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KEYS TO THE FISHES OF WASHINGTON, OREGON AND CLOSELY ADJOINING REGIONS

BY

LEONARD P. SCHULTZ

Third Printing
MAY, 1948

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Keys to the Fishes of Washington, Oregon and Closely Adjoining Regions

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INTRODUCTION

This publication contains keys for the identification of the marine and freshwater fishes reported to have been taken or expected to occur in the waters of the states of Washington and Oregon and neighboring waters. It originally appeared in mimeographed form, October, 1931, University Bookstore, Seattle, Washington, and was designed especially for use in the ichthyology laboratory of the University of Washington, School of Fisheries. During the last few years we have carefully checked the keys with specimens in the collection of fishes, School of Fisheries, University of Washington. The illustrations include several original drawings, made by Arthur D. Welander or the author. Certain portions of the keys have been modified after publications by Jordan, Evermann, Starks, Gilbert, Hubbs, Burke, and Parr, whose contributions are acknowledged as footnotes in the proper places.

HOW TO USE THE KEYS

The statements are arranged so one must consider *ALTERNATIVE CHARACTERS*. One character is given under a designation as "1a" and the contrasting character as "1b." In some cases three or four alternatives are given as "1c" and "1d." If in using the key the characters under the first alternative, for example "1a" do not agree with the specimen at hand try the next alternative, in this case "1b." When the characters do fit, read on down as long as they continue to fit, never progressing under designations that are not true for the specimen at hand. For example in running down a salmon to the family, use 1b, 3b, 15b, 16a, 17b, 19a, 20a, 21a, 22b, 24a, 25a, 26b, 27a, before you finally find the name at the end of the paragraph under 28a, "Salmon and Trout." 20. Salmonidae p. 134." The number "20" preceding the family (all families end in *idae*) refers to the 20th family, and the "p. 134" refers to the page on which the key to the genera and species of this family occurs. The keys to the genera and species should be used in exactly the same manner as the family key, continuing until the name of the fish is found at the end of a paragraph under a certain symbol as "15a."

To be more certain of your identification, the specimen at hand should be compared with a description of that species. Good descriptions and some figures of most of the American fishes may be found in the publication "Fishes of North and Middle America" by Jordan and Evermann, 1896 to 1900, Bulletin 47, Parts I to IV, United States National Museum.

No bibliography of the fishes of Washington and Oregon is given in this publication. However, if the reader is interested in obtaining a nearly complete list of papers on the fishes of this area it may be found in the *Journal of the Pan-Pacific Research Institute* which appears as a section of the *Mid-Pacific Magazine* for 1935 and 1936, entitled "Fishes of the American Northwest. A catalogue of the fishes of Washington and Oregon with distributional records and bibliography" by Leonard P. Schultz and Allan C. DeLacy.

In the preparation of keys as complicated as these, it is likely that mistakes were made. Though they have been used for several years by students of ichthyology at the University of Washington, should errors be found the author will be pleased to have the opportunity of correcting them.

ARTIFICIAL KEY TO THE FAMILIES OF FISHES OF WASHINGTON AND OREGON[1]

1a. Mouth a sucking disk, without jaws, but with teeth on the disk; a single median nostril; body eel-shaped with gill openings pore-like, 6 to 15 in number on each side. Fig. 1.

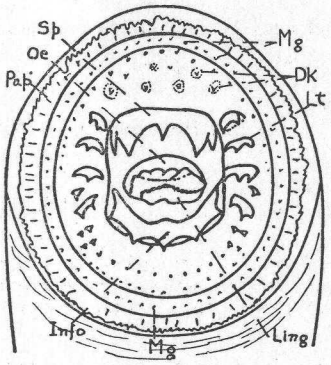


Fig. 1

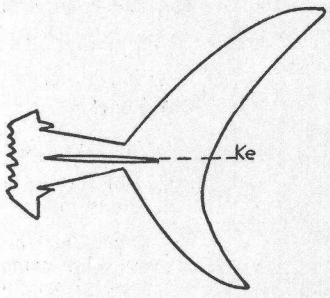


Fig. 3

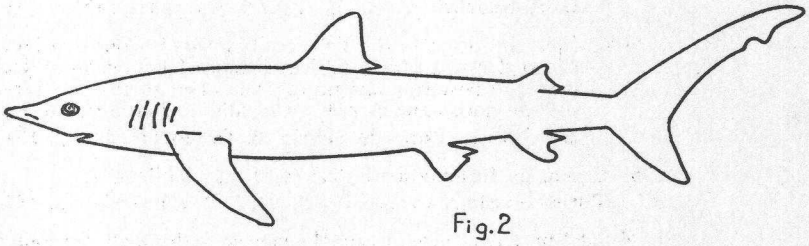


Fig. 2

Fig. 1. A diagram showing the arrangement of the teeth in the buccal cavity or mouth cavity of lampreys. Dk—disk teeth; Ling—lingual teeth; Lt—lateral teeth; Info—infraoral teeth; Oe—oral opening leading to the oesophagus; Pap—papillae of lips; Sp—supraoral teeth.

Fig. 2. *Prionace glauca,* showing the five gill openings on the side of the body, and two dorsal fins without spines. Modified after Jordan and Evermann.

Fig. 3. The lunate keeled tail of a "tiger shark." Ke—keel on caudal peduncle.

2a. Eyes covered by skin and aborted; gill openings 10 to 15 in number on each side and remote from head.

Hagfishes.....1. Eptatretidae, p. 130

2b. Eyes developed in adult but concealed in the larvae; gill openings close behind head and 7 in number on each side.

Lampreys.....2. Petromyzonidae, p. 130

1b. Mouth normal, agape, with well developed jaws; nostrils not single or median but paired.

[1]Certain parts of this key were modified after E. C. Starks, 1921, Fish. Bull. No. 5, California Fish and Game Commission.

3a. (See 3b, p. 114.) Gill openings 5 to 7, not covered by a large flap of skin or bones (the operculum); skeleton cartilaginous. Fig. 2.

4a. (See 4b, p. 113.) Gill openings wholly on the side of the body; body not depressed into a disk but normal in form. Fig. 2.

5a. Gill openings 6 or 7 on each side; a single dorsal fin.
Cow Sharks.....3. Hexanchidae, p. 130

5b. Gill openings 5 on each side; 2 dorsal fins, the 2nd sometimes small.

6a. Anal fin present; dorsal fins not provided with spines.

7a. First dorsal over or behind the pelvic fins.
Cat Sharks.....4. Scylliorhinidae, p. 131

7b. First dorsal in advance of the pelvic fins.

8a. Caudal fin not lunate; side of caudal peduncle without keel; head and tail normal. Fig. 2.

9a. Caudal fin forming less than 1/3 of the total length of the fish; 1st dorsal nearly equal distance between space from pectoral base to pelvic fin base; eye with a nictitating membrane.

10a. Spiracles obsolete; distance from tip of snout to origin of 1st dorsal is greater than the distance from origin of 1st dorsal to posterior margin of 2nd dorsal so that the former distance extends a little beyond the 2nd dorsal fin.
Gray Sharks.....5. Carchariidae, p. 131

10b. Spiracles present; the distance from tip of snout to origin of 1st dorsal a little less than distance from origin of 1st dorsal to posterior margin of 2nd dorsal so that the former distance extends only to middle of 2nd dorsal fin.
Oil Shark. Soup-fin Shark..6. Galeorhinidae, p. 131

9b. Caudal fin forming more than 1/2 of the total length.
Thresher Sharks.....7. Alopiidae, p. 131

8b. Caudal fin lunate, side of caudal peduncle with a well developed keel. Fig. 3.

11a. Dorsal fin just behind pectorals; gill slits about as long as snout, not extending up the whole side of head; gill rakers short, not long and slender.
Mackerel Sharks.....8. Lamnidae, p. 131

11b. Dorsal fin about midway between pectorals and pelvics; gill slits more than twice as long as snout, extending up the whole side of head; gill rakers long and slender, resembling whale bone.
Basking Shark.....9. Cetorhinidae, p. 131

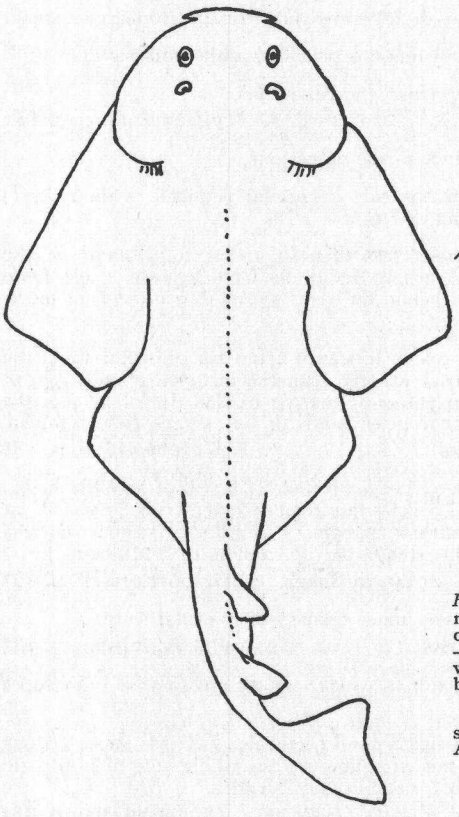
6b. Anal fin absent.

12a. Dorsal fins each with a stout spine.
Dogfish Sharks.....10. Squalidae, p. 131

12b. Dorsal fins without spines.
Sleeper Sharks.....11. Somniosidae, p. 131

4b. Gill openings wholly on lower side of body or in a deep notch at the "neck"; body much depressed. Figs. 4 and 5.

13a. Spiracles less than ⅓ length of snout behind the eyes, usually almost bordering on the eyes; snout longer than interorbital space.



