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Monographs of Fishes of China

**A STUDY ON THE CLASSIFICATION
OF THE SCIAENOID FISHES OF
CHINA, WITH DESCRIPTION OF
NEW GENERA AND SPECIES**

By

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Edited by: John A. Musick

Linda P. Mercer

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Director

中国鱼类专著集

中国石首鱼类分类系统的研究 和新属新种的叙述

朱元鼎 罗云林 伍汉霖 著

(上海水产学院 上海水产研究所)

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ABSTRACT

This book was a thesis selected by "The Collective Papers of Science and Technology Research of Shanghai City, 1960". The article reviews the literature of past hundred years on sciaenid fishes, examines sciaenid specimens collected along our coastal areas, and contains a detailed description of the taxonomy of Chinese sciaenids.

This book is for the use of the teachers and students of the biology departments in colleges and scientists of related specialties.

中国鱼类专著集
朱元鼎 主编
中国石首鱼类分类系统的研究
和新属新种的叙述
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FORWARD

The purpose of this article is to review the taxonomic information on Chinese sciaenids for the past hundred years or so, to supplement and advance the taxonomic system of Chinese sciaenids. It is also based on sciaenid specimens collected from different coastal areas of our country during last few years. Thus, a relatively complete report is made.

The taxonomic system of this article is mainly based on the comparative morphology of otoliths and swimbladders, and also on the external morphological characters often used by previous authors. Through detailed study and consideration, we think that the morphological differentiation of swimbladders and otoliths are closely related to the morphology of the fish and their ecology, which have significant importance to the evolutionary process and the phylogenetic relationship of this family of fishes. A relatively detailed observation of the position of the snout and mental (mandibular) pores was made. We think these characters also have certain significance to fish taxonomy and ecology.

This article describes 37 species of sciaenid fishes from the China coast, belonging to 13 genera, 7 subfamilies. These include four new subfamilies, two new genera and four new species.

The continental shelf along the coast of our country is a very large area. Generally, its depth is less than 100 meters and most bottom is muddy sand. The large input of freshwater and sediment from the rivers has provided the best natural environment and living conditions for sciaenid fishes. Therefore, the number of taxa is especially larger than adjacent countries. Some of the taxa are endemic to the Chinese coast. Sciaenids are the most productive economic fishes of our country. This is also a specific character of our fishery and a basic difference from the fisheries of other countries. Thus, any investigation about their taxonomy, morphology, ecology, physiology, etc., is not only highly essential, but also has high practical significance.

The illustrations in this article of the external fish features were made by comrades Yi Ze-Yian and Liu Sau-Ping.

During the preparation of this manuscript, comrades Ni Yung, Yu San-Xia and Cheng Chun-Shing helped in copying. We greatly appreciate their help.

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January 1962

Translation Note

This translation follows completely the original Chinese edition, using the same English style that the authors used in the English portions of the article. We made no effort to correct any error which appeared in the original edition. The sections that were already in English are indicated but are not included in this translation. Synonymy sections are omitted except those references originally in Chinese. Localities are transliterated from Chinese by following the "Xinhua (Hsinhua) Dictionary", 1972 edition, Sangwu Press, Peking. Xinhua transliteration is the standard romanized spelling of Chinese.

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Translated by: Labbish N. Chao

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INTRODUCTION

1. Literature Review and a Brief History of Research on the Sciaenids of China

The taxonomic study of sciaenids has a long history. The important literature of sciaenids, especially those dealing with Chinese sciaenids, is briefly reviewed as follows.

Linnaeus, 1758, [42]^{1/} in his 10th edition of "Systema natura", first volume, Pisces Thoracici, recorded one sciaenid genus (Sciaena) with five species. Three of these species, S. cappa, S. lepisma and S. unimaculata were never mentioned again in the literature. Thus, they are questionable. The other two species are S. cirrhosa, with one mental barbel, and S. umbra, without a mental barbel. Both are Mediterranean species.

Cuvier, 1817, [13] in his second volume of "Le règne animal" described 130 new fish genera. There were three new genera of sciaenids, Umbrina, Otolithes and Ancylodon. In 1829, in the second edition of "Le règne animal", he added 83 names for new fish genera. Corvina was the new genus of sciaenid. The nomenclature of Cuvier's (four) new genera has been disputed by later ichthyologists because of problems in Cuvier's designation of type species of genera or because of the strict limitations of the diagnostic characters of some genera. For example, Günther (1860), Day (1878-1888), Jordan and Gilbert (1883), and Jordan and Eigenmann (1889) had followed Cuvier by designating S. umbra L., without the mental barbel as the type-species of Sciaena L. and S. cirrhosa L., with the mental barbel, as the type-species of Umbrina Cuv. But Bleeker (1863) and most recent authors, e.g., Fowler (1933), Weber and DeBauford (1936), Lin (1938), Herre (1953), etc., thought that the type-species of Sciaena should be S. cirrhosa L. Therefore, Umbrina Cuv. should be a synonym of Sciaena L. Furthermore, they even placed Corvina Cuv. 1829, in the synonymy of Johnius Bl., 1793.

2 Cuvier and Valenciennes, 1830, [14] in their volume five of "Histoire naturelles des poissons" classified sciaenids into two groups, one with barbels and one without barbels. They described four genera of sciaenids with barbels, Pogonias, Micropogon, Umbrina (= Sciaena) and Lonchurus, and eleven genera of sciaenids without barbels, such as Ancylodon, Otolithus,

^{1/} The number in the brackets indicates the reference number in "Literature Cited". The title, volume, pages and figures are included in each reference item.

Larimus, Sciaena (= Johnius), Corvina (= Johnius) and Johnius. In their description of species and genera of sciaenids, they also described the shapes and the branches of swimbladders. This has given later authors a guide in studying swimbladder morphology.

Günther, 1860, [19] in his second volume of "Catalogue of the fishes of the British Museum" also classified the sciaenids into two groups, with and without barbels, a system similar to that of Cuvier and Valenciennes. First, he erected the new genus Collichthys on the basis of a Chinese species, Sciaena lucida Richardson, as type species of this new genus. But he also included the apparent morphologically different species Otolithus biauritus Cantor (= Otolithoides biauritus) and Bola pama Ham.-Buch. (= Pama pama) in the same genus Collichthys. In the description of genus characters, he often mentioned the shape of swimbladder but sometimes he confused different swimbladders. For example, the complicated swimbladders of Otolithes and Collichthys had been described. Actually, each of them includes more than one genus today.

Bleeker, 1863, [2] in his "Memoire sur les poissons de la Côte de Guinée" pointed out that Linnaeus followed the species list of Artedi's genus Sciaena, in which S. cirrhosa is the first on the list. Therefore, he thought that this species should be the type-species of the genus Sciaena. But Jordan and Eigenmann (1889, p. 397) disagreed with this idea, and they rejected the importance of the species order on the list. They claimed that Cuvier's classification should be followed. Bleeker, 1863, [3] reported an article about fishes collected from Xiamen (Amoy), China. Among them are four sciaenid species: Hemisciaena lucida [Collichthys lucidus (Richardson)], Pseudosciaena amblyceps [= P. crocea (Richardson)], Pseudosciaena amoyensis [= Miichthy miiuy (Basil.)], and Pseudosciaena albida [Wak coibor (Ham.-Buch.)]. In 1874, [6] he published a paper, "Memoire sur les sciaenoides et les sillaginoides de l'Inde Archipelagique", and classified the sciaenids into Otolithus, Collichthys, Pseudosciaena, Johnius and Sciaena, five genera with descriptions of 27 species. In 1879 [7] he wrote an article "Sur quelques espèces inédite ou peu connus de poissons de Chine, appartenant au Muséum de Hambourg". He described a new species, Pseudosciaena polyactis, from Shanghai with a figure of its external morphology.

Day, 1878-1888, [15] in "The fishes of India", classified Indian sciaenids into Umbrina (= Sciaena), Sciaena (= Johnius), Sciaenoides (= Otolithoides) and Otolithus, four genera with descriptions of 27 species and with 22 figures. In the species descriptions he occasionally mentioned the shape of the swimbladder and its number of diverticula. He also recorded some biological and fishery data of some fishes.

Jordan and Gilbert, 1883, [28] in "Synopsis of the fishes of North America" separated sciaenids into three subfamilies: Sciaeninae, Otolithinae and Isopisthinae. The first subfamily, Sciaeninae, has 10 + 14 vertebrae, dorsal fins are connected or very close and the second dorsal fin is longer than the anal fin. It consisted of 9 genera including Heploidonotus (Aplodinotus), Pogonias, Sciaena, Micropogon, Menticirrhus, Larimus. The second subfamily, Otolithinae, has 14 + 10 vertebrae, with or without canine teeth. The remaining characters are similar to those of the first subfamily. The second subfamily included Atractoscion and Cynoscion. The third subfamily, Isopisthinae, has two well separated dorsal fins, an elongated anal fin with 15-21 rays, the length of anal is approximately equal to second dorsal, and includes one genus, Seriphus.

Jordan and Eigenmann, 1889, [26] in their "A Review of the Sciaenidae of America and Europe" reported Otolithinae and Sciaeninae, two subfamilies, 26 genera and 112 species with four plates and 12 figures. In their analysis of subfamilies and genera of sciaenids, they also mentioned several Asian and African genera, Collichthys, Otolithus, Sciaenoides (= Otolithoides), etc.

Cohn, 1907, [12] published an article with the title of "Die Schwimmblase einiger Sciaeniden". He discussed and described the structure and branching of sciaenid swimbladders. He also published a photograph of the swimbladder of Collichthys lucidus (which was misidentified as Otolithes argenteus) from China as an example.

Jordan and Thompson, 1911, [35] in their "Review of sciaenoid fishes of Japan" described two genera: Bairdiella and Sciaena with seven species. Their report of B. acanthodes may be incorrect because Bairdiella is an east Pacific, west coast of America genus. In the species key, they included within Sciaena three subgenera, Nibeia, Argyrosomme and Othonias (= Pseudosciaena). Their specimens of N. albiflora and S. manchurica (= P. polyactis) were collected from Lu-Sung (Port Arthur), China.

Frost, 1927, [18] in his "A comparative study of the otoliths of the Neopterygian fishes, XVIII. Percomorphi", described the otoliths of Sciaenidae. Two types were proposed, the sub-oval and elongated-oval. The sub-oval type is represented by Aplodinotus grunniens and elongated-oval type by Cynoscion nebulosus. He also described the morphology of all parts of their otoliths in detail and with two figures.

Fowler, 1933, [16] in the fish parts of the "contribution to the biology of the Philippine Archipelago and adjacent regions", volume 12, monograph no. 100, classified Sciaenidae

into four subfamilies: Otolithinae, Collichthyinae, Johniinae and Sciaeninae, with eight genera and 53 species. Johnius had the most number of species, 32. Sciaena was the next with eight species. But his genus Johnius was a complex, including Nibea, Argyrosomus and Wak. He nominated two new genera; Pama had Bola pama Ham.-Buch. as the type species, and Otolithoides had Otolithus biauritus Cantor as type species. In his taxonomic system, he put Pseudosciaena and Johnius, two very different genera, under the same subfamily, Johniinae. Meanwhile, he separated two closely related genera, Pseudosciaena and Collichthys, into two subfamilies. In his "Marine fishes of West Africa", volume 2, 1936, [17] he described five genera and 12 species of West African sciaenids. Among them, Johnius had six species, and Otolithes and Sciaena had two species each. The others were Cynoscion and Larimus with one species each.

Wang, 1935, [52] in "Study of the teleost fishes of coastal region of Shantung, II", described five genera and 10 species of sciaenids. Two of them were nominated as new species, but actually his Othonias brevirostris was a synonym of Pseudosciaena polyactis Blkr., and Nibea pingi was Atrobucca nibe Jord. & Thom.

Weber and DeBaufort, 1936, [53] in "The fishes of Indo-Australian Archipelago", volume 7, recorded sciaenids of Indo-Australian Archipelago with two subfamilies, Otolithinae and Sciaeninae, with six genera and 34 species. The first subfamily included four genera, Otolithes, Pama, Otolithoides and Pseudosciaena, the second subfamily included two genera, Johnius and Sciaena. They pointed out that the mouth size and position, and teeth structure of the sciaenids are correlated with their habitats. Those species and genera with large terminal mouth, oblique or projecting lower jaw, and with larger teeth or canines are upper water layer predators. Other species and genera with a small inferior mouth, blunt snout, without enlarged teeth, and usually with mental barbels are suited for bottom habitats. Their genus of Pseudosciaena was too generalized; actually, it referred to both Argyrosomus and Pseudosciaena.

Herre, 1932, [22] in his report of "Fishes from Kwangtung Province and Hainan Island, China" in the "Lingnan scientific Journal" recorded 129 species. Only two species were sciaenids, Collichthys lucidus and his new species, Nibea taipingensis. We recognize that his new species is the synonym of Nibea diacanthus (Lac.). He nominated Bahaba (1935) as a new genus and used Otolithes lini Herre (= Nibea flavolabiata Lin) as the type-species of the genus. In his "Checklist of Philippine fishes", 1953, [24] he recorded the family Sciaenidae with four genera and 13 species. They were three species of Otolithes, two species of Johnius, six species of "Pseudosciaena" and two

species of Sciaena. In fact, "Pseudosciaena" referred to Nibea, Argyrosomus, and Wak, not the true Pseudosciaena. From his checklist, the number of sciaenids in Philippine waters is relatively small.

Lin, 1935, [38] in his report of "Notes on some important sciaenid of China", did a preliminary study of the specimens from Shangtung, Chaingsu, Kuangchou, Zusang and Shanghai. There were six genera and 13 species described, among them, one new species Nibea flavolabiata Lin [= Bahaba flavolabiata (Lin)]. He mistakenly identified Sciaena miiuy Basil. as Sciaena japonica T. & S., and named it Corvina japonica (T. & S.). In his "Further notes on sciaenid fishes of China", 1938, [39] he put Chinese sciaenids into 10 genera and 25 species. There were two new genera, Miichthys with Sciaena miiuy Basil. as type species and Wak with Bola coitor Ham.-Buch. as type-species. In his classification he didn't use the intrageneric relationships to put the closely related genera together. For example, Collichthys and Pseudosciaena are two closely related genera, but he introduced a very different genus Otolithes between these two genera. Argyrosomus and Nibea are also two closely related genera; nevertheless, he put Nibea after Johnius and Wak. In his "Croakers of the South China Sea", 1940, [41] he described six species of Argyrosomus. Among them, Argyrosomus pawak was a new species.

Tang, 1937, [49] published a report of "A study of sciaenoid fishes of China", which recorded five genera and 25 species of Chinese sciaenids. Among them, three are new species, Pseudosciaena tingi (= Wak tingi), Pseudosciaena acuta (= Argyrosomus acutus) and Pseudosciaena macrocephalus (= Argyrosomus macrocephalus). His classification followed Weber and de Beaufort, 1936.

Matsubara, 1937, [43] in "Sciaenoid fishes found in Japan and adjacent water", listed Nibea, Johnius and Pseudosciaena, three genera of Sciaenidae. There were seven species of Nibea, and he also put Miichthys miiuy in this genus as a new species (we think it is not necessary), Nibea imbricata Matsubara [= Miichthys miiuy (Basil.)]. The genus Johnius had only one species, Johnius belengerii, and the genus Pseudosciaena included two species, P. crocea and P. manchurica (= P. polyactis). In his listing of 10 species, three to four species including P. crocea and P. manchurica were from the Chinese coast or Southwest Korea. Only six to seven species were from Japanese coastal waters. This paper emphasized the various morphometrics of sciaenids.

Cheng, 1940, [8] in his unpublished thesis,^{2/} described and discussed the comparative morphology of scales, skulls, swimbladders and otoliths of Miichthys miiuy, Nibea albiflora, Pseudosciaena crocea, P. polyactis and Collichthys, five common sciaenid species. His descriptions of the otoliths and swimbladders of these five sciaenids were rather accurate. He described the tadpole-shaped impression on the ventral surface of the sagitta into two sections, the "head" and the "tail", for comparative descriptions. Much useful information and new methods were suggested for the study of the comparative morphology of this family.

Cheng, 1948, [9] in his college graduate thesis^{3/}, had used seven commonly seen sciaenids; Pseudosciaena crocea, P. polyactis, Collichthys, Argyrosomus argentatus, Nibea albiflora, Atrobucca nibe and Miichthys miiuy from Shanghai as study materials. Detailed morphological comparisons of the swimbladders of each species were made. But among seven species that he observed, there were only two forms of the swimbladders. Other forms of swimbladders occur in sciaenid species which were not studied by Cheng.

Smith, 1953, [48] in "The sea fishes of Southern Africa" recorded four genera and 11 species of sciaenids; one species each of Otolithes and Atrartoscion, four species of Johnius and five species of Sciaena. His Sciaena dussumieri (C. & V.) = Umbrina dussumieri C. & V. = Johnius amblycephalus (Blkr.) should be placed in Johnius, because its swimbladder and otolith are the same as those in Johnius. The presence or absence of mental barbels is of secondary importance (see text of genus Johnius).

^{2/}This thesis was submitted to College of Science, Tungwu University (Shanghai) by the author for a master's degree in June, 1940. With the agreement of the College of Science, Tungwu University, this study was completed at the Biology Department of St. John's University (Shanghai) under the direction of Professor Chu Yuan-Ting.

^{3/}This was the author's college graduate (Bachelor's Degree) thesis of the class of 1948, Biology Department, College of Science, St. John's University (Shanghai), completed under the direction of Professor Chu Yuan-Ting.

6 Chang, 1955, [54] in "Fishes of Yellow Sea and Po Hai, China", reported the sciaenids of Pao Hai and Yellow Sea with six genera and eight species. Johnius, Nibea, Argyrosomus and Miichthys each had one species, and Pseudosciaena and Collichthys each had two species.

The sciaenid part in "Fishes of South China Sea", 1962, described eight genera and 19 species; one species each in Collichthys, Pseudosciaena, Otolithes and Johnius, two species in Sciaena, three species in Wak and Nibea, and seven species in Argyrosomus. Many synonyms are among them; Sciaena dussumieri = Johnius amblycephalus, Wak cuja = Nibea coibar, Argyrosomus japonica = Nibea japonica, Argyrosomus nibe = Atrobucca nibe, Argyrosomus coibar = Nibea coibar, Argyrosomus indicus = Argyrosomus argentatus. Also the descriptions and figures of Argyrosomus japonica and Argyrosomus coibar were very different from the original references and other references; thus, the accuracy of the identification of these two species is very doubtful.

2. Description of Morphological Characteristics in Sciaenidae

Body elongated, compressed; head obtusely rounded or pointed; caudal peduncle short or moderately elongated. Head with well developed muciferous cavities, mainly constructed by bones of frontal, nasal, lachrymal, suborbital, sphenotic, preopercle, dentary and dorsal process of posttemporal. Vertebrae 14-15+10-11 or 9-12+13-20.

Snout blunt or pointed; rostral fold well developed, divided into four lobes or two lobes, or not divided into lobes. Mouth small, inferior, upper jaw slightly protruded; or mouth moderately large, subterminal, jaws subequal or upper jaw protruded; or mouth large, terminal, jaws subequal or lower jaw protruded. Teeth small, villiform, arranged in bands. Teeth in outer row of upper jaw slightly enlarged, and teeth in both outer and inner rows of lower jaw small; or teeth in outer row of upper jaw and inner row of lower jaw enlarged. Sometimes, anterior few teeth of upper jaw further enlarged into canines (e.g., Miichthys); or both upper and lower jaws with 1-2 pairs canine teeth anteriorly, like Otolithes, or only upper jaw with canines, as in Cynoscion. Vomer, palatines and tongue toothless. Eye, supra-lateral, situated at the anterior half of head, round or elliptical, margin free. Nostrils 2, separated, in front of eye, no nasal flap. Gill slit large, banchial membrane free from isthmus. Posterior margin of preopercle with fine serratures, stronger at the corner. Opercular ending postero-dorsally in two weak flat spines.

Snout and mandibular with muciferous pores. Snout pores situated on tip of snout and anterior margin of the rostral fold; rostral pores usually three, arranged semicircularly, prominent or not. Marginal pores five, median one rounded, posteriorly to rostral margin; lateral pores slit-like in species with two or four lobes, situated laterally or in between the lobes, in species with complete rostral fold, situated along anterior margin of rostral fold. Mandibular muciferous pores (mental pores) divided into three pairs; median, inner lateral and outer lateral. Median pores sometimes fused with one opening anterior to the base of mental barbel (e.g. Sciaena); or close together with separate openings (e.g. Nibeia); or the openings far from each other (e.g. Argyrosomus). Outer lateral pores sometime absent (e.g. Miichthys), or both inner and outer lateral pores absent (e.g. Otolithes).

Most sciaenids without barbels, some species with barbels on mandibular. With one mental barbel as in Sciaena; with two mental barbel as in Lonchurus of tropical Atlantic America; with many small barbels as in Pogonias and Micropogon of the Atlantic American coasts.

- 7 Scales relatively soft and thin, moderate large, ctenoid, cycloid or both. Head and body both covered with scales. Dorsal and anal fins with or without scales, caudal fin bearing scales. Lateral line arched or straight, almost reaching to the end of caudal fin.

Dorsal fin elongated, spinous and soft dorsal with a notch in between, connected with each other at the base; sometimes first and second dorsal continuous without a notch, e.g., Pama pama (Ham.-Buch.) of Indonesia; spine 10-11, sometimes 7-8 (e.g., Bahaba flavolabiata) or 10-17 (e.g., Eques of West Indies). Usually with 22-36 rays or 36-55 (e.g., Eques). Anal fin short or long, with 1-2 spines, 7-13 or 16-22^{4/} rays. Pelvic fin situated under the base of pectoral fin, with one spine and five rays, first ray sometimes with filamentous elongation. Pectoral fin lateral, with one unbranched ray and 10-19 branched rays. Caudal fin more variable, usually rhomboidal, pointed and rounded, sometimes truncate or forked (e.g., South Atlantic American and West India species, Leiostomus xanthurus), slightly truncate [e.g., South African species Sciaena capensis (Poppe)], double truncate (e.g., Chinese species Megalonibea fusca), or upper lobe pointed and lower lobe rounded (e.g., American species, Menticirrhus).

^{4/}For example, Seriphus politus Ayres of South California, U.S., and tropical American species of Isopisthus.

3. Geographic and Geological Distribution of Sciaenids

Sciaenids are a group of relatively warm water fishes. Most of them live in subtropical and tropical shallow waters with sandy or muddy bottoms. Some inhabit river mouths or enter tidal estuaries; only a few live in fresh water ^{5/}. Because sciaenids avoid deep sea and rocky bottom habitats, their geographic distribution is mainly determined by marine geological conditions. They have wide distribution ranges. Along both coasts of the Atlantic, more genera and species are found on the western Atlantic coast of America. Along the West Pacific in Chinese seas, there are very large areas of continental shelf, which form a shallow, submerged basin, with mostly sand or muddy sand bottoms. Thus many species are present in Chinese waters, more than in the neighbouring countries. Some species (e.g., Pseudosciaena crocea, P. polyactis, et al.) are abundant with large stocks and are the most important marine commercial fishes. In the East Pacific, along the American coast, there are also many species. In the Indian Ocean, south of the east Africa and Indian coasts, and the South China Sea off Indonesia, there are a certain number of representative genera and species. But in the South West Pacific off Australia and New Zealand very few species are present. In the vast area of the oceanic volcanic islands, there are almost no sciaenids present.

Sciaenids are not strong swimmers and except for local migrations they do not migrate long distances. Therefore, the geographic distribution of the genera and species is apparently limited. Among sciaenids, only one genus [Sciaena (Umbrina) cuv.] has a world wide distribution. It has representative species in both eastern and western hemispheres. All the other genera are limited to certain areas. For example, Aplodinotus is found only in the freshwaters of eastern North America. Nebris is distributed along both east and west coasts of Central America. Although Menticirrhus is distributed widely in the Atlantic and Pacific off South America and in the West Indies, it is still a typical American genus. There are also many oriental endemic genera. Such as Otolithes, which is distributed through East Africa, India, Indonesia, South and East China Seas. Pama is distributed in Western Indonesia, the Malay Peninsula, Burma and the coast of Calcutta, India. The range of Otolithoides is similar to Pama but extends to the South China Sea. Our attention is drawn by several endemic genera of the Chinese coasts, such as Pseudosciaena, Bahaba, Miichthys, Collichthys, and the newly nominated genera Megalonibea and Atrobucca. These genera

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^{5/}For example, Aplodinotus grunniens lives in lakes of Eastern North America.

have narrow ranges. Generally, they are limited to the Chinese coast from about 20-40°N, 100-120°E. Collichthys, used by previous authors [16], should be put into Pseudotolithes and the genus Pseudosciaena is actually composed of Nibea, Argyrosomus and Wak [19] [70] [41] [44].

Modern species of sciaenids are generally thought to have originated in the Pleistocene of the Cenozoic. From the Paleocene to recent, based on their fossil records, most of the modern living species may be derived separately from primitive ancestral species of the Tertiary or Quaternary in different parts of the ocean. For references, according to Jordan^{6/} and Romer^{7/}, the fossil sciaenid records of Europe and North America are summarized as follows. Fossils of Pogonias have been found in the European (Italy) Pliocene. Johnius + Corvina (= Sciaena Cuv.) have been found in European and North American Oligocene to Miocene. Cynoscion fossils have been found from the Miocene of North America. It is worth to determine if the European Otolithus fossil is the same as the Asian genus. Other sciaenid fossils, Lompoquia Jordan & Gilbert, Artistoscion Jordan and Ioscion Jordan, were all found in the Miocene from southern California, North America. Fossil sciaenid otoliths have been found from the Miocene and earlier. The earliest record, Archaeotolithus bornholmiensis, is from the lower Jurassic in Denmark. Therefore, the ancestor of the sciaenids must be placed prior to the Cenozoic.

