
Dayella																																
malabarica	1			1		1			1				?									1	1									
Clupeoides																																
borneensis			9	9		31	14		45	1	-	1	4	3	3	3						15							1	19	6	4
hypselosoma			1	1		1	2		3				1									1					1					
papuensis	8	-	1	9	2	28	2		32				1	4	5	7	2	-	-	1	1	21							1	11	10	2
venulosus	4			4		5	2		7							1	1	1	1			4							1	1	-	2
Corica																																
laciniata			7	7		17	1		18			2	4	7	-	1						14								1	11	2
soborna			5	5		11			11		2	1	2									5									6	
Clupeichthys																																
bleekeri	4			4			3	11	14					2	2	1	2	1				8							1	7		
aesarnensis		3		3			26	32	58			2	3	1	2							8						4	32	33		
goniognathus	2	-	1	3			2	3	5					1								1							2	1		
perakensis			1	1	1	39	1		41		2	2	-	2								6					3	21	2			

	Postpelvic scutes									Total ventral scutes																			
	0	-	4	5	6	7	8	9	10	1	-	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	n
Ehirava																													
fluviatilis	14											1	5	7	1														14
Dayella																													
malabarica	1									1																			1
Clupeoides																													
borneensis					1	4	24	1															1	2	19	6	2		30
hypselosoma					1															1									1
papuensis						2	8	13	1															1	5	11	5	2	24
venulosus						1	-	3															1	-	-	1	-	2	4
Corica																													
laciniata					1	9	4																	2	7	4	1		14
soborna					1	5																		1	5				6
Clupeichthys																													
bleekeri						7	1																1	6	1				8
aesarnensis					29	37	3														2	13	33	21					69
goniognathus						2	1																1	2					3
perakensis			4	20	2													1	4	18	3								26

Table 4. Frequency distributions for certain meristic characters in Indo-Pacific species of Sardinella.

Unbranched and branched dorsal fin rays

	iii	iv	v	12	13	14	15	16	n
Sardinella (Sardinella)									
longiceps		121			21	85	15		121
neglecta		28			2	24	2		28
lemuru		32			3	19	10		32
Sardinella (Clupeonia)									
jussieui		5					4	1	5
sindensis		133			1	64	59	9	133
gibbosa		133	6		2	53	67	17	139
fimbriata	1	31				3	23	6	32
albella	2	174				40	122	14	176
dayi		2				1	1		2
fijiense	1	2				3			3
tawilis		8				2	6		8
hualiensis		12				2	7	3	12
brachysoma		16			2	3	10	1	16
richardsoni		10				5	5		10
zunasi	2	53			1	34	20		55
marquesensis	1	29		1	28	1			30
melanura		79		11	66	2			79
atricauda		12				2	10		12

Unbranched and branched anal fin rays

	ii	iii	11	12	13	14	15	16	17	18	19	20	n
Sardinella (Sardinella)													
longiceps		114	1	10	41	51	11						116
neglecta		28			11	14	3						28
lemuru	1	32		2	6	13	10	2					33
Sardinella (Clupeonia)													
jussieui		5						1	2	2			5
sindensis	5	126				2	9	42	55	23			131
gibbosa	3	132				4	16	58	49	7	1		135
fimbriata	3	29						4	15	11	2		32
albella	9	177					1	19	48	70	42	6	186
dayi		2						1	1				2
fijiense	1	2					2	1					3
tawilis		8						1	3	2	2		8
hualiensis		12						1	6	4	1		12
brachysoma		16					1	3	7	4	1		16
richardsoni		10					2	4	3		1		10
zunasi		54				3	11	23	14	3			54
marquesensis	3	27				1	1	15	12	1			30
melanura	2	77				2	21	46	10				79
atricauda	1	11				6	6						12

Total pectoral fin rays

	13	14	15	16	17	18	n
Sardinella (Sardinella)							
longiceps		3	43	70	3		119
neglecta			2	22	2	2	28
lemuru			2	25	12		49
Sardinella (Clupeonia)							
jussieui		2	1	5			8
sindensis		23	86	44	2		155
gibbosa	2	23	71	45	4		145
fimbriata		4	27	20	2		53
albella		23	125	54	6		208
dayi			2	2			4
fijiense			3	3			6
tawilis		1	6	2			9
hualiensis	1	2	14	6			23
brachysoma			9	15			24
richardsoni		1	6	3			10
zunasi	1	19	33	3			56
marquesensis	2	22	10				34
melanura	5	51	25				81
atricauda		4	13				17

Prepelvic scutes / Postpelvic scutes

	Pre 15	Pre 16	Pre 17	Pre 18	Pre 19	Pre 20	Post 11	Post 12	Post 13	Post 14	Post 15	Post 16
Sardinella (Sardinella)												
longiceps			1	15	91	3			3	46	60	1
neglecta				2	26				2	5	19	2
lemuru				7	25					9	20	3
Sardinella (Clupeonia)												
jussieui			2	3					4	1		
sindensis			9	140	4				11	43	90	9
gibbosa			10	118	8	1			1	20	90	26
fimbriata			3	29				6	18	8		
albella			18	196	4		2	41	128	40	7	
dayi				2					1	1		
fijiense		1	2					1	2			
tawilis			4	4			3	5				
hualiensis				11	1			1	9	2		
brachysoma		1	4	10				2	11	2		
richardsoni			1	9					9	1		
zunasi			7	45	3		3	19	29	4		
marquesensis		3	27				1	22	7			
melanura	1	14	61	1			3	45	28	1		
atricauda				1	8	2				5	6	

Total ventral scutes

	27	28	29	30	31	32	33	34	35	n
Sardinella (Sardinella)										
longiceps					2	13	35	58	2	110
neglecta						2	8	16	2	28
lemuru						3	9	18	2	32
Sardinella (Clupeonia)										
jussieui				2	2	1				5
sindensis					10	48	87	8		153
gibbosa						24	87	25	1	137
fimbriata			1	6	18	7				32
albella			8	42	125	35	8			218
dayi					1	1				2
fijiense			2	1						3
tawilis		2	3	3						8
hualiensis				1	8	3				12
brachysoma			2	3	8	2				15
richardsoni				1	8	1				10
zunasi			5	17	30	3				55
marquesensis		3	21	6						30
melanura	1	13	38	24	1					77
atricauda						1	4	4	2	11

Table 4.1 Frequency distributions for certain meristic characters in Indo-Pacific species of Sardinella.

Lateral scale series

	38	39	40	41	42	43	44	45	46	47	48	49	n
Sardinella (Sardinella)													
longiceps						1	12	27	36	10			86
neglecta								6	14	8			28
lemuru						1	5	6	5	5	-	1	23
Sardinella (Clupeonia)													
jussieui				2	1	1	1						5
sindensis					2	14	28	22	24	3			93
gibbosa					4	12	25	21	32	10			104
fimbriata				2	8	12	6	4					32
albella			13	26	49	41	17	2					148
dayi			1	-	1								2
fijiense			3										3
tawilis		1	4	2	1								8
hualiensis		1	3	1	5	2							12
brachysoma			2	1	3	2	2						10
richardsoni		3	1	3	2								9
zunasi		2	6	6	8	4							26
marquisensis	8	7	9	5									29
melanura	6	9	33	19	8	1							76
atricauda						2	2	1	1				6

Predorsal scales

	11	12	13	14	15	16	17	18	n
Sardinella (Sardinella)									
longiceps			10	21	17	14	4		66
neglecta			6	8	8	4			26
lemuru				5	6	6	1		18
Sardinella (Clupeonia)									
jussieui			2	2	1				5
sindensis		2	9	21	22	19	13		86
gibbosa			8	14	35	24	8	1	90
fimbriata		1	6	14	6	4			31
albella	2	9	33	28	10	6	1		83
dayi				2					2
fijiense			2	1					3
tawilis	2	5	1						8
hualiensis	2	3	3	2					10
brachysoma		1	1	2	-	2	4		10
richardsoni	3	1	4	2	1				11
zunasi		3	6	4	7	1			21
marquisensis	9	3	7	5					24
melanura	2	18	33	20	4				77
atricauda					1	5			6

Transverse scales

	10	11	12	13	14	n
Sardinella (Sardinella)						
longiceps			3	7	3	13
neglecta			3	4	2	9
lemuru		4	8			12
Sardinella (Clupeonia)						
jussieui		5				5
sindensis		12				12
gibbosa	2	10				12
fimbriata		17	1	1		19
albella	1	16	3	3		23
dayi		2	1			3
fijiense		3				3
tawilis		7	1			8
hualiensis		6	2			8
brachysoma		2	1	4	1	8
richardsoni		10				10
zunasi	1	11				12
marquisensis		4				4
melanura	1	21				22
atricauda		6				6

Vertical insertion of pelvic fin below n^{th} dorsal fin ray (including unbranched dorsal fin rays)

	4	5	6	7	8	9	10	11	12	13	n
Sardinella (Sardinella)											
longiceps							3	14	10	5	32
neglecta							4	12	3	1	20
lemuru						3	6	4	5		18
Sardinella (Clupeonia)											
jussieui					3	1					4
sindensis		2	2	7	12	9	1				33
gibbosa	2	5	8	7	15	1	-	1			39
fimbriata			5	11	6	5					27
albella		3	2	12	25	27	8				77
dayi				1	-	1					2
fijiense			1	2							3
tawilis				1	1	3	3				8
hualiensis					1	2	4	2			9
brachysoma		1	1	1	2	1	1				7
richardsoni					2	5	1				8
zunasi				2	12	17	12	1			44
marquisensis	1	1	2	3	1						8
melanura	7	8	21	13	-	1					50
atricauda					1	2	-	1			4