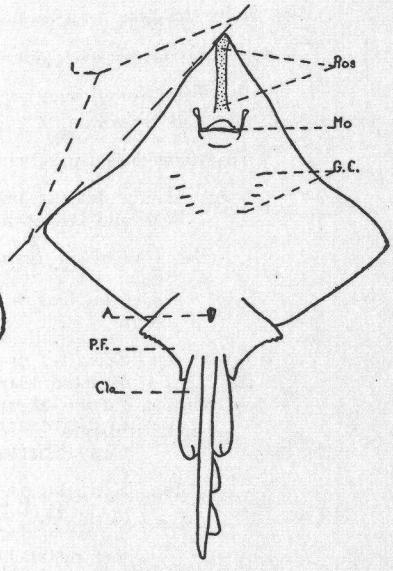


Fig. 4. The ventral side of a male skate, *Raja binoculata*, showing the position of the mouth, gill clefts, and the pelvic fins without the notch. A—anus; Cla—clasper; G C —gill clefts; Mo—mouth; P F—pelvic or ventral fins; Ros—Rostral cartilage. Drawn by A. D. Welander.

Fig. 5. A sketch of an Angel Shark showing the gill openings in the "neck." After Starks.

14a. Disk very broad and circular anteriorly; no spines or prickles anywhere; dorsal fins 2, the 1st dorsal anterior to the posterior tips of pelvics; jelly-like electric gland present at base of pectorals on dorsal side.

Electric Rays.....14. Torpedinidae, p. 132

14b. Disk not evenly circular anteriorly; spines and prickles present; origin of dorsal fin far back of tips of pelvic fins (claspers are not fins); no electric gland is developed.

Skates and Rays.....13. Rajidae, p. 131

13b. Spiracles from ½ to ¾ length of snout behind the eyes; interorbital space longer than the snout; origin of 1st dorsal at extreme posterior tips of pelvic fins. Fig. 5.

Angel Shark.....12. Squatinidae, p. 131

3b. A single external gill or opercular opening; the gills are covered by a fleshy or bony covering, the operculum.

15a. Gill cover composed of flesh or soft cartilage, not hard bones; tail tapers to a fine point; skin without scales; snout blunt; teeth rat-like; 1st dorsal with a long sharp spine.

L **Ratfish**.....**15. Chimaeridae, p. 132**

15b. Gill cover bony, composed of opercular elements (bones).

16a. (See 16b, p. 129.) Gill openings in front of or above base of pectoral fin, never behind it; no "bait" above on anterior part of head.

17a. Dorsal fin preceded by short free spines, not connected by membranes and none of which is developed into "bait" or luminous organs, Fig. 6.

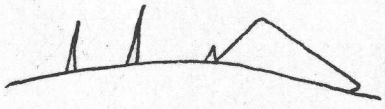


Fig. 6. Free spines before the dorsal fin.

18a. Pelvic fin with 1 spine and 0 to 2 soft rays; 2 to 15 free spines before the soft dorsal; snout not prolonged and not tubular.
Sticklebacks.....**46. Gasterosteidae, p. 159**

18b. Pelvic fin with 1 spine and 4 soft rays; more than 15 spines before the soft dorsal.
Many-spined Sticklebacks.....**47. Aulorhynchidae, p. 159**

17b. Dorsal fin not preceded by free spines, if spines are present these connected by membranes except when specialized into long filaments or into "bait."

19a. (See 19b, p. 120, and 19c, p. 126.) Pelvic fins present, abdominal in position, the pelvic girdle not connected by bones with the pectoral or shoulder girdle. Fig. 7.

20a. (See 20b, p. 117.) Dorsal fins 1 or 2 (the 2nd adipose) present on back, finlets not included as these are detached soft rays; if 1 dorsal fin is present, photophores are present.

21a. (See 21b, p. 117.) The anterior dorsal fin composed of rays; the posterior fin chiefly adipose or if an adipose fin is absent the body has photophores.

22a. Body scaleless.

23a. Head with barbels on chin and snout; teeth rather small and not fang-like; pectorals each with a strong spine. Fig. 8.
Catfishes.....**31. Ameiuridae, p. 150**

23b. No barbels on head; dorsal fin long and high; teeth fang-like; no spine in pectoral fin.
Lancet Fishes.....**34. Alepisauridae, p. 152**

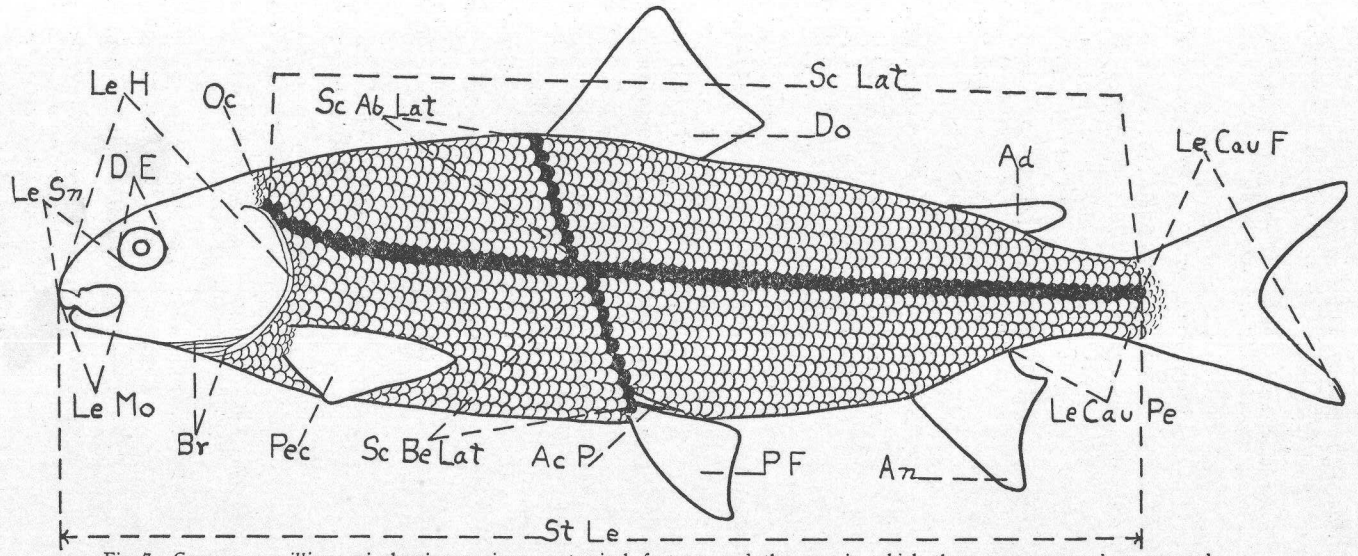


Fig. 7. *Coregonus williamsoni* showing various anatomical features and the way in which these are measured or counted. Ad—adipose fin; An—anal fin; Ac P—accessory pelvic appendage or accessory pelvic scale. Br—branchiostegal rays. D E—diameter of eye or orbit, Do—dorsal fin; Le Cau F—length of the caudal fin; Le Cau Pe—length of caudal peduncle. Le H—length of head; Le Mo—length of mouth or length of "maxillary" in descriptions by early authors; Le Sn—length of snout; Oc—occiput; Pec—pectoral fin; P F—pelvic fin; Sc Ab Lat—showing where and how to count the scales above the lateral line; Sc Be Lat—showing where and how to count the scales below the lateral line; Sc Lat—showing where and how to count the number of oblique scale rows crossing the lateral line; St Le—the standard length is measured from tip of snout to base of caudal fin rays. Drawn by Dorothea Bowers Schultz.

22b. Body covered with scales.
24a. Origin of dorsal fin little if any behind middle of body.
25a. Sides of body without photophores or luminous spots; head without scales.

26a. Dorsal and anal each with 1 or 2 spines.
Trout Perches .....40. Percopsidae, p. 156

26b. Dorsal and anal of soft rays only.

27a. Pelvic fin with a scaly appendage above its base; stomach with more than 11 pyloric caeca; dorsal fin base, shorter than length of head.

28a. Maxillary extending to posterior edge of, or behind eye in adult; dentition strong; mouth deeply cleft; scales in more than 115 oblique rows on side of body.
Salmon and Trout.....
.....20. Salmonidae, p. 133

28b. Maxillary not extending behind eye, usually ending before or just at anterior edge of eye; dentition weak; scales in fewer than 105 oblique rows on side of body.

29a. Dorsal fin of fewer than 17 fin rays.
Whitefishes....21. Coregonidae, p. 139

29b. Dorsal fin of 20 to 24 fin rays.
Grayling .....22. Thymallidae, p. 140

27b. Pelvic fin without a scaly appendage above its base; stomach with 11 or fewer pyloric caeca.

30a. Mouth large, the maxillary reaching under eye; both jaws with teeth; tongue with teeth on upper surface.
Smelts .....23. Osmeridae, p. 140

30b. Mouth small, maxillary not extending under eye; premaxillary toothless; tongue toothless except probably fine teeth on sides.

31a. Branchiostegals about 6. Fig. 12.
.....24. Argentinidae, p. 142

31b. Branchiostegals 3 or 4. Fig. 12.
.....25. Microstomidae, p. 142

25b. Sides of body with photophores; head without scales. Fig. 9.

32a. Pseudobranchiae present.
Lantern Fishes ...33. Myctophidae, p. 151

32b. Pseudobranchiae absent; teeth canine-like.

33a. Opercles incomplete, interopercle rudimentary; fig. 10; origin of dorsal in front of base of pelvic fin; gill rakers absent.
Viper Fishes.....
.....26. Chauliodontidae, p. 142

33b. Opercles complete; origin of dorsal behind base of pelvic fins; gill rakers present and long; adipose fin absent.
Viper Fishes ..27. Gonostomidae, p. 142

24b. Front of dorsal considerably behind middle of body.
.....32. Sudidae, p. 151

21b. The anterior dorsal fin composed of spines connected by membranes, the posterior dorsal fin composed of soft rays; no adipose fin present; pectoral fins entire, the lower 5 to 8 rays not detached, not prolonged, and not filamentous.