4. General Habits and Habitats of Sciaenids

Sciaenids live in tropical and subtropical continental shallow seas with sand or muddy sand bottoms and near river mouths, usually, less than 100 meters deep. They are not found in oceanic or deep sea regions nor in high latitude areas where there are no warm water currents. The sciaenids are also hardly represented in coral reef and volcanic islands. Some species inhabit shallow seas not far from rivers and move into freshwater with the tide. Some may even move 100 km up rivers, such as Collichthys. Some species form aggregations during the reproductive season, then migrate into inshore shallow waters to spawn. Such species are Pseudosciaena polyactis and P. crocea, which are also economically very important in the

^{6/} Jordan, D. S. 1923. Classification of fishes, Stanford Univ., Calif., U.S.A.

^{7/} Romer, A. S. 1945. Vertebrate paleontology, 2nd ed., Univ. of Chicago Press, Chicago, Illinois, U.S.A.

"Huang Hua Yu" fishery season. Some species follow the diel migration of food, such as Pseudosciaena polyactis. In Eastern North America and South America, several species move into freshwater. Among them one species, Aplodinotus grunniens, is a permanent resident of eastern North American rivers and lakes.

9 Sciaenids are carnivorous. The bottom living forms, such as Sciaena, Johnius, et al.^{8/}, have horizontal, small and inferior mouths, small teeth, sometimes with mental barbels, snout blunt, snout and mandibular pores well-developed. Their major foods are invertebrates in the sand and mud. The mid and lower water semipelagic forms, such as Argyrosomus, Nibea, Otolithes, etc.^{9/}, usually have a large oblique mouth, with enlarged external teeth of the upper jaw and internal teeth of the lower jaw. Sometimes the upper jaw or both upper and lower jaws have canine-like teeth. The upper and lower jaws may be equal or the lower jaw slightly longer. The snout is not protrusible and the mental barbel is absent. The snout and mental pores may be well-developed or partially degenerate. These species are predators. Their major foods are swimming crustaceans and small fishes. Another group of midwater fishes, such as Pseudosciaena crocea, P. polyactis and Collichthys, have an even larger mouth, oblique and subsuperior with the lower jaw protruding upward. The outer row of teeth on the upper jaw and inner row of teeth on the lower jaw are slightly enlarged with no canine-like teeth. The mental barbel is absent. Snout and mental pores are small or degenerate. Food habits are similar to the previous forms, but adapted to feed from a lower position upward.

The sciaenid fishes are famous for their capability of sound production and hence have been variously called "drum-fishes" or "croakers" by westerners. However, certain species such as American kingfishes (Menticirrhus) make no sound. In others, such as the North American black drum (Pogonias), sea trout (Cynoscion) and silver perch (Bairdiella), only the males can make sound (Smith, 1905^[47]). In Chinese waters, both sexes of Pseudosciaena crocea and P. polyactis produce sound generally during the breeding season, the sound is loud like "Sha! Sha!", "Wu! Wu!", "Ge! Ge!", and is heard clearly over

^{8/}Atlantic American Pogonias and Micropogon, Central and South American Lonchurus are also bottom living forms.

^{9/}American Cynoscion and tropical Atlantic American Ancylodon are also mid and lower water semipelagic forms.

wide areas. For a long time Chinese fishermen have used the sounds of fish aggregations to locate and determine the size of fish concentrations.

The mechanism of sound production in sciaenids consists of the swimbladder and its adjacent drumming muscles or *musculus conifici* (Tower, 1908^[51]). Drumming muscles are compressed broad and elongated, located at the lateral sides of the body cavity on the body wall, and ventrolaterally to the viscera and swimbladder. The drumming muscles are composed of red striated muscle fibers, with abundant cytoplasm and conspicuous nuclei. The central tendon runs from the upper part of the drumming muscles across the back of the swimbladder to connect with the muscles on the opposite side. The abdominal fascia connect the lower part of the drumming muscles from both sides in the mid-ventral line (Figs. 1-2). The contracting drumming muscles press the viscera and cause the vibration of the wall of the swimbladder, thus creating sound. The vibrating frequency of drumming muscles and the swimbladder wall is 24/sec in the American *Cynoscion* (Tower, 1908^[51]). In sciaenids, the swimbladder does not connect directly with the inner ear. When the wall and the diverticula of the swimbladder vibrate, the sound is transmitted through its anterior diverticula to the external wall of the ear capsule and from there to the perilymph, saccular membrane, endolymph, sagitta, and finally to the 8th pair of cranial nerves (auditory nerve). The biological significance of sound production in sciaenids is generally recognized as a means of communication, especially in the breeding season when it is used as a signal for fish aggregation.

5. Morphology and Forms of Snout and Mental Pores in Chinese Sciaenid Fishes

Sciaenids generally have muciferous pores on the snout and mandible. Snout pores are located at the tip of the snout and anterior margin of the rostral folds (upper lip). The former are called rostral pores, the latter called marginal pores. There are usually three rostral pores, small and rounded, in an arch-like arrangement. In the bottom-living species, such as *Sciaena*, *Johnius*, *Wak* and *Pseudosciaena*, the rostral pores are prominent. In species which live close to the bottom or in mid-water, the rostral pores are not prominent and may be degenerate or absent.

10 There are five marginal pores. The rounded central pore is located behind the rostral margin. Two slit-like pores are located on each side. In those species whose rostral fold is divided into two or four lobes, the lateral pores are located on the lateral side and in between the rostral lobes. In those

species with an entire or undivided rostral lobe, lateral pores are located on the anterior margin of the rostral fold. Marginal pores are present in all genera of sciaenids but with slight variations. In species with well-developed rostral folds which are divided, into two or four lobes, the marginal pores are very prominent, such as Sciaena, Johnius, Wak and Nibeia. In species with less-developed rostral folds which are flat and thin, the marginal pores are not prominent, such as Argyrosomus, Atrobucca, Pseudosciaena, Collichthys and Otolithes.

There are typically six mental pores on the mandible, arranged bilaterally and divided into three pairs as median, inner and outer mental pores. Mental pores vary greatly among different genera, and five patterns may be recognized as follows:

- (1) Sciaena form: Bottom inhabitants, such as Sciaena and Johnius amblycephalus, have a mental barbel, small horizontal mouth, protruding snout and prominent mental pores. The median two are located very close together and open jointly at the base of the mental barbel. Therefore only one opening, the common central mental pore, appears externally. In addition, there is a pair of inner and a pair of outer mental pores, for a total of five pores. This mental pore pattern is here called the "Sciaena form" or "five-pored form". (Figs. 3A, 3B).
- (2) Johnius form: Bottom or lower mid-water species, such as Johnius, Wak, Nibeia and Megalonibeia, have no mental barbel, a small horizontal mouth and protruding snout, or sometimes a median large mouth, slightly oblique and snout slightly protruding. Mental pores are prominent, the median pair close together, with a round fleshy pad in between. The fleshy pad has a shallow groove at its posterior and lateral margins. When the fleshy pad subsides, the median pair of mental pores appears as a shallow pit, as if there is only one larger pore externally. Consequently, with a pair of inner and a pair of outer mental pores, it appears as if there are only five pores present. This mental pore pattern is here called the "Johnius form" or "false five-pored form". (Fig. 4). We believe that the fleshy pad is a remnant of the mental barbel.
- (3) Argyrosomus form: The lower mid-water and pelagic species, such as Argyrosomus, Atrobucca and Pseudosciaena, have a large oblique mouth with jaws either equal or lower jaw projecting. The mental pores are small and the fleshy pad is absent. The two median mental pores are separate and placed in front of the pair of inner mental pores. They are arranged as a square. A pair of outer mental pores is present. This mental pore pattern is called "Argyrosomus form" or "six-pored form". (Fig. 5).

- (4) Miichthys form: Other lower mid-water pelagic species, such as the Miichthys and Collichthys, have a large oblique mouth, with jaws sub-equal or the lower jaw projecting. The median and inner mental pores are small and arranged as a square. The pair of outer mental pores are absent. This mental pore pattern is here called the "Miichthys form" or "four-pored form".
- (5) Otolithes form: The predatory species, such as Otolithes and Bahaba, have a large oblique mouth, with jaws about equal, with or without canine teeth. The inner and outer mental pores are absent. There is a pair of median pores placed close together, without a fleshy pad in between. This mental pore pattern is called the "Otolithes form" or "two-pored form".

6. The Morphology and Forms of Swimbladders in Chinese Sciaenid Fishes

The swimbladder of the sciaenid fishes is generally well-developed^{10/}. Like other Perciformes, it is the physoclistous type, i.e., the pneumatic duct is absent and there is no connection with the esophagus. The swimbladder is a single chamber, usually with an oval-shaped anterior half, tapering 11 posteriorly. Sometimes both sides of the anterior ends project laterally or postero-laterally to form two anchor chaped lateral sacs with tassel-like appendages. Sometimes both sides of the anterior end extend posteriorly as tubes which insert into the body wall above the drumming muscles^{11/}. The lateral sides of the swimbladder often have several pairs of lateral appendages or diverticula^{12/}. Sometimes, the lateral appendages extend only toward the ventral side of the swimbladder and form ventral branches, which may be divided into smaller tassel-like branches (Fig. 50A). In some cases, the lateral diverticula separate into dorsal and ventral branches. The former extend dorso-laterally from the swimbladder and form many small upper and lower branches, usually pointed posteriorly. In some species the dorsal branches of opposite sides meet at the dorsal mid-line of the swimbladder. The latter (ventral branches) extend ventro-laterally and form upper and

^{10/}The exception is Menticirrhus in the American Atlantic.

^{11/}Some Atlantic Sciaenids with a pair of anterior horns (e.g., Ancylodon, Cynoscion or two pairs of anterior horns (e.g., Lonchurus).

^{12/}Larimus and Eques of South American Atlantic have simple swimbladder without lateral appendages.

lower sub-branches. The lower sub-branches are divided further into small anterior and small posterior branches. In some species the small anterior and posterior branches extend along the mesentary and reach the mid-line or the ventral side of the body cavity (Fig. 65C).

Five morphological forms of swimbladders may be recognized in Chinese sciaenoid fishes as follows:

- (1) Sciaena form: The swimbladder is cylindrical with an arched anterior end, lateral sac and lateral tube absent. There are from 10 to over 30 pairs of twig-like diverticula on both sides.^{13/} The diverticula have only ventral branches. Each ventral branch is divided into many sub-branches, which are not elongated and all point backward. Occasionally the first and second diverticula at the anterior end are somewhat larger or enlarged into a flat finger shape (e.g., Nibea japonica). The subfamilies Sciaeninae, Argyrosominae and Otolithinae, which include the genera, Sciaena, Argyrosomus, Nibea and Otolithes belong to this form (Figs. 50, 51, 53, 59).
- (2) Johnius form: The swimbladder is "T"-shaped with the anterior end broadened or slightly pointed and projecting outward to form two spherical lateral sacs. There are more than 10 pairs of twig-like diverticula on both sides. The diverticula have only ventral branches. Each ventral branch is divided into many sub-branches, which are not elongated and all point posteriorly. The subfamily Johniinae, which includes the genera Johnius and Wak belongs to this form (Figs. 43, 46).
- (3) Megalonibea form: The swimbladder has a broadly rounded anterior end, which projects postero-laterally to form two anchor-like lateral sacs. There are more than 20 pairs of short twig-like diverticula on both sides, which have only ventral branches. The subfamily Megaloninae, which includes the genus Megolonibea, belongs to this form (Fig. 48).
- (4) Bahaba form: The swimbladder is cylindrical with the anterior end broad or slightly concave, and giving rise to two tube-like projections laterally. These projections extend posteriorly and insert into the body wall above the drumming muscles, almost reaching the posterior end of the

^{13/} Otolithus maculatus of Indonesia has more than 50 lateral diverticula.

swimbladder. Diverticula are absent (e.g., Bahaba flavo-labiata) or present with more than 20 pairs (e.g., Otolithoides biauritus). Subfamily Bahabinae, which includes two genera, Bahaba and Otolithoides belongs to this form (Fig. 49). The swimbladder of American croaker (Micropogon undulatus) also belongs to this form (Tower [51], p. 153, pl. 6, fig. 1). Nebris microps Cuv. & Val. of tropical America also has two elongated horns on its swimbladder (Günther [19], p. 316).

- (5) Pseudosciaena form: The swimbladder is cylindrical with a concave anterior end, lateral sac and lateral tube absent and posterior end is slender and pointed. There are 10 to more than 30 pairs of complicated diverticula on both sides. The diverticula have both dorsal and ventral branches. The dorsal branch is divided into many branchlet-like upper and lower sub-branches, all pointed backward. They extend toward the dorsal side of the swimbladder, sometimes reaching the mid-dorsal line (Collichthys). The ventral branch consists of an upper and a lower sub-branch; the lower sub-branch is again divided into anterior and posterior branchlets, or has only anterior branchlets (Atrobucca). The lower sub-branch is either short and located ventro-laterally on the swimbladder (Atrobucca nibe and Miichthys miiuy) or elongated along the mesentery and reaching the mid-ventral line of the body cavity (Pseudosciaena crocea, P. polyactis and Collichthys). The subfamily Pseudosciaeninae, which consists of four genera, Atrobucca, Miichthys, Pseudosciaena and Collichthys belongs to this form, (Figs. 63, 64, 65, 67).

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7. Morphology and Forms of Otoliths in Chinese Sciaenid Fishes.

The inner ear of sciaenids consists of the utricle and sacculus. Three semi-circular canals originate above the former and the latter is attached to a small lagena at one end. The utricle is rather narrow, and contains a small compressed otolith, the lapillus. The sacculus is large and broad and contains a large otolith, the sagitta. The lagena is an accessory sac and contains the otolith, asteriscus. All otoliths are bathed in lymph, oriented obliquely or horizontally, and serve the function of equilibrium (Figs. 8A, 8B). The sagitta is oval, elongate oval or shield-like in shape, and can be divided into several parts: dorsal surface, ventral surface, anterior margin, posterior margin, inner margin and outer margin. The dorsal surface of the sagitta is elevated and irregularly granulated, blotched or with a lump-like projection. The ventral surface is flat and smooth, curving slightly upward at both ends and has a tadpole-shaped impression (sulcus). The anterior part of the tadpole-shaped mark is herein called the

"head" section, may be pear-shaped, oval or elongated. The posterior portion, slender, curved or oblique, is herein called the "tail" section. A longitudinal shallow groove in between the inner side of the tadpole-shaped mark and the inner margin of the sagitta is herein called the "marginal groove".

Four morphological forms of sagitta may be recognized in Chinese sciaenid fishes.

- (1) Sciaena form: The sagitta is oval or elongated with the outer margin slightly arched and the posterior margin straight or rounded. The dorsal surface is elevated and granulated or with lumpy projections. The ventral surface is flat and smooth, with a tadpole-shaped impression. Its "head" bends to reach the anterior margin. The "tail" is narrow and elongated, shallow ditch-like and curved in a "J"-shape. The "tail" end is not expanded and bent toward the outer margin. This form of otolith includes Sciaeninae (Sciaena), Megalonibinae (Megalonibea), Bahabinae (Bahaba and Otolithoides), Argyrosominae (Nibea) and Pseudosciaeninae (Miichthys) (Figs. 74, 75, 76, 79, 90).
- (2) Johnius form: The sagitta is somewhat shield-like or inversely pear-shaped. Margins are often wavy and the outer and posterior margins pointed. The dorsal surface is elevated, with blotches or lump-like projections. The ventral surface is flat. The "head" of the tadpole-shaped impression is bent obliquely toward the outer margin, leaving a large space from the anterior margin. The short anterior portion of the "tail" extends to the outer margin, the posterior portion is greatly expanded like a round concave disc. The subfamily Johninae (Johnius and Wak) is the only taxon with otoliths of this form (Figs. 69, 70, 71, 72, 73).
- (3) Otolithes form: The sagitta is shield-like or inversely pear-shaped. The outer margin is prominently arched and the posterior margin pointed. The dorsal surface is elevated, with granules of lump-like projections. The ventral surface is flat with a tadpole-shaped impression. The "head" section is upright and in contact with the anterior margin. The "tail" section is narrow, elongated, shallow ditch-like, slightly bent, "T"-shaped and its posterior end is not expanded nor bent toward the outer margin. The Otolithinae (Otolithes), Argyrosominae (Argyrosomus) and Pseudosciaeninae (Atrobucca) have otoliths of this form (Figs. 77, 84, 89).
- (4) Pseudosciaena form: The general feature of the sagitta is similar to the Otolithes form. The "tail" section of the tadpole mark is oblique or slightly bent, but the "tail" end is expanded with a round projection

extending to the posterior margin. *Pseudosciaenae* (*Pseudosciaena* and *Collichthys*) have otoliths of this form (Figs. 91, 93).

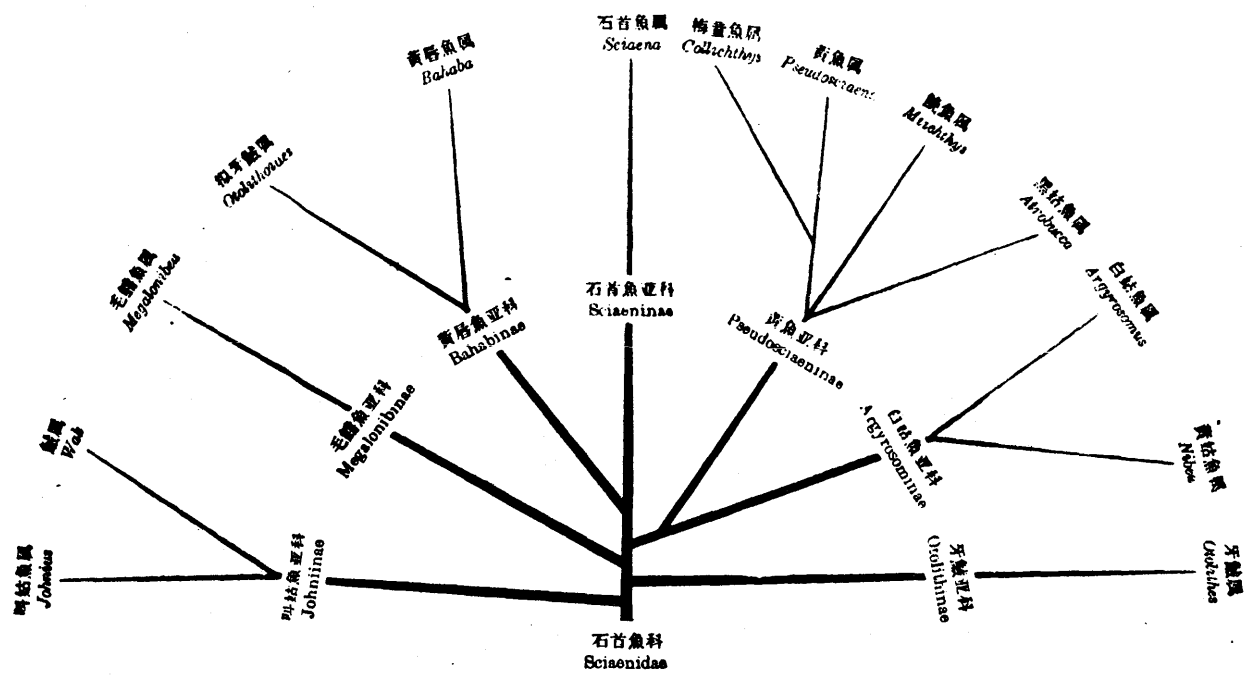
8. Phylogenetic Development of Chinese Sciaenid Fishes

13 The phylogenetic development of the Chinese sciaenid fishes discussed here is mainly based on the study of the comparative morphology of the swimbladder and sagitta. We mentioned that the Chinese continental shelf area is very extensive. Generally, the depth of water does not exceed 100 meters. The bottom in most areas is muddy sand. There is a large influx of fresh waters and sediments from rivers and the area is also affected by a warm current. All these factors, not only provide an excellent natural environment and living condition for sciaenid fishes, but also have apparently affected their phylogenetic development in this geographic area. We presume that the Chinese sciaenid fishes originated from the tropical Indo-Pacific region and that the pioneer species of immigration might have been the most widely distributed and geologically the earliest known forms, such as *Sciaena* and *Johnius*. These genera first appeared from the Oligocene to the Pliocene and the present living representatives are widely distributed in the Atlantic, Indian Ocean and Pacific. They live on the bottom, move slowly, have a small mouth in an inferior position, with a mental barbel, and villiform small teeth which are adapted to seek benthic invertebrates in the muddy-sand as food. We presume those species represent primitive forms. At present there are also species that live in lower-mid water. They are fast swimming, have a large terminal or oblique mouth, with partially enlarged teeth or well developed canine teeth, and prey on swimming crustaceans or fishes. They differentiated in the Tertiary or Quaternary when natural swimming preys were abundant and widespread. Eventually different localized taxa evolved.

There are 13 genera and 37 species of sciaenid fishes belonging to seven subfamilies known from Chinese coastal waters. Here we describe and discuss the phylogeny of the subfamilies and their representative genera. The attached diagram of the phylogeny of Chinese Sciaenidae outlines our view on this interesting problem.

(1) Subfamily Johniinae:

This subfamily includes *Johnius* Bl. and *Wak* Lin, whose swimbladders and sagittae are similar. The swimbladder is "T"-shaped with the anterior end broadened and projecting outward to form two anchor-like or spherical lateral sacs. There are more than 10 pairs of twig-like diverticula on the sides.



中国石首鱼类的系统发育图
 Diagram of Phylogenetic Development of Chinese Sciaenidae.

The sagittae are also specialized. The tadpole-like impression on the ventral side is distinctive. Its "head" section is bent obliquely toward the outer margin, leaving a large space to the anterior margin. The anterior part of the "tail" section is slender and short, the posterior end expanded to form a concave disc. As mentioned previously, this subfamily resembles Sciaeninae in general appearance and in habitats. However, the Johniinae differentiated to a separate taxon in the phylogenetic development of the Sciaenidae, based on their different forms of swimbladder and sagitta.

(2) Subfamily Megalonibinae:

This subfamily has only one genus Megalonibea. The swimbladder resembles that of Johniinae but is anchor-shaped. The anterior end is broadly rounded and projects posterolaterally to form two anchor-like lateral sacs. There are 26 pairs of short twig-like diverticula on the sides, the foremost pair is the largest with a reverse triangular-shaped base. The sagitta is similar to the Sciaeninae form, i.e., the "head" section of the tadpole-shaped impression on the ventral surface is upright and in contact with the anterior margin, and the "tail" section is "J"-shaped and curved toward the outer margin. Notably, the body form in this subfamily has evolved from the bottom grovelling type into a free swimming type, e.g., the terminal mouth, the subequal jaws and the more elongated and slightly fusiform body. However, its sagitta still retains the primitive form. Its snout and mandibular pores are also similar to the Sciaeninae. Thus, it could be recognized as another independent branch of the Sciaenidae.

(3) Subfamily Bahabinae:

This subfamily includes two genera, Otolithoides Fowler and Bahaba Herre. The American genera Cynoscion Gill and Ancylodon Cuv. & Val. have been described as having "a pair of long horns" on their swimbladders and they may also be put in this subfamily. The swimbladder of this subfamily differs from the above two subfamilies, in that the anterior end of the swimbladder gives rise to a pair of elongated lateral tube-like projections which extend backward and insert into the body wall above the drumming muscle. In Otolithoides, there are more than 20 pairs of twig-like diverticula on the sides, but there are no lateral diverticula in Bahaba. The former is recognized as the primitive type, the latter is a differentiated or "degenerated" form. The genera of this subfamily are active swimming fishes, with a large oblique mouth. Their body shapes apparently differ from Sciaeninae, but the morphology of the sagitta is still of the primitive Sciaeninae form. This also explains the relationship between them.

(4) Subfamily Sciaeninae:

This subfamily has only one genus, Sciaena Linnaeus. Many of its representative species are distributed widely over the Atlantic, Indian and Pacific Ocean regions. Fossil specimens have been found in the Pliocene of Europe. They are typical bottom living fishes, with a blunt snout, small horizontal mouth, small villiform teeth, and a mental barbel on the chin. Both snout and mandibular pores are well-developed. These fishes are specially adapted to forage for small invertebrates in muddy sand. From the Pliocene to the fourth glacial epoch of the Pleistocene free swimming prey became less abundant. This type of feeding habit became more important for survival. The swimbladder is cylindrical, lateral sacs or tubes are absent, but with more than 10 pairs of lateral diverticula, which have only ventral branches are present. This is recognized as a typically primitive form. The sagitta is elliptical. The "head" section of the tadpole-shaped impression on the ventral surface is upright and in contact with the anterior margin. The "tail" section is "J"-shaped, bending toward the outer margin. This is also a typical primitive form. In addition, their snout pores and mandibular pores are also of primitive form. This subfamily is the main stem of the phylogenetic development of the Sciaenidae. Other subfamilies radiate, branching out from this subfamily.