Frontoparietal striae

	5	6	7	8	9	10	11	12	13	14	15	n
Sardinella (Sardinella)												
longiceps			1	11	5	7	3					27
neglecta			3	18	25	6	2					54
lemuru		2	1	3	5	12	5	5	1			34
Sardinella (Clupeonia)												
jussieui					1	5	3					9
sindensis				3	13	21	27	25	4	5		98
gibbosa				6	27	24	30	25	10	5	1	128
fimbriata			3	12	17	17	6	1				56
albella	2	1	4	20	19	28	12	2	1			89
dayi	1	-	-	1	1							3
fijiense	1	-	-	1	2							3
tawilis		2	5	4	1							12
hualiensis			3	4	-	3						10
brachysoma			1	5	1	2	5					14
richardsoni				1	-	5	5	3				14
zunasi		1	5	6	17	9	11	5				54
marquisensis		1	1	8	3							13
melanura		6	14	17	16	3						56
atricauda				3	3	1						7

Branchiostegal rays

	5	6	7	n
Sardinella (Sardinella)				
longiceps		10		10
neglecta		4		4
lemuru	1	19		20
Sardinella (Clupeonia)				
jussieui		2		2
sindensis		23	1	24
gibbosa		50	2	52
fimbriata		30	1	31
albella		46	2	48
dayi		4		4
fijiense		3		3
tawilis	5	6		11
hualiensis		7		7
brachysoma		11		11
richardsoni		18	1	19
zunasi	2	40	2	44
marquisensis		16		16
melanura		33		33
atricauda		7		7

Table 4.2 Frequency distributions for certain meristic characters in Indo-Pacific species of Sardinella.

	Pseudobranchial filaments																	
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	n
Sardinella (Sardinella)																		
longiceps							1	-	1	6	9	12	12	8	1	-	1	51
neglecta								1	2	1	3	10	7	2				26
lemuru							2	2	-	1	8	6	4	-	2	1	1	27
Sardinella (Clupeonia)																		
jussieui				1	-	2	1	1										5
sindensis		2	3	1	4	10	14	21	11	2								68
gibbosa	1	2	7	3	19	17	15	14	12	1								91
fimbriata					4	7	5	2	2	1	1							22
albella		1	9	16	32	27	17	8	2	2	1							115
dayi				1	-	-	1	1										3
fijiense				1	-	-	-	2										3
tawilis				1	3	1	2	-	1									8
hualiensis					4	2	2	1	2	-	1							12
brachysoma				2	1	1	4	3										11
richardsoni				1	1	1	3	3										9
zunasi				3	4	14	7	6	1									35
marquesensis		1	1	4	1	5	1											13
melanura			3	4	14	5	3	1										30
atricauda							2	1	2	1								6

Table 5. Frequency distributions for certain meristic characters in Indo-Pacific species of Amblygaster, Herklotsichthys and Escualosa.

	Unbranched and branched dorsal fin rays								
	iii	iv	v	12	13	14	15	16	n
Amblygaster									
sirm		99				14	81	4	99
clupeoides		11				1	10		11
leiogaster		13					13		13
Herklotsichthys									
quadrimaculatus	9	122	4			21	99	15	135
koningsbergeri		4	1			1	4		5
castelnaui		28	1		1	23	4	1	29
gotoi		1					1		1
lossei		40				19	21		40
spilura		37	10		2	26	19		47
punctatus	1	76	6		3	46	33	1	83
dispilonotus	2	13			1	1	11	2	15
Escualosa									
elongata	1				1				1
thoracata	74	8		17	57	8			82

	Unbranched and branched anal fin rays													
	ii	iii	iv	10	11	12	13	14	15	16	17	18	19	n
Amblygaster														
sirm		95	5					3	17	40	38	1	1	100
clupeoides		11						2	5	4				11
leiogaster		13						4	7	1	1			13
Herklotsichthys														
quadrimaculatus	22	102	7				7	34	63	23	3	1		131
koningsbergeri	1	4								1	1	1	2	5
castelnaui	10	19						1	1	9	11	6	1	29
gotoi		1						1						1
lossei		37	3			3	15	19	3					40
spilura	6	39	1			3	12	27	4					46
punctatus	5	75	2	1	4	12	46	15	4					82
dispilonotus		13	5				1	9	4	4				18
Escualosa														
elongata		1								1				1
thoracata		77	4					10	25	30	13	3		81

	Total pectoral fin rays								
	12	13	14	15	16	17	18	19	n
Amblygaster									
sirm					9	56	44	4	113
clupeoides					2	6	4		12
leiogaster					4	10			14
Herklotsichthys									
quadrimaculatus			6	80	66	5			157
koningsbergeri				3	3				6
castelnaui			4	17	9	1			31
gotoi				2					2
lossei			1	18	21	1			41
spilura			2	20	24	1			47
punctatus			4	45	34	1			84
dispilonotus			1	9	14	1			25
Escualosa									
elongata	2								2
thoracata	53	39	12	3					107

Table 5.1 Frequency distributions for certain meristic characters in Indo-Pacific species of Amblygaster, Herklotsichthys and Escualosa.

	Lateral scale series												Predorsal scales									
	35	36	37	38	39	40	41	42	43	44	45	n	10	11	12	13	14	15	16	17	18	n
Amblygaster																						
sirm						9	30	51	24	5		119			2	37	47	18	1			105
clupeoides						1	7	1	3	1		13				4	2	1	2	-	2	11
leiogaster						1	2	5	4			12					1	7	4	1		13
Herklotsichthys																						
quadrimaculatus				6	6	15	22	32	23	3	1	108		7	17	8						32
koningsbergeri					1	1	3					5	2	3								5
castelnaui		2	8	5	12	1						28	1	3	10	6						20
gotoi			1									1	1									1
lossei			1	9	18	10	1					39	1	3	-	1	2	6	2	1		16
spilura		1	10	12	12	8	2					45		1	6	4	2	2				15
punctatus		9	21	23	19	6						78			2	8	14	1				25
dispilonotus	8	4	4	1								17		1	3	4						8
Escualosa																						
elongata			1									1					1					1
thoracata	5	13	25	18	4	1						66				7	29	15	1			52

	Transverse scales					Branchiostegal rays				
	10	11	12	13	n	4	5	6	7	n
Amblygaster										
sirm		7			7			6		6
clupeoides		3	1		4		1	11		12
leiogaster		9			9			11		11
Herklotsichthys										
quadrimaculatus	1	18	3		22			57	1	58
koningsbergeri		1	4		5			7	2	9
castelnaui		2	20	5	27			28	4	32
gotoi		1			1			2		2
lossei		2	25	4	31			23		23
spilura			6	3	9			10		10
punctatus		6	15		21			18		18
dispilonotus		8	4	1	13			12		12
Escualosa										
elongata	1				1	2				2
thoracata	8				8	38	36	1		75

	Prepelvic scutes						Postpelvic scutes							Total ventral scutes									
	14	15	16	17	18	19	9	10	11	12	13	14	15	25	26	27	28	29	30	31	32	33	n
Amblygaster																							
sirm			2	100	6						4	72	32					1	4	67	34	2	108
clupeoides			2	6	1	1			1	1	6	2					1	3	3	2	-	1	10
leiogaster				9	2						2	7	2						1	8	1	1	11
Herklotsichthys																							
quadrimaculatus			2	26	95	6			1	18	82	29					1	4	26	75	23	1	130
koningsbergeri			1	4					1	3	1					1	-	3	1				5
castelnaui			5	23	1				12	17						3	10	16					29
gotoi				1						1								1					1
lossei			2	34	4				3	15	22						4	12	23	1			40
spilura			8	38				1	2	33	10					1	10	26	9				46
punctatus			9	68	4	1	2	5	27	37	9	2		1	1	7	27	33	11	1	1		82
dispilonotus	1	21							1	18	3				2	17	3						22
Escualosa																							
elongata					1					1									1				1
thoracata				5	85	2		6	68	18							9	64	19				92

Table 5.2 Frequency distributions for certain meristic characters in Indo-Pacific species of *Amblygaster*, *Herklotsichthys* and *Escualosa*.

	Frontoparietal striae																		Vertical insertion of pelvic fin below n^{th} predorsal scale or n^{th} dorsal fin ray (including unbranched dorsal ray)														
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	n	3	2	1	-	1	2	3	4	5	6	7	8	9	10	n
Amblygaster																																	
sirm						2	5	7	6	5	11	16	13	13	7	5	2	92										3	4	4	4	2	17
clupeoides									1	1	-	-	1					3									1	2	5	2	1		11
leiogaster										1	2	2	4	2				11					5	4	2								11
Herklotsichthys																																	
quadrimaculatus	6	23	38	18	-	2												87									1	1	6	8	5	2	23
koningsbergeri			1	3	2	1												7											1	2	1	1	5
castelnaui	1	4	13	8	3													29									2	1	3	6	3	1	16
rotoi			1															1													1		1
lossei	2	15	8	15														40											3	3	19	7	32
spilura	4	3	1															8											3	5	1	1	10
punctatus	8	11	6															25												8	8	3	19
dispilonotus			3	8	6													17										1	4	4	3	2	14
Escualosa																																	
elongata						1	1											2							1								1
thoracata					2	5	6	2	2									17	2	3	3	-	10	1	1	3							23

	Pseudobranchial filaments																				
	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	n
Amblygaster																					
sirm					1	1	4	6	8	9	10	6	11	3	8	2	1	-	-	1	71
clupeoides										1	-	1	1	1							4
leiogaster												1	3	2	4	2					12
Herklotsichthys																					
quadrimaculatus				2	1	6	5	10	21	24	15	16	7								107
koningsbergeri											1	1	-	1	2						5
castelnaui					1	-	1	2	8	6	3	2	3	1	2						29
rotoi							1														1
lossei						1	4	7	6	1											19
spilura					6	4	6	5													21
punctatus			1	2	13	12	13	9	5												55
dispilonotus						2	4	2													8
Escualosa																					
elongata							1														1
thoracata	1	-	2	4	9	9	5	4	3	-	1										38

Table 6. Frequency distributions for certain meristic characters in Indo-Pacific species of *Pellona* and *Ilisha*.