34a. Teeth strong, canine-like, unequal; lateral line present; branchiostegals 7.
Barracudas.....50. Sphyraenidae, p. 160

34b. Teeth weak; lateral line absent; branchiostegals 5 or 6.
Silversides.....49. Atherinidae, p. 160

20b. Dorsal fin single; no adipose fin and no photophore present.

35a. Dorsal fin followed by a series of detached soft rays or finlets. Fig. 11.
Sauries.....37. Scomberesocidae, p. 154

35b. Dorsal fin not followed by finlets, nor preceded by disconnected spines; no adipose fin present.

36a. Upper lobe of caudal fin much longer than lower lobe and tail heterocercal; body with large bony plates, each with a sharp keel or spine.
Sturgeons .....16. Acipenseridae, p. 133

36b. Upper lobe of caudal fin not longer than lower and tail homocercal; body without plates as above.

37a. Head with scales; anal and dorsal fins placed in the posterior 3rd of the body; origin of dorsal fin nearly over the origin of anal.

38a. Lateral line present; jaws shaped much like a duck's bill and prolonged; teeth strong.
Pikes or Pickerels.....35. Esocidae, p. 152

38b. Lateral line wanting; jaws normal and not prolonged; teeth not strong or canine-like.
Mud Minnows .....36. Novumbridae, p. 152

37b. Head without scales; dorsal fin placed in middle 3rd of the body except in the *Alepocephalidae;* origin of dorsal much in advance of anal origin, less so in the *Alepocephalidae.*

39a. Branchiostegals 6 to 15; gill membranes not joined to isthmus; fig. 12.

40a. No lateral line; gill rakers long and slender.

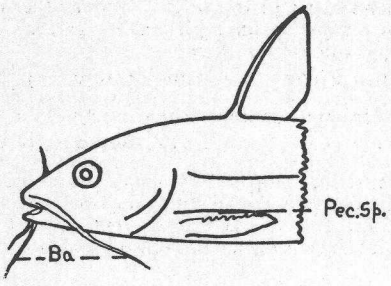


Fig. 8

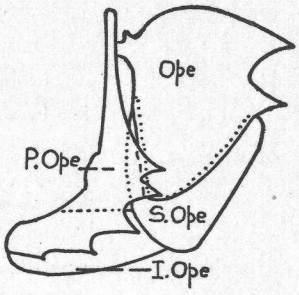


Fig. 10

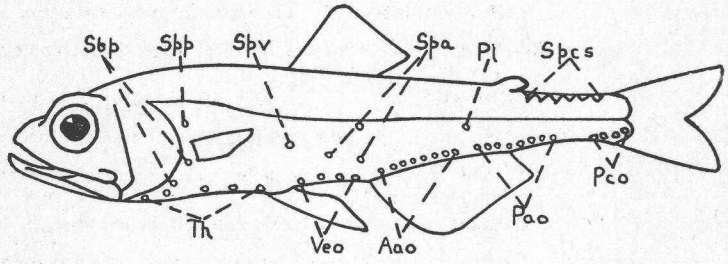


Fig. 9

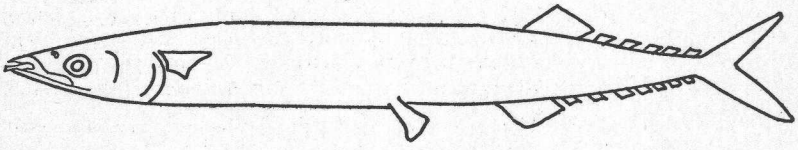


Fig. 11

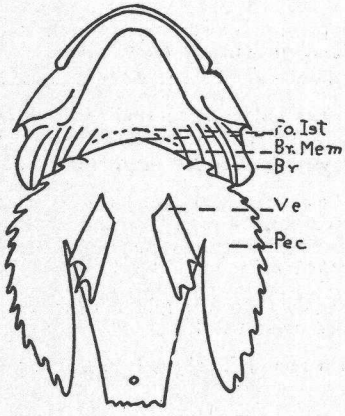


Fig. 12

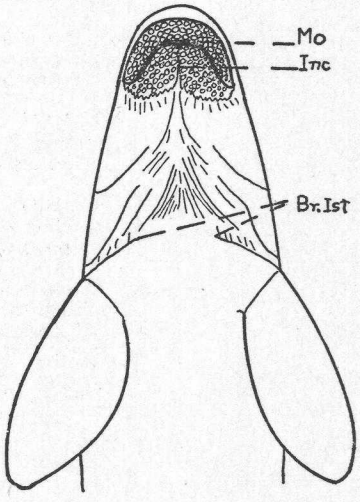


Fig. 13

Fig. 8. The head of a catfish showing the pectoral spine and the location of the barbels; Ba—barbels; Pec Sp—pectoral spine.

Fig. 9. A lantern fish, *Myctophidae*, showing the arrangement and names applied to the photophores. Aao—anterior anal organs; Pao—posterior anal organs; Pco—precaudal organs; Pl—posterior lateral organs; Sbp—suprapectoral organ; Spa—supra-anal organs; Spcs—supracaudal luminous scales; Spp—suprapectoral organ; Spv—supraventral organ; Th—thoracic organs; Veo—ventral organs. Modified after Parr.

Fig. 10. A sketch showing the arrangement and names of the opercular bones in *Sebastodes caurinus*. Ope—operculum; I Ope—interoperculum; P Ope—preoperculum; S Ope—suboperculum.

Fig. 11. The Pacific Saury, *Cololabis saira*, showing the finlets behind the dorsal and anal fins. Drawn by Arthur D. Welander.

Fig. 12. The ventral side of the head of *Myoxocephalus polyacanthocephalus* to show the free fold of the gill membrane across the isthmus. Br.—branchiostegal ray; Br Mem—branchiostegal or gill membranes broadly joined to each other; Fo Ist—gill membranes forming a free fold across the isthmus by being unattached along their margins; Pec—pectoral fin; Ve—ventral or pelvic fin. Modified after Jordan and Evermann.

Fig. 13. The ventral side of the head region of *Catostomus macrocheilus*, the Columbia River coarse-scaled sucker, showing the corners of the mouth without the notches in the lips. Br Ist—branchiostegal or gill membranes broadly joined to the isthmus; Inc—incision in the lower lip; Mo—mouth. Drawn by Arthur D. Welander.

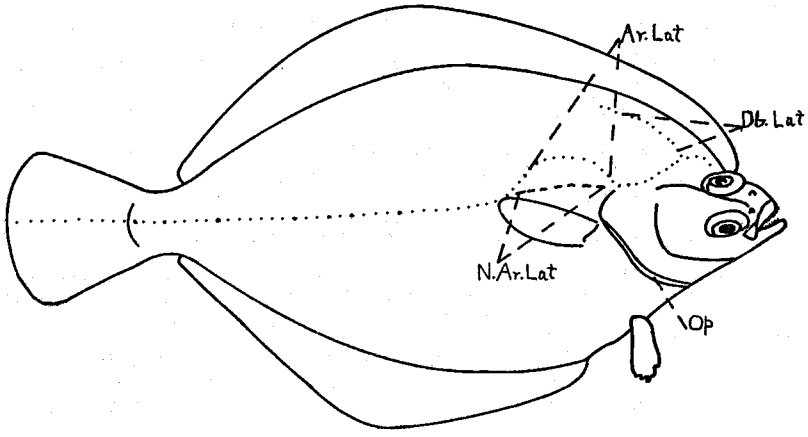


Fig. 14. A diagram of a hypothetical flatfish, *Pleuronectidae*, to show the various modifications of the lateral line and the asymmetry of the head. Ar Lat—a distinct arch in the lateral line; Db Lat—dorsal branch of the lateral line; N Ar Lat—no distinct arch in the lateral line.

41a. Mouth terminal; not excessively large; maxillary not nearly reaching to gill openings.

Herrings and Shad..... .....**17. Clupeidae, p. 133**

41b. Mouth inferior, below a tapering snout; mouth very large, the maxillary reaching nearly or quite to gill openings.

Anchovies.....**18. Engraulidae, p. 133**

40b. Lateral line present; dorsal fin in posterior 3rd of body.

..... **19. Alepocephalidae, p. 133**

39b. Branchiostegals 3; gill membranes united to the isthmus; fig 12; gill rakers not long and slender; lateral line usually present.

42a. Pharyngeal teeth many more than 9 and in 1 row arranged like the teeth of a comb; mouth usually directed downward, excessively protractile and sucker-like with or without papillous lips. Fig. 13.
Suckers .....29. Catostomidae, p. 142

42b. Pharyngeals few in number, less than 9 and in 1 to 3 rows, not comb-like; mouth not especially directed downward, without papillous lips.
Minnows. Chubs. Dace..... .....30. Cyprinidae, p. 145

19b. (See 19a, p. 114, and 19c, p. 126.) Pelvic fins thoracic (placed under or just a little behind the pectorals, and internally connected with the shoulder girdle, with exceptions), or jugular (placed in front of the pectorals); the rays are not modified into round pads forming a sucking disk. Figs. 16 and 17.

43a. Both eyes on the same side of the head. Fig. 14.

44a. Pelvic fins symmetrical in position or nearly so, neither located on the median ridge of abdomen.
Flounders. Halibut .....44. Pleuronectidae, p. 157

44b. Pelvic fin of eyed side located on median ridge of abdomen; eyes and color on left side.
Sand Dabs.....43. Bothidae, p. 156

43b. Eyes normal, each eye on opposite side of the head.

45a. A bony stay (suborbital stay) extending from below eye backward across the cheek just under the skin, or else the side of the head is mostly covered with bony plates. Fig. 15.

46a. Head and body mostly covered with bony plates in 8 to 12 longitudinal rows.
Sea Poachers.....70. Agonidae, p. 182

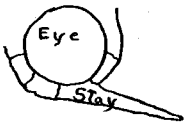


Fig. 15. A sketch showing the position of the bony suborbital stay.

46b. Head and body not covered with bony plates arranged in rows.