(5) Subfamily Otolithinae:

This subfamily has only one genus, Otolithes Cuv. The swimbladder retains the Sciaena form. However, the number of lateral diverticula has increased to more than 20 to 50 pairs. The sagitta is already differentiated to another form, shield-like or inversely pear-shaped. The "tail" section of the tadpole-shaped impression on the ventral side is narrowly elongated in a "T" shape and the posterior end does not bend toward the outer margin. The general morphology of this subfamily is also changed. The body shape is slightly streamlined, the mouth is large and terminal, the anterior end of the upper and lower jaw have 1-2 pairs of canine teeth. They represent a group of rather active predacious sciaenids.

(6) Subfamily argyrosominae:

This subfamily includes two genera, Nibea Jordan & Thompson and Argyrosomus de la Pylaie. Their swimbladders retain the primitive Sciaena form, with no morphological changes, but the sagittae are differentiated into two different forms. The sagitta in Nibea is still of the primitive Sciaena form, but in Argyrosomus it has differentiated into a form similar to Otolithes. The morphology and ecology of this subfamily show a different level of evolutionary development. The mouth has moved from an inferior to a terminal

position, the snout changed from a blunt shape to pointed, and mandibular pores changed from a false five-pores form to six-pored form. The habitat has also changed from bottom-dwelling to lower water pelagic.

(7) Subfamily Pseudosciaeninae:

This subfamily includes four genera, Atrobucca gen. nov., Miichthys Lin, Pseudosciaena Blkr., and Collichthys Gthr. This is the most abundant subfamily of Chinese sciaenid fishes and also represents the highest level of evolutionary development of Sciaenidae in Chinese waters. From the morphology of the sagitta, this subfamily is closely related to the Otolithinae and Argyrosominae, especially to the latter. Their swim-bladders have developed into a new form in which the lateral diverticula are first divided into dorsal and ventral branches. Each ventral branch is again divided into an upper and a lower sub-branch, with anterior and posterior branchlets. The different ways of branching may be diagnostic for a specific genus or species. Their sagittae are derived from the Otolithes form. The "tail" section is oblique or slightly bent, and forms a "T" shape against the "head" section, but the posterior end of the "tail" section is rounded and expanded, with a disc-like elevation. In the genus Atrobucca, the sagitta still retains the Otolithes form without changes and Miichthys has even kept the Sciaena form sagitta. These cases seem to show, in the process of phylogenetic development of a subfamily, there are some characters evolving at different levels and stages. And that they are not necessarily the same in each genus. From another view, the presence of these exceptional (mixed or intermediate) characters may support the relationships described among different subfamilies. All genera in this subfamily are lower mid-water pelagic fishes with large oblique mouths and jaws may be equal or the lower jaw projecting slightly upward. The outer row of teeth on the upper jaw is enlarged and the most anterior one or two teeth are strong and canine-like. The mandibular pores are degenerate. The species and genera of this subfamily are most abundant in Chinese coast waters. They occur in extremely large numbers and are of primary importance to the marine fisheries. Zoogeographically, most of the species are endemic to our coastal waters.

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9. The Taxonomic System of Chinese Sciaenid Fishes

We suggest in this article a classification of Chinese sciaenids based on our concepts of the phylogeny of the Chinese sciaenids. In following sequence (they are on either side of the diagram of phylogeny) we place the presumed primitive Sciaeninae at the center, then we list the other subfamilies which have radiated from the Sciaeninae. At the top, it starts with the Johniinae, then Megalonibinae and Bahabinae is the third one (swimbladder with lateral sacs or tubes). At the bottom are the Otolithinae, then the Argyrosominae and Pseu-

dosciaeniae (swimbladder without lateral sacs or tubes). In the text of "A description of the classification of the sciaenoid fishes of China", we will follow this order of presenting the taxonomic descriptions:

Sciaenidae

Johniinae

Johnius Bloch

Johnius amblycephalus (Bleeker)
Johnius semiluctuosus (Cuvier & Valenciennes)
Johnius fasciatus Chu, Lo & Wu sp. nov.
Johnius belengerii (Cuvier & Valenciennes)
Johnius dussumieri (Cuvier & Valenciennes)
Johnius carutta Bloch

Wak Lin

Wak coitor (Hamilton-Buchanan)
Wak soldado (Lacépède)
Wak cuja (Hamilton-Buchanan)
Wak tingi (Tang)
Wak sina (Cuvier & Valenciennes)
Wak axillaris (Cuvier & Valenciennes)

Megalonibinae

Megalonibea Chu, Lo & Wu gen nov.
Megalonibea fusca Chu, Lo & Wu sp. nov.

Bahabinae

Otolithoides Fowler

Otolithoides microdon (Bleeker)
Otolithoides brunneus (Day)
Otolithoides biauritus (Cantor)

Bahaba Herre

Bahaba flavolabiata (Lin)

Sciaeninae

Sciaena Linnaeus

17 Sciaena russelli (Cuvier & Valenciennes)

Otolithinae

Otolithes Oken

Otolithes argenteus (Cuvier & Valenciennes)
Otolithes ruber (Bloch & Schneider)

Argyrosominae

Nibeas Jordan & Thompson

Nibeas coibor (Hamilton-Buchanan)
Nibeas albiflora (Richardson)
Nibeas semifasciata Chu, Lo & Wu sp. nov.
Nibeas diacanthus (Lacépède)
Nibeas miichthioides Chu, Lo & Wu sp. nov.
Nibeas japonica (Temminck & Schlegel)
Nibeas acuta (Tang)

Argyrosomus de la pylaie

Argyrosomus aneus (Bloch)
Argyrosomus macrocephalus (Tang)
Argyrosomus pawak Lin
Argyrosomus argentatus (Houttuyn)

Pseudosciaeninae

Atrobucca Chu, Lo & Wu gen. nov.
Atrobucca nibe (Jordan & Thompson)

Miichthys Lin

Miichthys miiuy (Basilewsky)

Pseudosciaena Bleeker

Pseudosciaena crocea (Richardson)
Pseudosciaena polyactis Bleeker

Collichthys Günther

Collichthys lucidus (Richardson)
Collichthys niveatus Jordan & Starks

DESCRIPTION

(Description of the Classification of Chinese Sciaenids)

[Sciaenidae]

Body elongated, compressed. Head moderately large, blunt or pointed. Snout, moderately long, rostral fold complete or slightly divided into two or four lobes. Rostral pores, three, prominent or not; marginal pores, five, central marginal pore above rostral margin, lateral marginal pores located between rostral lobes and lateral to rostral lobes or on rostral margin. Nostrils 2, anterior one smaller, rounded; posterior one large ellipsoid. Eye median, large or small, located at anterior half of head. Mouth inferior or terminal, mouth-cleft horizontal or oblique. Teeth usually small, lined as narrow tooth band, outer row teeth of premaxillary and inner row teeth of dentary usually larger, sometimes canine-like. No teeth on palatine, vomer and tongue. Tongue well developed with round anterior end. Mandibular pores, 6, 5, 4, 2, prominent or not. Mental barbel present or absent. Preopercular margin often serrated. Posterior dorsal end of opercle with 1-2 flat spines. Branchiostegals 6-7. Pseudobranchial present. Body covered with cycloid or ctenoid scales. Fin-ray membranes of dorsal and anal fin often covered with small cycloid scales. Lateral line scales always extending to tail end. Dorsal fin VIII-X, I⁺ 24-45; spinous and soft portion often separated by a deep notch or continuous without notch. Anal fin I-II, 7-13 or 16-22. Pectoral fin with 16-19 rays, pointed or rounded. Ventral I, 5. Caudal fin pointed, rhomboidal, truncate or double truncate. Intestine short with two loops, pyloric caeca 5-16. Generally, swimbladder well-developed^{1/}, cylindrical, tapering posteriorly. Sometimes the anterior end protrude laterally form lateral sac or elongated tube, laterally swimbladder often with many pairs of lateral diverticula^{2/}, diverticulum usually has ventral branch or both dorsal and ventral branches. Ventral branch either long and extending to ventral side or short and limited to ventral lateral side of swimbladder. Otolith large, the dorsal side often with granulated projection or crest-like elevation; the ventral side with a tadpole-shaped impression, its "head" upright and extending to anterior margin, or bent obliquely toward the outer margin. "tail" section in "J" or "T"-shaped shallow groove, the marginal groove prominent or not prominent.

^{1/} Atlantic American genus Menticirrhus without a swimbladder.

^{2/} Atlantic American genera Larimus and Eques have a simple swimbladder, without diverticula.

Key to the subfamilies of Sciaenidae

- 1(6) Anterior end of swimbladder with lateral sac or diverticula.
- 2(5) Anterior end of swimbladder with a pair of lateral sacs.
- 3(4) Swimbladder in "T" shape, anterior margin broadened or slightly convex, laterally projecting outward to form two subspherical lateral sacs. Sagitta with a tadpole-shaped impression on the ventral surface "head" section bent obliquely toward the outer margin, separate from anterior margin; "tail" section short and narrow anteriorly, having the posterior end greatly expanded to a round concave disc.
 Johniinae
- 19 4(3) Swimbladder anchor-like, anterior end broadly convex and sides projecting posteriorly to form an anchor-like lateral sac. Ventral surface of sagitta with a tadpole-shaped impression, "head" section upright, in contact with the anterior margin, "tail" section, narrowly elongated, as a shallow groove bend like "J". Megalonibinae
- 5(2) Anterior end of swimbladder has a pair of lateral tubes, extending backward to posterior end of swimbladder.
 Bahabinae
- 6(1) Anterior end of swimbladder without lateral sacs and lateral tubes.
- 7(12) Swimbladder with more than 10 to more than 20 pairs lateral diverticula on both sides, diverticula with ventral branches, without dorsal branches.
- 8(9) With mental barbel, mouth small, inferior; inner row teeth of dentary villiform not enlarged. . . . Sciaeninae
- 9(8) Without mental barbel, mouth moderately large or large, terminal or sub-terminal; inner row teeth of dentary enlarged.
- 10(11) Anterior end of premaxillary with 1-2 pairs canine teeth; anterior end of dentary also with 1-2 canine teeth at the middle with 2 mental pores Otolithinae
- 11(10) No canine teeth on both jaws; mental pores 5-6. Argyrosominae
- 12(7) Both sides of swimbladder with more than 10 to more than 30 pairs lateral diverticula, diverticula with dorsal and ventral branches Pseudosciaeninae

Johniinae

Snout blunt or pointed. Mouth small and horizontal or moderately larger and oblique, inferior or sub-terminal, with 5 mental pores, with or without mental barbel. Teeth on both inner and outer rows of dentary small, lined as villiform tooth band or teeth on inner row slightly enlarged. Soft dorsal and anal covered with small cycloid scales. Swimbladder in "T" shape, anterior end broadened or convex at middle and projecting laterally to form two spherical lateral sacs. Lateral sides with more than 10 twig-like diverticula; diverticula with only ventral branches, the dorsal branches absent. Each ventral branch divided into many sub-branches usually extending posteriorly. Dorsal surface of sagitta elevated, with crest-like or patch-like elevation, ventral side with a tadpole-shaped impression, located at posterior 2/3 of sagitta. "Head" section bent obliquely toward the outer margin, separate from anterior margin; "tail" with a short narrow groove anteriorly, but the posterior end expanding to form a round concave disc.

Key to the subfamily Johniinae

- 1(1) Upper jaw round pointed; rostral fold divided into 4 lobes; both inner and external rows of dentary teeth small, villiform Johnius
- 2(2) Both jaws of equal length; rostral fold complete, not divided or only forming two lobes; inner row of dentary teeth slightly enlarged. Wak

Johnius Bloch, 1730

20 Body elongate, compressed. Head moderate, round pointed. Snout bluntly pointed. Rostral fold with free margin, divided into 4 lobes; with 3 rostral pores in arc-like arrangement, 5 marginal pores, the middle one rounded, the lateral ones slit-like, located lateral to external margin of rostral lobes and in between rostral lobes. Eye large, upper lateral position. Nostrils 2, near eye margin. Mouth small, horizontal, upper jaw protruding. Outer row teeth of premaxillary large; inner row of dentary teeth small. No teeth on palatine and vomer. Mental pores in "five-pored form" or "false five-pored form" (central pair of mental pores close, located at either side of the flesh pad. Posterior and lateral margin of flesh pad with shallow groove, when flesh pad depressed this central pair of mental pores not visible and form a shallow pore, externally look like one pore; inner and outer mental pores present). With or without mental barbel. Gill slit large, gill membrane not united with isthmus. Preopercular margin serrated, opercle with two flat spines at posterior dorsal end. Branchiostegals 7, Pseudobranchial present. Gill rakes thin and short. Body covered with cyenoid scales, head usually with small cycloid scales. Soft dorsal and

anal covered with many rows small cycloid scales, almost reaching the distal end of rays.

Dorsal fin continuous, with 10-11 spines, 27-28 rays, a notch present between spinous and soft parts; anal with 2 spines, 7 rays. Caudal truncate or rounded. Anterior end of swimbladder projecting laterally to form two subspherical sacs; sides with more than 10 pairs twig-like diverticula, diverticula with ventral branch, without dorsal branch. Sagitta slightly shield-like or pear shape, often with curved margin, external and posterior edges protrude; dorsal surface projected with patch or crest elevation; ventral surface smooth, the "head" of tadpole-shaped impression bent obliquely toward outer margin, widely separate from the anterior margin; "tail" section with short anterior part, its posterior end greatly expanded reaching to the margin. Vertebrae 24-26.

Key to species of genus Johnius

- 1(2) Mouth with mental barbel Johnius amblycephalus (Bleeker)
- 2(1) Without mental barbel
- 3(10) Side of body without white longitudinal stripes along the lateral line.
- 4(7) Side of body with many black longitudinal stripes or several rows of black cross stripes. Second spine of anal long or medium long.
- 5(6) Second anal spine strong and long, about half of head, anal origin under 8th to 9th dorsal ray. Anterior margin of snout with only superfacially divided lobes. Dorsum with black or dark gray stripes obliquely toward anterior ventrum. Side of body with black or dark gray stripes along the middle of each longitudinal row of scales. Fins black. D. X, I+28-31; A. II, 7. Lateral line scale 55-60. $\frac{6-8}{13-15}$
 Johnius semiluctuosus (Cuv. & Val.)
- 6(5) Second anal spine medium long, less than half of the head, about 1.6-1.8 times of eye diameter. Anal origin under 13th dorsal ray. Rostral fold divided into four lobes. Dorsum with 5 black vertical stripes. Fins black. D. X, I+28-29. A. II, 7, lateral line scales 47-49 $\frac{7-8}{10}$
 Johnius faciatus (Chu, Lo & Wu sp. nov.)

- 7(4) Side of body without longitudinal or cross stripes, 2nd anal spine moderate small or short.
- 8(9) Second anal spine strong, longer than eye diameter about $\frac{2}{5}$ - $\frac{2}{6}$ of head, $\frac{3}{4}$ of the 1st anal ray. Gill raker short, 5+9-12, $\frac{1}{2}$ of gill filament or $\frac{2}{5}$ of eye diameter. D. X, I+27-28, A. II, 8, lateral line scales 44-50 $\frac{6}{9}$
 Johnius belengerii (Cuv. & Val.)
- 9(8) Second anal spine weak and short, shorter than eye diameter about $\frac{2}{7}$ of head. Gill raker 6+14, about $\frac{1}{2}$ of gill filament of $\frac{1}{4}$ of eye diameter. Body without spots or stripes. D. X, I+28-30; A. II, 8; lateral line scale 48-50 5.
 Johnius dussumieri (Cuv. & Val.)
- 10(3) Side of body with white longitudinal stripe along lateral line. Johnius carutta Bloch

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Johnius amblycephalus

(Figs. 10, 43, 69)

D. X, I+24-26; A. II, 7; P. 16; V. I, 5. L.l. 51-53 $\frac{6}{16-17}$

Body compressed, dorsal profile evenly arched, ventral surface rather straight. Depth 3.4-3.7 in body length, head 3.1-3.3. Head obtuse and compressed, about 3.8-4.8 times of eye, divided into four lobes, the median two small, lateral ones large and distinct; rostral pores 3; marginal pores 5, median one rounded and deeply concaved, inner and outer lateral ones slit-like. Eye moderate, round, supra-lateral shorter than snout; interorbit convex, longer than eye. Nostrils two, anterior one small and rounded, posterior one larger and oblong. Mouth small, inferior, cleft horizontal, beneath the lower margin of eye; maxillary reaching to below the middle of eye or slightly beyond. Mental barbel strong and short, about $\frac{1}{3}$ of eye. Mental pores belong to the "five-pored form", median pair of mental pores, small and close together, open jointly at a common central pore at the base of mental barbel, and two pairs of outer and inner lateral pores. Teeth of jaws in villiform bands; outer row teeth of upper jaw slightly enlarged, arranged dispersively; lower jaw teeth similar in size. Vomer, palatines and tongue toothless. Tongue large, free, with round tip. Gill cleft wide, gill membrane free from isthmus. Preopercular margin with fine serratures, opercle ending in 2 flat spines. Branchiostegals 7. Pseudobranchiae well developed. Gill rakers short, 4+7, the longest raker about $\frac{1}{7}$ - $\frac{1}{8}$ of eye diameter.

Scales cycloid, body covered with scales, except the tip of snout. Soft dorsal, anal and caudal covered with small cycloid scales, extending to cover 1/3 of the fins. Lateral line slightly arched reaching to tip of caudal.

Dorsal continuous, with 11 spines, 24-26 rays, a notch between the spinous and soft portion, dorsal origin above pectoral base; first spine short, third and fourth spines filamentously elongated, about the body depth or slightly shorter. Anal with 2 spines, 7 rays, commencing below 10th to 11th dorsal ray; first spine minute, second rather short and about or less than 1/3 of head, or 1.2-1.5 times of eye. Pectoral pointed, as long as post snout length of head. Ventral inserted a little behind the base of pectoral, shorter than pectoral, first ventral ray filamentous. Caudal rhomboidal.

Body cavity moderate, peritoneum pale. Intestine short, with two loops, pyloric caeca 10. Swimbladder "T"-shaped, anterior end broadened and projecting outward to form two subspherical lateral sacs, posterior end pointed. Sides with 12 pairs diverticula, each pair with several twig-like branches, last pair with only two branches.

Sagitta shield-like. Dorsal surface without granular projections, middle of internal margin concaved, 2 notches at posterior section of external margin. Ventral surface with a tadpole-shaped impression, the "head" section bent and elliptical; the "tail" section short and its posterior end greatly expanded like a round and concave disc. Marginal groove located at inner side of ventral surface, starting from "head" to the end of "tail", groove narrow and not distinct.

Color blackish brown, upper half of spinous dorsal black, lower half grayish, other fins blackish gray.

Distribution: South Africa, India, Malay, Indonesia, South China Sea, Philippines, Japan.

Specimens examined: 60-159 mm TL.

[Locality]: Guangdong (Zha-po, Shan-wei, Guang-hai), Hainan Is. (Xin-cun, San-ya).

Synonymy

Sciaena dussumieri, Fishes of South China Sea, p. 461, Fig. 343 (Shan-wei, Bei-hai, Guang-hai, Tan-jia-wan).

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Johnius semiluctuosus (Cuvier & Valenciennes)

D. X, I+28-31; A. II, 7; P. 19; V. I, 5. L.1 52-60 6-9
~~13-15~~

Body elongate, compressed, dorsal profile evenly arched. Ventral surface rather straight. Depth 3.1-3.5 in body length, head 3.5-4. Head compressed, obtusely rounded; about 3.8 times of snout, 4.5-6 of eye. Snout rounded, projecting. Rostral fold divided into four lobes; rostral pores 3; marginal pores 5. Eye supra-lateral, placed at the anterior half of head; interorbital convex. Mouth small, inferior, cleft horizontal; maxillary extending to below the middle of eye or posterior edge of pupil. Mental pores 5. Teeth minute; arranged in bands, outer row teeth of upper jaw slightly larger; lower jaw teeth similar in size. Preopercular margin with fine serratures, opercular ending in 2 weak flat spines. Branchiostegals 7.

Body covered with ctenoid scales, snout and cheek covered with cycloid scales. Soft dorsal and anal covered 1/3 with small cycloid scales.

Dorsal continuous, with 11 spines, 28-31 rays, a deep notch between the spinous and the soft portion; spines weak, 3rd spine, the longest, about 3/7 of body depth. Anal with 2 spines, 7 rays, commencing below 8th to 9th dorsal ray, second spine strong and elongated, about half of head length. Pectoral fin rounded, longer than postorbital length of head. First ventral ray elongated and filamentous. Caudal rhomboidal or round.

Pyloric coeca 7-8, about 3 times of eye diameter.

Distribution in South China Sea, India, Indonesia, Phillipines.

(Adapted from Day, Günther, Weber and Beaufort)

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Johnius fasciatus Chu, Lo & Wu sp. nov.

(Figs. 11, 44, 70)

English description on pp. 88-89 of original edition.

24 Johnius belengerii (Cuvier & Valenciennes)

(Figs. 12, 45, 71)

D. IX-X, I+27-28; A. II, 7; P. 17; V.I, 5. L.1. 44-50 $\frac{6}{9}$

Body elongate, compressed, back slightly elevated, ventral profile broadly curved, caudal peduncle narrow and long. Depth 3-3.7 in body length, head 3.2-3.4. Head compressed, short and obtusely rounded, about 4-4.4 times of eye, 3.5-3.8 snout. Snout obtusely rounded, slightly longer than eye. Rostral folds free, divided into four lobes; rostral pores 3, small, arranged semi-circularly; marginal pores 5, median pore rounded, inner and outer lateral pores slit-like, situated outside and in between rostral lobes. Eye large, supra-lateral, placed at the anterior half of head; interorbital convex, larger than eye. Nostrils 2, anterior one rounded, smaller, posterior one larger, slit-like, just in front of eye. Mouth small, inferior, cleft deeply arched, beneath the lower margin of eye; maxillary reaching under middle of eye. The outer row teeth of upper jaw larger, dispersed; inner rows and lower jaw teeth minute, in villiform band. Vomer and palatine toothless. Tongue rounded, anterior end free. Mental pores in "false five-pored form", a median pair close together with a fleshy pad in between. When the fleshy pad subsides, a shallow pit appears, inner lateral and outer lateral pores present. Mental barbel absent. Gill cleft large, gill membranes free from isthmus. Preopercular margin serrated, opercular ending in 2 flat spines. Branchiostegals 7. Pseudobranchia present. Gill rakers slender and short, the longest one about 1-1/2 of gill filament.

Body covered with ctenoid scale. Soft dorsal and anal fins with several rows cycloid scales, almost extending to distal end of fins. Snout and cheek with small cycloid scales. Lateral line slightly curved, almost extending to the end of caudal.

Dorsal continuous with 10-11 spines, 27-28 rays, a deep notch in between the spinous and soft portion, dorsal origin above the base of pectoral; first spine short, second and third the longest, the third spine about 2.2 times of eye. Anal with 2 spines, 7 rays, commencing below 11th to 12th dorsal ray, second spine moderately large, elongated, about 1.5-1.7 of eye. Pectoral long and pointed, posterior end reaching the end of pelvic fin. First ray of pelvic elongated and filamentous. Tail rhomboidal, pointed in juveniles.

25 Body cavity moderate peritoneum grayish. Intestine short, with two loops; stomach large, sac-like; pyloric caeca 7. Swimbladder moderately large, anterior end projecting outward to form two spherical lateral sacs, anterior end truncated, posterior end tapering elongated. Sides with 14 pairs of twig-like diverticula, diverticulum without dorsal branch, ventral branch present. The first pair of diverticula, largest, situated at anterior end of swimbladder. Vertebrae 24-25.

Sagitta relatively large, shield-like. Dorsal surface concave in the middle, posteriorly with a crest-like longitudinal projection. Ventral surface with a tadpole-shaped impression, the "head" section bent obliquely toward the outer margin, separating from anterior margin; the "tail" section in a shallow groove, its posterior end expanded like a round and concave disc. Marginal groove situated at the inner side of lateral margin on the ventral surface.

Body grayish brown, dorsal darkish, sides and ventral silver white. Spinous dorsal with black margin, other fins pale. Gill cover blackish.

Distribution: South Africa, India, Indonesia, Chinese coast, Korea, Japan and Phillipines.

Specimens examined: 111-163 mm TL.

[Locality] Zhejiang (Dong-tou, Kan-men, Shi-tan, Long-jiang, Shen-jia-men, Da-chen, Si-jiao, Shi-pu, Fujian (Dong-wo, San-sha), Guangdong (Zha-po), Hai nan Is (San-ya, Chiang-hua).

Synonymy

Johnius belengaerii Chang chung-lin, 1955, Fishes of Yellow Sea and Po Hai, p. 143, Fig. 97 (Liaoning Hubei, Shandong); Fishes South China Sea; 1962, p. 418, Fig. 348 (Ying-ge-hai, Luzhou, Zha-po, Guang-hai, Shan-wei).

Johnius dussumieri (Cuvier & Valenciennes)

D. X. I+28-30; A. II, 8; P. 16; V.I, 5. L.1.50 $\frac{5-6}{10-12}$

26 Body compressed; dorsal profile arched, ventral rather straight. Depth 3.3 in body length, head 3.3. Head obtusely rounded, compressed, 4.5 of snout, 4.2-5 of eye. Snout rounded, projecting. Rostral folds free, divided into four lobes; rostral pores 3; marginal pores 5, not prominent. Eye supra-lateral, placed at the anterior half of head, interorbit slightly convex. Nostrils two, in front of eye. Mouth small, inferior, cleft horizontal, upper jaw longer than lower jaw; maxillary reaching below hind-margin of pupil. Mental pores 5. Teeth minute, arranged in bands, outer row teeth of upper jaw enlarged; inner rows and lower jaw teeth minute. Preopercular margin with serratures, opercular ending in a flat spine posterodorsally. Gill rakers short, 6+14, about 1/2 of gill filament, or 1/2 of eye. Branchiostegals 7.