	Unbranched and branched dorsal fin rays									Unbranched and branched anal fin rays																						
	iii	iv	12	13	14	15	16	17	n	iii	iv	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	n
Pellona																															
dayi	8				1	7			8	5	3		1	4	-	2	-	1													8
ditchela	49	5		4	25	24	1		54	46	6	3	2	8	4	11	11	10	3												52
Ilisha																															
sirishai	18	2			19	1			20	21	1						4	7	5	3	3										22
novacula	4			4					4	3	1										2	1	1								4
megaloptera	28	15		7	21	15			43	41	53					1	4	6	8	4	8	9	11	13	8	7	3	7	2	3	94
elongata	11	10		1	11	8	1		21	11	10										1	1	1	2	3	5	3	2	1	2	21
filigera	1	5			3	2	-	1	6	6														1	-	-	2	1	1	1	6
macrogaster		2			1	1			2		2															2					2
pristigastroides	2				1	1			2	1	1														2						2
kampeni	10	17		14	13				21	4	26					3	3	3	11	6	3	-	1								30
striatula	44	8	2	29	20	1			52	38	15							2	1	5	9	15	15	3	3						53
melastoma	44	14	1	10	40	7			58	75	16		1	-	7	10	15	20	14	17	3	1	1	1	1						91
obfuscata	2			2					2	1	1						1	-	1												2

	Total pectoral fin rays							Lateral scale series																				
	14	15	16	17	18	19	n	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	n
Pellona																												
dayi				2	9	4	15				2	2	3	1														8
ditchela	5	37	27	9	15	1	94	1	2	6	8	11	8															36
Ilisha																												
sirishai		4	19	13			36				3	10	5	1														19
novacula	1	4					5										1	-	1	1	1							4
megaloptera		2	24	36	7		69				2	1	2	5	6	2	9	12	12	4	7	4	4					70
elongata		1	19	12	2		34										1	-	-	-	-	1	2	5	5	2	2	18
filigera		3	3	4	2		12													1	-	-	4	-	1			6
macrogaster		1	1				2													1	1							2
pristigastroides	1	1					2									1	-	-	1									2
kampeni	3	12	14				29					7	4	6														17
striatula		8	17	9			34				3	5	11	8	1													28
melastoma		35	48	5			88		2	7	13	16	12	6														56
obfuscata		4					4				2																	2

Table 6.1 Frequency distributions for certain meristic characters in Indo-Pacific species of Pellona and Ilisha.

	Predorsal scales														Transverse scales									Branchiostegal rays			
	12	13	14	15	16	17	18	19	20	21	22	23	24	n	10	11	12	13	14	15	16	17	n	5	6	7	n
Pellona																											
davi	1	2	3	1										7			4						4	1	15		16
ditchela	2	1	9	1	2									15			5	27					32	2	28		30
Ilisha																											
sirishai			7	10	2									19				15					15		28	2	30
novacula												3	1	4	1	3							4		4		4
megaloptera					3	20	7	3						33				2	13	1	2	1	19		17		17
elongata								1	1	8	5	2	2	19					1	4	5	6	16		22		22
filigera				1	-	-	2	2	1					6					1	2	1	2	6		10		10
macrogaster									2					2						2			2		4		4
pristigastroides								1	1					2						1	1		2		2		2
kampeni				3	8	3	1							15			6	4					10		11	2	13
striatula		3	11	5										19			1	1	3	1			6		5		5
melastoma	7	10	12	6	2									37		1	8	9					18	1	17		18
obfuscata		2												2			1	1					2		2		2

	Prepelvic scutes											Postpelvic scutes									
	17	18	19	20	21	22	23	24	25	26	27	6	7	8	9	10	11	12	13	14	15
Pellona																					
davi			4											1	3						
ditchela	2	12	35	7										38	17	1					
Ilisha																					
sirishai		1	8	12	2									1	22						
novacula								2	2							2	2				
megaloptera			2	4	35	32	19							4	52	18	17	1			
elongata							2	7	3	3	1					2	-	3	5	7	4
filigera							1	2	2	1							3	2	1		
macrogaster									2								2				
pristigastroides										1	1						1	1			
kampeni		1	7	15	7								4	23	3						
striatula		5	13	26	8	1							8	39	6						
melastoma	10	15	29	36	9	1						4	1	44	48	2	1				
obfuscata			1	1										2							

	Total ventral scutes																			
	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	n
Pellona																				
davi				1	3															4
ditchela		1	9	27	18	1														56
Ilisha																				
sirishai				1	9	11	2													23
novacula											1	2	1							4
megaloptera					2	3	28	25	16	10	7	1								92
elongata											2	-	2	2	6	7	1	-	1	21
filigera											1	-	3	1	1					6
macrogaster													2							2
pristigastroides														1	-	1				2
kampeni			1	10	9	10														30
striatula		2	7	10	22	11	1													53
melastoma	3	6	10	19	36	18	6	1	-	1										100
obfuscata				1	1															2

Table 6.2 Frequency distributions for certain meristic characters in Indo-Pacific species of *Pellona* and *Ilisha*.

	Pseudobranchial filaments													
	12	13	14	15	16	17	18	19	20	21	22	23	24	n
Pellona														
dayi						1	4	1	-	-	-	-	1	7
ditchela			3	1	5	3	3	-	2	4	-	2		23
Ilisha														
sirishai		4	2	6	5	-	2	1						20
novacula				2	1	-	1							4
megaloptera			1	-	2	8	1	2	2					16
elongata		1	-	2	-	5	3	2	3	2	2	1		21
filigera					1	1	2	-	1	-	-	-	1	5
macrogaster								1	1					2
pristigastroides								1	1					2
kampeni				1	1	3	4	-	1	1				11
striatula			1	3	8	11	8	9	1					41
melastoma			2	4	12	4	14	1	-	2				39
obfuscata	1	1												2

	Vertical insertion of anal fin before or behind dorsal base or below n^{th} dorsal fin ray (including unbranched dorsal fin rays)																					
	X	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Y	Z	n
Pellona																						
dayi													1	-	5	1	-	-	-	1		8
ditchela											1	6	5	2	4	3	2	-	-	17	3	43
Ilisha																						
sirishai																			3	5	3	11
novacula		1	-	1	1	-	1															4
megaloptera						1	1	3	5	4	11	5	8	2								40
elongata									1	1	1	6	1	5	-	-	-	1	-	-	2	18
filigera								1	-	6												7
macrogaster										1	-	-	1									2
pristigastroides	1	-	-	-	1																	2
kampeni									4	5	6	6	1	3								25
striatula										1	6	11	8	12	6	-	-	-	-	1	2	47
melastoma										1	1	2	3	7	9	2	1	-	-	17	11	54
obfuscata																				2		2

X just before origin of dorsal fin.
Y last dorsal fin ray.
Z just behind last dorsal fin ray.

Table 7. Frequency distributions for certain meristic characters in Indo-Pacific species of Opisthopterus and Raconda.

	Unbranched and branched anal fin rays																														
	ii	iii	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	-	79	80	81	82	83	84	85	86	87	88	89	90	n
Opisthopterus																															
valenciennesi		31				1	2	1	2	3	2	4	9	2	3	-	2														31
tardoore		57	1	2	5	3	4	9	8	9	2	9	2	2	1																57
Raconda																															
russeliana	24	3																	1	2	2	6	2	2	3	3	4	1	-	1	27

	Unbranched and branched dorsal rays								Total pectoral fin rays							Ventral scutes											Branchio-stegal rays	
	ii	iii	11	12	13	14	15	n	12	13	14	15	16	17	n	29	30	31	32	33	34	35	36	37	38	n	6	n
Opisthopterus																												
valenciennesi	1	29			1	14	15	30			1	6	21	4	32		5	12	11	3						31	20	20
tardoore		37	4	15	17	1		37	6	42	25	1			74	3	5	9	15	12	2	1				47	8	8
Raconda																												
russeliana			dorsal fin absent					51	5	17	15	2			39					4	6	11	5	-	4	30	10	10

	Lateral scale series																						Predorsal scales									
	46	47	48	49	50	51	52	53	54	55	56	-	60	61	62	63	64	65	66	67	68	n	25	26	27	28	29	30	31	32	33	n
Opisthopterus																																
valenciennesi						6	11	4	3	-	1											25				2	-	2	-	2	3	9
tardoore	1	3	10	5	3	4																26	7	6	-	3	1	-	-	1		18
Raconda																																
russeliana													1	1	1	9	1	1	2	1	1	18				- dorsal fin absent -						51

	Transverse scales						Extremity of pectoral fin terminating above nth ventral scute																	Vertical insertion of dorsal fin above nth anal fin ray (including unbranched anal fin rays)								
	13	14	15	16	17	n	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	n	13	14	15	16	17	18	19	20	n
Opisthopterus																																
valenciennesi			2	2	4	8	3	-	5	-	2												10	1	-	1	4	4	5			15
tardoore	1	6	-	1		8										2	2	3	2				9			1	-	4	1	4	5	15
Raconda																																
russeliana		3	1			4											1	1	2	2	-	1	7			- dorsal fin absent -						51

	Pseudobranchial filaments													
	9	10	11	12	13	14	15	16	17	18	19	20	21	n
Opisthopterus														
valenciennesi							4	2	1	2	-	1		10
tardoore	1	-	2	4	8	6	3	8	1	1				34
Raconda														
russeliana			1	1	1	-	6	2						11

Table 8. Frequency distributions for certain meristic characters in Indo-Pacific species of *Hilsa*, *Tenualosa* and *Gudusia*.