47a. Gill openings not extending to opposite lowest pectoral ray; slit behind the 4th gill reduced to a mere pore or wanting.
Northern Sea Horse .....69. Rhamphocottidae, p. 182

47b. Gill opening extending down to at least lowest pectoral ray.

48a. Body wholly or partly naked, or covered with prickles but never completely covered with scales; when the body is partially scaled, the scaleless areas occur between the bands of scales.
Sculpins.....68. Cottidae, p. 172

48b. Body uniformly and evenly covered with scales in local species.

49a. Slit behind 4th gill a mere pore or wanting; anal spines III, dorsal spines XII to XVII; preopercle with 5 or 6 strong spines. Fig. 10.
Rockfish. Rock Cod.....63. Scorpaenidae, p. 163

49b. Slit behind the 4th gill larger than a pore, an obvious slit; preopercle without 5 or 6 strong spines.

50a. Nostril single on each side and the second if present reduced to a mere pore; dorsal fins contiguous or connected often with a deep notch between the spines and soft rayed portion.

51a. Mouth smaller, the maxillary not reaching or barely reaching to orbit; jaws without strong canine teeth.
Greenlings.....66. Hexagrammidae, p. 171

51b. Mouth large, the maxillary reaching beyond orbit; jaws with strong canine teeth.
Ling Cod.....67. Ophiodontidae, p. 172

50b. Nostrils 2 on each side and of nearly equal development.

52a. Dorsal fins widely separated; dorsal rays XX to XXII, 16 to 18; anal 15 to 17.
Skilfish. Black Cod..64. Anoplopomidae, p. 170

52b. Dorsal fin deeply notched; dorsal XIV-I, 15; anal ii+11.
Priest Fish.....65. Erilepidae, p. 170

45b. No bony suborbital stay or plates on side of head as in 45a.

53a. Pelvic fins completely united with each other; fig. 16, the rays being normal and not modified into round pads as in the *Liparididae;* fig. 17.
Gobies.....74. Gobiidae, p. 191

53b. Pelvic fins separate, not united.

54a. Body covered with scales.

55a. (See 55b, p. 123.) Pelvic fins definitely I, 5, the spine sometimes grown fast to the first soft ray; pectoral fin entire.

56a. Dorsal and anal each followed by finlets. Fig. 11.

57a. There is no middle keel on each side of caudal peduncle, only the small pair of keels dorsally and ventrally; 1st dorsal separated from 2nd dorsal by an interspace as long as or longer than snout; color on back of almost vertical stripes.
Mackerels.....51. Scombridae, p. 160

57b. There is a middle keel on each side of caudal peduncle. and a small keel above and below the large one.
Tunny and Albacore.....52. Thunnidae, p. 160

56b. Dorsal and anal not followed by finlets.

58a. Vomer with teeth. Fig. 18.

59a. Dorsal fin, without pungent spines, continuous (unnotched); dorsal fin not beginning on head; caudal rounded or truncate.

60a. Lateral line running high, not far from the dorsal fin base and not reaching the caudal fin (lateral line incomplete).

Ronquils.....76. Bathymasteridae, p. 191

60b. Lateral line if present not high on back, but reaching to caudal fin.

Ragfishes.....56. Icosteidae, p. 161

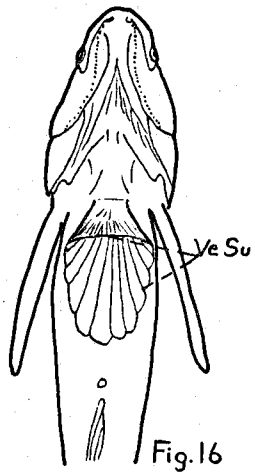


Fig. 16

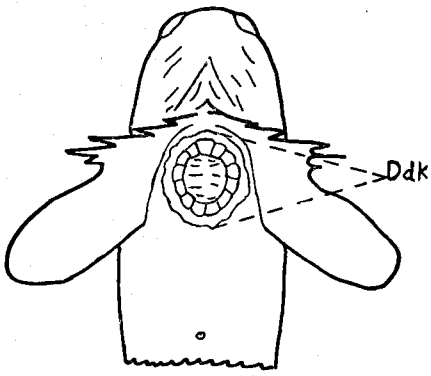


Fig. 17

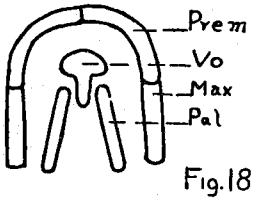


Fig. 18

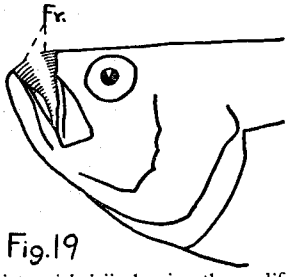


Fig. 19

Fig. 16. The ventral side of the goby, *Rhinogobiops nicholsii*, showing the modification of the pelvic fins into the sucker. Ve Su—ventral or pelvic fins modified into the sucking disk. Drawn by Arthur D. Welander.

Fig. 17. A diagram of the ventral side of a sea snail, *Liparididae*, showing the modification of the pelvic fins into a sucking disk. Ddk—width or diameter of the disk.

Fig. 18. A diagram to show the approximate positions of the teeth bearing bones in the roof of the mouth of many fishes. Max—maxillary; Pal—palatine; Prem—premaxillary; Vo—vomer.

Fig. 19. The fringe-like "teeth" of the Sandfish, *Trichodon trichodon*. Fr—fringes of lips (not true teeth).

59b. Dorsal fin or fins with pungent spines anteriorly and soft rays posteriorly.

61a. Dorsal fins 2, entirely separated or slightly joined together when a spine is present in the 2nd fin, preceding the soft rays.

62a. Anal III, 11 or 12; dorsal IX-I, 12; body with very narrow longitudinal stripes in local species.
Bass .....60. Moronidae, p. 163

62b. Anal I or II, 7 or 8; dorsal VI to XVI, 12 or 13 in local species.
Perches.....58. Percidae, p. 161

61b. Dorsal fin single (deeply emarginate in *Aplites*); body with not more than 1 longitudinal stripe; anal normally III to VI (rarely II), 10 to 19; dorsal VI to XI, 11 to 15.
Bass and Sunfishes ..59. Centrarchidae, p. 161

58b. Vomer without teeth. Fig. 18.

63a. Scales just before middle of body, 3 or 4 times deeper vertically than longer horizontally.
Pompreys .....54. Bramidae, p. 160

63b. Scales not as above.

64a. Dorsals and anals without distinct spines.
Ragfishes.....56. Icosteidae, p. 161

64b. Dorsal and anal with spines.

65a. Anal spines I or II in local species.
Croakers or Sea Bass.....
.....61. Otolithidae, p. 163

65b. Anal spines III.
Viviparous Perch.....
.....73. Embiotocidae, p. 189

55b. Pelvic fins definitely not I, 5.

66a. Pelvic fins with more than 5 soft rays and with or without a spine.

67a. Numerous nearly round light spots, about the size of the pupil or smaller occur all over the body; dorsal fin single, very long, elevated, falcate in front, of 49 to 55 rays, without distinct spines; anal fin long and low, not elevated or falcate in front, of 33 to 41 rays; in life all fins are scarlet in color; pelvic fins of 14 to 17 rays, and about as long as head; pectorals nearly as long as head; depth of the compressed body 1¾ in standard length.
Moonfish.....42. Lampridae, p. 156

67b. Characters not as in 67a.

68a. Dorsals and anals without spines.

69a. Tail not tapering to a point, dorsal and anal fins separate from the distinct caudal fin.
Cods and Hake .....39. Gadidae, p. 154

69b. Tail tapering to a point, the dorsal and anal fins confluent, there being no caudal fin.
Grenadiers .....38. Coryphaenoididae, p. 154

68b. Dorsal spines III.
..... **45. Melamphaidae, p. 159**

66b. Pelvics with fewer than 5 soft rays, and with or without a spine.

70a. Body covered with bony plates.
Sea Poachers.....70. Agonidae, p. 182

70b. Body not covered with bony plates; the body either naked or covered with scales.

71a. Dorsal composed of soft rays only.

72a. Body tapering to a blunt point behind; dorsal and anal continuous around the caudal; gill membranes joined to isthmus.
Eel Pouts .....84. Zoarcidae, p. 195

72b. Body not tapering to a blunt point; the caudal fin distinct.
Brotulids .....85. Brotulidae, p. 197

71b. Dorsal composed of spines anteriorly with or without soft rays posteriorly.

73a. Dorsal fin with at least 1 soft ray but less than 20, usually 5 to 13 in local species; vertebrae 52 or fewer; lateral line arched high above the pectoral, if present.
Blennies.....78. Clinidae, p. 192

73b. Dorsal fin without soft rays (except in *Cebidichthys* which has 40 to 44); vertebrae usually more than 53.

74a. Origin of anal fin under the 34th to 55th spinous ray of dorsal fin; body ribbon-like and never with multiple branched lateral lines; all vertebrae with haemal arches.
Blennies .....79. Pholididae, p. 192

74b. Origin of anal fin under the 12th to 32nd spinous ray of the dorsal fin; body round and not ribbon-like except in *Phytichthys* which has multiple branched lateral lines and II (rarely III) anal spines; only the caudal vertebrae with haemal arches.
Blennies .....80. Stichaeidae, p. 192

54b. Body naked and smooth, or armed with tubercles, prickles, scattered bony plates, or scales in rows between which are naked areas, never uniformly covered with scales.

75a. Breast with a sucking disk. Fig. 17.

76a. Gill membranes free from isthmus; a single. soft dorsal placed posteriorly.
Cling-fishes.....87. Gobiesocidae, p. 197

76b. Gill membranes joined to isthmus.

77a. Skin smooth; dorsal somewhat hidden by the lax skin, long and continuous or with a short portion anteriorly more or less separated by a notch.
Sea Snails or Rock Suckers..72. Liparididae, p. 186

77b. Skin with strongly developed tubercles or spines; dorsal fins 2, well separated and about of equal length.
Lump Suckers .....71. Cyclopteridae, p. 186

75b. Breast without a sucking disk.