Body covered with ctenoid scales; cheek, preopercule and opercle covered with cycloid scales; more than 2/3 of soft dorsal and anal covered by small cycloid scales.

Dorsal continuous, with 11 spines, 28-30 rays. A notch between the spinous and soft dorsal, dorsal origin above the base of pectoral; third and fourth spines the longest, about 1/2 of head length. Anal with 2 spines, 8 rays, commencing below the middle of soft dorsal, second spine short and weak, less than eye. Pectoral pointed, shorter than head behind snout. Ventral about post-orbital head length, the first ray filamentously elongated. Caudal rhomboid.

Body brownish, ventrum pale, upper half of dorsal fin blackish, base of pectoral with a black blotch.

Distribution: India, Ceylon, Indonesia, Malay, South China Sea.

(Adapted from Fowler, Weber & Beaufort)

Johnius carutta Bloch

D. X. I+25-28; A.II, 7; P. 17; V.I, 5. L.1. 50 $\frac{5-6}{18}$

Body elongated, compressed, dorsal profile arched, ventral rather straight. Depth 3.9-4 in body length; head 4-4.6. Head moderately large, obtusely pointed, 3.5 of snout, 4 of eye. Snout rounded, projecting. Rostral fold free, divided into four lobes; marginal pores 5, situated outside rostral fold and in between rostral lobes. Eye supra-lateral, placed at the anterior half of head, inter-orbital about equal to eye. Nostrils two, in front of eye. Mouth, inferior, upper jaw projecting; maxillary reaching below middle of eye. Teeth minute, in villiform bands, outer row teeth of upper jaw slightly enlarged; teeth of lower jaw equal. Mental pores 5, no mental barbel. Preopercular margin serrated. Opercular ending in 2 flat spines. Gill rakers short and small, 3+8.

Body mostly covered with cycloid scales, posteriorly few cyenoid scales present, scales on head larger than those on side of body. Soft dorsal and anal more than 1/2 covered with small scales. Lateral line arched, extending almost to the end of caudal.

Dorsal continuous, a notch between spinous and soft dorsal, with 10 spines, 25-28 rays, second and third spines the longest, about 1/2 of head. Anal with 2 spines, 7 rays, second spine short and weak, about 2/3 of first ray, 2/7-2/5 of head. Pectoral about equal to head. The first ray of ventral, filamentously elongated. Caudal nearly rounded.

27 Body purple brown, ventral side golden yellow, a white longitudinal stripe above lateral line. Spinous dorsal blackish, margins of other fins grayish.

Distribution: India, Ceylon, Maylay, Vietnam, South China Sea.

(Adapted from Day, Weber & Beaufort, Tang)

Wak Lin, 1938

Body elongate, compressed. Head moderately large, slightly pointed. Snout obtusely rounded. Rostral fold divided into two lobes or entire; rostral pores 3, arranged in semicircularly; marginal pores 5, situated at sides and anterior margin of rostral fold or posterior margin of rostral fold. Eye moderately large, supra-lateral, placed at anterior half of head. Nostrils two. Mouth moderately large, oblique, subterminal or terminal, upper and lower jaws equal, or upper jaw slightly projecting. Outer row teeth of upper jaw and inner row teeth of lower jaw slightly enlarged; dispersely arranged, without canine teeth. Mental pores in "false five-pored form", median pair close together, with a fleshy pad in between. When the fleshy pad subsides, a shallow pit appears; inner lateral and outer lateral pores present. No mental barbel. Gill cleft large, gill membranes free from isthmus. Preopercular margin serrated, posteroventral margin rounded. Branchiostegals 7. Pseudobranchiae present. Gill rakers short and small.

Body and posterior half of head covered with ctenoid scales, anterior half of head and opercles covered with small cycloid scales. Soft dorsal and membrane of anal covered with small cycloid scales over 1/2 of rays.

Dorsal with 10-11 spines, 26-33 rays. Anal short, with 2 spines, 7-8 rays. Caudal rhomboidal. Swimbladder moderately large, anterior end projecting laterally to form two spherical lateral sacs, laterally swimbladder with 10-18 pairs lateral diverticula, diverticulum with only ventral branches. Sagitta in 'Johnius form'.

Key to the species of genus Wak

- 1(6) Second anal spine strong and large, equal to or longer than post-orbital head length.
- 2(5) Without obliquely arranged darkish wavy stripes above lateral line.
- 3(4) Snout projecting, upper jaw longer than lower jaw, maxillary reaching under middle of eye; second anal spine about twice of eye diameter; distal 1/2 of spinous dorsal blackish, soft dorsal, anal and caudal back; D. X, I+26-29, A. II, 7; L. 1. scales 50-55 $\frac{6}{15}$
 Wak coitor (Ham.-Buch.)
- 28 4(3) Upper and lower jaws about equal, maxillary reaching under post 2/3 of eye; second anal spine about 2.5 of eye diameter, margin of soft dorsal black, margins of other fins darkish; D. IX-I, I+28-30; A. II, 7; L.1 scales 50 $\frac{8}{16}$ Wak soldado (Lacépède)
- 5(2) Many obliquely arranged darkish wavy stripes above lateral line, below lateral line many longitudinally arranged darkish wavy stripes; spinous dorsal margin blackish, soft dorsal with 2 or 3 rows blackish spots; D. X, I+28, A. II, 7; L. 1. scale 50-52 $\frac{7}{13}$ Wak cuja (Ham.-Buch.)
- 6(1) Second anal spine relatively weak, shorter than post-orbital head length, usually about 1/2 of post-orbital head length.
- 7(10) Snout projecting slight, lower jaw shorter than upper one, maxillary reaching under middle of eye, no black blotch on the ventral side of pectoral.
- 8(9) A whitish longitudinal streak present on lateral line, and along the base of dorsal fin another, D. X, I+28-30, A. II, 7; L. 1. scales 47-55 $\frac{7}{10}$; gill rakers 5+9
 Wak tingi (Tang)
- 9(8) No whitish streak on body sides; D. X, I+28, A. II, 7; L. 1. scales 51 $\frac{7}{8-9}$; gill raker 6+11... Wak sina (Cuv. & Val.)
- 10(7) Upper and lower jaws equal, maxillary reaching to posterior margin of eye; pectoral pit with a prominent black blotch. Wak axillaris (Cuv. & Val.)

Wak coitor (Hamilton-Buchanan)

D. I, I+26-29; A. II, 7, P. 17; V. I, 5. L.1. 50-55 $\frac{5-6}{15}$

Body elongate, compressed, dorsal and ventral profiles broadly curved. Depth 3.8 in body length, head 3.5. Head moderately large, compressed; about 3.6 of snout, 4-5.5 of eye. Snout obtusely rounded. Rostral fold divided, lateral lobes well-developed, marginal pores 5, rostral pores 3. Eye moderately large, supra-lateral; interorbital rather flat. Nostrils two, posterior one close to eye. Mouth relatively small, subterminal, upper jaw slightly longer than lower jaw; maxillary reaching to middle of eye. Mental pores 5; mental barbel absent. Teeth villiform, outer row teeth of upper jaw and the inner row teeth of lower jaw enlarged, other teeth arranged in bands. Preopercular margin with small serrations, posterodorsal end of opercle ending in two weak flat spines. Branchiostegals 7.

Body covered with ctenoid scales, snout and cheek with cycloid scales. Soft dorsal and anal 1/2 covered with small cycloid scale. Anterior half of lateral line arched, posterior half straight.

Dorsal continuous, with 11 spines, 26-29 rays. A notch between spinous and soft dorsal, dorsal origin above base of pectoral; spines weak, first spine the shortest, second the longest, about 1/2 of body depth. Anal with 2 spines, 7 rays, second spine large, about 4/5 of ray, almost equal to post-orbital head length. Pectoral about post-snout head length. Caudal rounded. Pyloric caeca 6-7.

Body golden yellow, slightly purplish, spinous dorsal margin black, soft dorsal, anal and caudal margins darkish.

Distribution: India, South China Sea.

(Adapted from Day, Fowler, Günther)

29

Wak soldado (Lacepede)

D. IX-X, I+ 28-30; A.II,7; P.17; V.I-5. L.1. $\frac{8}{16}$

Body elongate, compressed, dorsal arched, ventral rather straight. Depth 3.3-3.5 in body length, head 3.4. Head moderately large, compressed, about 4.3 of snout, 4.5-5 of eye. Snout obtusely rounded, not projecting. Rostral fold free, with lateral lobes, rostral pores 3, marginal pores 5. Eye moderately large, supra-lateral, placed at anterior half of head. Nostrils two, close to eye. Mouth moderate, terminal, cleft oblique, upper and lower jaws equal or upper jaw slightly longer than lower jaw; maxillary reaching to posterior margin of eye. Mental pores 5, without mental barbel. Outer row teeth of upper jaw and inner teeth of lower jaw enlarged; other teeth arranged in villiform band. Vomer, palatine and tongue toothless. Preopercular margin serrated, opercular ending in 2 flat spines.

Body covered with ctenoid scales, head and chest with cycloid scales. Soft dorsal and anal $1/2$ to $1/3$ covered by small cycloid scales. Lateral line arched anteriorly then straight behind anal fin, extending to caudal; lateral canal branched.

Dorsal continuous, with 10-11 spines, 28-30 rays, a notch between the spinous and soft dorsal, dorsal origin above the base of pectoral; length of spinous portion about $1/2$ of soft portion. Anal with 2 spines, 7 rays, commencing below 12th dorsal ray, second spine strong, about length of first ray or one half of head length. Pectoral about post-snout head length. Caudal rhomboidal.

Body grayish dark, slightly greenish, ventrum white, sides pale; distal margin of dorsal black, a black spot in front of each ray. Ventral fin whitish, other fins with dark margin.

Distribution: India, Ceylon, Malay, Indonesia, South China Sea.

(Adapted from Day, Günther)

30

Wak cuja (Hamilton-Buchanan)

D. X, I+27-29; A. II, 7; P. 17; V. I, 5. L. 1. 50-52 $\frac{7}{16}$

Body elongated, compressed. Depth 3.5-4 in body length, head 3.3-4.6. Head moderate large, compressed, 3.6-3.8 of snout, 4.5-5 of eye. Snout bluntly pointed. Rostral fold with free margin, rostral lobes not distinct; marginal pores 5, rostral pores 3. Eye moderately large, supra-lateral, placed at anterior half of head. Nostrils two, in front of eye. Mouth moderately large, terminal, cleft oblique, jaws equal or upper jaw slightly projecting; maxillary reaching to the posterior margin of eye. Mental pores 5, median one slit-like, 2 lateral pores of both sides larger than median one. No mental barbel. Outer row teeth of upper jaw and inner row teeth of lower jaw enlarged, other teeth arranged in bands. Vomer, palatine and tongue toothless. Tongue free, rounded. Preopercular margin with minute serratures. Opercular ending in two flat spines. Gill rakers relatively long, 5+9, the longest one about $1/3$ of eye.

Body covered with ctenoid scales, head with cycloid scales. Soft dorsal and anal more than $1/2$ covered with small cycloid scales. Anterior part of lateral line arched, straightened posteriorly, extending to caudal.

Dorsal continuous, with 11 spines, 27-29 rays. A deep notch between the spinous and soft dorsal, dorsal origin above pectoral base; first spine short, third and fourth the longest, about $1/2$ of body depth. Anal with 2 spines, 7 rays, commencing below 12th dorsal ray, second spine strong, about length of first ray or $1/2$ or head. Caudal rhomboidal.

Many dark wavy streaks arranged obliquely above lateral line and longitudinally below lateral line. Ventral pale; spinous dorsal margins black, soft dorsal with 2 or 3 rows black spots.

Distribution: India, Vietnam, South China Sea.

(Adapted from Day, Fowler, Lin)

Wak tingi (Tang)

(Figs. 4, 16, 46, 72)

D. X, I+28-30; A. II, 7; P. 18; V. I, 5 L.1 47-55 $\frac{7}{10}$

Body elongate, compressed, dorsal and ventral evenly arched. Depth 3.2-3.6 in body length, head 3.3-3.4. Head moderately large, projecting, slightly pointed, about 3.4-3.8 of snout, 4.2-4.8 of eye. Snout short and blunt, slightly projecting. Rostral pores 3, arranging slightly arched; rostral fold free at margin, divided into two lobes; marginal pores 5, median pore round, inner lateral and outer lateral pores slit-like. Eye moderately large, supra-lateral, placed at anterior half of head; interorbital wide, slightly convex. Nostrils two, anterior one small, rounded, posterior one large, oval elongated. Mouth moderately large, sub-terminal, cleft slightly oblique, originating below the lower margin of eye, upper jaw slightly longer than lower one; maxillary reaching almost below the middle of eye. Lip thin. Outer row teeth of upper jaw large and pointed, dispersely arranged, other teeth small, in bands; inner row teeth of lower jaw slightly larger, other teeth small, in bands. When mouth closed, the outer row teeth of upper jaw often exposed. Vomer, palatine and tongue toothless. Tongue well developed, free. Mental pores in "false five-pored form", median pair close together, with a fleshy pad in between. When the fleshy pad subsides, a shallow pit appears; inner lateral and outer lateral pores present. No mental barbel. Gill cleft large, branchial membrane free from isthmus. Preopercular margin with small serratures, posterior dorsally opercle end with two soft flat spines. Branchiostegals 7. Pseudobranchiae present. Gill rakers slender and short, 5+9, longest raker about $\frac{2}{5}$ of gill filament.

Body and head covered with ctenoid scales, interorbit, snout, cheek and opercles covered with cycloid scales. Soft dorsal and anal membranes with several rows small cycloid scales almost reaching distal margin of fins. Caudal fin mostly covered with small scales. Lateral line complete, extending to end of caudal.

Dorsal continuous, with 11 spines, 28-30 rays, a deep notch between the spinous dorsal and soft dorsal, dorsal origin above pectoral base; first spine short, second and third spine the longest, second spine about 1.7-1.9 of eye; soft dorsal lower than spinous. Anal with 2 spines, 7 rays and origin closer to caudal base than to ventral base, commencing below 14th to 15th dorsal ray, second spine slender and short, about 1-1.3 of eye. Pectoral elongate, pointed, distal end exceed the tip of ventral fin, 1.2-1.4 in head. Caudal rhomboidal.

Peritoneum black. Intestine short, with two loops. Stomach small; pyloric caeca 8, relatively small, digital-like. Swimbladder large, anterior end truncate, posterior end elongated tub-like; anterior end projecting outward to form subspherical lateral sacs.

Sides of swimbladder with 16 pairs of twig-like diverticula, the first pair of diverticula largest, with more branches and situated in front of swimbladder.

Sagitta relatively large, shield-like, anterior end broad, posterior end narrow. Dorsal surface without granular projections, but elevated as crest and lumps. Ventral surface with a tadpole-shaped impression, the "head" section elongated and bent, centrally located; the "tail" section with a shallow groove anteriorly, the posterior end expand spherically with concave surface. Marginal groove distinct, situated at inner lateral margin of ventral surface.

32 Dorsal sides grayish brown, ventral sides silver white. Back with a pale streak longitudinally on the middle of body, also a pale streak present along the lateral line longitudinally. Spinous dorsal with a black spot at distal end, soft dorsal margin black, with a black streak at the base. Caudal fin with blackish margin, other fins light gray. Opercle almost black.

Distribution: South and East China Seas.

Specimens examined: 115-221 mm TL.

[Locality] Zhejiang (Zhou-Shan), Guangdong (Miao-dao, Shan-wei, Zha-po).

Synonymy

Wak tingi 1962. Fish South China Sea., p. 426, Fig. 353 (San-ya, Xin-cun, Shan-wei, Zhe-lang).

Wak sina (Cuvier & Valenciennes)

(Figs. 17, 47, 74)

D. X, I+28-29; A. II-7; P. 18; V. I, 5. L.1. 49-51 $\frac{7}{8-9}$

Body elongate, compressed, dorsal highly arched, ventral evenly rounded. Depth 3.2-2.3 in body length, head 3.1-3.4. Head moderately large, compressed, about 3.4-3.7 of snout, 4.7-5.1 of eye. Snout obtusely rounded, slightly projecting, length larger than eye. Rostral fold free, no prominent division; rostral pores 3, minute, arranged semi-circularly; marginal pores 5, median one rounded, lateral pores slit-like. Eye moderately large, supra-lateral, placed at anterior half of eye; interorbit broad, slightly convexed, larger than eye. Nostrils two, anterior one round, posterior one oval elongated, just in front of anterior eye margin. Mouth moderately large, subterminal, slightly oblique, upper jaw slightly projecting; maxillary extending to the middle of eye. Mental pores in "false five-pored form", median pair

close together, a fleshy pad present in between. When the fleshy pad subsides, a shallow pit appears; inner and outer lateral mental pores present. Teeth in villiform bands, outer row teeth of upper jaw enlarged and pointed, arranged dispersely; inner row teeth of lower jaw slightly enlarged. When the mouth closed, outer row teeth of upper jaw often exposed. Vomer, palatine and tongue toothless. Tongue large, free, anterior end rounded. Gill cleft large, gill membrane free from isthmus. Preopercular margin with minute serratures, opercle ending in two flat spines posterio-dorsally. Branchiostegals 7. Gill rakers, 6+11, longest gill raker about $1/3-1/4$ of eye.

Body covered with ctenoid scales, cheek with cycloid scales. Soft dorsal and anal membrane $2/3$ covered with small cycloid scales. Lateral line arched, extending almost to the end of caudal.

Dorsal with 11 spines, 28-29 rays, a deep notch in between the spinous and soft dorsal; dorsal origin above pectoral base; first spine small and short, third spine longest, about postorbital head length. Anal with 2 spines, 7 rays, commencing below 13th dorsal ray, first spine rather short and small, second spine elongated, about eye. Pectoral pointed, shorter than post snout head length. Ventral located below pectoral base, first ray slightly elongated. Caudal rhomboidal.

Body cavity moderate, peritoneum black. Intestine short, with 2 loops. Pyloric caeca 8, digital. Swimbladder large, anterior end projecting outward to form spherical sacs, anterior end truncate, posterior end slender and pointed. Sides with 16-18 pairs of twig-like lateral diverticula, each diverticulum with ventral branch, dorsal branch absent; first pair large and with many branches, last pair with only 2 branches.

Sagitta large, slightly shield-like, broad anteriorly and narrow posteriorly. Dorsal surface with crest-like elevation. Ventral surface with a tadpole-shaped impression, the "head" section bent, elongate oval in shape, centrally located; the "tail" section with a shallow groove anteriorly, the posterior end expanded, disk-like. Marginal groove situated at inner lateral margin of ventral surface. Body purplish brown, ventral silver-white. Spinous dorsal black, soft dorsal with black margin and with a longitudinal pale band at the middle; anal margin grayish, other fins pale. Opercle with a black blotch.

Distribution: South Africa, India, Indonesia, South China Sea, Japan, Philippines.

Specimens examined: 140-180 mm TL.

[Localities]: Gongdong (Zha-po, San-ya, Xin-cun).

Synonymy

Wak sina, 1962, Fish. South China Sea, p. 427, Fig. 354 (Gan-chong, Qing-lan, San-ya, Xin-cun, Ao-tou, Shan-wei).

Wak axillaris (Cuvier & Valenciennes)

(Fig. 18)

D. X, I+26-29; A. II, 7; P. 17; V. I, 5. L. 1. 48-50 $\frac{6-7}{9-10}$.

Body elongate, compressed, dorsal arched, ventral smoothly rounded. Depth 3-3.5 in body length, head 2.8-3. Head relatively large, compressed, about 4-5.5 of snout, 3.8-4 of eye. Snout obtusely rounded, not projecting. Rostral fold entire, no prominent pores. Eye rather large, supra-lateral, placed at anterior half of head; inter-orbit rather flat. Nostrils two, posterior one very close to eye. Mouth large, terminal, cleft oblique, upper and lower jaw equal; maxillary extending under posterior margin of eye. Mental pores 5; lower jaw with a small knob at end of mandibular, without mental barbel. Teeth villiform, outer row teeth of upper jaw and inner row teeth of lower jaw slightly enlarged, conical in shape, other teeth arranged in bands. Preopercular margin with minute serrations. Opercle ending in 2 flat spines postero-dorsally. Gill rakers 7+4. Branchiostegals 7.

Scales rather large, body covered with ctenoid scales, cheek and opercles with cycloid scales. Spinous dorsal and anal densely covered with small cycloid scales. Lateral line arched anteriorly and straight posteriorly.

34 Dorsal continuous, with 11 spines, 26-29 rays, a notch between spinous and soft dorsals, dorsal originating above pectoral base, first spine short, fourth and fifth the longest, about $\frac{2}{5}$ of depth. Anal with 2 spines, 7 rays, commencing below 13th to 14th rays, second spine rather short, less the post-orbit head length, about $\frac{3}{4}$ of rays. Pectoral equal to post-snout head length. Ventral with an elongated first ray. Caudal rounded or sub-truncate.

Body grayish brown, ventral silver white, spinous dorsal black, soft dorsal and caudal margin black. Base of pectoral with a prominent black blotch.

Distribution: India, Ceylon, Indonesia, South China Sea, Philippines.

(Adapted from Day, Weber & Beaufort, Fowler, Tang)

Megalonibinae

Snout bluntly pointed. Mouth terminal oblique. Jaws about equal. Outer row teeth of upper jaw and inner row teeth of lower jaw slightly enlarged, conical in shape. Mental pores in "false five-pored form", median pair close together, with a fleshy pad in between. When the fleshy pad subsides a shallow pit appears; inner and outer lateral pores present. Without mental barbel. Eye small, about 1/10 of head. Body covered with weak ctenoid scales. Dorsal continuous, with 11 spines, 21-22 rays. Caudal double truncate. Swimbladder slightly anchor-like, anterior end broadly curved and convexed, and projecting posterolaterally to form two anchor-like lateral sacs. Sides with more than 20 pairs twig-like diverticula; diverticulum with ventral branch only. Sagitta oblong, both anterior and posterior ends rounded, inner margin rounded and convex with serratures, outer margin wavy. Dorsal surface granulated, blotch-like, posteriorly. Ventral surface with a tadpole-shaped impression, its "head" section upright, reaching the anterior margin; the "tail" section with a "J"-shaped groove, "tail" end bending to reach the outer margin. Marginal groove prominent, starting from "head" section anteriorly.

34

Megalonibea Chu, Lo & Wu gen. nov.

English description on pp.89-90 of original edition.

35

Megalonibea fusca Chu, Lo & Wu sp. nov.

(Figs. 19, 48 74)

English description on pp. 90-91 of original edition.

Bahabinae

- 36 Snout bluntly pointed. Mouth terminal, cleft oblique. Jaws about equal. Outer row teeth of upper jaw and inner row teeth of lower jaw slightly enlarged. Mental pores in "four-pored form" or "two-pored form"; outer lateral pores absent or both outer and inner lateral pores absent. Without mental barbel. Dorsal continuous, with 8-10 spines, 22-36 rays; anal fin short. Caudal fin rhomboidal, elongate, pointed. Swimbladder cylindrical, anterior margin broad, laterally tube-like projections extending backward and reaching the end of the swimbladder. Sides of swimbladder either without diverticula or with more than 20 pairs of diverticula. Sagitta slightly rectangular, round anteriorly, truncate posteriorly, sides almost parallel. Dorsal surface with granulated projections. Ventral surface with a tadpole-shaped impression, its "head" section upright and reaching to the anterior margin; the "tail" section with a "J"-shaped groove, "tail" end curving toward the outer margin. Marginal groove prominent, starting from anterior part of "tail" section.

Key to the subfamily Bahabinae

- 1(2) Swimbladder with lateral diverticula; D. VIII-X, I+27-36
 Otolithoides
- 2(1) Swimbladder without lateral diverticula; D. VII, I+22-25
 Bahaba

Otolithoides Fowler, 1933

- 37 Body elongate, compressed. Snout bluntly pointed. Rostral fold with complete margin. Eye moderately large, supra-lateral; inter-orbital slightly convex. Mouth large, terminal, cleft oblique. Upper and lower jaws equal. Outer row teeth of upper jaw and inner row teeth of lower jaw enlarged, slightly canine-like. Mental pores 2 or 4; no mental barbel. Dorsal VIII-IX, I+27-36; Anal II, 7-8; caudal rhomboidal. Swimbladder cylindrical, sides of anterior ends with tube-like projections, extending backward and reaching end of swimbladder. Sides with more than 20 pairs diverticula.