	Unbranched and branched dorsal fin rays								
	iii	iv	11	12	13	14	15	16	n
Hilsa									
kelee	20	52			17	53	2		72
Tenualosa									
toli	1	14				13	2		15
macrura		5					5		5
reevesii	2	8				8	2		10
ilisha	3	52				1	37	17	55
thibaudeaui	4	3			6	1			7
Gudusia									
chapra	21	13	2	27	5				34
variegata		3		1	2				3

	Unbranched and branched anal fin rays														
	ii	iii	iv	14	15	16	17	18	19	20	21	22	23	24	n
Hilsa															
kelee	2	78	2		1	9	23	32	17						82
Tenualosa															
toli	2	13			3	6	5	1							15
macrura	2	- 3					3	1	1						5
reevesii	3	7		3	3	2	2								10
ilisha	2	55	8			3	16	33	11	2					65
thibaudeaui	5	2					1	1	2	3					7
Gudusia															
chapra		34						2	5	17	6	4			34
variegata		3										1	1	1	3

	Total pectoral fin rays					
	12	13	14	15	16	n
Hilsa						
kelee		3	30	47	4	84
Tenualosa						
toli			9	15	3	27
macrura				4	4	8
reevesii			10	2		12
ilisha		1	23	52	4	80
thibaudeaui	2	5	6			13
Gudusia						
chapra	6	16	20			42
variegata			4	2		6

	Lateral scale series																										
	37	38	39	40	41	42	43	44	45	46	47	-	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	n
Hilsa																												
kelee			3	9	17	18	10	2																				59
Tenualosa																												
toli	1	2	3	6	3	1																						16
macrura							1	4																				5
reevesii						4	2	2	2																			10
ilisha								9	16	16	3																	44
thibaudeaui				3	2	2																						7
Gudusia																												
chapra													1	1	-	5	1	-	2	1	-	1	2	3	3	3	2	25
variegata																										1	2	3

	Transverse scales															
	13	14	15	16	17	18	19	-	30	31	32	33	34	35	36	n
Hilsa																
kelee	16	9	1													26
Tenualosa																
toli	6	7	3													16
macrura			3	2												5
reevesii				10												10
ilisha				1	25	10	5									41
thibaudeaui			4	2	1											7
Gudusia																
chapra									3	5	9	5	-	-	1	22
variegata									1	2						3

	Circumpeduncular scales								
	12	14	16	18	-	32	34	36	n
Hilsa									
kelee	8	10							18
Tenualosa									
toli			12						12
macrura			2						2
reevesii			10						10
ilisha			10	5					15
thibaudeaui			7						7
Gudusia									
chapra						2	5	2	9
variegata						1	2		3

Table 8.1 Frequency distributions for certain meristic characters in Indo-Pacific species of *Hilsa*, *Tenualosa* and *Gudusia*.

	Predorsal scales																				Frontoparietal striae											
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	-	36	37	38	39	n	4	5	6	7	8	9	10	11	12	13	14	n
Hilsa																																
kelee	5	4	11	5																25					1	6	26	20	16	9	5	83
Tenualosa																																
toli		7	9																	16					several only							16
macrura						2	2	1												5					several only							5
reevesii					2	3	4	1	1											10					several only							11
ilisha					4	8	6	2	2											22	10	8	4	3								25
thibaudeaui					2	3	2	2												9	1	2	4									7
Gudusia																																
chapra									1	1	4	1	3	2						12			10	8	10	7	5	4	4	1		49
variegata																1	1	-	1	3	1	2										3

	Prepelvic scutes					Postpelvic scutes									Total ventral scutes									Branchio-stegal rays	
	15	16	17	18	19	8	9	10	11	12	13	14	15	16	26	27	28	29	30	31	32	33	n	6	n
Hilsa																									
kelee	5	79	3							5	70	12					9	64	14				87	31	31
Tenualosa																									
toli			15	1					1	6	9						1	5	10				16	21	21
macrura			5								2	3							2	3			5	4	4
reevesii			10									8	2							8	2		10	7	7
ilisha		2	66	2							3	45	20	2					5	42	20	3	70	15	15
thibaudeaui			6	1					2	5							2	4	1				7	6	6
Gudusia																									
chapra			4	21	9	2	11	20	1						2	9	19	4					34	11	11
variegata					3			1	2									1	2				3	5	5

	Vertical insertion of pelvic fin below n^{th} predorsal scale or n^{th} dorsal fin ray (including unbranched dorsal rays)															Pseudobranchial filaments																
	2	1	-	1	2	3	4	5	6	7	8	9	10	11	n	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	n
Hilsa																																
kelee									1	8	6	2	1	1	19	1	-	-	-	1	4	10	10	7	3	8	2	6				52
Tenualosa																																
toli								2	-	3	2	3			10						1	-	2	3	3	1	-	1				11
macrura							2	-	-	-	1				3							2	1	-	-	1	-	1				5
reevesii				5	2	2	-	-	1						10								1	1	-	-	1	-	5	-	1	9
ilisha				1	-	3	5								9				1	-	2	1	5	18	7	7	4	3	2	1		51
thibaudeaui				2	2	1	2								7					1	2	2	1	-	1							7
Gudusia																																
chapra	2	4		2											8				2	2	5	1	2									12
variegata		1		1	1										3							1	1	-	-	1						3

Table 9. Frequency distributions for certain meristic characters in Indo-Pacific species of Konosirus, Clupanodon and Nematalosa.

	Unbranched and branched dorsal fin rays									Total dorsal fin rays							Total pectoral fin rays						
	iii	iv	v	10	11	12	13	14	15	14	15	16	17	18	19	n	13	14	15	16	17	18	n
Konosirus																							
punctatus	5	13	4			3	11	6	2			2	14	4	2	22			6	15	6	1	28
Clupanodon																							
thrissa	1	8				8	1					9				9	3	9	3				15
Nematalosa																							
erebi	4	44		18	25	5				22	21	5				48		11	29	10	1		51
chanpole		6			2	2	2				2	2	2			6	1	1	6				8
come	1	12	2			2	8	5					11	4		15		1	16	6			23
arabica		9	2				7	4					6	4	1	11			1	5	5		11
nasus	3	21	9			16	14	3			1	12	14	5	1	33	2	1	12	21	5		41
japonicus		18				1	13	4				1	13	4		18		1	6	9	1	1	18
vlaminghi	1	9				4	6					5	5			10			4	9	1		14
papuensis	20	26			23	22	1			6	31	9				46	10	38	5				53
flyensis	22	20			16	26				4	30	8				42	6	32	7				45

	Unbranched and branched anal fin rays														Total anal fin rays											Branchio-stegal rays			
	ii	iii	iv	15	16	17	18	19	20	21	22	23	24	25	18	19	20	21	22	23	24	25	26	27	n	5	6	7	n
Konosirus																													
punctatus	7	15					2	5	9	4	1							3	9	5	4	1			22		9		9
Clupanodon																													
thrissa	3	6					1	-	1	1	4	2						1	-	1	4	1	2		9		10		10
Nematalosa																													
erebi	9	36	3		7	16	14	11								9	17	15	7						48	5	25	1	31
chanpole		4	2					1	1	2	2								1	1	1	2	1		6	5			5
come	5	10					4	4	4	2	1						1	4	4	4	2				15	14			14
arabica	6	5		1	5	4	1								3	6	2								11	4	10		14
nasus	13	20					1	7	16	6	2	1					1	3	9	15	2	2	1		33		17		17
japonicus	13	4				2	5	9	1							1	6	7	3						17	4	16		20
vlaminghi	3	7				1	1	2	3	2	1					1	-	2	1	4	1	1			10	4	9		13
papuensis	18	27							5	14	20	5	-	1					2	10	13	15	4	1	45	10	25		35
flyensis	13	27	1				1	-	8	11	14	7						1	3	4	18	12	3		41	6	39		45

Table 9.1 Frequency distributions for certain meristic characters in Indo-Pacific species of *Konosirus*, *Clupanodon* and *Nematalosa*.

Lateral scale series

	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	n
Konosirus																	
punctatus											-	1	5	7	4	2	19
Clupanodon																	
thrissa						1	1	3	-	1	2						8
Nematalosa																	
erebi	4	7	12	9	9	2	1										44
chanpole				2	1	1	2										6
come				6	3	1	1	2	-	1	-	1					15
arabica			1	-	-	-	1	3	4	2							11
nasus							10	11	7	3							31
japonicus							1	1	5	7	2	2					18
vlaminghi						3	1	5	1								10
papuensis			2	4	7	9	3	3									28
flyensis				1	8	9	8	2									28

Transverse scales

	15	16	17	18	19	20	21	22	23	n
Konosirus										
punctatus						3	3	3	1	10
Clupanodon										
thrissa							4	1	2	7
Nematalosa										
erebi		6	9	4	2					21
chanpole	6									6
come		1	7	5	1	1				15
arabica				2	6					8
nasus			7	12	12	1				32
japonicus					1	8	7	1	1	18
vlaminghi					7	3				10
papuensis					2	3	2			7
flyensis				1	4	5	2			12

Predorsal scales

	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	n
Konosirus																	
punctatus											3	-	4	1	2	1	11
Clupanodon																	
thrissa						1	3	2	-	2							8
Nematalosa																	
erebi	6	3	5	6	1												21
chanpole	2	2	1	1													6
come	2	5	7	1													15
arabica		1	5	1	3	1											11
nasus		3	14	4	1												22
japonicus		1	5	5	4	3											18
vlaminghi				2	-	6	2										10
papuensis		2	1	2	2												7
flyensis				5	3	-	1										9

Circumpeduncular scales

	14	16	18	20	22	24	n
Konosirus							
punctatus			2	11	4	1	18
Clupanodon							
thrissa			5				5
Nematalosa							
erebi	10	7					17
chanpole	2	4					6
come	3	12					15
arabica		9	2				11
nasus	5	11	2				18
japonicus			16	1			17
vlaminghi		9	1				10
papuensis		6					6
flyensis	1	8					9

Table 9.2 Frequency distributions for certain meristic characters in Indo-Pacific species of *Konosirus*, *Clupanodon* and *Nematalosa*.