78a. Dorsal and anal followed by detached rays or finlets. Fig. 11.

79a. There is no middle keel on each side of caudal peduncle, only the small keels, 1 above and 1 below; 1st dorsal separated from 2nd dorsal by an interspace as long as or longer than snout; color on back of almost vertical stripes.
Mackerels.....51. Scombridae, p. 160

79b. A single median keel on each side of caudal peduncle and a small one above and below the large one. Fig 3.
Tunny and Albacore.....52. Thunnidae, p. 160

78b. Dorsal and anal without finlets.

80a. A bony stay (suborbital stay) extending from below eye backward across the cheek just under the skin, or else the side of the head is bony.

81a. Gill opening small, not extending below the lower edge of the pectoral fin.
Northern Sea Horse .....
..... 69. Rhamphocottidae, p. 182

81b. Gill opening extending at least to lower edge of pectoral fin.
Sculpins.....68. Cottidae, p. 172

80b. No suborbital stay or bony cheeks.

82a. Body tapering to a blunt point behind; the dorsal and anal continuous around caudal; gill membranes joined to isthmus.
Eel Pouts .....84. Zoarcidae, p. 195

82b. Body not tapering to a point.

83a. Anal fin absent; caudal fin directed obliquely upward.
Ribbon Fishes ....41. Trachipteridae, p. 156

83b. Anal fin present; caudal normal.

84a. Dorsal spines soft and ray-like.

85a. Both jaws of about the same length; head about 4 in length; depth about 3; lateral line and fins with prickles; body not long and not ribbon-like.
Ragfishes.....56. Icosteidae, p. 161

85b. Lower jaw longest; head about 7 to 8 in length; depth 6 or more in length; body ribbon-like; skin naked without scales or prickles.
Cutlassfishes ....53. Trichiuridae, p. 160

84b. Dorsal spines stiff and sharp.

86a. Lips with long teeth-like fringes; mouth when closed nearly vertical. Fig. 19.
Sand Fishes..62. Trichodontidae, p. 163

86b. Lips without fringes; mouth often oblique but not vertical.

87a. Dorsal with only I or II very short spines just behind head; body with many small luminous organs or photophores arranged in series.
Toad Fishes .....
.....86. Batrachoididae, p. 197

87b. Dorsal with many spines; body often ribbon-like.

88a. Dorsal fin with at least 1 soft ray but fewer than 20, usually 5 to 13 in local species; vertebrae 52 or fewer; lateral line, if present, arched high above the pectoral.
Blennies.....78. Clinidae, p. 192

88b. Dorsal fin without soft rays (except in *Cebidichthys* which has 39 to 44); vertebrae usually more than 53.

89a. Origin of anal fin under the 34th to 55th spinous ray of the dorsal fin; body ribbon-like and never with multiple branched lateral lines; all vertebrae with haemal arches.
Blennies ....79. Pholididae, p. 192

89b. Origin of anal fin under the 12th to 32nd spinous ray of the dorsal fin; body round and not ribbon-like except in *Phytichthys* which has multiple branched lateral lines and II (rarely III) strong anal spines; only the caudal vertebrae with haemal arches.
Blennies....80. Stichaeidae, p. 192

19c. (See 19a, p. 114, and 19b, p. 120.) Pelvic fins absent or modified into sucking disks. Fig. 17.

90a. Gill membranes united to the isthmus, Fig. 12, (gill opening sometimes reduced to a small slit high on the side).

91a. Jaws long, very slender, almost thread-like, diverging to form a snipe-like beak. Fig. 20.

Snipe Eels.....**28. Nemichthyidae, p. 142**

Fig. 20. The snipe-like jaws of *Nemichthys avocetta*. Modified after Jordan and Evermann.

91b. Jaws not as above.

92a. Snout elongate and tubular, bearing very small toothless jaws at the end; covering of body of bony plates.

Pipe Fishes.....**48. Syngnathidae, p. 160**

92b. Snout not tubular; mouth and body covering not as above.

93a. Breast with a sucking disk. Fig. 17.

94a. Skin smooth and lax; anal fin with more than 20 rays.

Sea Snails.....**72. Liparididae, p. 186**

94b. Skin thick and firm, smooth or covered with tubercles or broad plates bearing spines; anal fin of fewer than 20 rays.

Lumpsuckers.....**71. Cyclopteridae, p. 186**

93b. Breast without a sucking disk.

95a. Skin very loose and lax, without scales; gill opening above pectoral or not extending below the base of the middle ray of the pectoral fin.

Sea Snails.....**72. Liparididae, p. 186**

95b. Skin firm, normal, with or without scales, never loose and lax; gill opening extending down below the base of the middle ray of pectoral fin.

96a. Body elongate not short and deep and not truncate behind; dorsal fin single, extending along nearly the whole back; gill openings in front of the pectorals.

97a. Jaws and vomer with some coarse molar or pebble-like teeth; body tapering to a slender point behind in local species.

Wolf Fishes.....**81. Anarrhichthyidae, p. 195**

97b. Teeth not as above, or not molar-like.

98a. Origin of anal fin under the 34th to 55th spinous ray of dorsal fin; body ribbon-like and never with multiple branched lateral lines; all vertebrae with haemal arches.

Blennies.....**79. Pholididae, p. 192**

98b. Origin of anal fin under the 12th to 32nd spinous ray of the dorsal fin; body round and not ribbon-like except in *Phytichthys* which has multiple branched lateral lines, and II (rarely III) anal spines; only the caudal vertebrae with haemal arches.

Blennies.....**80. Stichaeidae, p. 192**

96b. Body oblong, short and deep, compressed, truncate behind so there is no caudal peduncle; dorsal not extending along the back as in 96a; gill openings in front of the pectoral as is usual in fishes.
Head Fish. Ocean Sunfish .....88. Molidae, p. 197

90b. Gill membranes free from the isthmus or with a wide free fold across isthmus, or continuing forward before becoming joined. Fig. 12.

99a. Caudal fin not widely forked or lunate; least depth of caudal peduncle if present fewer than 6 times in greatest depth of body; depth of body more than 2.5 times in the standard length.

100a. Dorsal rising so gradually from the back that its beginning is scarcely evident.

101a. Dorsal and anal not reaching to caudal; caudal peduncle slender, caudal fin concave behind.
Great Ray Fishes.....57. Acrotidae, p. 161

101b. Dorsal and anal connected with caudal fin.

102a. Tail tapering to a point and with a caudal filament (usually broken off preserved specimens); head about 16 in length without filament.
Quillfish.....83. Ptilichthyidae, p. 195

102b. Tail rounded; head about 8 in length.
Burrowing Blennies.....82. Scytalinidae, p. 195

100b. Beginning of dorsal fin evident, rising more or less abruptly.

103a. Gill membranes broadly united to each other.

104a. Dorsal fins 2.
Sculpins.....68. Cottidae, p. 172

104b. Dorsal fin single.

105a. No sucking disk on breast.

106a. Small imbricated scales on gill membranes, all over body and on the fins except the distal third; dorsal fin of very flexible spines; depth of body about 3 to 4½ in length.
Flaccid Fishes.....77. Zaproridae, p. 191

106b. Scales if present usually embedded and never occurring on gill membranes nor on the fins; dorsal fin spines not flexible; depth of body more than 5 times in the length.

107a. Origin of anal fin under the 34th to 55th spinous ray of dorsal fin; body ribbon-like and never with multiple branched lateral lines; all vertebrae with haemal arches.
Blennies .....79. Pholididae, p. 192

107b. Origin of anal fin under the 12th to 32nd spinous ray of the dorsal fin; body round and not ribbon-like except in *Phytichthys* which has multiple branched lateral lines and II (rarely III) anal spines; only the caudal vertebrae with haemal arches.

Blennies .....80. Stichaeidae, p. 192

105b. A large sucking disk on breast; fish tadpole-shaped.

Cling Fishes.....87. Gobiesocidae, p. 197

103b. Gill membranes free from each other, or nearly so, continuing far forward under the head; depth of body about 9 or 10 times in standard length.

108a. Body with scales arranged to form oblique folds; caudal fin deeply concave.

Sand Lances or Launces ..75. Ammodytidae, p. 191

108b. Body scaleless; sometimes the scales are embedded; dorsal and anal continuous around the tail; skin rather lax, at least not firm.

Eel Pouts.....84. Zoarcidae, p. 195

99b. Caudal fin very widely forked, nearly lunate; caudal peduncle small, its least depth about 6.5 to 9 times in greatest depth of body; body compressed, its depth 1.9 times in standard length; premaxillaries not protractile.

Pampanos .....55. Stromateidae, p. 161

16b. Gill opening behind the base of the pectoral fin; the spinous dorsal fin is represented by a single upright spine, developed into "bait"; the bait consists of a bulb supplied with filaments; pectoral radials 3; articular spines well developed and crossing, that of the quadrate, longer than the mandibular.

Angler Fishes.....89. Oneirodidae, p. 197

ARTIFICIAL KEYS TO THE GENERA AND SPECIES OF FISH IN WASHINGTON, OREGON AND IN CLOSELY ADJOINING REGIONS

Family 1. Eptatretidae. Hagfishes or Borers

1a. Head to first gill opening 6.5 times in total length; gill openings, ventral fold and anal not bordered by white. Range: Alaska to Santa Barbara Islands. Marine. Common.

Black Hagfish.....1. *Polistotrema deani* Evermann and Goldsborough

1b. Head to first gill opening 4.5 times in total length; gill openings bordered by white ring. Range: British Columbia to San Diego. Marine. Common.

Common Hagfish.....2. *Polistotrema stoutii* (Lockington)

Family 2. Petromyzonidae. Lampreys

1a. Teeth of the buccal funnel not in distinct radiating series, but in several groups; several enlarged lateral teeth, usually multicuspid, at the edge of the oral opening; a marginal series around edge of disk; few to many teeth on the anterior part of the disk; supraoral broad, the main cusps are separated by a bridge. Fig. 1.