Key to the genus Otolithoides

- 1(2) Dorsal rays 34-36; lower margin of eye above the line horizontally to mouth cleft; L.1 scales 70-80 $\frac{12}{17-20}$, the scale row above lateral line with 95 scales. Pyloric caeca 6. Upper part of body grayish, ventral silver-white. Gill cover with a dark blotch.....
..... Otolithoides microdon (Bleeker)
- 2(1) Dorsal rays 27-32.
- 3(4) Snout short; eye situated at anterior 1/3 of head; mouth cleft large, maxillary exceeds the posterior margin of eye. D. IX, I+27-29; A. II, 7-8, L. 1. scale 50-51 $\frac{10-11}{9-12}$, the scale row above lateral line with 78 scales. Body grayish black, fin black.....
..... Otolithoides brunneus (Day)
- 4(3) Snout long; eye situated at 1/2 of head; mouth cleft large, maxillary not exceeding the posterior margin of eye. D. IX, I+27-32; A. II, 7. L. 1. scales 60-70 $\frac{15}{30}$, the scale row above lateral line with 120 scales. Dorsal grayish green, sides yellowish green. Ventral grayish white, fin yellow with black margin.....
..... Otolithoides biauritus (Cantor)

Otolithoides microdon (Bleeker)

(Fig. 20)

D. VIII-IX, I+32-36; A. II, 7-8; V. I, 5; P. 19. L.1 70-80

 $\frac{11-12}{18-20}$

Body slender, elongate, compressed. Depth 4-5 in body length, head 3.2-4.1. Head bluntly pointed, compressed, 4.1 of snout, 5-6.1 of eye. Snout relatively pointed, slightly longer than eye. Rostral fold not divided, with 3 marginal pores. Eye relatively small, supra-lateral, placed at anterior half of head; inter-orbit rather flat, about equal to snout. Nostrils two, in front of eye, anterior one smaller, rounded, posterior one lanceolate. Mouth large, terminal, cleft oblique, lower jaw slightly projecting; maxillary reaching under the middle of eye. Mental pores 4. Teeth of jaws in villiform bands; outer row teeth of upper jaw, large, conical in shape, the anterior ones flase canine-like; inner row teeth of lower jaw large and conical. Palatine, vomer and tongue toothless. Preopercular margin with serratures, opercle with 2 soft flat spines postero dorsally. Branchiostegals 7.

Body covered with ctenoid scales, head with cycloid scales; juvenile fish covered with cycloid. Lateral line slightly arched anteriorly, straight posteriorly, reaching almost to the end of caudal fin.

38 Dorsal continuous, with 8-9 spines, 32-36 rays, a deep notch in between spinous and soft dorsal, dorsal origin above pectoral base; third and fourth spines longest, about 1/2 of body depth. Anal with 2 spines, 7-8 rays, commencing under the 15th dorsal ray, second spine about 1/2 of ray. Pectoral broadly pointed. Caudal pointed.

Dorsal side grayish green, ventral side silvery white or yellow. Gill cover with a blue blotch. Fins yellowish, dorsal and anal margin black.

Distribution: India, Indonesia, South China Sea.

(Adapted from Day, Fowler, Weber & Beaufort)

Otolithoides brunneus (Day)

D. IX, I+27-29; A. II, 7-8; P. 18; V. I, 5; L.1. 102 $\frac{21}{34}$

Body compressed and elongated. Dorsal profile slightly arched. Depth 5.5-6 in body length, head 4-4.5. Head rather pointed, compressed, about 5.5 of snout, 7-8 of eye. Snout short, slightly larger than eye. Rostral fold not divided, margin without pores. Eye supra-lateral, placed at anterior half of head; inter-orbit convex. Nostrils two, in front of eye. Mouth large, terminal, cleft oblique; maxillary reaching under posterior margin of eye. Mental pores 2. Upper and lower jaws with villiform teeth bands, outer row teeth of upper jaw enlarged, anterior ones canine-like; inner row teeth of lower jaw enlarged. Palatine, vomer and tongue toothless. Preopercular margin with weak serrations. Opercle ending in two flat spines posteriorly. Branchiostegals 7. Gill rakers 6+11, longest raker 1-2/3 of eye.

Body covered with ctenoid scales, head with cycloid. Soft dorsal and anal 1/4 covered with small cycloid scales. Lateral line slightly arched anteriorly, straight posteriorly, almost reaching the end of caudal.

Dorsal continuous, with 10 spines, 27-29 rays, a deep notch between the spinous and soft dorsal, dorsal origin above pectoral base; spines weak, third to sixth, the longest, about 2/1/4 in body depth. Anal with 2 spines, 7-8 rays, commencing under the 13th dorsal ray; spine short and weak, second spine about 1/3 of ray. Pectoral pointed, about post-orbital head length. Caudal pointed. Dorsal sides brownish, ventral golden yellow, fin black.

Distribution: India, Indonesia, Vietnam, South China Sea.

(Adapted from Day, Fowler, Weber & De Beaufort)

Otolithoides biauritus (Cantor

D. IX, I+27-32; A. II, 7; P. 19; V. I-5. L.1 120 $\frac{12}{25}$

Body elongate, compressed, dorsal profile arched, slightly convex behind head, ventral surface rather straight. Depth 4.6-5.6 in body length, head 3.5-4.3. Head bluntly pointed, compressed, 4.5-5 of snout, 6-7 of eye. Snout relatively longer, larger than eye. Rostral fold complete, not divided into lobes; marginal pores 5. Eye supra-lateral, elliptical, placed at the anterior half of head; interorbital slightly convex, about 2 times of eye. Nostrils two, in front of eye. Mouth large, terminal, cleft oblique, jaws equal; maxillary extending to below the posterior margin of pupil or eye. Mental pores 4. Teeth minute, arranged in bands; outer row teeth of upper jaw and inner row teeth of lower jaw enlarged, canine-like. Palatine, vomer and tongue toothless. Preopercle margin with minute serratures, opercle ending in two weak flat spines. Branchiostegals 7.

Body covered with cycloid scales, below lateral line covered with weak ctenoid scales, dorsal and anal base covered with small scales. Lateral line arched anteriorly and straight posteriorly, extending to caudal fin.

Dorsal continuous, with 10 spines, 27-32 rays, a deep notch between the spinous and soft portion, dorsal origin above pectoral base; spines weak, fourth and fifth spine, the longest, equal to the length of rays posteriorly or $\frac{2}{5}$ of body depth. Anal with 2 spines, 7 rays, commencing below 15th ray of dorsal; second anal spine long, about $\frac{1}{4}$ of head. Pectoral pointed, about post-snout head length. Caudal truncate.

Swimbladder with 25 pairs of diverticula, anterior end with a pair of lateral tubes extending posteriorly to the end of swimbladder. Pyloric caeca 13.

Dorsal side grayish green, ventral side pale; fins yellow with black margin.

Distribution: India, Malay, Indonesia, South China Sea, East China Sea, Philippines.

(Adapted from Day, Günther, Weber & Beaufort, Fowler)

Bahaba Herre 1935

Body elongate, compressed; caudal peduncle relatively slender and long. Head large, bluntly pointed. Eye small, supra-lateral, placed at anterior half of the head; inter-orbital slightly convex. Nostrils two, anterior one small, rounded, posterior one slit-like. Mouth terminal, large and oblique, lower jaw rather projected. Outer row teeth of upper jaw and inner row teeth of lower jaw enlarged, conical, other teeth minute, arranged in villiform band, no canine teeth. Palatine, vomer and tongue toothless. Mental pores 2, inner and outer mental pores absent; no mental barbel. Preopercular margin with minute serratures. Opercle ending in two weak spines. Branchiostegals 7. Pseudobranchiae present. Gill rakers slender, long 5+13. Scales at anterior half of head cycloid; the rest ctenoid; dorsal and anal fins without minute scales except scale sheath. Dorsal VII, I+22-25, a notch in between the spinous and soft dorsal; spines strong. Anal II, 7; second spine strong. Caudal fin long, pointed. Swimbladder cylindrical. Sides of anterior end with tube-like elongations extending posteriorly, without lateral diverticula. Otolith in "Sciaena form".

Bahaba flavolabiata (Lin)

(Figs. 29, 49, 75)

D. VII, I+22-25; A. II, 7; P. 17; V. I, 5. L.1. 55-58 $\frac{9}{II}$

Body elongate, compressed, dorsal slightly convex, ventral profile broadly curved. Depth 3.8 in body length, head 3.7. Head moderately large, slightly compressed, about 4.4 times of snout, 5.4 of eye. Snout bluntly pointed, slightly larger than eye diameter. Rostral fold complete, not divided into lobes; marginal pores 5, not prominent, median pore rounded, situated above snout margins, lateral pores slit-like, situated on snout margin. Eye small, supra-lateral, placed at anterior half of head; inter-orbital relatively narrow, smaller than eye, slightly convex in the middle. Nostrils two, anterior one smaller, rounded, posterior one elliptical, close to eye. Mouth terminal, cleft rather oblique, upper and lower jaws equal when mouth closed, lower jaw projecting when mouth opened; maxillary reaching to below the middle of eye. Outer row teeth of upper jaw enlarged, conical and dispersely set, most exposed externally when mouth closed, inner row teeth minute, arranged in tooth band; inner row teeth of lower jaw slightly enlarged. Palatine, vomer and tongue toothless. Mental pores 2, not prominent, inner and outer lateral pores absent. Mental barbel absent. Preopercular margin with fine serratures; opercle ending in 2 flat spines. Gill membrane free from isthmus. Branchiostegals 7. Gill rakers long and slender, 5+13, about 4/5 of gill filament, or 1/2 of eye diameter in juvenile. Pseudobranchiae well-developed.

- 41 Posterior portion of head, body and tail covered with ctenoid scales; snout, interorbit and preopercle covered with small cycloid scales. Soft dorsal and anal base each with a scale sheath.

Dorsal with 8 spines, 22-25 rays, originating behind pectoral base, a deep notch between the spinous and the soft portion; first spine small, third spine rather long, about 2.5 times of eye (in juveniles); soft dorsal lower than spinous one. Anal fin short with 2 spines, 7 rays, commencing below the middle of soft dorsal, or 10th to 11th ray; second spine strong and long, about 2.7 of eye or one half of head length. Pectoral elongated and pointed, about 2/3 of head. Ventral situated below pectoral about equal in length, the first external ray slight filamentous. Caudal round, pointed (in juvenile) or truncate. Caudal peduncle slender and long, length of caudal peduncle about 3.4 times its depth.

Body cavity moderately large, peritoneum pale. Intestine large and short, with two loops; pyloric caeca 8. Swimbladder moderately large, cylindrical, anterior end broadly flattened, lateral ends with tube-like elongations, extending toward the end of swimbladder and reaching into the muscle layer of body wall. Swimbladder without lateral diverticula.

Otolith slightly rectangular in shape, anterior end rounded, posterior end truncated, sides almost parallel, outer margin with minute serrations. Dorsal surface with granulated projection at posterior half. Ventral surface with a tadpole-shaped impression, the "head" section upright, reaching anterior margin; the "tail" section in "J"-shape, shallow groove, "tail" bent to reach outer margins. Marginal groove prominent, starting from anterior part of "tail" section.

Back grayish brown with orange, belly grayish-white, pectoral pit with a black blotch. Spinous and soft dorsal with black margin; caudal fin grayish black, ventral and anal fins pale.

Distributed along the South East shores of China, a large food fish, usually only found south of Yang-tze River. Each winter from November to January, larger catches are obtained along Guangdong shores; in East China Sea, they often caught during summer. The largest fish may over a hundred Jin (1 Jin = 1/2 kg). Juvenile Bahaba flavolabiata feed on crustaceans. Their swimbladders are expensive and used as high class nutritious delicacy.

Distribution: South and East China Seas.

S. Y. Lin's original stuffed, dry skin specimen: Zhejiang (Zhou-shan), 1935, length 1500 mm. Fu-jian (Fu-zhou) 1957, November, 174 mm TL.

Subfamily Sciaeninae

42 Snout rounded, projecting. Rostral fold divided into four small lobes; rostral pores 3, marginal pores 5. Mouth small, inferior, cleft horizontally; upper jaw longer than lower jaw. Mandible with a barbel. Mental pores in "five-pored form"; a pair of median pores close together and open jointly from a common median pore at the base of the mental barbel, a pair of inner mental pores and outer mental pores present. Upper jaw with enlarged outer row teeth, inner row teeth of lower jaw all minute. Dorsal continuous, anal fin short, pectoral pointed, caudal truncate. Swimbladder cylindrical, anterior margin curved, no lateral sac. Sides with more than 10 pairs twig-like diverticula; diverticula have only ventral branches, without dorsal ones. Sagitta elliptical. Dorsal surface with middle and posterior portion granulated near the inner margin. Ventral surface with a tadpole-shaped impression, the "head" section upright, reaching the anterior margin; the "tail" section in "J"-shaped, "tail" bent towards outer margin. Marginal groove prominent, starting from middle of "head" at the inner side.

Genus Sciaena Linnaeus, 1758

Body elongate, compressed. Snout rounded, projecting. Rostral fold divided into 4 lobes, middle 2 lobes smaller, lateral lobes large and prominent; rostral pores 3, arranged in semi-circle; marginal pores 5, the median one round, lateral pores slit-like, situated at the sides and in between the lobes. Eye moderately large, placed at the anterior half of head. Nostrils two, anterior one small and rounded, posterior one large, elongated oval in shape, close to eye. Mouth small, inferior, horizontal. Mandible with a short barbel, less than eye diameter. Mental pore in "five-pored form", a pair of median pores close together, open jointly at the base of mental barbel, a common median pore; a pair of inner lateral pores and outer lateral pore present. Teeth villiform, arranged in bands; outer row teeth of upper jaw larger, widely set; inner row teeth of lower jaw all minute. Preopercular margin with minute serratures, opercle ending in 2 flat spines. Branchiostegals 7. Gill rakers slender and short, or degenerate, less than 15. Body and head covered with cycloid and ctenoid scales, soft dorsal and anal densely covered 1/3 with small cycloid scales. Dorsal with 10-13 spines, 21-31 rays, a deep notch in between the spinous and soft dorsal. Anal with 2 spines, 7 rays. Pectoral pointed. Ventral fin thoracic, first ray with filamentous elongation. Caudal truncate. Swimbladder cylindrical, anterior margin curved, no lateral sac. Sides with more than 10 pairs twig-like diverticula, diverticula with only ventral branches and without dorsal ones. Sagitta in "Sciaena form". This genus is the inshore benthic fish, lives in tropical and sub-tropical seas.

Sciaena russelli (Cuvier & Valenciennes)

(Figs. 3A, 3B, 9, 24, 50, 76)

D. X, I+24-27; A. II, 7; P. 16; V. I, 5, L.1. 46-48 $\frac{6-7}{10-11}$

43

Body compressed, dorsal evenly arched, ventral profile rather straight. Depth 3.1-3.5 in body length, head 3.1-3.5. Head blunt, compressed, 4-4.5 of eye, 3.7-4.2 of snout. Snout short, rounded, projecting. Rostral fold divided into four small lobes, median 2 lobes small, lateral lobes large and distinct; rostral pores 3, distinct, arranged semi-circularly; marginal pores 5, median pore round, lateral pores slit-like. Eye moderately large, round, supra-lateral, about the length of snout; interorbit convex, about equal to eye. Nostrils two, anterior one small, rounded, posterior one large, elongated oval in shape. Mouth small, inferior, cleft below the horizontal line of lower eye margin; maxillary reaching to below the middle of eye. Mental barbel slender and short, less than eye diameter. Mental pores belonging to "five-pored form", median pair close together, open jointly at the base of the mental barbel, a common median pore, inner lateral and lateral pores present. Upper and lower jaw teeth small, arranged in band; outer row teeth of upper jaw enlarged, dispersely set; teeth on lower jaw equal in size. Palatine, vomer and tongue toothless. Tongue large, free, anterior end round. Gill slit large, gill membrane free from isthmus. Preopercular margin with minute serratures, opercle ending in 2 flat spines. Branchiostegals 7. Pseudobranchiae present. Gill rakers short and small, 4+9, the longest raker about 1/6-1/7 of eye.

Body and top of head covered with ctenoid scales, snout and cheek with cycloid scales. Soft dorsal, anal and caudal more than 1/3 densely covered with small cycloid scales. Lateral line arched, extending to the end of caudal fin.

Dorsal continuous, with 11 spines, 24-27 rays, a notch in between the spinous and soft portion, origin above pectoral base; first spine small, third one longest, about 1/2 of head. Anal with 2 spines, 7 rays, commencing below 10th to 12th dorsal ray; first spine small, second rather long and large, less than 1/2 of head, about 1.6-1.8 of eye diameter. Pectoral pointed, about equal to post-orbital head length. Ventral commencing below pectoral base, slightly shorter than pectoral, first ray filamentous. Caudal truncate.

Body cavity moderately large, peritoneum light grayish in color. Intestine short, with two loops pyloric caeca 5, short. Swimbladder cylindrical, anterior margin semicircular, posterior end tapered. Sides with 16 pairs of twig-like diverticula, the

most anterior pair of diverticula larger and stout, the last pair of diverticula with only 2 branches, diverticula have only ventral branch and no dorsal branch.

Sagitta nearly oval in shape. Dorsal surface with granulated projections. Ventral surface with a tadpole-shaped impression, divided into the "head" section and the "tail" section. "Head" upright, pear-shaped, reaching to anterior margin; "tail", "J"-shaped, in shallow groove, bent towards external margin. Marginal groove distinct, starting from inner margin of upper half of "head".

Back pale, grayish in color, spinous dorsal black, other fins light gray, a diamond-shaped black blotch in front of dorsal.

Distribution: India, Ceylon, Malay, Indonesia, South China Sea, South of East China Sea, Philippines.

Specimen examined: 93-133 mm TL.

[Locality]: Guangdong (Zha-po, Shan-wei, Guang-hai).

Synonymy

Sciaena russelli, 1962, Fishes of South China Sea, p. 145, Fig. 346 (Bei-hai, San-wei, Guang-hai, Tang-jiá-wang).

Subfamily Otolithinae

Snout pointed. Rostral fold complete, not divided into lobes; rostral pores present or not, marginal pores 5, inconspicuous. Mouth large, terminal, cleft oblique, lower jaw slightly protruding. Outer row teeth of upper jaw and inner row teeth of lower jaw enlarged, anterior end of upper jaw with 1-2 pairs canine-like teeth, lower jaw with 1-2 pairs canine teeth in the middle. No mental barbel. Mental pores small, belonging to "two-pored form", both inner lateral and outer lateral pores absent. Dorsal continuous, with 10-11 spines, 25-30 rays; anal with 2 spines, 7-11 rays; caudal truncate. Swimbladder cylindrical, anterior end semi-circular, no lateral sacs. Sides with 20 to more than 50 pairs diverticula; diverticula with only ventral branches. Sagitta shield-like, anterior end truncate, inner margin curved, outer margin slightly triangular in shape, posterior margin bluntly pointed. Dorsal surface with granulate projections on posterior part. Ventral surface with a tadpole-shaped impression; "head" section upright, reaching anterior margin; the "tail" section slightly "J"-shaped, longer than "head", "tail" not bending outward. Marginal groove distinct, starting from inner side of anterior part of "head".

Genus Otolithes Oken, 1782

Body elongate, slightly compressed. Snout slightly pointed. Rostral fold complete, not divided into lobes; rostral pores present or not; marginal pores 5, median pore rounded, distinct, lateral pores slit-like, located at rostral margin, inconspicuous. Eye relatively small, placed at anterior half of head. Nostrils two, in front of eye, anterior nostril small, rounded, posterior one larger and elliptical. Mouth large, terminal, cleft oblique, lower jaw longer than upper jaw. No mental barbel. Mental pores minute, 2, inner and outer lateral pores absent. Upper jaw with several rows of teeth, outer row teeth enlarged, anterior end with 1-2 strong canine teeth on either side; lower jaw with one row of teeth, 1-2 canine teeth at anterior end. Preopercular margin with minute serratures, opercle ending in 2 flat spines. Branchiostegals 7. Pseudobranchiae present. Gill rakers rather short, few. Body and head covered with cycloid scales, dorsal and anal fin with a sheath of scales, formed by 1-2 rows small scales. Lateral line arched, almost reaching to end of caudal. Dorsal with 9-10 spines, 28-30 rays, a notch in between the spinous and soft portion; spines slender and weak. Anal with 2 spines, 7 rays. Pectoral pointed, elongate. Ventral thoracic. Caudal rhomboidal. Swimbladder rounded anteriorly, lateral end not projecting to form lateral sac, posterior end tapered. Sides of swimbladder with 35-37 pairs diverticula, diverticula with only ventral branches. Sagitta belonging to "Otolithes form".

Key to the species of genus Otolithes

- 1(2) Dorsal rays 27-30; anal origin below the 12th to 14th ray; gill rakers 5+8; body silver
 Otolithes argenteus (C. & V.)
- 45 2(1) Dorsal rays 28-30; anal origin below the middle of soft dorsal; gill rakers 9+16; body red
 Otolithes ruber (Bl. & Schn.)

Otolithes argenteus (Cuvier & Valenciennes)

(Figs. 7, 25, 51, 77)

D. X, I+28-30; A. II, 7; P. 16; V. I, 5. L.1. 51-54 $\frac{7-8}{10-13}$

Body elongate, slightly compressed. Depth 4.1-4.5 in body length, head 3.3-3.5. Head pointed, compressed, 5.5-6.8 times of eye, 3.8-4.2 of snout. Snout bluntly pointed, greater than eye. Rostral fold complete, not divided into lobes; rostral pores not distinct; marginal pores 5, median one rounded, lateral pores slit-like, not distinct. Eye relatively small, rounded, supra-lateral, placed at anterior half of head; inter-orbit broad, slightly convex, larger than eye. Nostrils two, in front of eye, anterior one rounded, posterior one elliptical. Mouth large, terminal, cleft oblique, lower jaw slightly longer than upper jaw; maxillary extending to below the middle of eye or posterior margin of pupil. Mental pores 2, minute, median in position, inconspicuous, inner and outer lateral pores absent. Teeth rather large, pointed; upper jaw with one row of teeth, with 1-2 canine teeth at anterior end; lower jaw with one row of teeth, with 1-2 centrally located canine teeth. Palatine, vomer and tongue toothless. Tongue large, free, anterior end rounded. Gill slit large, gill membrane free from isthmus. Preopercular margin with minute serrations, opercle with 2 weak flat spines postero dorsally. Branchiostegals 7. Gill rakers short and few, 4+10, the longest raker about 2-1/2 in eye.

Body covered with cycloid scales, tip of snout and cheek without scales. Soft dorsal and anal base with a scaly sheath, formed by 1-2 rows small scales. Lateral line slightly arched, almost reaching the end of caudal.

Dorsal continuous, with 11 spines, 28-30 rays, a notch in between the spinous and soft portion, dorsal origin above pectoral base; spines slender and weak, first spine short, second spine the longest, about 1/2 of head. Anal with 2 spines, 7 rays, commencing below 13th to 14th dorsal rays; first spine short and small, second one long, about 1/5-1/6 of head, equal to or slightly larger than eye. Pectoral pointed, elongate, equal to or shorter than post-orbital head length. Ventral located below the pectoral base, shorter than pectoral fin. Caudal rhomboidal.

Body cavity moderately large, peritoneum pale. Intestine short, with two loops at the middle; pyloric caeca large, 5. Swimbladder large, silver in color, anterior end rounded, posterior end tapered. Sides with 35-37 pairs diverticula, without dorsal branch, each diverticulum divided into several branches; base of diverticula stout, branches slender and long, branches of adjacent diverticula overlapping each other, last pair of diverticula with only 2 branches. Swimbladder surrounded with fat tissue, each diverticulum attached to fat, forming an elliptical external margin.

Sagitta slightly shield-like, inner margin curved, external margin near triangular in shape. Dorsal surface with 4-5 rounded granulars close to the inner margin at the posterior end. Ventral surface with a tadpole-shaped impression, "head" upright, in pear shape, reaching to the anterior margin, "tail" slightly "T"-shaped, longer than "head"; "tail" end not bending toward external margin, surface with many crossed marks. Marginal groove located at inner margin of ventral surface, starting from external side of anterior part of "head" to end of "tail", groove shallow and not distinct.

Body silver, back light gray, dorsal fin grayish black, other fins yellow, a black blotch on opercle.

Distribution: India, Ceylon, Indonesia, Chinese shores, Japan and Philippines.

46 Specimens examined: 143-262 mm TL.

[Locality]: Guangdong (San-ya, Shan-wei, Zha-po).

Synonymy

Otolithes argenteus, 1962, Fishes of South China Sea, p. 413, Fig. 435 (Shan-wei, Gung-hai).

Otolithes ruber (Bloch & Schneider)

D. X, I+28-30; A. II, 7. L. 1. 49-54 $\frac{7-9}{10-17}$

Body elongate, compressed. Depth 3.5-4.0 in body length, head 3.5-4.0. Head pointed, 4-6 times of eye, 3.2-4.2 of snout. Snout length greater than eye. Rostral pores absent. Eye supralateral, placed at anterior half of head. Nostrils two, located in front of eye. Mouth large, terminal, cleft oblique; maxillary reaching to below posterior margin of pupil. Teeth relatively large, pointed; upper jaw with 1-2 pairs canine teeth anteriorly; lower jaw with 1-2 canine teeth at the middle; other teeth minute, single row. Preopercular margin with minute serratures, opercle with 2 weak flat spines posterodorsally. Gill rakers slender, 9+16, equal to gill filament.

Dorsal continuous, with 11 spines, 28-30 rays, a deep notch in between the spinous and soft dorsal; second and third spines, the longest, about 1/2 of body depth. Anal with 2 spines, 7 rays, commencing below middle of soft dorsal; spines weak, second spine about 5-1/2-6-2/5 in head. Caudal rounded or rhomboid.

Body reddish brown with silver white, ventral sometimes golden yellow; spinous dorsal with grayish black margin, soft dorsal and anal margin grayish, pectoral and ventral yellow.

Distribution: India, Ceylon, Indonesia, South China Sea, Philippines.