	Prepelvic scutes							Postpelvic scutes						
	14	15	16	17	18	19	20	10	11	12	13	14	15	16
Konosirus														
punctatus				1	2	12	6					1	12	8
Clupanodon														
thrissa				1	8				4	5				
Nematalosa														
erebi	1	3	35	29	1				7	35	23	4		
chanpole				6				2	4					
come					7	7	1	3	5	6	1			
arabica					1	10		1	-	-	2	7	1	
nasus				3	26	4			7	19	7			
japonicus			1	2	14	1					1	12	4	1
vlaminghi			1	2	5	2				6	3	1		
papuensis			2	44	2				13	32	3			
flyensis			2	33	7			2	19	20	1			

	Total ventral scutes												
	25	26	27	28	29	30	31	32	33	34	35	36	n
Konosirus													
punctatus								1	-	11	7	2	21
Clupanodon													
thrissa				1	3	5							9
Nematalosa													
erebi	1	1	4	23	24	12	4						69
chanpole			2	4									6
come					3	10	2						15
arabica					1	-	-	3	6	1			11
nasus				1	5	19	8						33
japonicus						1	2	10	4	1			18
vlaminghi					3	2	4	1					10
papuensis				14	30	4							48
flyensis		1	2	16	22	-	1						42

	Frontoparietal striae										
	2	3	4	5	6	7	8	9	10	11	n
Konosirus											
punctatus		2	3								5
Clupanodon											
thrissa		2	6	3							11
Nematalosa											
erebi	3	2	1	5	4	2					17
chanpole				1	2	2	2	2			9
come				4	8	8	-	2	1		23
arabica	3	4	1	3							11
nasus					2	2	9	9	-	3	25
japonicus				5	7						12
vlaminghi			1	1	1						3
papuensis		3	5	2							10
flyensis		2	2	1	1						6

	Pseudobranchial filaments																					
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	n
Konosirus																						
punctatus															2	-	-	-	2	2	3	9
Clupanodon																						
thrissa											1	-	-	-	1	3	1	2				8
Nematalosa																						
erebi							2	5	7	6	7	5	2	5	4	1	1	-	3	1		49
chanpole										1	-	1	1	1	2							6
come				1	1	1	1	1	-	5	1	-	-	2	-	1						14
arabica								2	-	-	1	6	1	-	-	1	1					12
nasus				2	-	3	-	1	2	7	2	2	7	1	-	1						28
japonicus							4	-	2	-	3	-	3	-	-	1						13
vlaminghi													1	2	1	4	1					9
papuensis	1	1	1	4	6	2	2	6	4	1	5	-	1									34
flyensis	1	-	-	4	4	5	2	3	5	3	2	1	-	1	1							32

Table 10. Frequency distributions for certain meristic characters in Indo-Pacific species of Gonialosa and Anodontostoma.

	Unbranched and branched dorsal fin rays									Total dorsal fin rays									Total pectoral fin rays					
	iii	iv	v	11	12	13	14	15	16	14	15	16	17	18	19	20	21	n	13	14	15	16	17	n
Gonialosa																								
manmina	11	3		7	7					4	9	1						14		3	7	13	1	24
modesta	2	7			6	3					1	6	2					9		5	12	1		18
whiteheadi		1		1							1							1		1				1
Anodontostoma																								
thailandiae	7	27	4				10	21	7				2	7	22	7		38		4	31	29	4	68
chacunda	8	119	23		1	11	55	74	9				12	43	82	12	1	150	2	39	156	92	4	
selangkat		8	1				1	7	1				-	1	6	2		9			4	14		18

	Unbranched and branched anal fin rays														Total anal fin rays												
	ii	iii	iv	15	16	17	18	19	20	21	22	23	24	25	17	18	19	20	21	22	23	24	25	26	27	28	n
Gonialosa																											
manmina	5	8						1	1	3	6	-	2							1	3	3	4	1	1		13
modesta		9								2	2	3	1	1								2	2	3	1	1	9
whiteheadi		1											1												1		1
Anodontostoma																											
thailandiae	20	18				8	18	10	2							1	5	15	9	7	1						38
chacunda	41	105	4	4	18	60	48	16	4						2	3	26	71	36	12							150
selangkat	4	4	1	2	2	2	2	1							1	2	1	2	3								9

	Lateral scale series																												
	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	-	71	n
Gonialosa																														
manmina														1	2	1	-	-	-	2	-	1	1	1	1	2	1	-	1	14
modesta							2	3	-	2	1	-	1																	9
whiteheadi						1																								1
Anodontostoma																														
thailandiae	2	2	9	11	6	6	1	1																						38
chacunda	1	4	23	48	41	23	5	1																						146
selangkat		2	2	2	1	2																								9

	Predorsal scales																		Transverse scales															
	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	n	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	n
Gonialosa																																		
manmina													1	3	4	3	3	14										2	3	2	3	2	1	13
modesta									3	1	4	1						9					2	5	2									9
whiteheadi									1									1					1											1
Anodontostoma																																		
thailandiae		1	5	11	5	6	2	1										31		3	11	16												30
chacunda	4	32	74	27	7													144	2	33	101	16												152
selangkat	1	1	2	5														9		1	8													9

Table 10.1 Frequency distributions for certain meristic characters in Indo-Pacific species of Gonialosa and Anodontostoma.

	Circumpeduncular scales								Prepelvic scutes						Postpelvic scutes						Total ventral scutes									Branchiostegal rays	
	12	14	16	18	20	22	24	n	15	16	17	18	19	20	9	10	11	12	13	14	26	27	28	29	30	31	32	33	n	5	n
Gonialosa																															
manmina				1	7	4	1	13		1	4	6	1	2			5	4	4	1		1	-	4	4	4	-	1	14	4	4
macrura		5	2	2				9			3	4	2			1	7	1					2	6	1				9	6	6
whiteheadi			1					1			1					1						1							1	1	1
Anodontostoma																															
thailandiae		24						24		3	35					3	25	10				5	24	9					38	16	16
chacunda	12	117						129	2	17	118	11			2	12	116	18			3	16	116	13						32	32
selangkat		9						9			9						2	6	1				2	6	-	1			9	9	9

	Pseudobranchial filaments																					
	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	n
Gonialosa																						
manmina							1	2	1	3	1	3	1									12
macrura								3	1	2	3											9
whiteheadi								1														1
Anodontostoma																						
thailandiae					1	-	4	7	10	7	3	7	4	7	4	6	1	2				63
chacunda	1	-	-	-	2	9	9	8	23	39	51	33	22	7	5	1	1					211
selangkat											1	2	2	-	-	2	1	2	1			12

Table 11. Frequency distributions for certain meristic characters in Indo-Pacific species of Engraulis.

	Unbranched and branched dorsal fin rays							Unbranched and branched anal fin rays											Total pectoral fin rays								Branchiostegal rays					
	ii	iii	11	12	13	14	n	ii	iii	12	13	14	15	16	17	18	19	n	13	14	15	16	17	18	19	n	12	13	14	15	16	n
Engraulis																																
japonicus																																
tropical form[1]	2	56	6	37	15		116	29	31	1	4	29	22	4				60		6	23	33	2			64	4	29	22			55
temperate form[2]	7	92	1	52	62	9	223	30	92		2	8	33	60	12	6	1	122	1	1	13	48	42	17	2	124	2	16	39	26	3	86

	Lateral scale series									Predorsal scales						Pseudobranchial filaments													
	38	39	40	41	42	43	44	45	n	16	17	18	19	20	n	22	23	24	25	26	27	28	29	30	31	32	33	34	n
Engraulis																													
japonicus																													
tropical form	1	2	12	12	13	9	2		51	3	6	2			11			3	3	12	14	7	7	4	-	1	-	1	52
temperate form			5	7	19	15	16	2	64	1	8	6	3	1	19	1	-	7	3	7	10	9	16	8	6	5	2	2	76

1 From North Arabian Sea, Mahé (French), Philippines and Indonesia.
2 From South Africa, Australia, Tasmania, Hong Kong, China and Japan.

Table 12. Frequency distributions for certain meristic characters in Indo-Pacific species of *Stolephorus*.