2a. A posterior series of small teeth developed, parallel to the marginal series and connecting the last pair of enlarged laterals; 57 to 74 mytomes between last gill slit and anus. Range: Unalaska to southern California. Marine and freshwater. Common.

Three-toothed Lamprey. Pacific Lamprey...3. *Entosphenus tridentatus* (Gairdner)

2b. No teeth other than the marginals on the posterior field of the disk; 3 enlarged laterals; myotomes between last gill opening and vent 57 to 70.

3a. Dorsal fins usually well separated by an interspace except during spawning; myotomes between the last gill opening and the vent 63 to 70; all teeth sharp and strong. Parasitic. Range: Eurasia and western North America. Freshwater. Locally abundant.

River Lamprey. Lake Lamprey....4. *Lampetra fluviatilis* (Linnaeus)

3b. Dorsal fins separated only by a notch to base; myotomes between last gill opening and vent 57 to 66; all teeth weak and blunt, non-functional. Non-parasitic. Range: Eurasia and western North America. Freshwater. Common.

Brook Lamprey.....5. *Lampetra planeri* (Bloch)

Family 3. Hexanchidae. Cow Sharks

1a. Gill openings 7 on each side. Range: Puget Sound to Monterey Bay. Marine. Not rare.

Spotted Cow Shark. Mud Shark.....6. *Notorynchus maculatus* Ayres

1b. Gill openings 6 on each side. Range: Mediterranean, North Atlantic and North Pacific, Puget Sound to Monterey Bay. Marine. Not rare.

Mud Shark. Shovelnose Shark.....7. *Hexanchus griseus* (Bonnaterre) (=*H. corinus* Jordan and Gilbert)

Family 4. Scylliorhinidae. Cat Sharks

Range: Puget Sound to Gulf of California. Marine. Not rare.
Brown Shark. Cat Shark.....8. *Apristurus brunneus* (Gilbert)

Family 5. Carchariidae. Gray Sharks

Range: Warm seas. Marine. Rare northward.
Great Blue Shark. Fig. 2.....9. *Prionace glauca* (Linnaeus)

Family 6. Galeorhinidae. Oil Shark. Soup-fin Shark

Range: British Columbia to Lower California. Marine. Rare northward.
Soup-fin Shark.....10. *Galeorhinus zyopterus* Jordan and Gilbert

Family 7. Alopiidae. Thresher Sharks

Range: Mediterranean Sea, Atlantic and Pacific Oceans. Marine, Not rare.
Fox Shark. Long-tailed Shark.11. *Alopias vulpinus* (Bonnaterre)

Family 8. Lamnidae. Mackerel Sharks

Range: North Atlantic and North Pacific. Marine. Common northward.
Salmon Shark. Tiger Shark.....12. *Lamna nasus* (Bonnaterre)

Family 9. Cetorhinidae. Basking Sharks

Range: Arctic seas southward to California, Virginia, and Portugal. Marine. Common northward.
Basking Shark. Elephant Shark. Bone Shark....13. *Cetorhinus maximus* (Gunner)

Family 10. Squalidae. Dogfish Sharks

Range: Aleutian Islands to Santa Barbara. Marine. Abundant.
Grayfish. Dogfish Sharks.....14. *Squalus suckleyi* (Girard)

Family 11. Somniosidae (=Dalatiidae). Sleeper Sharks

Range: North Atlantic and North Pacific south to San Francisco. Marine. Common.
Sleeper Shark..15. *Somniosus microcephalus* (Bloch and Schneider)

Family 12. Squatinidae. Angel Sharks

Range: South eastern Alaska and southward. Marine. Rare northward.
Angel Shark. Fig. 5.....16. *Squatina californica* Ayres

Family 13. Rajidae. Skates and Rays

1a. Outline of body at each side of the snout convex or straight; a line drawn from tip of snout to outer tip of pectoral angle passing everywhere inside of outline of disk. Fig. 4.

2a. Outline of body undulating, first convex and then concave.

3a. Shoulder girdle with about 6 spines; orbital rim with spines; width of disk about 1.2 in its length; tail is contained about 1.4 times in length of disk, 1.7 in width of disk; the tail is shorter than the disk by ¾ length of snout. Range: Unalaska to California. Marine. Not rare.
Prickly Skate.....17. *Raja stellulata* Jordan and Gilbert

3b. Shoulder girdle and orbital rims without spines; width of disk 1½ in its length; tail longer than the disk by ½ the snout. Range: Central Alaska and Santa Barbara in deep water. Marine. Rare.
Rough-tailed Skate.....18. *Raja trachura* Gilbert

3c. Shoulder girdle with 2 to 4 spines: orbital rim without spines: width of disk about 7/10 to 8/10 in length of disk; tail longer than length of disk by 8/10 to 1½ length of snout. Range: British Columbia to Santa Catalina Island, California.
.....19. *Raja kincaidii* Garman

1b. Outline of body at each side of snout concave; a line drawn as in 1a, passing at some one point well outside of the outline of the body.

4a. Pelvic fins with a notch that divides it into 2 distinct lobes when the anterior tip is held at right angles to the axis of the tail (often in *Raja inornata* the edge of the fin is deeply concave); usually 3 to 10 hooked orbital spines.

5a. A line drawn from tip of snout to outer angle of pectoral touches the outline of the body near the middle of this line; interorbital space 3 to 3.4 times in length of snout; length of tail about equal to the disk; in the young there are 2 or 3 spines in middle line of back followed by a space without spines before the continuous series begins just anterior to the pelvics. Range: Str. Juan de Fuca to San Diego. Marine. Rare northward.
California Skate.....20. *Raja inornata* Jordan and Gilbert

5b. A line drawn from tip of snout to outer angle of pectoral passes the width of the interorbital space outside the outline of the body (except in the young); interorbital space 3.5 to 4 in snout; tail shorter than disk by ⅔ snout; in the young of *rhina* there is 1 strong spine followed by a space before the continuous series on mid-line of back begins over the pelvics. Range: Alaska to Pt. Loma, California. Marine. Common.
Long-nosed Skate.....21. *Raja rhina* Jordan and Gilbert

4b. Pelvic fins without a deep notch, when the anterior tip is held at right angles to the axis of the tail the edge of the pelvic fin is nearly straight; the hooked spines around the eye number 3 or fewer on young and are usually absent on adults; length of disk about 1.1 in width; tail about 1.3 in length of disk; in the young there is only a single spine in mid-line of back (this may be absent in very young) followed by a continuous series which begins over pelvics. Range: Sitka, Alaska, to San Diego. Marine. Common.
Big Skate.....22. *Raja binoculata* Girard

Family 14. Torpedinidae. Electric Rays

Range: Nootka Sound, Vancouver Island to San Diego Bay. Marine. Common northward.
Torpedo. Crampfish.....23. *Tetranarce californica* (Ayres)

Family 15. Chimaeridae. Chimaeras

Range: Alaska to San Diego Bay. Marine. Abundant.
Ratfish. Chimaera.....24. *Hydrolagus colliei* (Lay and Bennett)

Family 16. Acipenseridae. Sturgeons.

1a. Plates between pelvics and anal small, in 2 rows of 4 to 8; dorsal rays 44 to 48; anal rays 28 to 30. Range: Alaska to Monterey. Marine and freshwater. Common.
White Sturgeon.....25. *Acipenser transmontanus* Richardson

1b. Plates between pelvics and anal large, in 1 or 2 rows of 1 to 4 each; dorsal rays 33 to 35; anal rays 22 to 28. Range: North Pacific southward to Monterey Bay. Marine and freshwater. Not abundant
Green Sturgeon.....26. *Acipenser acutirostris* Ayres (=*A. medirostris*)

Family 17. Clupeidae. Herrings.

1a. Ventral scutes strong and sharp, the ventral edge of the belly much compressed; depth 3½ in length; peritoneum white; about 60 scales in a lateral series. Range: Atlantic Coast of U.S. and southeastern Alaska to Monterey Bay. Marine and freshwater. Abundant.
Shad.....27. *Alosa sapidissima* (Wilson)

1b. Ventral scutes not strong, the ventral edge of the belly only a little compressed; depth 4 to 5 in length; peritoneum black or dusky; about 38 to 55 scales in a lateral series.

2a. About 40 rakers on lower arch of first gill; peritoneum dusky; vomer with teeth; about 38 to 45 scales; no striae on the operculum. Range: Kamchatka to San Diego. Marine. Abundant.
Pacific Herring.....28. *Clupea pallasii* Cuvier and Valenciennes

2b. About 50 to 60 rakers on lower arch of first gill; peritoneum black; about 53 scales; opercle with 7 long striae extending downward and backward. Range: British Columbia to Gulf of California. Marine. Abundant.
Pilchard. Sardine.....29. *Sardinops caerulea* (Girard)

Family 18. Engraulidae. Anchovies

Range: Vancouver Island to Lower California. Marine. Abundant.
Northern Anchovy.....30. *Engraulis mordax mordax* Girard

Family 19. Alepocephalidae

Range: Coast of Oregon. Marine. Rare.
Deep Sea Fish.....31. *Bathytroctes stomias* Gilbert

Family 20. Salmonidae. Salmon and Trout

1a. Anal fin elongate, of 13 to 19 rays (rarely 12 or 18 or 19); vomer narrow, long, flat, with weak teeth; gill rakers 19 to 40 (rarely 19 or 20) on 1st gill arch; branchiostegals 13 to 19; species with or without black spots, adults with anal and dorsal seldom spotted. Figs. 21, 22, 23, and 24.