(Adapted from Weber & beaufort, Fowler, Day)

Subfamily Argyrosominae

Snout slightly pointed or blunt. Rostral fold complete or divided, rostral pores 3; marginal pores 5. Mouth moderately large, terminal or subterminal, cleft oblique, both jaws equal or upper jaw slightly longer. Mental barbel absent. Mantal pores belonging to "false five-pored form" or "six-pored form". Outer row teeth of upper jaw and inner row teeth of lower jaw enlarged. Dorsal continuous; anal short and small. Caudal rhomboidal, truncate or double truncate. Swimbladder cylindrical, anterior margin semicircular, without lateral sacs. Sides with more than 10 to 20 pairs twig-like diverticula, diverticula with only ventral branches and no dorsal branches. Sagitta elongate, ovoid or shield-like. Dorsal surface with granulated projections. Ventral surface with a tadpole-shaped impression, the "head" section upright, oval-shaped, reaching anterior margin; the "tail" section "J"- or "T"-shaped, shallow groove, tail end bending toward or not toward outer margin. Marginal groove distinct.

Key to the Genera of Subfamily Argyrosominae

- 1(2) Sagitta with arched outer margin; the "tail" section of the tadpole-shaped impression on ventral surface "J"-shaped, end bending toward outer margin; mandibular pores usually five..... Nibeia
- 2(1) Sagitta with obliquely truncate posterior half of outer margin; the "tail" section of the tadpole-shaped impression on ventral surface "T"-shaped, end not bending towards outer margin; mandibular pores usually six...
..... Argyrosomus

Nibeia Jordan & Thompson 1911

Body elongate, compressed. Head moderately large, slightly pointed. Snout obtusely rounded, broad and short. Rostral fold with wave-like margin; rostral pores 3, arranged in semi-circular; marginal pores 5, median pore rounded, lateral pores slit-like, located at rostral margin. Eye moderately large, supra-lateral, interorbit broad and convex. Nostrils two. Mouth median large, cleft slightly oblique, terminal or sub-terminal in position. Outer row teeth of upper jaw and inner row teeth of lower jaw enlarged. Palatine, vomer and tongue toothless. Mental pores usually belonging to "false five-pored form", a pair of median pores close together, surrounded by a fleshy pad. When the fleshy pad subsides, a shallow pit appears, inner lateral and outer lateral pores present; or belonging to "six-pored form", median, inner lateral and outer lateral pores present; without mental barbel. Gill cleft large, gill membrane free from isthmus. Preopercular margin with minute serrations, opercle ending in two weak flat spines posterodorsally. Branchiostegals 7. Pseudobranchiae present. Gill rakers short or medium long. Body covered with

- 48 ctenoid scales, base of soft dorsal and anal with a scaly sheath, fin rays and membrane not covered with minute scales. Dorsal continuous, with 10-11 spines, 21-31 rays. Anal short, with 2 spines, 7 rays. Caudal rhomboid. Swimbladder cylindrical, anterior end rounded, not projecting to form lateral sacs. Sides with 20 pairs of twig-like diverticula. Sagitta with arched inner margin. Ventral surface with the "tail" of tadpole-shaped impression "J"-shaped, end bending to reach the outer margin.

Key to the species of Nibeia

- 1(12) Head obtusely rounded.
- 2(9) Mandibular pores belonging to "false five-pored form".
- 3(8) Dorsal rays 25-31, usually more than 26; gill rakers more than 14.
- 4(5) Sides of body without black wavy streaks; soft dorsal about 4.5 times of anal base, anal origin below the 11th dorsal ray..... Nibeia coibor (Ham.-Buch.)
- 5(4) Sides of body with distinct black wavy streaks, or with several rows pale wavy streaks on the back behind the head; soft dorsal 4 times of anal base, anal origin below the 13th to 15th dorsal rays.
- 6(7) Sides with many thin black wavy streaks, horizontally or obliquely toward front; body length 3.4-3.8 of depth; swimbladder with 22 pairs diverticula.....
..... Nibeia albiflora (Richardson)
- 7(6) Body behind head, with slender pale wavy streaks above lateral line, oblique anteroventrally, not distinct on posterior half of body; body length three times of depth; swimbladder with 19 pairs diverticula.....
..... Nibeia semifasciata chu, Lo & Wu sp. nov.
- 8(3) Dorsal rays 21-22; gill rakers less than 13.....
..... Nibeia diacanthus (Lacepede)
- 9(2) Mandibular pores belonging to "six-pored form".
- 10(11) Caudal rhomboidal, eye moderately large, head length about 5.4 of eye diameter, upper half of sides with many light brown wavy streaks..... Nibeia miichthioides Chu, Lo & Wu sp. nov.
- 11(10) Caudal double truncate, eye small, head 8-8.3 of eye, body blackish brown..... Nibeia japonica (Temm. & Schl.)
- 12(1) Head pointed; sides with black spots; anterior end of upper jaw with teeth extremely enlarged on both sides, exposed externally when mouth closed.....
..... Nibeia acuta (Tang)

Nibeia coibor (Hamilton - Buchanan)

(Figs. 26, 52, 78)

D. X, I+24-28; A. II, 7; P. 17; V. I, 5. L.1. 53-54 7-8
10-11

Body elongate, compressed, dorsal and ventral profile broadly curved. Depth 3.2-3.4 in body length, head 3.3-3.6. Head moderate, slightly projecting. Head 4.7-5.3 times of eye, 3.4-4.1 of snout. Snout short and slightly projecting, greater than eye. Rostral margins waved; rostral pores 3, minute, arranged in semi-circle; marginal pores 5, median one rounded, lateral pores slit-like. Eye medium large, supra-lateral, placed at anterior half of eye; interorbit slightly convex. Nostrils two, in front of eye, anterior nostril rounded, posterior one larger, elliptical, close to eye. Mouth moderate, cleft oblique, upper and lower jaws about equal or the upper one slightly longer than the lower one; maxillary reaching to below middle of eye. Outer row teeth of upper jaw and inner row teeth of lower jaw enlarged, anterior several teeth widely set, other teeth in villiform band. Palatine and vomer toothless. Tongue well-developed, free. Mental pores belonging to "false five-pored form", a pair of median pores close together, surrounded by a fleshy pad. When the fleshy pad sets aside, a shallow pit appears, inner lateral and outer lateral pores present. Gill slit moderately large, gill membrane free from isthmus. Preopercular margin with minute serratures. Opercle ending in two flat spines posterodorsally. Branchiostegals 6. Pseudobranchiæ present. Gill rakers slender and long, 5-6+10, the longest raker about 2/3 of gill filament.

Body and head covered with ctenoid scales, snout and cheek with small cycloid scales. Soft dorsal and anal base with a scaly sheath, formed by 1-2 rows of small scales. Lateral line broadly curved, bending ventrally before anal fin, reaching almost to tip of caudal.

Dorsal continuous, with 11 spines, 24-28 rays, a notch in between the spinous and soft portion, dorsal origin above pectoral base; first spine small, third and fourth the longest, third spine about 2.2-3.0 of eye. Anal commencing below the 10th to 12th dorsal rays, with 2 spines, 7 rays; the second spine strong and large, about 3.5-4 times of the first spine, 1.8-2.2 of eye. Pectoral pointed, elongate. Ventral thoracic, about equal to pectoral. Caudal rhomboidal.

Body cavity moderately large, peritoneum pale with small black spots. Intestine short, with two loops; stomach large, sac-like, pyloric caeca 8. Swimbladder with truncate anterior end, posterior end tapered, laterally not projecting to form lateral sacs. Sides with 22 pairs of lateral diverticula, diverticula with only ventral branches.

Sagitta large, elliptical, outer margin curved. Dorsal surface elevated, granulated projections not distinct. Ventral with a tadpole-shaped impression, the "head" section upright, pear-shaped, reaching to the anterior margin; the "tail" section in "J"-shaped shallow groove, end bending toward outer margin. Marginal groove narrow, located along inner margin on ventral surface.

Body silvery gray, back relatively darker. Scales with many black spots. Spinous dorsal membrane light gray, with black margin; soft dorsal grayish, on top, each ray with a black spot at the base, middle of the soft dorsal with a pale longitudinal streak; pectoral, ventral, anal and caudal fins light gray.

Distribution: India, South China Sea, East Sea and Philippines.

Specimens examined: 154-281 mm.

[Locality]: Fujiang (dong-wo), Guangdong (Ying-ge-hai, San-ya, Qing-lan, Zha-po, Zhe-lang).

50

Nibeia albiflora (Richardson)

(Figs. 27, 53, 79)

D. X, I+28-30; A. II, 7; V. I, 5. L.1. 51-53 $\frac{10}{9-10}$

Body elongate, compressed, dorsal convexed, slightly curved, ventral broadly curved. Depth 3.3-3.8 in body length, head 3.2-3.5. Head moderate, compressed, slightly projecting, head 3.4-3.8 of snout, 4.7 of eye. Snout blunt, short, larger than eye. Rostral pores 3, minute, arranged semi-circularly; rostral fold free, divided into two lobes, not distinct; marginal pores 5, median one rounded, lateral pores slit-like. Eye moderately large, supra-lateral, placed at anterior half of head, shorter than snout; interorbit broad, convex, larger than eye. Nostrils two, anterior one small, rounded, posterior one large, oval elongated, close to eye. Mouth moderately large, sub-terminal, cleft oblique, lower jaw slightly shorter than upper one; maxillary extending to below the posterior margin of pupil. Both upper and lower jaw teeth in villiform band; outer row teeth of upper jaw large and pointed; inner row teeth of lower jaw slightly enlarged. Palatine and vomer toothless. Tongue free, anterior end round. Mental pores belonging to "false five-pored form", a pair of median pores close together, surrounded by a fleshy pad. When fleshy pad subsides, a shallow pit appears; inner lateral and outer lateral pores present. Mental barbel absent. Gill membrane free isthmus. Preopercular margin with minute serrations, with small spine on the angle; preopercle ending in two soft flat spines. Branchiostegals 7. Pseudobranchiae present. Gill rakers slender and long, 6+11, the longest raker 2/3 of gill filament.

Body and posterior portion of head covered with ctenoid scales; anterior part of head covered with small cycloid scales, cheek without scales. Soft dorsal and anal base with a scaly sheath. Lateral line well-developed, arched, reaching to tip of caudal.

Dorsal continuous, with 11 spines, 28-30 rays, a deep notch in between the spinous and soft portion, dorsal above pectoral base; first spine small, second and third spine the longest, about 1/2 of head. Anal with 2 spines, 7 rays, commencing below 15th dorsal ray; second spine strong and large, about 1/2 of head, 2.2 of eye. Pectoral pointed, long, larger than post-orbital head length. Ventral commencing below slightly behind pectoral base; first ray with slight filamentous elongation. Caudal rhomboidal.

Body cavity moderately large, peritoneum grayish white. Intestine short, 2-coiled; pyloric caeca 8. Swimbladder large, anterior end rounded, lateral ends not projecting to form lateral sac. Sides with twig-like diverticula, about 22 pairs, without dorsal branch, with ventral branch. Vertebrae 25.

Sagitta pointed, rounded. Dorsal surface with few granulated projections. Ventral surface with a tadpole-shaped impression, the "head" section upright, pear-shaped, reaching the anterior margin; the "tail" section in "J"-shaped shallow groove. Marginal groove long and narrow, located at the inner lateral margin on ventral surface.

Back grayish orange, ventral silvery white; back with many grayish wavy streaks, oblique anteroventrally, not united to streaks below lateral line. Upper part of spinous dorsal dark brown, soft dorsal with black margin, each ray with a black spot at the base. Pectoral, ventral and anal orange.

Distribution: Chinese coasts and Korea.

Specimens examined: 124-372 mm TL.

51 [Locality]: Zhejiang (Kan-men, Shi-tang, Hai-men, Shen-jia-men), Fujian (Dong-yang, Ma-wei, Dong-wo, San-sha, Xia-men), Gungdong (Zha-po, Shan-wei), Shandong (Qing-dao).

Synonymy

Nibea albiflora C. L. Chang. 1955. Fishes of Yellow Sea and Po Hai, p. 141, Fig. 91 (Liao-ning, Hebei, Shandong); 1962 Fishes of South China Sea, p. 421, Fig. 350 (Qing-lan, Zha-po, Shan-wei, Jia-zi, Hai-men, Nan-wo).

Nibea semifasciata Chu, Lo & Wu

(Figs. 28, 54, 80)

English description on pp.91-92 of original edition.

Nibea diacanthus (Lacépède)

(Figs. 29, 55, 81)

D. X, I+22-23; A. II, 7; P. 16; V. I, 5. L.1. 51-54 $\frac{7}{II}$

53 Body compressed, elongate, dorsal evenly arched, ventral rather straight. Depth 3.2-3.4 in body length, head 3.1-3.3. Head compressed, rather pointed, 3.9-4.3 times of snout, 4.4-6.6 of eye. Snout bluntly pointed, greater than eye. Rostral fold with free margin, divided into two lobes; rostral pores 3, arranged semi-circularly; marginal pores 5, median one rounded, lateral pores slit-like. Eye relatively small, supra-lateral, placed at anterior half of head; interorbit slightly convex. Nostrils two, located in front of eye, anterior nostril rounded, posterior one elliptical. Mouth large, sub-terminal; cleft slightly oblique, upper jaw slightly longer than lower one; maxillary reaching below posterior margin of eye or slightly anterior. Mental pores belonging to "false five-pored form", median pair close together and surrounded by a fleshy pad. When fleshy pad subsides, a shallow pit appears; inner lateral and outer lateral pores present. Teeth small, in villiform band; outer row teeth of upper jaw and inner row teeth of lower jaw enlarged, widely set. Palatine, vomer and tongue toothless. Tongue large, free, anterior end round. Gill cleft large, gill membrane free from isthmus. Preopercular margin with fine serrations, opercle ending in two flat spines. Branchiostegals 7. Gill rakers short and weak, 4+8, the longest raker 1/3 of eye diameter.

Body all covered with ctenoid scales except tip of snout and preorbital region. Soft dorsal and anal base with only one row of small scales. Lateral line slightly curved, reaching almost to end of caudal.

Dorsal continuous, with 11 spines, 22-23 rays, a deep notch in between the spinous and soft portion, dorsal origin above pectoral base; first spine small, fourth spine the longest about 1/2 of head. Anal with 2 spines, 7 rays, commencing below 8th dorsal ray; first spine small, second one large, about 2 times of eye diameter. Pectoral short, rounded. Ventral placed below pectoral base, slightly shorter than pectoral. Caudal pointed.

Body cavity moderately large. Intestine short, 2-coiled; pyloric caeca 9, right side ones larger than left ones. Swim-bladder large, anterior part without projected diverticula, anterior end round, posterior end tapered. Sides with 20 pairs of twig-like diverticula, diverticula with only ventral branches, first pair largest, last two pairs with a single branch.

Sagitta ovoid, anterior margin round, inner margin straight, outer margin curved. Dorsal surface projected, with granulated projections. Ventral surface with a tadpole-shaped impression, the

"head" section upright, pear-shaped, its anterior end pointed round, reaching to anterior margin; the "tail" section "J"-shaped, surface concave, end bending toward outer margin. Marginal groove narrow and elongated, located at inner lateral margin of ventral surface.

Adult fish, body blackish-brown, dorsal fin with irregular black spots; anal, pectoral and ventral black. In juvenile, body with five black streaks above lateral line, one on top, one under spinous dorsal, two under soft dorsal, one on caudal peduncle. Sometimes these streaks form blotches in different sizes.

Distribution: India, Malay, Indonesia, Chinese Coast, Korea and Japan.

Specimens examined: 124-284 mm TL.

[Locality]: Shanghai fish market, Fujiang (Dong-wo), Guangdong (Zha-po).

Synonymy

Nibeia diacanthus, 1962, Fishes of South China Sea, p. 422, Fig. 35, (Xin-cun, San-ya, Xiong-zhou; Zha-po, Shan-wei, Tai-shan).

54 Nibeia miichthioides Chu, Lo & Wu Sp. nov.

(Figs. 30, 56, 82)

English description on pp. 92-93 of original edition.

55 Nibeia japonica (Temminck & Schlegel)

(Figs. 31, 57, 83)

D. IX-X, I+27-29; A. II, 7-8; P. 16; V. I, 5. L.1. 50 $\frac{8-9}{10}$

Body elongate, compressed, dorsal and ventral profiles broadly curved. Depth 3.3-3.7 in body length, head 3.5. Head moderately large, compressed and pointed, 3.6 times of snout, 8-8.3 of eye. Snout pointed, about 2 times of eye. Rostral fold complete, margin wavy; rostral pores 3, arranged semicircularly; marginal pores 5, median one round, lateral pores slit-like. Eye relatively small, supra-lateral, placed at anterior half of head; interorbital broad and flat. Nostrils two, anterior one round, posterior one semicircular, in front of eye. Mouth large, terminal cleft oblique, jaws about equal; maxillary reaching below the middle of eye or slightly posterior. Upper jaw with outer row of teeth enlarged, conical, inner row teeth minute; lower jaw with two rows of teeth, inner row relatively larger, conical, widely set. Palatine, vomer and tongue toothless. Tongue round, anterior end free. Mental pores 6, median pair separate, inner lateral and outer lateral

pores present. Mental barbel absent. Gill cleft large, gill membrane free from isthmus. Preopercular margin with minute serrations, opercle with two flat spines postero dorsally. Branchiostegals 7. Pseudobranchial present. Branchial cavity black; gill rakers strong and short, 4+9-10, the longest raker about 1/2 of eye.

Body covered with ctenoid scales, snout with cycloid scales. Dorsal and anal base with a scaly sheath formed by 1-2 rows of small cycloid scales. Lateral line slightly arched, reaching to end of caudal.

Dorsal continuous, with 10-11 spines, 27-29 rays, a notch in between the spinous and soft portion, dorsal origin above pectoral base posterior-dorsally; first spine short, third spine, the longest, about 2/5 of head. Anal with 2 spines, 7-8 rays, commencing below the 12th to 15th dorsal rays; first spine short, second spine strong and large, about 2 times of eye. Pectoral relatively short, about equal to post-orbital head length. Caudal double truncate, with 9 rays on upper lobe and 8 on lower one.

56 Body cavity moderate, peritoneum white. Intestine short, 2-coiled; pyloric caeca 8, digital. Swimbladder relatively small, anterior end round, without laterally projected sacs, posterior end tapered. Sides with 26 pairs diverticula, fourth and fifth diverticula extremely large, with ventral branches but no dorsal branches.

Sagitta elongated oval in shape, anterior end pointed, posterior end broad and flat, inner and outer margin slightly arched. Dorsal surface with patch-like projections. Ventral surface with a tadpole-shaped impression; the "head" section upright, slightly pear-shaped, reaching to the anterior margin; the "tail" section in "J"-shaped shallow groove, end bending outward. Marginal groove located at the inner margin of ventral surface.

Body blackish brown, ventral grayish, dorsal margin black, soft dorsal grayish black. Pectoral and ventral fins gray. Caudal grayish-black. Pectoral with a black blotch on the pit.

A large marine food fish, large size reaches tens of jings (1 jing = 1/2 kg), rather common in East China Sea.

Distribution: South and East China Sea, South of Japan.

Specimens examined: 655-875 mm TL.

[Locality]: Shanghai Fish Market, Offshore Lu-si.

Synonymy

? Argyrosomus japonica, 1962, Fishes of South China Sea, p. 430, Fig. 356 (Shang-wei, Zhe-long).

Nibe acuta (Tang)

(Figs. 32, 58, 84)

D.X, I+26-27; A. II, 7; P. 17; V. I, 5. L.1. 50-51 $\frac{7}{10}$

Body elongate, compressed, dorsal slightly arched, ventral rather straight. Depth 3.8-4 in body length, head 3.3-3.5. Head moderately large, pointed and compressed. Head 4-4.1 times of snout, 5.5-6.3 of eye. Snout projected, greater than eye. Rostral fold free, divided into two lobes; rostral pores 3, arranged semicircularly; marginal pores 5, median one round, deeply concave, lateral pores slit-like. Eye relatively small, placed at anterior half of head; interorbit slightly convex, about equal to the eye. Nostrils two, round, in front of eye, posterior nostril larger. Mouth large sub-terminal, cleft rather oblique, upper jaw slightly longer than the lower one; maxillary extending to below the posterior margin of pupil. Mental pores belonging to "false five-pored form" or "six-pored form". Mental barbel absent. Outer row teeth of upper jaw larger, conical, anterior several teeth largest, canine-like, widely set, exposed externally when mouth closed, other teeth minute in band; lower jaw teeth minute, band-like arrangement, inner row teeth slightly enlarged, this is more distinct in juvenile fish. Palatine, vomer and tongue toothless. Tongue large, free, anterior end slightly pointed. Gill cleft large, gill membrane free from isthmus. Preopercular margin with fine serratures. Opercle ending with two weak flat spines. Branchiostegals 7. Gill rakers short and strong, 5+8, the longest raker about 1/3 of gill filament.

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Body covered with ctenoid scales, snout, cheek and inter-orbit covered with cycloid or weak ctenoid scales. Soft dorsal and anal base with a scaly sheath formed by 1-2 rows small scales. Lateral line arched, reaching posteriorly to end of caudal.

Dorsal continuous, with 11 spines, 26-27 rays, a deep notch in between the spinous and soft portion, dorsal origin above the pectoral base; first spine the shortest, second and third spines the longest, about 1/2 of head. Anal with 2 spines, 7 rays; commencing below the 11th to 12th ray; first spine small, second one moderately large, 4.5-5 times of first spine, 1.3-1.4 of eye. Pectoral pointed, elongate, larger than post-orbital head length. Ventral located below the base of pectoral, shorter than pectoral. Caudal rhomboidal, juvenile with a long pointed tail.

Body cavity moderately large, peritoneum gray. Intestine short, a straight tube only slightly curved anteriorly; pyloric caeca large, 6, digital. Swimbladder large, anterior end rounded, without projected lateral sac, posterior end tapered. Sides with 30 pairs of twig-like lateral diverticula, diverticula without dorsal branch, each diverticulum divided into many twig-like branches, first pair diverticulum the largest, last pair with only two branches.

Sagitta elongated, anterior margin rounded, posterior margin slightly pointed. Posterior half of dorsal surface with granulate clusters, piled up in blotches. Ventral surface with a tadpole-shaped impression; the "head" section upright, pear-shaped, reaching the anterior margin, the "tail" section in "J"-shaped deep groove, end slightly curved towards outer margin. Marginal groove not distinct.

Body grayish brown, back darkish, ventral silvery white, over 2/3 of the sides with black spots, arranged in wavy oblique stripes anteroventrally. The spots not distinct in a specimen of 125 mm body length. Pectoral and ventral fins with many small black spots; dorsal margin grayish brown; ventral white, caudal slightly blackish; opercle with a black blotch.

Distribution: South China Sea.

Specimens examined: 120-312 mm TL.

[Locality]: Guangdong (Shan-wei, Zha-po)

Synonymy

Nibeia acuta, 1962, Fishes of South China Sea, p. 419, Fig. 349, (Zha-po, Gung-hai, Shan-wei).

Genus Argyrosomus de la Pylaie, 1834

Body elongate, compressed. Head bluntly pointed. Snout blunt. Rostral fold complete; rostral pores 3, marginal pores 5. Eye moderately large, placed at anterior half of head. Nostrils two. Mouth median large, oblique, upper and lower jaws about equal, teeth minute; upper jaw teeth arranged in band, outer row teeth relatively larger; lower jaw with 2-3 rows teeth, inner row enlarged. Mental pores small, usually 6, sometimes 4, median pair and inner lateral pair arranged in rectangular, outer lateral pores present. Mental barbel absent. Gill slit large, gill membrane free from isthmus. Preopercular margin with weak fine serrations, opercle with 2 flat spines postero-dorsally. Branchiostegals 6-7. Pseudobranchiae present. Gill rakers slender and short. Body covered with ctenoid scales, dorsal and anal base with scaly sheath. Dorsal with 10 spines 23-29 rays. Anal with 2 spines, 7 rays. Caudal rhomboidal, truncate. Swimbladder with a round anterior end, without projected lateral sac. Sides with 24-27 pairs of diverticula, diverticula usually with ventral branches but without dorsal ones. Sagitta with a truncate posterior outer margin. On ventral surface the "tail" section of tadpole-shaped impression in "T"-shaped, end not bending to reach outer margin.

Key to the species of genus Argyrosomus

- 1(2) Caudal truncate; pyloric caeca 11; swimbladder with small diverticula, not enlarged; eye moderately large. Argyrosomus aneus (Bloch)
- 2(1) Caudal rhomboidal or pointed; pyloric caeca 6-10; swimbladder with relatively large diverticula.
- 3(4) Mouth and pharyngeal cavity blackish; pyloric caeca 9... Argyrosomus macrocephalus (Tang)
- 4(3) Mouth and pharyngeal cavity pale; pyloric caeca 10; swimbladder with more than 20 pairs diverticula.
- 5(6) A black spot present on 6th to 7th dorsal spines (sides of juvenile fish with 2 rows black spots, they disappear when fish grow); gill rakers 4+9. Argyrosomus pawak Lin
- 6(5) Spinous dorsal without a black spot, soft dorsal with a white longitudinal stripe; gill rakers 5+10 Argyrosomus argentatus (Houttuyn)

Argyrosomus aneus (Bloch)

(Figs. 33, 59, 85)

D. X, I+23-25; A. II, 7; P. 16; V. I, 5. L.1. 48-50 $\frac{7-8}{14}$

Body elongate, compressed, dorsal slightly arched, ventral rather straight. Depth 3.2-3.5 in body length, head 3.1-3.3. Head moderately large, compressed, 4.6-4.8 times of eye, 3.6-4.1 of snout. Snout blunt and short, slightly greater than eye. Rostral fold with complete margin; rostral pores, 3, minute, not distinct; marginal pores 5, median pore round, lateral pores slit-like. Eye moderate, supra-lateral, placed at anterior half of head; interorbit rather wide, convex, greater than eye. Nostrils two, in front of eye, anterior one small, round, posterior one large, semicircular. Mouth large, terminal, cleft oblique, lower jaw slightly longer than upper one; maxillary reaching to below the middle of eye. Mental pores rather small, 6, median pores and inner lateral pores arranged in square, outer pores sometimes absent. Mental barbel absent. Teeth of both jaws minute, arranged in bands; outer row teeth of upper jaw and inner row teeth of lower jaw enlarged, widely set. Palatine, vomer and tongue toothless. Tongue large free, anterior end rounded. Gill cleft large, gill membrane free from isthmus. Preopercular margin with weak serratures, opercle with 2 weak flat spines posterodorsally. Branchiostegals 7. Gill rakers relatively long, 5-6+11-12, the longest gill raker larger than 1/2 of eye.