Unbranched and branched dorsal fin rays

	ii	iii	10	11	12	13	14	15	n
Stolephorus									
purpureus	110		1	59	48	2			110
buccaneeri	116		2	33	70	10	1		116
heterolobus	83	5		6	69	13			88
devisi	9	113		25	89	8			122
indicus		124		1	4	109	10		124
commersonii		148			13	124	11		148
brachycephalus		15				14	1		15
chinensis		38				13	22	3	38
waitei		146			12	119	15		146
holodon		26			2	19	4	1	26
andhraensis		25			4	18	3		25
tysoni		23			2	17	4		23
ronquilloi		88			26	61	1		88
insularis		215		3	64	139	9		215
dubiosus		75		21	48	6			75
baganensis		48		12	32	4			48
tri		29		4	25				29

Unbranched and branched anal fin rays

	ii	iii	12	13	14	15	16	17	18	19	20	21	22	n
Stolephorus														
purpureus	112		2	17	60	32	1							112
buccaneeri	115		16	41	50	8								115
heterolobus	87			1	17	42	24	3						87
devisi		130			4	24	61	39	2					130
indicus		124			1	1	18	67	34	3				124
commersonii		152						19	70	54	9			152
brachycephalus		15								1	7	5	2	15
chinensis		38						4	9	18	7			38
waitei		179					2	7	50	98	20	2		179
holodon		26						2	12	10	2			26
andhraensis		25					2	14	7	-	2			25
tysoni		23							2	7	11	2	1	23
ronquilloi		90					8	45	25	12				90
insularis		200					15	69	83	28	5			200
dubiosus		77					1	5	29	31	10	1		77
baganensis		48						2	21	21	4			48
tri		30					2	7	18	3				30

Total pectoral fin rays

	10	11	12	13	14	15	16	17	n
Stolephorus									
purpureus				19	51	31	5	1	107
buccaneeri				4	28	52	19	2	105
heterolobus			3	29	51	7			90
devisi			12	57	65	6			140
indicus				8	55	60	7	1	131
commersonii			1	34	104	20			159
brachycephalus		1	7	6	1				15
chinensis	1	1	21	44	8				75
waitei			4	91	70	5	1		171
holodon		1	11	10	2	1			25
andhraensis		7	12	4	1				24
tysoni		2	12	8	1				23
ronquilloi		5	42	51	1				99
insularis		30	143	60	6				239
dubiosus		7	55	16	2				80
baganensis		3	40	5					48
tri			5	20	6				31

Lateral scale series

	33	34	35	36	37	38	39	40	41	42	43	44	45	n
Stolephorus														
pupureus								17	39	24	5	1		86
buccaneeri						1	9	22	22	19	7	1	1	82
heterolobus							12	11	15	18	9	2		67
devisi					6	1	15	17	19	10	3			71
indicus					2	29	18	28	17	8	-	1		103
commersonii			12	62	49	14								137
brachycephalus		7	6	1										14
chinensis			1	15	8	7	5	1						37
waitei		1	11	54	31	11								108
holodon						8	8	5						21
andhraensis					2	9	11	1						23
tysoni					7	9	6							22
ronquilloi			6	33	39	14	1							93
insularis			4	39	73	59	7							182
dubiosus	1	7	10	16	16	6	2							58
baganensis		8	26	17	3									54
tri	1	6	7	3										17

Predorsal scales

	15	16	17	18	19	20	21	22	n
Stolephorus									
pupureus			1	14	35	17	7		74
buccaneeri			15	37	28	9			89
heterolobus				11	25	18	6	2	62
devisi			2	7	25	25	9	2	70
indicus				1	24	41	24	1	91
commersonii	1	10	11	45	44	6			117
brachycephalus		3	9	1					13
chinensis				8	17	9	3		37
waitei		1	-	12	21	4			44
holodon					7	8	1		16
andhraensis				6	6	6			18
tysoni			1	10	9				20
ronquilloi				11	38	37	5		91
insularis				4	27	45	9		85
dubiosus			10	24	11	2			47
baganensis			1	16	7				24
tri				3	22				25

Branchiostegal rays

	9	10	11	12	13	14	15	n
Stolephorus								
pupureus			1	12	32	21	3	69
buccaneeri		3	6	24	18	7	1	59
heterolobus			4	20	33	14	2	73
devisi				17	37	14	3	71
indicus		1	1	10	54	25	4	95
commersonii			10	63	33	3		109
brachycephalus		7	9					16
chinensis		2	29	14	1			46
waitei			8	40	51	14		113
holodon		6	16	1				23
andhraensis	1	6	5	1				13
tysoni		9	7	6				22
ronquilloi		15	33	3				51
insularis	3	55	55	8				121
dubiosus		16	24	3				43
baganensis	1	16	11	2				30
tri		5	13	3				21

Table 12.1 Frequency distributions for certain meristic characters in Indo-Pacific species of Stolephorus.

	Prepelvic scutes										Pseudobranchial filaments																		
	0	1	2	3	4	5	6	7	8	n	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	n
Stolephorus																													
purpureus	32	3	7	6	2	3				53							1	1	1	2	10	16	14	7	3	7			62
buccaneeri			2	6	37	65	7	1		118								1	-	2	7	6	20	12	12	5	4	3	72
heterolobus					3	60	14			77							4	7	15	19	16	18	5	1					85
devisi				2	10	74	31			117	1	-	-	-	-	1	3	9	8	12	19	16	8	8	3				88
indicus			1	11	66	24	3			105								2	2	3	14	30	19	15	12	8	3		108
commersonii	1	13	42	70	14	1				141					2	5	18	26	20	16	16	7	4						114
brachycephalus					8	6				14					4	4	2	1											11
chinensis					3	15	14	2		34				1	1	2	7	19	3	3									36
waitei					2	25	34	16		77					1	1	8	12	22	38	22	8	2	3	1				118
holodon							1	15	3	19					4	1	6	1	3	2	1	1							19
andhraensis							20	4		24					2	3	7	3											15
tysoni						1	17	5		23		3	10	7	3														23
ronquilloi					1	5	18	9		33						9	20	11	5	1									46
insularis					2	11	149	64	5	231				2	9	22	14	6	2	1									56
dubiosus					1	2	50	23		76					2	-	5	7	5	1	1								21
baganensis							14	32	2	48				2	3	8	9	3	1										26
tri							19	10	1	30					1	2	8	3	2										16

	Vertical insertion of anal fin below n^{th} dorsal fin ray (including unbranched dorsal fin rays)																
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	more or less behind dorsal fin base	n
Stolephorus																	
purpureus																- always -	222
buccaneeri																- always -	162
heterolobus										4	15	27	20	6	1	5	78
devisi												5	14	23	2	25	69
indicus						1	11	4	-	4	1						21
commersonii						2	12	21	27	10							72
brachycephalus							4	6	2	1							13
chinensis				1	6	18	9	2									36
waitei						2	18	14	3	2							39
holodon						4	7	7									18
andhraensis						2	8	14									24
tysoni	1	2	4	9	7												23
ronquilloi					1	8	14	10	1								34
insularis						2	7	13	3								25
dubiosus						1	2	9	8	12	1						33
baganensis								1	3	4							8
tri									3	8	1						12

Table 13. Frequency distributions for certain meristic characters in Indo-Pacific species of *Thryssa*.

	Unbranched and branched dorsal fin rays					
	iii	9	10	11	12	n
Thryssa (*Thrissina*)						
baelama	18				18	18
Thryssa (*Scutengraulis*)						
chefuensis	7			7	-	7
rastrosa	4			3	1	4
scratchleyi	2			2	-	2
aestuaria	7		1	3	3	7
kammalensis	19			17	2	19
kammalensoides	2			2	-	2
vitrirostris	21		6	14	1	21
adelae	10		5	5	-	10
dussumieri	25	1	3	20	1	25
mystax	29		2	7	20	29
polybranchialis	10		3	6	1	10
gautamiensis	26		4	18	4	26
malabarica	13		2	10	1	13
hamiltonii	40		2	33	5	40
whiteheadi	20	1	14	5	-	20
purava	43	3	38	2	-	43
stenosoma	9	1	7	1	-	9
dayi	12		6	6	-	12
spinidens	8	2	5	1	-	8
Thryssa (*Thryssa*)						
setirostris	17		1	4	12	17

	Unbranched and branched anal fin rays																									
	iii	iv	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	n
Thryssa (*Thrissina*)																										
baelama	75	8	1	2	10	16	29	17	5	2	1															83
Thryssa (*Scutengraulis*)																										
chefuensis	6	1		1	-	3	-	-	2	1																7
rastrosa	2	2						1	1	1	1															4
scratchleyi	2													2												2
aestuaria	1	6						1	3	1	2															7
kammalensis	36	1						1	7	10	11	7	1													37
kammalensoides	2									1	1															2
vitrirostris	144	3								3	12	25	14	20	17	28	17	5	6							147
adelae	9	1											1	-	1	-	3	1	3	1						10
dussumieri	90							1	1	8	26	27	17	9	-	1										90
mystax	70							1	1	3	9	14	24	8	6	4										70
polybranchialis	9	1												3	1	3	2	1								10
gautamiensis	37	2										3	7	10	7	12										39
malabarica	17												1	2	3	5	6									17
hamiltonii	91	4									4	5	10	19	20	29	7	1								95
whiteheadi	20																	1	4	5	5	5				20
purava	39	9															2	1	3	12	15	8	7			48
stenosoma	9																		1	-	3	-	2	3		9
dayi	12																			1	4	2	3	1	1	12
spinidens	7	1																		3	1	1	2	1		8
Thryssa (*Thryssa*)																										
setirostris	40	1						1	1	2	6	17	5	7	2											41

	Total pectoral fin rays							
	9	10	11	12	13	14	15	n
Thryssa (*Thrissina*)								
baelama				3	15	9	1	28
Thryssa (*Scutengraulis*)								
chefuensis				6	7			13
rastrosa					7			7
scratchleyi					1	2	1	4
aestuaria				6	8			14
kammalensis		10	33	1				44
kammalensoides				1	3			4
vitrirostris				21	20			41
adelae				13	3			16
dussumieri	1	3	74	82	2			162
mystax			2	31	19			52
polybranchialis				15	5			20
gautamiensis				24	23			47
malabarica				1	20	7		28
hamiltonii			3	37	14			54
whiteheadi				11	26	3		40
purava			1	18	50	6		75
stenosoma				5	10	2		17
dayi				18	12	4		34
spinidens				9	7			16
Thryssa (*Thryssa*)								
setirostris				12	49	15		76

	Lateral scale series																			
	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	n
Thryssa (*Thrissina*)																				
baelama					2	3	12	15	14	4										50
Thryssa (*Scutengraulis*)																				
chefuensis	1	1	1	4																7
rastrosa											3	1								4
scratchleyi														1	1					2
aestuaria					2	2	1	-	1	1										7
kammalensis							1	2	11	-	-	2								16
kammalensoides							1	1												2
vitrirostris											4	9	9	7	3					32
adelae														3	3	1				7
dussumieri						1	2	8	1	5	5									22
mystax											2	6	9	7	7	4	6	1	1	43
polybranchialis												1	4	4	1					10
gautamiensis												1	3	7	7	6				24
malabarica								1	2	-	3	5	2	4						17
hamiltonii												2	8	12	13	9	1			45
whiteheadi											1	1	-	5	9	3				19
purava													2	1	10	19	3			35
stenosoma														5	1	2	1			9
dayi															3	1	3	4		11
spinidens														1	-	-	2	4	1	8
Thryssa (*Thryssa*)																				
setirostris												5	4	4	4	2	1			20

Table 15.1 Frequency distributions for certain meristic characters in Indo-Pacific species of Thryssa.