2a. Scales very small, in about 170 to 231 oblique rows on the side, and usually 30 to 37 (range 26 to 40) above, and 28 to 35 (range 25 to 40) below, the lateral line; caudal spots large and oblong; gill rakers 11 to 13 +15 to 18 (usually totaling from 27 to 35); anal rays usually 14 to 16; young without any trace of parr marks. Range: Northern Japan to Alaska, southward to San Francisco. Marine and freshwater. Abundant.
Pink Salmon. Humpback Salmon.....32. *Oncorhynchus gorbuscha* (Walbaum)

2b. Scales in fewer than 160 oblique rows crossing the lateral line, usually about 120 to 153. Fig. 25.

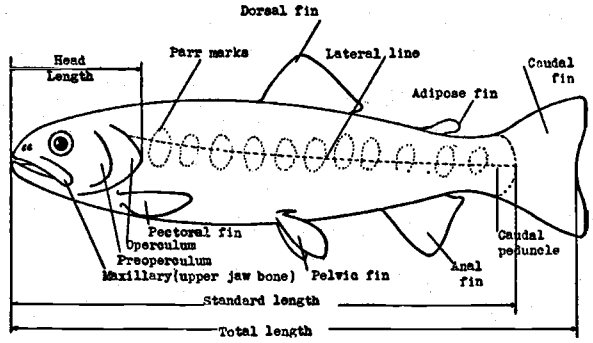


Fig. 21. A diagrammatic sketch of a trout to show the names of the parts that are used in differentiating species. Parr marks occur, with certain exceptions, in immature fish only. After Schultz and Hanson. Courtesy of the *Washington Sportsman.*

3a. Gill rakers comparatively short and few, 19 to 28 (rarely 29) in number on the 1st gill arch.

4a. Scales usually 19 to 26 (range 19 to 31) above, and usually 15 to 24 (range 15 to 27 below, the lateral line; anal rays usually 13 to 15; gill rakers 7 or 8+11 to 13; pyloric caeca 150 to 180; young with rather faint small parr marks mostly above the lateral line. Range: Kamchatka to Alaska to San Francisco. Marine and freshwater. Abundant.

Chum Salmon. Dog Salmon....33. *Oncorhynchus keta* (Walbaum)

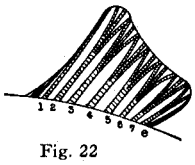


Fig. 22

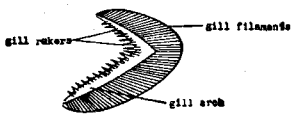
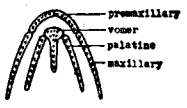


Fig. 23

Fig. 22. This diagram illustrates the method employed in counting the number of rays in the dorsal and anal fins. The first two or three short, unsegmented rays closely crowded together are not counted. The first ray counted is unbranched and extends nearly as far out as the first branched ray which follows. The last ray is usually "double-branched" at the base giving the superficial appearance of two rays, and hence is counted as one ray. After Schultz and Hanson. Courtesy of the *Washington Sportsman.*

Fig. 23. This diagram illustrates the gill rakers on the first gill arch, the latter located under the operculum. The gill rakers, including all rudiments are always counted on the first gill arch; those on the upper half of the arch are given first, followed by those on the lower half of the arch as 8+13 in the drawing. After Schultz and Hanson. Courtesy of the *Washington Sportsman.*

Fig. 24. This diagram illustrates the approximate positions of the various tooth-bearing bones in the roof of the mouth of a salmonoid game fish. After Schultz and Hanson. Courtesy of the *Washington Sportsman.*



4b. Scales usually 25 to 31 (range 23 to 34) above, and usually 23 to 34 (range 19 to 39) below, the lateral line.

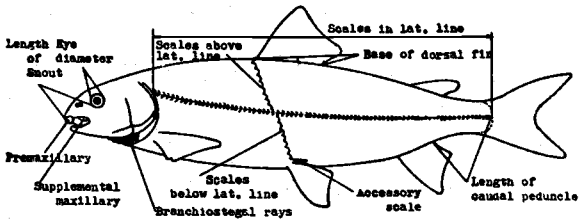


Fig. 25. A diagrammatic drawing of a Rocky Mountain Whitefish, illustrating various anatomical characters used in the identification of salmonoid game fishes. After Schultz and Hanson. Courtesy of the *Washington Sportsman.*

5a. Anal rays usually 15 to 17; pyloric caeca about 140 to 150; 1st 2 or 3 anal rays in individuals less than 4 inches long, not extending behind or longer than the following rays of anal fin; gill rakers 7 to 9+11 to 13; parr marks usually wider than the interspaces. Range: Northern China to Alaska to San Francisco. Marine and freshwater. Abundant.

Chinook, King, or Spring Salmon.....34. *Oncorhynchus tshawytscha* (Walbaum)

5b. Anal rays usually 13 to 15 (rarely 16); pyloric caeca about 50 to 80; the 1st 2 or 3 anal rays are characteristically longer than rest of anal rays and are margined with white, in individuals less than 4 inches in length; parr marks usually narrower than the interspaces. Range: Japan to Alaska to Monterey Bay. Marine and freshwater. Abundant.

Coho or Silver Salmon.....35. *Oncorhynchus kisutch* (Walbaum)

3b. Gill rakers comparatively long and numerous, 30 to 50 in number, (11 to 24+20 to 26); scales about 130 (125 to 145) in the lateral line, and usually 19 to 24 (range 18 to 26) above, and usually 19 to 23 (range 17 to 27) below, the lateral line; anal rays usually 14 or 15; young with rather large round black spots above the lateral line; sides red at spawning. Range: Japan to Alaska to Klamath River, California. Marine and freshwater. Abundant. Fig. 26.

Sockeye or Blueback Salmon. Little Red Fish. Silver Trout.
Red Salmon.....36. *Oncorhynchus nerka* (Walbaum)

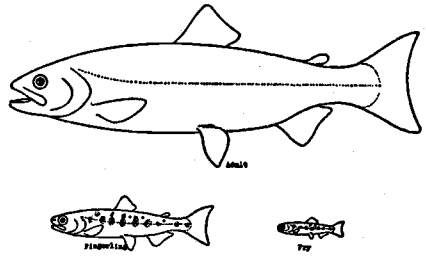


Fig. 26. Silver Trout. Redfish. Landlocked Salmon. *Oncorhynchus nerka.* After Schultz and Hanson. Courtesy of the *Washington Sportsman.*

1b. Anal fin short, of 9 to 12 rays, rarely 13; gill rakers 20 or fewer on 1st arch; branchiostegals 10 to 12; dorsal fin black-spotted.

6a. Species with darkish spots on a lighter background; fewer than 190 scale rows crossing the lateral line; vomer flat, its toothed surface plane, teeth on shaft of the vomer in alternating rows or in one zigzag row, those on the shaft placed directly on the surface of the bone, not on a free crest.

7a. Red dash on dentary (between lower jaw bone and isthmus) evident in life; no red spots on side of body; vertebrae 58 to 62 (usually 60 or 61); dorsal rays 9 to 11 (usually 10); anal rays 9 to 11; maxillary on adults extending behind eye, about 1.6 to 2.25 in head; hyoid teeth (those located behind the patch of teeth on tip of the tongue) usually present but few and scattered.

8a. Black spots large and scattered over the body, those on anterior part of the body widely separated, the spots are usually absent from belly and almost to the lateral line; scales above and below lateral line 32 to 42 (usually 35 to 38); scales in the lateral line 156 to 190 (usually about 165 to 170); gill rakers 6 to 9+10 to 13, totaling 15 to 22. Range: Middle and upper Columbia River drainage. Introduced elsewhere. Freshwater. Abundant. Fig. 27.

Montana Black-spotted Trout.....37. *Salmo clarkii lewisi* (Girard)

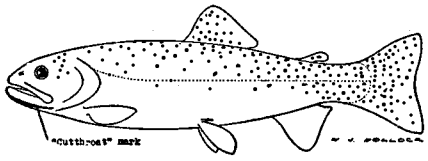


Fig. 27. Montana Black-spotted Trout. Cutthroat Trout. *Salmo clarkii lewisi*. After Schultz and Hanson. Courtesy of the *Washington Sportsman*.

8b. The body is profusely covered with black spots, a few even occurring on the belly, the spots about as close together posteriorly as anteriorly; scales above the lateral line 35 or fewer; scales below lateral line 35 or fewer; scales in the lateral line 120 to 180 (usually fewer than 160). In the Puget Sound drainage 2 types of cutthroat trout have been observed. They are distinguishable as follows: Scales 120 to 140 (usually about 125 to 130) instead of 143 to 180 in the lateral line; scales 25 to 29 instead of 30 to 36 (usually 31 to 35) above the lateral line; scales below the lateral line about 27 to 28 instead of 30 to 34. Recent evidence indicates that this great variation in the number of scales may be caused by the different temperatures during which early development takes place in the various localities. Range: British Columbia to California. Marine and freshwater. Fig. 28

Coastal Cutthroat Trout.....38. *Salmo clarkii clarkii* Richardson[2]

[2]Under this name we are including *Salmo clarkii crescentis*, the speckled trout of Lake Crescent, Olympic Mountains.

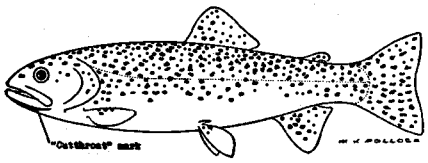


Fig. 28. Cutthroat Trout. Coastal Cutthroat. Steelhead Cutthroat. *Salmo clarkii clarkii*. After Schultz and Hanson. Courtesy of the *Washington Sportsman*.

7b. No red dash on dentary evident in life; dorsal fin rays 10 to 13 (usually 11 or 12); hyoid teeth always absent.

9a. Vertebrae 56 to 59 (usually 57 to 58); color brownish yellow and usually with a few red spots on the sides; scales in the lateral line 118 to 130 (usually about 125); scales 24 to 28 above the lateral line and 22 to 30 below it; gill rakers 6 to 9+9 to 10. Range: Introduced into western United States. Freshwater. Abundant locally. Fig. 29.