Body covered with ctenoid scales, cheek and operculars covered with cycloid scales. Soft dorsal and anal base with a scaly sheath formed by 1-2 rows small scales. Lateral line slightly arched almost reaching to tip of caudal.

Dorsal with 11 spines, 23-25 rays, a deep notch in between the spinous and soft portion, dorsal origin above pectoral base; first spine short and small, third spine the longest, less than 1/2 of head. Anal with 2 spines, 7 rays, commencing below 12th to 13th dorsal rays; first spine small, second spine about 1/4 of head, about equal to eye. Pectoral pointed, elongate, about equal to post-orbital head length. Ventral fin located below the base of pectoral, shorter than pectoral. Caudal truncate.

Body cavity moderately large, peritoneum grayish black. Intestine short, 2-coiled; pyloric caeca median large, 11. Swim-bladder without projected lateral sac anteriorly, anterior end rounded, posterior end tapered. Sides with 21 pairs of twig-like diverticula, diverticula slender and weak with only ventral branches, each diverticulum with many branches, last pair of diverticula with two branches only.

Sagitta about shield-like, anterior margin nearly arched, posterior margin rather pointed, posterior part of outer margin truncate, inner margin straight. Dorsal surface with five granular projections in the middle. Ventral surface with a tadpole-shaped impression; the "head" section small, upright, in pear-shape, reaching to the anterior margin, the "tail" section in "T"-shaped concave groove, end not bending toward outer margin. Marginal groove located along inner lateral margin on ventral surface, starting from "head" section extending to the end of "tail" section, groove shallow and not distinct.

Back greenish gray, belly silvery white, dorsal and anal fins grayish black.

Distribution: India, Malay, Indonesia, South China Sea, Philippines.

Specimens examined: 142-200 mm TL.

[Locality]: Guangdong (Zha-po, Miao-wan, Gan-chong, San-ya).

Synonymy

Argyrosomus aneus, 1962, Fishes of South China Sea, p. 429, Fig. 355 (Bai-ma-jing, Ying-ge-hai, Shan-wei).

Argyrosomus macrocephalus (Tang)

(Figs. 34, 60, 86)

D. X, I+27-29; A. II, 7; P. 16; V. I, 5. L.1. 44-49

60 Body elongate, compressed, dorsal profile arched, ventral rather straight. Depth 2.9-3.1. Head large and blunt, about 4-4.5 times of snout, 4.2-4.8 of eye. Snout blunt, equal or slightly larger than eye. Rostral pores, 3, not distinct; rostral fold free, not divided; marginal pores 5, minute, median one small, rounded, lateral pores slit-like. Eye median large, supra-lateral, placed at anterior half of head; interorbit slightly convex, greater than eye. Nostrils two, anterior one small, rounded, posterior one large, semicircular or elongate oval. Mouth large, cleft oblique, starting below lower margin of eye, upper and lower jaws about equal; maxillary reaching to below posterior margin of pupil. Upper jaw with several rows of teeth, outer row teeth larger, widely set; lower jaw with 2 rows of teeth, inner row teeth larger. Palatine and vomer toothless. Tongue large, rounded, free. Mental pores 6, small and not distinct, median pores and inner lateral pores arranged in square, outer lateral pores present. Mental barbel absent. Gill cleft large, gill membrane free from isthmus. Preopercular margin with fine serratures, opercle with two weak flat spines postero dorsally. Branchiostegals 7. Pseudobranchiæ present. Gill rakers relatively long, 5-7+12-13, the longest raker slightly larger than 1/2 of eye.

Body covered with ctenoid and cycloid scales. Opercles, snout, cheek and base of dorsal and anal covered with cycloid scales, others covered with ctenoid scales. Dorsal and anal with only a scaly sheath at base. Lateral line complete, reaching to end of caudal.

Dorsal continuous, with 11 spines, 27-29 rays, a notch between the spinous and soft portion, dorsal origin above the base of pectoral; first spine small, third spine the longest, about 1/2 of head. Anal with 2 spines, 7 rays, commencing below the 11th dorsal ray; first spine short, second spine long about 1.3-1.5 of eye. Pectoral pointed, smaller than head. Caudal truncate or near round.

Body cavity moderately large, peritoneum grayish black. Intestine short, with 2-coiled at right side; stomach sac-like, pyloric caeca 9. Swimbladder silvery, anterior end round, not projecting to form lateral sac, posterior end tapered. Sides with 18 pairs of twig-like diverticula, without dorsal branches.

Sagitta large, turtle-shell-like. Dorsal surface elevated, with small concaved area; posterior and anterior margin pointed round, inner margin arched, outer margin obliquely truncate. Ventral surface with a tadpole-shaped impression; the "head" section upright, reaching to anterior margin; the "tail" section in a "T"-shaped concaved groove, end not bending toward outer margin. Marginal groove placed along inner lateral margin of ventral side, starting from "head" section reaching to "tail" end.

Back light gray, belly silver; at the middle of the anterior end of lower jaw with a group of small black spots; breast densely covered with small melanophore.

Distribution: South China Sea and South of East China Sea.

Specimens examined: 122-219 mm TL.

[Locality]: Shanghai Fish Market, Guangdong (Shan-wei, San-ya, Chang-hua).

Synonymy

Argyrosomus macrocephalus, 1962, Fishes of South China Sea, p. 435, Fig. 360 (Gan-chong, San-ya, Tan-jia-wan, Zha-po, Shan-wei).

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Argyrosomus pawak Lin

(Figs. 35, 61, 87)

D. X, I+23-25; A. II, 7; P. 16; V. I, 5. L.1. 48-49 $\frac{6}{12-14}$

Body elongate, compressed, dorsal and ventral profiles slightly curved. Depth 3.1-3.3 in body length, head 3.1-3.2. Head moderately large, bluntly pointed, 3.2-3.5 times of snout, 4.9-5.1 of eye. Snout round, larger than eye. Rostral fold free, not divided; rostral pores 3, minute, sometimes absent; marginal pores 5, median pore round, lateral pores slit-like. Eye median large, supra-lateral, placed at anterior half of head; interorbit slightly convex, greater than eye. Nostrils two, in front of eye, anterior one small, round, posterior one large, elliptical. Mouth large, terminal, cleft oblique, starting above the horizontal line of the lower margin of eye. Upper jaw slightly longer than lower jaw; maxillary reaching to the middle of eye or posterior margin of pupil. Teeth minute, arranged in band; outer row teeth of upper jaw enlarged; lower jaw with 2-3 rows of teeth, inner row slightly enlarged. Palatine, vomer and tongue toothless. Tongue median large, free. Mental pores 6, rather small, median pores and inner lateral pores arranged in square, outer lateral pores present. Mental barbel absent. Gill slit large, gill membrane free from isthmus. Preopercular margin with fine serrations, opercle with 2 flat spines on posterior margin. Branchiostegals 7. Pseudobranchiae present. Gill chamber grayish black; gill rakers 4+9, the longest raker about 1/2 or slightly larger of eye.

Snout, cheek, opercle covered with cycloid scales, body covered with weak ctenoid scales, a few cycloid scales above lateral line. Dorsal and anal with only scaly sheath at base. Lateral line arched and reaching to caudal tip.

Dorsal continuous, with 11 spines, 23-25 rays, a notch in between the spinous and soft portion, dorsal origin above pectoral base; first spine short, third and fourth spines the longest, less than 1/2 of head. Anal with 2 spines, 7 rays, commencing below the 12th dorsal ray; first spine short and small, second spine equal to or slightly larger than eye. Pectoral pointed, shorter than head. Caudal truncate or near to rounded.

Body cavity median-large, peritoneum grayish black. Intestine short, coiled twice at right side; stomach thick, and large, sac-like; pyloric caeca 10. Swimbladder large, silvery, anterior end round, not projecting laterally to form lateral sac, posterior end tapered. Sides with 24-26 pairs of diverticula, without dorsal branches, first pair of diverticula large, last three pairs of diverticula with only one branch.

Sagitta slightly shield-like, anterior margin broadly rounded, posterior margin narrow and pointed, inner margin curved, outer margin triangular. Dorsal surface with many granulate projections near to outer margin. Ventral surface with a tadpole-shaped impression, the "head" section upright, oval in shape, reaching to anterior margin; the "tail" section in "T"-shaped groove, "tail" end enlarged, not bending outward. Marginal groove distinct, located along inner lateral margin of ventral surface.

Back grayish black, belly white. Spinous dorsal grayish black, a black blotch located in between the sixth and ninth spines; soft dorsal with black margin and grayish black base, pale in the middle; caudal light gray, black at the middle of posterior end. Juvenile fish with 2 rows black spots along sides, one row under dorsal base, other one located on lateral line, each row with 5-6 black spots, these spots disappear as the fish grows.

Distribution: South China Sea and South of East China Sea.

Specimens examined: 62-194 mm TL.

62 [Locality]: Fu-jian (dong-wo), Guangdong (Zha-po, San-ya, Gan-chong).

Synonymy

Argyrosomus pawak, 1962, Fishes of South China Sea, p. 432, Fig. 358 (Qi-sha, Bai-ma-jing, Gan-chong, Qing-lan, Zha-po, Shan-wei).

Argyrosomus argentatus (Houttuyn)

(Figs. 5, 36, 62, 88)

D. X, I+25-27; A. II, 7; P. 16; I, 5. L.1. 48-51 $\frac{6}{11-12}$

Body elongate, compressed, dorsal broadly curved, ventral rounded. Depth 3-3.4 in body length, head 2.9-3.1. Head moderately large, compressed, 3.4-3.8 times of snout, 3.4-4.5 of eye. Snout blunt, snout about 1.6-1.8 of eye. Rostral fold complete, no division; rostral pores 3, minute, arranged in semicircular, marginal pores 5, median pore rounded, lateral pores slit-like. Eye median large, supra-lateral, placed at anterior half of head; interorbit slightly convex, slightly greater than eye. Nostrils two, close together, anterior one small, rounded, posterior one large, oval shaped, in front of eye. Mouth large, terminal, cleft slightly oblique, starting horizontally to lower eye margin, upper jaw slightly longer than lower one; maxillary reaching to below the middle of eye. Upper jaw teeth minute, arranged in band, outer row teeth slightly larger. Palatine, vomer and tongue toothless. Mental pores 6, minute, median pores and inner lateral pores arranged in square, outer lateral pores present. Gill-cleft large, gill-membrane free from isthmus. Preopercular margin with fine serrations, opercle with 2 flat spines, postero dorsally. Branchiostegals 7. Pseudobranchiae present. Gill rakers 5+11, the longest raker about 1/2 of eye.

Body covered with ctenoid scale, dorsal and anal base with a row of scaly sheath. Lateral line broadly curved anteriorly and straight posteriorly, extending to end of caudal.

Dorsal continuous, with 11 spines, 25-27 rays, a notch in between the spinous and soft portion, dorsal origin above the base of pectoral; first spine short and small, third and fourth spines the longest, third spine about 1/3 of head. Anal with 2 spines, 7 rays, commencing below 12th dorsal ray; first spine weak, second spine equal to eye, reaching to 1/3-1/2 of first ray. Pectoral pointed, commencing before ventral base. Caudal rounded or truncate.

Body cavity moderately large, peritoneum grayish. Intestine short, coiled twice at right side; stomach large, sac-like; pyloric caeca 10. Swimbladder large, silvery, anterior end round, not projecting to form lateral sac, posterior end tapered. Sides with 25 pairs diverticula, diverticula rather short, with ventral branches but without dorsal branches.

Sagitta shield-like, anterior end broad, posterior end pointed, inner margin curved, outer margin triangular. Dorsal surface with patch-like elevation in the middle of anterior half, surrounded by small granulars. Ventral surface with a tadpole-shaped impression, the "head" section upright, reaching to the

anterior margin, the "tail" section in "T"-shaped shallow groove, end bending slightly, not reaching to the outer margin. Marginal groove narrow, located along inner lateral margin of ventral surface.

Body grayish brown laterally, belly silvery white. Soft dorsal with a white stripe in the middle. Caudal and pectoral pale.

- 63 This fish is one of the important demersal food fishes, with large production, rather common in East China Sea.

Distribution: India, Chinese Coast, Korea and Japan.

Specimens examined: 146-278 mm.

[Locality]: Shandong (Qing-dao, Yan-tai), Zhejiang (Maidao), Fujian (Dong-yang), Guangdong (Shan-wei, Miao-wan).

Synonymy

Argyrosomus argentatus. Change, C. L. 1955. Fishes of Yellow Sea and Po Hai, p. 140, Fig. 90 (Liaoning, Hebei, Shandong).

Subfamily Pseudosciaeninae

Snout obtusely pointed. Rostral fold complete; rostral pores 3, arranged semicircularly; marginal pores 5. Mouth large, terminal, cleft oblique, upper and lower jaw about equal or lower jaw slightly projected. Outer row teeth of upper jaw and inner row teeth of lower jaw slightly enlarged. Mental barbel absent, mental pores 4 or 6. Dorsal continuous, with 9-11 spines, 23-34 rays; anal short or moderately long, with 2 spines, 7-13 rays. Caudal truncate, long pointed. Swimbladder cylindrical, anterior end curved without lateral sac. Sides with 10 to more than 30 pairs branches. Sagitta shield-like, sub-circular or elongate oval in shape. Dorsal surface with granulated, patch-like or crest-like cross projections. Ventral surface with a tadpole-shaped impression, the "head" section upright, reaching to anterior margin; the "tail" section in "T"-shaped, "tail" end often enlarged, with a round projection, bending or not bending toward outer margin.

Key to the genera of subfamily Pseudosciaeninae

- 1(4) The ventral branches from diverticula of swimbladder with a short inferior branch, which end by the side of swimbladder.
- 64 2(3) The inferior branch (from ventral branch) of swimbladder with only anterior sub-branch; with six minute mandibular pores; mouth and pharyngeal cavity black.
..... Atrobucca gen. nov.
- 3(2) The inferior branch of swimbladder with both anterior and posterior sub-branches; with four small mandibular pores, mouth cavity orange. Miichthys
- 4(1) The ventral branch of swimbladder with an elongate inferior branch, which extending along peritoneum to the mid-line of abdomen.
- 5(6) Swimbladder with 26-33 pairs diverticula; anal with 7-9 ray; super-occipital not distinct Pseudosciaena
- 6(5) Swimbladder with 14-21 pairs diverticula; anal with 11-13 rays; super-occipital distinct. Collichthys

Atrobucca Chu, Lo & Wu gen. nov.

English description on P. 93 of original edition.

65 Atobucca nibe (Jordan & Thompson) emend.

(Figs. 37, 63, 89)

English description on p.94 of original edition.

Synonymy

Argyrosomus nibe, 1962, Fishes of South China Sea, p. 432, Fig. 357 (San-wei).

Miichthys Lin, 1938

Body elongate, compressed. Head moderately large, projecting. Snout short and blunt, not projected. Rostral margin complete; rostral pores 3, arranged semicircularly; marginal pores 5, median one round, located slightly above rostral margin, lateral marginal pores, slit-like, located on rostral margin. Eye moderately large, supra-lateral. Two nostrils, close together. Mouth terminal, cleft large and oblique, upper and lower jaws about equal; maxillary reaching to below posterior margin of eye. Outer row teeth of upper jaw and inner row teeth of lower jaw enlarged, canine form. Palatine, vomer and tongue toothless. Mental pores 4, median pores and inner lateral pores arranged in square, outer lateral pores absent. Mental barbel absent. Gill cleft large, gill membrane free from isthmus. Preopercular margin with fine serrations, opercle with a flat spine posterodorsally. Branchiostegals 7. Pseudobranchiae present. Gill rakers short. Scales moderate or small, anterior half of head covered with small cycloid scales, soft dorsal and anal 1/2-1/3 covered with small cycloid scales. Body covered with ctenoid scales. Lateral line arched, extending to end of caudal. Dorsal continuous, with 9-10 spines, 28-30 rays, a notch in between the spinous and soft portion. Anal with 2 spines, 7 rays; second spine relatively small and weak. Caudal rhomboidal. Swimbladder moderately large, anterior end round, not projecting laterally to form lateral sac, posterior end tapered. Sides with dense and short diverticula, each diverticulum with dorsal and ventral branches, branching complicated. Sagitta in "Sciaena form". Vertebrae 24-25.

Miichthys miiuy (Basilewsky)

(Figs. 6, 38, 64, 90)

D. VIII-IX, I+28-30; A.II,7; P.21; V.I,5. L.1. 50-54⁹/₁₀

Body elongate, compressed, dorsal and ventral profiles broadly curved. Depth 3.4-4.2 in body length, head 3.4-3.7. Head median large, slightly compressed, rather pointed, 4.1-5.2 times of snout, 5-5.4 of eye. Snout short and bluntly pointed. Rostral fold free, not divided into lobes; rostral pores 3; marginal pores 5, median one rounded, shallow well-like, located above rostral margin, lateral pores slit-like, located above rostral margin, lateral pores slit-like. Eye median large, supra-lateral, at anterior half of eye; interorbit, slightly convex, equal to or larger than eye. Nostrils two, anterior one small, rounded, posterior one large, elongate, immediately in front of eye. Mouth large terminal, cleft oblique, upper and lower jaw about equal, upper jaw slightly projected when mouth closed; maxillary extending to reach below posterior margin of eye. Outer row teeth of upper jaw enlarged, canine-like, most of them exposed externally when mouth closed, inner row teeth minute, arranged in band; inner row teeth of lower jaw enlarged, canine-like, outer row teeth smaller in bands. Tongue well-developed, free. Mental pores 4, the median pair small, inner lateral pores

slit-like in square arrangement, outer pores absent. Mental barbel absent. Gill cleft large, gill membrane free from isthmus. Preopercular margin with minute serratures, opercle with a flat spine posterodorsally. Branchiostegals 7. Pseudobranchiae present. Gill rakers slender and long, 6+9-11.

67 Snout and opercle covered with cycloid scales, cheek, upper and lower jaw without scales, body covered with ctenoid scales; each fin base covered with small cycloid scales, small scales on tail extending to the middle of caudal fin. Lateral line slightly arched, reaching to end of caudal.

Dorsal continuous, with 9-10 spines, 28-30 rays, a notch in between the spinous and soft portion, dorsal origin above pectoral base, slightly behind ventral origin; first spine short and small, third one the longest, about 1.7-2 times of eye. Anal with 2 spines, 7 rays, commencing below the 13th to 14th dorsal rays; second spine slender and long, about 1-1.3 of eye. Pectoral pointed elongate, longer than ventral. Caudal rhomboidal.

Body cavity moderately large, peritoneum grayish black. Intestine short, 2-coiled; stomach elongate sac-like; pyloric caeca 5, long and large. Swimbladder large, conical in shape, anterior end not projecting to form lateral sac, posterior end tapered. Sides with 34 pairs diverticula, each diverticulum with dorsal and ventral branches, dorsal branch further divided into miniature sub-branches, crossing as a net.

Sagitta elongate oval in shape, anterior and posterior margin bluntly pointed, inner margin rather straight, outer margin curved. Dorsal surface with many granulated projections, united, patch-like, more distinct in juveniles. Ventral surface with a tadpole-shaped impression, the "head" section upright, sub-oval shape, reaching to anterior margin; the "tail" section in "J"-shaped deep groove, "tail" end bending toward outer margin. Marginal groove narrow, placed along inner lateral margin of ventral surface.

Body darkish gray with purplish-green, belly grayish white. Spinous dorsal with black margin, soft dorsal with a longitudinal black stripe in the middle; pectoral with a dark blotch under the base; other fins grayish black.

Distribution: Coasts of China and Korea.

Specimens examined: 137-458 mm TL.

[Locality]: Shanghai Fish Market, Zhe-jian (Hua-niao, Shen-jia-men, Shi-tang), Fujian (Dong-wo).

Synonymy

Miichthys miiuy Chang, 1955. Fishes of Yellow Sea and Po Hai, p. 138, Fig. 89 (Liaoning, Hebei, Shandong).

Genus Pseudosciaena Bleeker, 1863

68 Body elongate, compressed; caudal peduncle slender and long. Head large and bluntly pointed, with mucus cavity on the skull. Snout broad and short, bluntly round. Rostral fold complete, not divided into lobes; rostral pores minute, 3, arranged semi-circularly; marginal pores 5, median one round, located slightly above the rostral margin, lateral pores not distinct, slit-like, located on margin. Eye median large, supra-lateral placed at anterior half of eye; interorbit convex. Nostrils two, relatively small, in front of eye. Mouth terminal, cleft large and oblique, upper and lower jaw about equal. Teeth minute, canine-like; upper jaw teeth in villiform band, outer row teeth enlarged, sharp and widely set; inner row teeth of lower jaw enlarged. Palatine, vomer and tongue toothless. Mental pores 6, not distinct, median pores and inner pores arranged in square, outer pores present. Mental barbel absent. Branchiostegals 7. Pseudobranchiae present. Gill rakers slender and long, 8-11+16-20. Body covered with cycloid and ctenoid scales, head covered with cycloid scales; soft dorsal and anal fin membrane over $\frac{2}{3}$ covered by small cycloid scales. Scales on the lower part of body often acquiring a golden colored glandular body. Dorsal continuous, with 9-11 spines, 31-36 rays, a deep notch in between the spinous and soft portion. Anal with 2 spines, 8-10 rays. Caudal pointed and long. Intestine short, 2-coiled; pyloric caeca digital-like, 11-17. Swimbladder moderately large, cylindrical, anterior end round, laterally not projected to form lateral sac, posterior end pointed and long. Sides with 30-33 pairs diverticula, diverticulum with dorsal branch and ventral branch. Sagitta in shield-like, outer margin projected, posterior margin pointed. Dorsal surface elevated, with granulate or patch-like projections. Ventral surface with a tadpole-shaped impression, the "head" section upright, reaching to anterior margin, the "tail" section oblique or slightly curved, in "T"-shaped, "tail" end enlarged, reaching to posterior margin, a disc-like projection at the center. Vertebrae 26-29.

Key to the species of Pseudosciaena

- 1(2) Caudal peduncle length more than 3 times of its depth; second anal spine equal to or slightly longer than eye; scales relatively small, 8-9 rows between base of dorsal and lateral line; the inferior branch from ventral branch of swimbladder with its anterior and posterior sub-branches in equal length; vertebrae usually 26.....
.....Pseudosciaena crocea (Rich.)
- 2(1) Caudal peduncle length more than 2 times of its depth; second anal spine smaller than eye; scales relatively larger, 5-6 rows between base of dorsal and lateral line; the inferior branch from ventral branch of swimbladder with its anterior sub-branch elongated and posterior sub-branch short; vertebrae usually 29.....
.....Pseudosciaena polyactis Bleeker

Pseudosciaena crocea (Richardson)

(Figs. 39, 65, 91)

D. VIII-IX, I+31-34; A. ii, 8; P. 15-17; V. I, 5. L.1. 56-57

8-9
8

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Body elongate, compressed, both dorsal and ventral profiles broadly curved; caudal peduncle slender and long, length of caudal peduncle about 3 times or more of its depth. Depth 3.7-4 in body length, head 3.6-4. Head compressed, larger and obtusely pointed, with well-developed mucus canals, 4-4.8 of snout, 4-6 of eye. Snout bluntly pointed, greater than eye. Rostral fold complete, not divided into lobes; rostral pores small, 3, or absent occasionally; marginal pores 5, median one rounded, lateral pores slit-like. Eye median large, supra-lateral, placed at anterior half of head; interorbit, convex, larger than eye. Nostrils two, anterior one small, rounded, posterior one large, elongate oval, immediately in front of eye. Mouth terminal, cleft large and oblique, lower jaw slightly projected, a tumor-like process present at the symphysis; maxillary almost reaching to the posterior margin of eye. Teeth minute, sharp; upper jaw with many rows of teeth, outer row teeth enlarged, anterior several teeth the largest; lower jaw teeth in two rows, inner row teeth enlarged, posterior several teeth larger, two teeth behind the tumor-like process relatively larger and pointed inward. Palatine, vomer and tongue toothless. Tongue large, free, anterior end rounded. Mental pores 6, not distinct, median pair and inner pair of pores arranged in square, outer lateral pores present. Mental barbel absent. Gill cleft large, gill membrane free from isthmus. Preopercular margin with minute serratures, opercle with 2 flat spines postero dorsally. Branchiostegals 7. Pseudobranchiae present. Gill rakers slender and long, 8-9+16-18, longest gill raker about equal to gill filament and 2/3 of eye.

Head and anterior half of body covered with cycloid scales, posterior half with ctenoid scales. Soft dorsal and anal fin membrane over 2/3 covered with small cycloid scales, caudal fin covered with scales. Each scale on the lower part of sides with a golden colored glandular body. Lateral line complete, anterior end slightly curved, posterior part straight, reaching to end of caudal.