	Predorsal scales												Transverse scales						Prepelvic scutes													
	13	14	15	16	17	18	19	20	21	22	23	n	9	10	11	12	13	n	4	5	6	7	8	9	-	14	15	16	17	18	19	20
Thryssa (Thryssina)																																
baelama	1	3	8	-	1							13	6	1				7	2	14	51	27	15	2								
Thryssa (Scutengraulis)																																
chefuensis		1	5	1								7	6	1				7										4	2	1		
rastrosa							2	1	1			4		4				4											3	-	1	
scratchleyi							1	1				2		1	1			2													2	
aestuaria	1	1	3	2								7	5	2				7								1	3	3				
kammalensis		2	3	3	4	6						17	4	11	1			16									11	20	3			
kammalensoides						2						2		2				2										1	-	1		
vitrirostris						2	6	7	4			19		1	8	10		19										15	59	62	6	
adelae								1	3			4			2	4		6											8	1		
dussumieri		2	4	7	4	2						19	7	4	3			14								3	64	28				
mystax			1	-	1	2	1	2	10	7	2	26			2	16	3	21										2	19	32	11	2
polybranchialis						4	4	2				10			4	2		6									1	3	5			
gautamiensis						2	9	5	5	1		22			11	6		17								1	5	28	6			
malabarica				6	7	4						17			12	1		13								1	9	5	2			
hamiltonii								1	-	-	2	3			11	4	3	18									2	6	44	31	6	1
whiteheadi						3	4	10	1			18			10	2		12									12	6	2			
purava							5	13	11	-	1	30			6	15		21									9	34	4			
stenosoma							2	2	1	2	2	9			5	3		8									1	5	3			
dayi								3	8	1		12			1	10		11									4	8				
spinidens							1	1	2	2	2	8			3	5		8										7	1			
Thryssa (Thryssa)																																
setirostris							1	9	1	2		13			12	1		13										7	22	10		

	Postpelvic scutes								Total ventral scutes																					
	6	7	8	9	10	11	12	13	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	n
Thryssa (Thrissina)																														
baelama		1	13	88	9				1	2	17	48	27	14	2															111
Thryssa (Scutengraulis)																														
chefuensis				3	4																	2	3	1	1					7
rastrosa					2	2																		1	2	1				4
scratchleyi							2																					2		2
aestuaria			1	6																2	2	3								7
kammalensis		2	25	7															1	10	15	7	1							34
kammalensoides					1	1																	1	-	-	1				2
vitrirostris			1	10	66	59	6															1	8	39	63	26	5			142
adelae				6	2	1																	5	3	1					9
dussumieri	2	43	48	2														2	32	48	13									95
mystax			6	4	6	41	8	1													2	3	4	1	15	27	8	5	1	66
polybranchialis				6	3																	4	3	2						9
gautamiensis					37	3															1	5	25	9						40
malabarica			4	12	1															2	10	3	2							17
hamiltonii				4	54	27	5																6	32	34	15	1	2		90
whiteheadi					12	7	1															7	8	4	1					20
purava				4	16	26	1															8	15	21	3					47
stenosoma					2	4	3																1	4	4					9
dayi					6	6																3	4	5						12
spinidens						2	5	1																2	4	2				8
Thryssa (Thryssa)																														
setirostris				30	9																	6	19	10	4					39

Table 13.2 Frequency distributions for certain meristic characters in Indo-Pacific species of Thryssa.

	Branchiostegal rays								Pseudobranchial filaments																												
	10	11	12	13	14	15	16	n	0	-	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	n
Thryssa (Thrissina)																																					
baelama			38	102	28	1		169															1	1	3	10	19	17	11	6	6	2	3	1	-	3	83
Thryssa (Scutengraulis)																																					
chefuensis	6	8						14									1	1	1	-	1	2	1														7
rastrosa			3	1				4											1	-	3																4
scratchleyi				2	1			3											1	1																	2
aestuaria	1	2	4					7													2	-	1	-	2	-	1	-	1								7
kammalensis	27	24	3					54			1	1	2	1	3	4	1 (greatly covered by basal membrane)																				-
kammalensoides				4				4																- hidden -													-
vitrirostris			33	118	108	3		262																- hidden -													-
adelae			4	8				12																- hidden -													-
dussumieri		4	51	92	8			156																- hidden, sometimes exposed only at their tips													-
mystax				20	47	16	1	84																- hidden -													-
polybranchialis			12	3				15																- hidden -													-
gautamiensis			6	32	26	1		65																- hidden -													-
malabarica		1	10	22				33																- hidden, sometimes exposed only at their tips													-
hamiltonii			35	52	4			91																- hidden, sometimes exposed only at their tips													-
purava			6	39	2			47																- hidden -													-
whiteheadi		15	23					38																- hidden -													-
stenosoma			7	6	2	1		16																- hidden -													-
dayi			8	10	4			22																- hidden -													-
spinidens		2	4	7	1			14																- hidden -													-
Thryssa (Thryssa)																																					
setirostris	27	40	7					74																- hidden -													-

Table 14. Frequency distributions for certain meristic characters in Indo-Pacific species of Lycothrissa.

	Unbranched and branched dorsal fin rays					Unbranched and branched anal fin rays								Total pectoral fin rays				Lateral scale series						Branchiostegal rays				
	ii	iii	9	10	n	iii	iv	44	45	46	47	48	n	13	14	15	n	45	46	47	48	49	n	12	13	14	15	n
Lycothrissa crocodilus	1	19	8	12	20	18	2	4	3	5	4	4	20	10	12	1	23	3	4	7	3	2	19	1	5	13	3	22

	Predorsal scales									Prepelvic scutes			Postpelvic scutes				Total ventral scutes					Vertical insertion of dorsal fin above nth anal fin ray (including unbranched anal fin rays)					
	25	26	27	28	29	30	31	32	n	7	8	9	8	9	10	11	16	17	18	19	n	7	8	9	10	11	n
Lycothrissa crocodilus	2	3	1	5	5	-	2	1	19	4	13	1	1	6	8	3	4	3	8	3	18	1	4	5	4	3	17

Table 15. Frequency distributions for certain meristic characters in Indo-Pacific species of Papuengraulis.

	Unbranched and branched dorsal fin rays				Unbranched and branched anal fin rays									Total pectoral fin rays			Lateral scale series			Predorsal scales			Transverse scales		
	ii	3	4	n	iii	51	52	53	54	55	56	57	n	13	14	n	50	51	n	19	20	n	11	12	n
Papuengraulis micropinna	3	1	2	3	4	1	-	-	-	2	-	1	4	5	3	8	3	1	4	3	1	4	3	1	4

	Prepelvic scutes			Branchiosteral rays			Pseudobranchial filaments			
	5	6	n	10	11	n	14	15	16	n
Papuengraulis micropinna	3	1	4	2	6	8	3	-	1	4

Table 16. Frequency distributions for certain meristic characters in Indo-Pacific species of Setipinna and Heterothrissa.

	Unbranched and branched anal fin rays																																	
	iii	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	-	65	66	67	68	69	70	71	72	73	74	75	76	77	78	n
Setipinna																																		
brevifilis	7																			1	1	-	1	1	2	-	1							7
phasa	10																				2	1	-	1	1	2	1	-	1	-	-	-	1	10
wheeleri	3																							1	-	-	-	1	1					3
tenuifilis tenuifilis	48		1	-	2	6	13	7	11	4	3	-	1																					48
tenuifilis gilberti	2					1	-	-	-	-	-	-	1																					2
papuensis	4							2	-	-	2																							4
melanochir	17	1	1	3	2	5	5																											17
taty	81	1	6	2	7	14	21	13	11	4	1	1																						81
Heterothrissa																																		
breviceps	6												2	-	3	-	-	1																6

Table 16.1 Frequency distributions for certain meristic characters in Indo-Pacific species of *Setipinna* and *Heterothrissa*.