Dorsal continuous, a deep notch in between the spinous and soft portion, dorsal origin above pectoral base, with 9-10 spines, 31-34 rays; first spine short and weak, third spine the longest. Anal with 2 spines, 8 rays, commencing opposite the middle of soft dorsal; second spine equal to or slightly larger than eye. Pectoral pointed and elongate, longer than ventral. Ventral relatively small, commencing behind pectoral origin. Caudal long, pointed, slightly rhomboidal.

Body cavity moderately large, peritoneum light gray. Intestine short, 2-coiled on right side of body; pyloric caeca 14. Swimbladder large, anterior end rounded, laterally, not projected to form lateral sac, posterior end tapered. Sides with 31-33 pairs diverticula, each diverticulum with dorsal and ventral branches, ventral branch divided into upper and lower sub-branch, lower branch further divided into anterior and posterior sub-branches, they are equal in length, and parallel to each other, extending along the peritoneum to ventral side of body.

Sagitta slightly shield-like or pear-shaped, anterior end broad and rounded, posterior end narrow and pointed, inner and outer margins curved. Dorsal surface with a group of granulation near to outer margin. Ventral surface with a tadpole-shaped impression, the "head" section upright, rounded, reaching to anterior margin; the "tail" section in "T"-shaped shallow groove, end enlarged, with a disc-like process at center. Marginal groove distinct, broad and short, located along inner lateral margin on the ventral surface. Vertebrae 26.

Dorsal and upper part of sides yellowish brown, lower part and ventral golden yellow. Dorsal and caudal grayish yellow; pectoral and ventral yellow. Lip orange.

Distribution: South China Sea, East China Sea and South of Yellow Sea.

Specimens examined: 106-408 mm TL.

[Locality]: Jiangsu (Lu-si), Shanghai Fish Market, Zhejiang (Si-tang, Si-pu, Zhou-shan), Fujian (Dong-wo, Dong-xiang, Sha-cheng), Gongdong (Shan-wei, Zha-po).

Synonymy

Pseudosciaena crocea, Chang, 1955, Fishes of Yellow Sea and Po-hai, p. 135, Fig. 87 (Shandong); 1962, Fishes of South China Sea, p. 411, Fig. 344 (Xiong-zhou, Zha-po, Shan-wei, Zhelong, Hai-men, Nan-wo).

Pseudosciaena polyactis Bleeker

(Figs. 40, 66, 92)

D. IX-X, I+31-36; A. II, 9-10; P. 16; V. I, 5. L.1. 50-62

$\frac{5-6}{8}$

Body elongate, compressed, both dorsal and ventral profiles broadly curved; caudal peduncle length about 2.5 of depth. Depth 3.5-3.8 in body length, head 3-3.6. Head large, obtusely pointed, compressed, with well-developed mucus canals, head 3.6-4.8 times

of snout, 4.1-6.3 of eye. Snout short and bluntly pointed, slightly larger than eye. Rostral fold complete, not divided into lobes. Rostral pores 3, not distinct; marginal pores 5, median one rounded, located above rostral margin, lateral pores slit-like. Eye moderately large, supra-lateral, placed at anterior half of eye; interorbit broad and convex, larger than eye. Nostrils two, anterior one small, round, posterior one large, slit-like, close to anterior eye margin. Mouth terminal, cleft large and oblique, upper and lower jaws about equal; maxillary extending to below the posterior margin of eye. Teeth minute, sharp; upper jaw with many rows of teeth, arranged in band, outer row teeth rather large; lower jaw teeth in two rows, inner row relatively larger; tumor-like process in the middle of lower jaw with two larger teeth. Palatine, vomer and tongue toothless. Tongue free, rounded. Mental pores small, 6, not distinct, median pair and inner lateral pores arranged in square, outer lateral pores present, sometimes absent. Mental barbel absent. Gill cleft large, gill membrane free from isthmus. Preopercular margin with fine serrations, opercle with 2 flat spines posterodorsally. Branchiostegals 7. Pseudobranchiae well-developed. Gill rakers slender and long, 10+8-20, the longest raker longer than gill filament and more than 1/2 of eye.

Anterior part of body and head covered with cycloid scales, posterior part with ctenoid scales. Soft dorsal and anal fin membranes more than 2/3 covered with small cycloid scales. Lateral line well-developed, anterior portion slightly curved, posterior portion straight, reaching to end of caudal. Caudal covered with small cycloid scales.

Dorsal continuous, a notch in between the spinous and soft portion, dorsal origin above the base of pectoral, with 10-11 spines, 31-36 rays; first spine weak, third spine longest. Anal commencing below the 16th and 17th dorsal ray, with 2 spines, 9-10 rays; second spine shorter than eye. Pectoral pointed and long, larger than ventral. Ventral commencing behind pectoral origin. Caudal pointed, slightly rhomboidal.

Body cavity median large, peritoneum grayish black. Intestine short, 2-coiled at right side of body cavity; pyloric caeca 12-16; stomach sac-like. Swimbladder large, anterior part rounded, not projecting to form lateral sac, posterior end tapered. Sides with 26-32 pairs lateral diverticula, each diverticulum with dorsal and ventral branches. Ventral branch divided into upper and lower sub-branches, the lower sub-branches divided further into anterior and posterior sub-branches, posterior one short and small, anterior one slender and long, extending along peritoneum to ventral surface.

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Sagitta near elliptical, anterior end broad and rounded, posterior end narrow and pointed, inner margin and outer margin curved. Dorsal surface elevated, with crossing crest. Ventral surface with a tadpole-shaped impression, the "head" section upright, reaching to anterior margin, the "tail" section in "T"-

shaped shallow groove, "tail" end enlarged, rounded with a disc-shaped process at center. Marginal groove broad, short and distinct, located along inner lateral margin of ventral surface.

Back and upper lateral side yellowish brown, lower lateral side golden yellow, all fins grayish yellow. Lip orange.

Distribution: East China Sea, Yellow Sea, Po Hai and South West Coast of Korea.

Specimen examined: 112-353 mm TL.

[Locality]: Shandong (Qing-dao), Jiangsu (Lu-si), Zhejiang (Shi-tong, Da-cheng, Shen-jia-men, Zhou-shan), Fujian (Dong-wo).

Synonymy

Pseudosciaena polyactis Chang, 1955, Fishes of Yellow Sea and Po Hai, p. 156, Fig. 88 (Liaoning, Hebei, Shandong).

Genus Collichthys Gunther, 1860

Body elongate, compressed; caudal peduncle slender and long. Head large, nape convex, mucus canal well-developed, super-occipital crest distinct. Snout broad, short and blunt. Eye median large or small, supra-lateral, placed at anterior half of head; interorbit broadly convex. Nostrils two. Mouth large, terminal, both jaws equal or lower jaw slightly projected. Teeth minute, upper and lower jaw with villiform teeth bands. Palatine, vomer and tongue toothless. Mental pores 4, not distinct. Mental barbel absent. Gill cleft large, gill membrane free from isthmus. Preopercular margin with minute serratures, opercle with 2 flat spines posterodorsally. Branchiostegals 7. Pseudobranchiae present. Gill rakers long and dense. Body covered with cycloid scales, under lateral line each scale with a golden colored glandular body. Dorsal continuous, with 8-9 spines, 23-28 rays. Anal with 2 spines, 11-13 rays. Caudal pointed, elongate. Swimbladder median large, anterior end arched, laterally not projecting to form lateral sacs. Sides with 14-22 pairs lateral diverticula, diverticulum with dorsal and ventral branches. Sagitta in "Pseudosciaena form", vertebrae 26-28.

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Key to species of genus Collichthys

- 1(2) Gill chamber entirely white or grayish. Swimbladder with 21-22 pairs lateral diverticula.....
 Collichthys lucidus (Richardson)
- 2(1) Gill chamber deep black. Swimbladder with 14-15 pairs lateral diverticula.....
 Collichthys niveatus Jordan & Starks

Collichthys lucidus (Richardson)

(Figs. 41, 87, 93)

D. VIII, I+24-28; A. II, 11-13; P. 15; V. I, 5. L.1. 49-50

Body elongate, compressed, dorsal broadly curved, ventral evenly rounded, caudal peduncle long. Depth 3.2-3.7 in body length, head 3-3.6. Head large and blunt, nape convex, not smooth; mucus canals well-developed; head 3.6-5.3 times of snout, 5.8-8 of eye. Head with distinct superoccipital crest, bearing an anterior and a posterior spine, with 2-3 small spines in between. Snout short and blunt. Rostral fold complete, not divided into lobes; rostral pores not distinct, 3; marginal pores 5, median one rounded, lateral marginal pores slit-like. Eye small, supra-lateral, placed at anterior half of head; inter-orbit broad and convex, larger than eye. Nostrils two, anterior one large, rounded, posterior one slit-like, near to eye margin. Mouth terminal, cleft large, deeply oblique, upper and lower jaws about equal; maxillary extending to below the middle of eye. A process at the middle of lower jaw, opposite to the concaved part at the middle of upper jaw. Teeth of upper and lower jaws villiform, arranged in band; outer row teeth of upper jaw and inner row teeth of lower jaw enlarged, slightly bending backward. Palatine and vomer toothless. Tongue well-developed, free. Mental pores 4, minute, distinct, lateral pores absent. Mental barbel absent. Gill cleft large, gill membrane united with each other from either side but free from isthmus. Preopercle thin, with minute serratures along posterior margin, opercle with a flat spine posterodorsally. Branchiostegals 7. Pseudo-branchiae present. Gill rakers long, 10-11+16-20, the longest raker longer than gill filament, about equal to eye.

Body and head covered with thin cycloid scales, fall off very easy; glandular body relatively few, limited to abdomen. Lateral line well-developed, slightly curved, reaching to end of caudal.

Dorsal continuous, with 9 spines, 24-28 rays, spines weak, a notch in between the spinous and soft portions, dorsal origin above pectoral base. Anal with 2 spines, 11-12 rays, commencing opposite to the 10th to 11th dorsal ray; spines weak, second spines longest, larger than eye. Pectoral pointed elongate, exceeding end of ventral fin. Ventral commencing behind the pectoral base. Caudal pointed.

Body cavity moderately large, peritoneum white. Intestine short, 2-coiled; stomach sac-like; pyloric caeca slender and long, 16-18. Swimbladder large, sub-cylindrical, anterior end curved, laterally not projected to form lateral sac, posterior end tapered. Sides with 21-22 pairs lateral diverticula, each diverticulum divided into dorsal branch and ventral branch. Dorsal branch from either side meet at the middle of dorsal

surface of swimbladder; ventral branch also divided into many sub-branches and meet with each other on the ventral wall from either side.

73 Sagitta near shield-like, anterior margin broad, posterior margin narrow and pointed, inner and outer margin curved. Dorsal surface elevated or with granulated projections. Ventral surface with a tadpole-shaped impression, the "head" section upright, rounded, reaching to the anterior margin, the "tail" section in "T"-shaped groove, "tail" end expanded, with a disc-like projection at center. Marginal groove broad and distinct, located along inner lateral margin of ventral surface.

Back grayish yellow, belly golden colored; gill chamber white or grayish white. Spinous dorsal and posterior end of caudal with black margin; other fins light yellow.

A common, small food fish, they are caught year-round along Chinese coast, usually between 80-100 mm TL.

Distribution: Philippines, Coasts of China, West Coast of Korea and Japan.

Specimens examined: 93-150 mm TL.

[Locality]: Jiangsu (Lu-si), Zhejiang (Kan-men, Long-jiang, Zhou-shan, Ma-yi-dao), Fujian, (Fu-zhou, San-sha, Sha-cheng), Gungdong (Zha-po).

Synonymy

Collichthys fragilis, Chang, 1955, Fishes of Yellow Sea and Po Hai, p. 133, Fig. 85 (original Fig. 86 mistake) (Liaoning, Hebei, Shandong): 1962, Fishes of South China Sea, p. 409, Fig. 343 (Gung-hai, Tang-jia-wan).

Collichthys niveatus Jordan & Starks

(Figs. 42, 68, 94)

D. VIII, I+23-25, A. II, 11-12; P. 15; V. I 5. L.1. 47

Body elongate, compressed, dorsal curved, ventral rather straight; caudal peduncle slender and long. Depth 3.3-3.5 in body length, head 3.3-3.7. Head large and blunt, nape convex, not smooth; mucous canals well-developed; head 4.1-4.7 times of snout, 4-5.0 of eye. Supra-occipital with distinct crest spines, saddle-like, with an anterior and a posterior spine, between
74 these two spines without small spines, smoothly concave. Snout short and blunt. Rostral fold complete, not divided into lobes; rostral pores 3, not distinct; marginal pores 5, median one rounded, distinct, lateral pores slit-like, not distinct. Eye median large, supra-lateral, placed at anterior half of eye; interorbit broad and convex, longer than eye. Nostrils two, anterior one small, rounded, posterior one large, oval elongated. Mouth terminal, cleft large, deeply oblique, upper and lower jaws equal; maxillary reaching below the posterior margin of eye. A process presents at mid-line of lower jaw, which is opposite to the concaved area at the middle of upper jaw. Teeth of upper and lower jaws villiform, arranged in bands; outer row teeth of upper jaw and inner row teeth of lower jaw slightly enlarged and bending backward. Palatine and vomer toothless. Tongue well-developed. Mental pores 4, not distinct, median and inner pairs arranging in square, outer lateral pores absent. Mental barbel absent. Gill cleft large, gill membrane free from isthmus. Preopercular margin without serrations, opercle with a weak flat spine posterodorsally. Branchiostegals 7. Pseudobranchiae present. Gill rakers slender and long, 9+15-16, the longest raker longer than gill filament.

Scales large and thin, easy to fall off; head and body covered with cycloid scales. Many distinct glandular bodies present ventrally around ventral fin, above anal, ventral side of caudal peduncle and opercles. Lateral line slightly curved, extending to the end of caudal.

Dorsal continuous, with 9 spines, 23-25 rays, spines weak; a notch in between the spinous and soft portion, dorsal origin above pectoral base. Anal with 2 spines, 11-12 rays, commencing below 12th dorsal ray; spines weak. Pectoral pointed, elongate, exceeding tip of ventral. Ventral commencing slightly behind pectoral base. Caudal pointed.

Body cavity large, peritoneum pale. Intestine short, 2-coiled; stomach large, sac-like; pyloric caeca slender and long, 10-14. Swimbladder large, anterior end curved, laterally not projecting to form lateral sacs, posterior end tapered. Sides with 14-15 pairs diverticula, each diverticulum divided into dorsal and ventral branches. Dorsal branches of one side meet ones from opposite side at the middle of dorsal surface of swimbladder; ventral branches slender and long, extending along the peritoneum

to meet ventral branches from opposite side at the middle of ventral surface.

Sagitta, shield-like, anterior margin broadly rounded, posterior margin narrow and pointed, inner and outer margin curved. Dorsal surface with granulated processes, only elevated at posterior part. Ventral surface with a tadpole-shaped impression, the "head" section upright, oval-shaped, reaching to anterior margin; the "tail" section in "T"-shaped groove, "tail" end slightly enlarged, round, with a disk-like process at center. Marginal groove, broad and distinct, located along inner lateral margin on ventral surface.

Back grayish yellow, belly golden yellow. Gill chamber black on upper part. Lip orange; buccal cavity pale. Fins light yellow.

Distribution: East China Sea and Yellow Sea, West Coast of Korea.

Specimens examined: 109-118 mm TL.

[Locality]: Yellow Sea Fishery region, Shanghai Fish Market.

Synonymy

Collichthys niveatus, Change, 1955, Fishes of Yellow Sea and Po Hai, p. 132, Fig. 86 (original description in Fig. 85, mistaken) (Liaoning, Hebei, Shandong).

CONCLUSION

This paper is a taxonomic report of Chinese sciaenids. The system of classification is based mainly on morphological comparisons of swimbladders, otoliths and other external characters such as mental pores. The most important parts of the present paper are summarized as follows:

1. The taxonomic study of sciaenids has a long history. A review of the important literature on sciaenid taxonomy, especially that dealing with Chinese sciaenids, more than 30 references, are reviewed here.
2. The morphological characters of sciaenids are generally variable, and are closely correlated with their ecotypes. As a group the representatives of Oriental and Western genera and species often are distinctly different in the numbers of vertebrae, dentition, dorsal and anal fin ray counts and the shape of tail.
3. Sciaenids are relatively warm water fishes, mostly distributed in subtropical and tropical inshore shallow waters over muddy sand bottoms. Their distribution range is very wide. Although present in both the Eastern and Western Atlantic, more genera and species are found on the American Atlantic coasts. The Chinese Western Pacific coast also has many forms. Some species, such as Pseudosciaena crocea and P. polyactis are very abundant with large stocks. They are the most economically important marine fishes of China. Very few higer taxa of sciaenids have a world-wide distribution. The geographic distributions of most taxa are restricted. The sciaenids probably originated during the Cenozoic, as early as the Paleocene. No fossils of Chinese sciaenids have been discovered yet.
4. Sciaenids are carnivorous fishes, their food habits are closely related with ecological conditions. Some species aggregate in schools during the spawning season, and migrate to shallow coastal waters to spawn. Pseudosciaena crocea and P. polyactis form a "yellow fish swarm" which is of great economic importance. Sciaenids are well known for their ability to produce sound. The sound producing mechanism is the swimbladder and its associated drumming muscles. When the drumming muscles contract, they press the viscera and vibrate the wall of the swimbladder, which then produces sound.
5. The snout and mandible of all Chinese sciaenids have muciferous pores. Snout pores are distributed on the tip of the snout and anterior margin of the rostral fold. The former are called rostral pores, the latter marginal pores.

Mental pores can be classified into five forms: Sciaena^m form, Johnius form, Argyrosomus form, Miichthys form and Otolithes form.

6. The swimbladder of Chinese sciaenids is usually well-developed and may also be classified into five forms: Sciaena form, Johnius form, Megalonibea form, Bahaba form and Pseudosciaena form.
7. The inner ear of sciaenids consists basically of the utriculus and sacculus, two parts. The utriculus is attached to three semicircular canals. The posterior end of the sacculus connects with the lagena. The utriculus contains a lapillus, the sacculus a sagitta, and lagena an asteriscus. The sagitta is the largest otolith and the word "otolith" refers hereafter only to the sagitta for convenience. The otolith (sagitta) of Chinese sciaenids can be classified into four forms: Sciaena form, Johnius form, Otolithes form and Pseudosciaena form.
8. Based on the study of the comparative morphology of otoliths and the differentiation of forms, we believe that the Chinese sciaenids originated from tropical Indo-Pacific stocks. The earliest immigrant may have been one of the geographically most widely distributed and geologically oldest genera, such as Sciaena, Johnius or other similar primitive forms. The external morphology and ecology of the subfamily Johniinae is very similar to the subfamily Sciaeninae, but the swimbladder and otolith are specialized. It is believed that during the process of sciaenid evolution, Johniinae has become a separate lineage by itself. The swimbladder of Megalonibinae is similar to that of Johniinae, its otolith still retains the primitive form and is similar to the basic form of Sciaeninae. Its body form has changed from bottom-groveling into a free-swimming type, and hence it can be recognized as another lineage of Sciaenidae. Bahabinae is an active free-swimming group, its swimbladder is specialized, but the otolith still retains the basic form of Sciaeninae. Therefore, it is another lineage of Sciaenidae. Sciaeninae is a group of typical bottom groveling fishes. The morphology of swimbladder and otolith both show the typical primitive form, considered to be the evolutionary stem to other sciaenids. All other subfamilies have radiated from this subfamily. The swimbladder of the Otolithinae still retains the Sciaena form but its otolith has differentiated into another form. Its general morphology has also been changed. The body is slightly stream-lined, and the jaws have canine teeth. They are a group of rather voracious sciaenids. The swimbladder of Argyrosominae still retains the primitive Sciaeninae form, but its otolith is of two types, one retains the primitive form (Nibea), the other has

differentiated into a form similar to that in Otolithinae (Argyrosomus). The habitats of this subfamily has changed from bottom grovelling to a bottom swimming type, and its morphology and habits exhibit intermediate stages of evolution. Pseudosciaeninae has close relationships with both the Otolithinae and Argyrosominae. The swimbladder has differentiated into a new form. The otolith also differentiated from Otolithes form to a new form. These fishes are lower mid-water free-swimming fishes. This subfamily is among the most abundant of Chinese Sciaenidae and also represents the highest level of phylogenetic development of the Sciaenidae in Chinese waters.

9. Along the coast of China there are 37 species and 13 genera of sciaenids, belonging to 7 subfamilies which include 4 new subfamilies (Megalonibinae, Bahabinae, Argyrosominae and Pseudosciaeninae), 2 new genera (Megalonibea and Atrobucca) and 4 new species (Johnius fasciatus, Nibea semifasciatus, Nibea miichthioides and Megalonibea fusca). In the past, the systematics of the Sciaenidae have been very confused. Closely related genera were separated into different subfamilies and unrelated genera were placed in the same subfamily. At times one species, such as Argyrosomus argentatus (Houttuyn), has been placed in as many as five or six different genera (see synonymy of this species). Also in the genera Sciaena and Johnius nomenclatural problems have existed since Cuvier & Valenciennes, 1830, because the presence or absence of a mental barbel and the weakness or strength of the anal spine fail to differentiate these two genera. But the forms of their swimbladders and otoliths are completely different and are diagnostic for each genus. For instance, Johnius amblycephalus(Blkr.) = Sciaena dussumeri (Cuv. & Val.) was put in the genus Sciaena in the past.
10. There are 37 species of sciaenids known to China. Most species are widely distributed in the Indian Ocean and south-west Pacific, and are also found in coastal waters of China and neighboring countries. But the distributions of certain species such as Pseudosciaena crocea, P. polyactic, Miichthys miuy, Collichthys lucidus, C. niveatus, Megalonibea fusca and Bahaba flavolabiata are restricted to the Chinese coast, or only reach the Southwest coast of Korea. These species could be recognized as endemic to the Chinese coast.
11. This publication has illustrations of sciaenid fishes, swimbladders and anatomic figures of otoliths. A total of 94 figures is presented and 55 references have been recorded.

Species	India; Ceylon	Malaya	Indonesia	Philippines	Vietnam	China South Sea	China East Sea	China Yellow Sea	Pohai	South-Western Korea	South-Western Japan
<u>Johnius amblycephalus</u> (Blkr.)	+	+	+	+		+					+
<u>Johnius semiluctuosus</u> (C. & V.)	+		+	+		+					
<u>Johnius fasciatus</u> Chu, Lo & Wu						+					
<u>Johnius belengerii</u> (C. & V.)	+		+	+		+	+	+	+	+	+
<u>Johnius dussumeri</u> (C. & V.)	+	+	+			+					
<u>Johnius carutta</u> Bloch	+	+			+	+					
<u>Wak coitor</u> (Ham.-Buch.)	+					+					
<u>Wak soldado</u> (Lacépède)	+	+	+			+					
<u>Wak cuja</u> (Ham.-Buch.)	+				+	+					
<u>Wak tingi</u> (Tang)						+	+				
<u>Wak sina</u> (C. & V.)	+		+	+		+					+
<u>Wak axillaris</u> (C. & V.)	+		+	+		+					
<u>Megalonibea fusca</u> Chu, Lo & Wu							+	+			
<u>Otolithoides microdon</u> (Bleeker)	+		+			+			+		
<u>Otolithoides brunneus</u> (Day)	+		+		+	+					
<u>Otolithoides biauritus</u> (Cantor)	+	+	+	+		+	+	?			
<u>Bahaba flavolabiata</u> (Lin)						+	+				
<u>Sciaena russelli</u> (C. & V.)	+	+	+	+		+	+				+
<u>Otolithes argenteus</u> (C. & V.)	+	+	+	+		+	+				+
<u>Otolithes ruber</u> (Bl. & Schneid.)	+		+	+		+					
<u>Nibea coibor</u> (Ham.-Buch.)	+			+		+	+				
<u>Nibea albiflora</u> (Rich.)						+	+	+	+	+	
<u>Nibea semifasciata</u> Chu, Lo & Wu						+					
<u>Nibea diacanthus</u> (Lacépède)	+	+	+			+	+	+		+	+
<u>Nibea miichthioides</u> Chu, Lo & Wu						+					
<u>Nibea japonica</u> (Temm. & Schl.)						+	+				+
<u>Nibea acuta</u> (Tang)						+					
<u>Argyrosomus aneus</u> (Bloch)	+	+	+	+		+					
<u>Argyrosomus macrocephalus</u> (Tang)						+	+				
<u>Argyrosomus pawak</u> Lin						+	+				
<u>Argyrosomus argentatus</u> (Houttuyn)	+					+	+	+	+	+	+
<u>Atrobucca nibe</u> (Jord. & Thom.)						+	+	+	+	+	***
<u>Miichthys miuy</u> (Basil.)							+	+	+	+	
<u>Pseudosciaena crocea</u> (Rich.)						+	+	+	+	+	
<u>Pseudosciaena polyactis</u> Blkr.							+	+	+	+	
<u>Collichthys lucidus</u> (Rich.)						+	+	+	+	+	
<u>Collichthys niveatus</u> Jordan & Starks							+	+	+	+	

^{1/}This table is based on the specimens we have examined. "+" indicates present in the region, "+*" indicates the region of north East China Sea or south Yellow Sea. "+**" indicates Ji-zhou Dao (Quelpart Is.), Korea. "+?" indicates doubtful distribution.

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