	Unbranched and branched dorsal fin rays								Total pectoral fin rays						Lateral scale series																		
	iii	10	11	12	13	14	15	n	11	12	13	14	15	n	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	n
Setipinna																																	
brevifilis	8	3	4	1				8				6	10	16													1	1	3	-	2		7
phasa	10	1	3	6				10			1	15	3	19															4	2	2	1	9
wheeleri	3		3					3				4	2	6															1	1	1		3
tenuifilis tenuifilis	15		3	11	1			15	4	78	8			90			1	9	15	12	1												38
tenuifilis gilberti	2			1	1			2			4			4						1	1												2
papuensis	4		1	3				4		3	1			4				3	1														4
melanochir	17	1	15	1				17			1	13	6	20						1	1	1	4	5	-	1							13
taty	18	1	6	11				18		6	69	59		134	4	5	6	17	10	7	-	-	1										50
Heterothrissa																																	
breviceps	6					3	3	6			9			9										1	1	-	2	1					5

	Predorsal scales															Transverse scales							Circumpeduncular scales				
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	n	11	12	13	14	15	16	n	12	14	16	18	n
Setipinna																											
brevifilis								1	-	-	1	3	2	1	8					2	4	6				8	8
phasa									1	-	4	2	1	2	10				4	1	2	7			6	4	10
wheeleri									3						3				2			2			2	1	3
tenuifilis tenuifilis		3	17	10	5										35	7	2					9	13				13
tenuifilis gilberti			1	-	1										2		1	1				2	2				2
papuensis			3	1											4	4						4	4				4
melanochir						2	3	3	2	-	2	1			13					4	1	5		4	1		5
taty	3	7	11	14	3	1									39	8	1					9	11				11
Heterothrissa																											
breviceps							1	-	3						4		1	1	3			5		1	4		5

	Branchiostegal rays								Prepelvic scutes														
	12	13	14	15	16	-	20	n	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Setipinna																							
brevifilis	6	9						15	2	1	1												
phasa		7	9	4				20	10														
wheeleri		2	4					6	3														
tenuifilis tenuifilis		1	50	38	2			91			1	11	26	9	1								
tenuifilis gilberti				2				2					1	1									
papuensis			2	2				4				1	3										
melanochir		5	13	2				20							1	-	4	3	5	2			
taty	2	13	66	39	6			126						2	1	8	17	13	19	6	7	3	1
Heterothrissa																							
breviceps							9	9			1	2	1	1	-	-	1						

Table 16.2 Frequency distributions for certain meristic characters in Indo-Pacific species of *Setipinna* and *Heterothrissa*.

	Postpelvic scutes									Total ventral scutes																				
	6	7	8	9	10	11	12	13	14	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	n
Setipinna																														
brevifilis	1	3									2	2																		4
phasa	2	8								2	8																			10
wheeleri	1	2								1	2																			3
tenuifilis tenuifilis		48											1	11	26	9	1													48
tenuifilis gilberti			2													1	1													2
papuensis		3	1											1	2	1														4
melanochir			2	6	7														1	-	-	9	1	4						15
taty				1	9	21	42	3	1												4	5	12	12	17	12	6	6	3	77
Heterothrissa																														
breviceps				3	2	1										2	1	1	1	-	1									6

	Tip of pectoral filament extending to above n^{th} anal fin ray (including unbranched anal fin rays)																													
	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	n
Setipinna																														
brevifilis	1	-	1	-	5	-	-	1																						8
phasa								1	-	-	1	-	1	-	-	1	2	1	1	2										10
wheeleri																							1	-	1	1				3
tenuifilis tenuifilis						2	4	4	6	1	1																			18
tenuifilis gilberti					1																									1
papuensis														1	1	-	1	-	-	-	1									4
melanochir																	- pectoral filament very short -													21
taty												3	-	2	2	-	1	4	2	3	4	2	2	4	2	2	-	-	1	34
Heterothrissa																														
breviceps																		1	-	-	1									2

Table 17. Frequency distributions for certain meristic characters in Indo-Pacific species of Coilia.

Unbranched and branched dorsal fin rays

	iii	9	10	11	12	13	n
Coilia							
ramcarati	6			3	2	1	6
borneensis	7			6	1		7
reynaldi	14		3	11			14
coomansi	1			1			1
rebentischii	7			6	1		7
neglecta	16		3	12	1		16
dussumieri	33		8	19	6		33
rendahlii	2		1		1		2
grayii	8		4	4			8
lindmani	23	1	13	8	1		23
macrognathos	5			2	3		5
mystus	16		2	12	2		16
nasus	33		8	17	8		33

Pectoral filaments

	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Coilia															
ramcarati		11													
borneensis									8	1					
reynaldi						3	10	7	3						
coomansi						3	1								
rebentischii												1	7	3	3
neglecta		28													
dussumieri	1	56													
rendahlii		5													
grayii			17												
lindmani		42													
macrognathos		8													
mystus		31													
nasus		52													

Pectoral rays

	5	6	7	8	9	10	11	12	13	14	n
Coilia											
ramcarati	5	6									11
borneensis	1	4	4								9
reynaldi		12	12								23
coomansi			2	2							4
rebentischii			3	8	2	1					14
neglecta					2	13	13				28
dussumieri				1	9	36	12				58
rendahlii							4	1			5
grayii						9	7	1			17
lindmani					4	24	14				42
macrognathos						2	4	2			8
mystus						7	22	2			31
nasus							28	20	2	2	52

Total pelvic fin rays

	6	7	8	9	10	n
Coilia						
ramcarati				2	9	11
borneensis		5				5
reynaldi		6				6
coomansi		9				9
rebentischii		14				14
neglecta		24				24
dussumieri		34				34
rendahlii		5				5
grayii	2	16				18
lindmani		37				37
macrognathos		8				8
mystus	2	26				28
nasus		39				39

Predorsal scales

	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	n
Coilia																		
ramcarati			1	-	3	1	1											6
borneensis	1	4	4	1														10
reynaldi			1	4	6	1												12
coomansi			1															1
rebentischii					2	5												7
neglecta				1	7	7	1											16
dussumieri			7	3	7	7	4											28
rendahlii								1	-	2								3
grayii					3	3	-	2										8
lindmani			3	8	7	5	2											25
macrognathos				3	2													5
mystus			1	2	6	6	1											16
nasus										3	12	5	6	2	3	1	1	33

Branchiostegal rays

	9	10	11	12	13	n
Coilia						
ramcarati		1	4	2		7
borneensis		8	1			9
reynaldi	4	4	8			16
coomansi	2	1				3
rebentischii		7	1			8
neglecta		16	52	13	1	82
dussumieri	1	13	31	7		52
rendahlii				5		5
grayii		2	14			16
lindmani	1	18	22	2		43
macrognathos		4	3			7
mystus		26				26
nasus		2	25	20	2	49

Table 17.1 Frequency distributions for certain meristic characters in Indo-Pacific species of <u>Coilia</u>.

Prepelvic scutes

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
<u>Coilia</u>																											
<u>ramcarati</u>						6																					
<u>borneensis</u>					6	1																					
<u>reynaldi</u>							2	1	5	5																	
<u>coomansi</u>												1	1														
<u>rebentischii</u>	1	6																									
<u>neglecta</u>						11	44	3																			
<u>dussumieri</u>					1	16	22																				
<u>rendahli</u>																			1	-	2						
<u>grayii</u>													1	-	-	8											
<u>lindmani</u>														3	14	8											
<u>macrognathos</u>															1	1	3										
<u>mystus</u>																	5	2	7	3							
<u>nasus</u>																	1	1	10	11	6	3	2	1	-	1	1

Postpelvic scutes

	7	8	9	10	11	12	-	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
<u>Coilia</u>																											
<u>ramcarati</u>				4	2																						
<u>borneensis</u>	1	6																									
<u>reynaldi</u>	1	1	4	5	2																						
<u>coomansi</u>			1	-	1																						
<u>rebentischii</u>				3	2	2																					
<u>neglecta</u>	8	36	14																								
<u>dussumieri</u>	6	28	5																								
<u>rendahli</u>																						1	1	1			
<u>grayii</u>										1	-	2	2	2	-	-	2										
<u>lindmani</u>								2	6	8	4	2	3														
<u>macrognathos</u>																			1	-	1	1	-	-	1	-	1
<u>mystus</u>												2	4	2	4	2	-	1	-	2							
<u>nasus</u>													1	-	4	4	6	6	4	3	3	3	2	1			

Table 17.2 Frequency distributions for certain meristic characters in Indo-Pacific species of Coilia.

	Total ventral scutes													
	11	12	13	14	15	16	17	18	19	20	21	22	23	n
Coilia														
ramcarati					4	2								6
borneensis	1	5	1											7
reynaldi			1	-	-	3	1	3	5					13
coomansi										1	-	-	1	2
rebentischii	3	3	1											7
neglecta		3	9	35	11									58
dussumieri		4	13	18	4									39

	Total ventral scutes																												
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	n
rendahli																					2	1							3
grayii			1	1	-	1	3	2	-	-	1																		9
lindmani	3	6	5	3	4	3	1																						25
macrognathos														1	1	1	-	-	-	1	1								5
mystus								1	1	7	2	2	1	-	1	1	1												17
nasus										1	1	1	4	7	4	1	1	6	4	1	1	1	-	1	1	-	1	1	37

	Pseudobranchial filaments																						
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	n
Coilia																							
ramcarati											1	-	1	-	1								3
borneensis									2														2
reynaldi						2	1	1	1	1	1	2											9
coomansi												2											2
rebentischii									1	1	-	1	3	-	-	-	1						7
neglecta			3	1	1	4	1	-	1	1													12
dussumieri	1	6	2	2	5	1	1	1	-	1	1												21
rendahli											1	-	-	-	-	-	1	1					3
grayii												2	-	1	3	2	-	1					9
lindmani											2	7	4	-	4	1	1						19
macrognathos								1	1	1	1	1	1										6
mystus									2	1	-	1	1	1	1	-	1	1	2	-	-	1	12
nasus											1	-	1	2	4	9	5	3	3	1	1		30