Brown Trout.....39. *Salmo trutta* Linnaeus

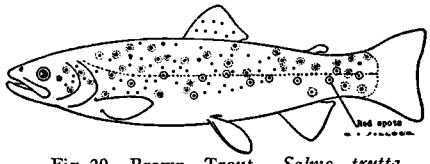


Fig. 29. Brown Trout. *Salmo trutta*. After Schultz and Hanson. Courtesy of the *Washington Sportsman*.

9b. Vertebrae 59 to 65 (rarely 59 or 60), usually 63; color not brownish yellow, but gray to bluish above, the reddish lateral band usually but slightly interrupted by faint parr marks on adults; no red spots on sides of body; gill rakers 7 to 9+9 to 13; maxillary usually 2.0 to 2.5 in head of adults, and not extending behind the eye.

10a. Scales 120 to 138 (usually 125 to 135) in the lateral line; 23 to 30 above and 20 to 26 below the lateral line; body profusely spotted. Range: Coastal region and lower and middle Columbia River. Marine and freshwater. Abundant. Fig. 30.

Coastal Steelhead or Rainbow Trout.....
.....40. *Salmo gairdnerii gairdnerii* Richardson[3]

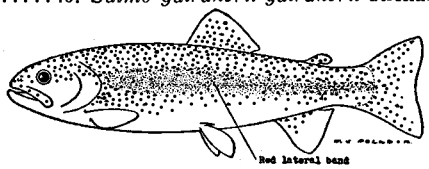


Fig. 30. Rainbow Trout. Steelhead. Sea-run Rainbow. *Salmo gairdnerii gairdnerii*. After Schultz and Hanson. Courtesy of the *Washington Sportsman*.

[3]Under this name we are including *Salmo gairdnerii beardsleei*, the blueback trout of Lake Crescent, Olympic Mountains.

10b. Scales 135 to 160 (usually 140 to 150) in the lateral line; 27 to 32 above and 25 to 30 below the lateral line. Range: Upper Fraser River basin and the middle and upper Columbia River in northeastern Washington. Marine and freshwater. Abundant.

Kamloops Trout. Rainbow Trout.....
.....41. *Salmo gairdnerii kamloops* Jordan

6b. Species with light spots (white or gray) on a darker background of color; often with red spots on the sides; over 190 scale rows crossing the lateral line; vomer boat shaped (the shaft depressed), shaft without teeth.

11a. Vomer with a raised crest extending backward from the head of the bone, this crest armed with strong teeth; species gray spotted, without red spots; fins not markedly bright edged. Range: Northeastern United States; Great Lakes region; Columbia and Fraser rivers. Freshwater. Not common. Fig. 31.

Lake Trout. Mackinaw Trout.....
.....42. *Cristivomer namaycush* (Walbaum)

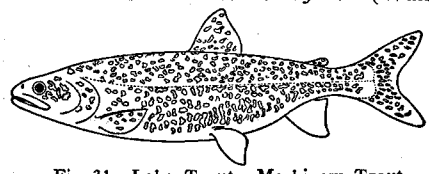


Fig. 31. Lake Trout. Mackinaw Trout. *Cristivomer namaycush*. After Schultz and Hanson. Courtesy of the *Washington Sportsman*.

11b. Vomer without a raised crest which extends backward, head of bone toothed; species red-spotted in life, the lower fins with bright silvery edgings.

12a. Back unspotted, but strongly mottled with olive and black, that is, the spots run together causing the mottled appearance; dorsal and caudal finely mottled; body robust or stout, the head heavy. Range: Northeastern North America. Introduced into the western States. Freshwater. Common. Fig. 32.

Eastern Brook Trout.....
.....43. *Salvelinus fontinalis* (Mitchill)

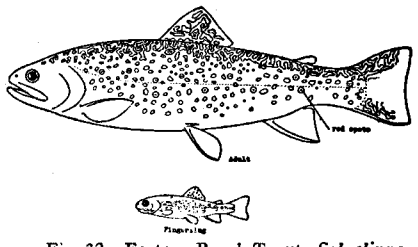


Fig. 32. Eastern Brook Trout. *Salvelinus fontinalis*. After Schultz and Hanson. Courtesy of the *Washington Sportsman*.

12b. Back not mottled, but with light spots like those on the sides of the body, only smaller and paler; body less robust or stout. Range: Coastal streams from Alaska to northern California. Marine and freshwater. Abundant. Fig. 33.

Western Charr or Bull Trout. Dolly Varden Trout. .....44. *Salvelinus malma spectabilis* (Girard)

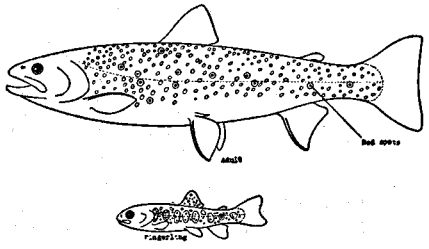


Fig. 33. Dolly Varden Trout. Bull Trout. *Salvelinus malma spectabilis.* After Schultz and Hanson. Courtesy of the *Washington Sportsman.*

Family 21. Coregonidae. Whitefishes

1a. Upper jaw longer than lower jaw, projecting over the latter; gill rakers short, conic, 15 or fewer on lower limb of 1st gill arch; snout pointed; maxillary not reaching past vertical line to anterior of eye; 1 nasal flap between the 2 nostrils instead of 2 as in the genus *Coregonus.*

2a. Scales in lateral line fewer than 65; species small, usually much less than 8 inches.

3a. Scale formula 8+60 to 63+6; length of pectoral fin 7 times in standard length; height of dorsal fin 7 times in standard length; length of head 4.5 to 5 in standard length. Range: Alaska (L. Aleknagik, Kendall, 1921) to headwaters of the Columbia. Freshwater. Common.

Brown-backed Whitefish..... .....45. *Prosopium coulteri* (Eigenmann and Eigenmann)

3b. Scale formula 7+58+4 to 7; length of pectoral fin 4.3 in the standard length; height of dorsal fin 4.6 in standard length; length of head 4.0 in standard length; gill rakers 5+10. Range: Lake Crescent, Olympic Peninsula, Washington. Freshwater. Rare.

Lake Crescent Whitefish.....46. *Prosopium snyderi* Myers

2b. Scales in lateral line more than 75, usually 8 to 10+80 to 95+6 to 9.

4a. Adipose base contained 1 to 1.2 in anal fin base; total length of adipose fin 1.9 to 2.4 in head. Range: Streams and lakes of western slope of Rocky Mountains from Fraser River and Jasper Park southward to the Truckee River, Lahontan Basin of Nevada and the headwaters of the Saskatchewan and Missouri Systems. Freshwater. Common. Fig. 34.

Rocky Mountain Whitefish.....47. *Prosopium williamsoni* (Girard)

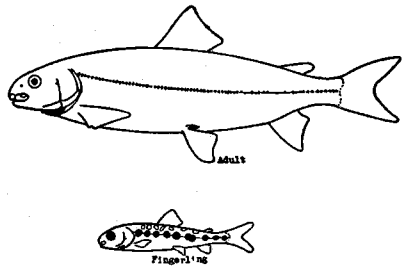


Fig. 34. Rocky Mountain Whitefish. *Prosopium williamsoni.* After Schultz and Hanson. Courtesy of the *Washington Sportsman.*

4b. The base of the adipose fin is contained from .75 to 1 times in anal fin base; total length of adipose fin in head 1.3 to 1.6. Range: Columbia River and tributaries. Freshwater. Common in Columbia River.

Oregon Whitefish...48. *Prosopium oregonum* (Jordan and Snyder)

Family 22. Thymallidae. Grayling

Range: Rocky Mountain region of northern United States and of southern Canada. Freshwater. Locally abundant. Fig. 35.

Montana Grayling.....49. *Thymallus montanus* Milner

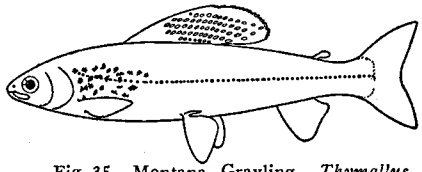


Fig. 35. Montana Grayling. *Thymallus montanus.* After Schultz and Hanson. Courtesy of the *Washington Sportsman.*

Family 23. Osmeridae. Smelts[4]

1a. Scales of moderate size (fewer than 80 in the lateral line); scales on sides not forming villous bands in the breeding male although they may be enlarged and edematous.

2a. Teeth on the vomer canine-like, few in number, and not covering the whole head of the bone. Fig. 18.

3a. Vomerine teeth confined to lateral tips of U shaped vomer, fang-like, 1 to 3 in number on each side, very strong, not deciduous at spawning; pelvic fins inserted distinctly behind origin of dorsal; gill rakers in moderate number, 8 to 10+19 to 23 on first arch; scales 66 to 69 in lateral line; anal fin low, its height contained 2.6 to 3.3 times in head; upper jaw about reaching vertical from posterior margin of eye; spawning in streams. Range: Northern China to Alaska. Marine. Abundant.

Rainbow "Herring".....50. *Osmerus dentex* Steindachner

[4]Modified after Hubbs 1926, Proc.. Biol. Soc. Wash.

3b. Vomerine canine moderate, inserted at front of vomerine arch (often flanked on one side by a smaller tooth, other teeth of moderate strength).

4a. Teeth larger and stronger; never deciduous; head sharply pointed as seen above; pelvic fins inserted under or barely in advance of origin of dorsal fin; opercles weakly striate; gill rakers longer 10 or 11 +22 to 26 in number on the first arch; anal fin of moderate length, with 15 to 17 rays; probably spawning in the ocean; pigmentation on top of head and chin very fine stippling in the young. Range: Str. Juan de Fuca to San Francisco Bay. Marine. Common.

Whitebait.....51. *Allosmerus attenuatus* (Lockington)

4b. Teeth smaller and weaker; deciduous at spawning, the breeding fish are almost completely endentulous; head bluntly rounded anteriorly, as seen above; pelvic fins inserted much in advance of origin of dorsal fin; opercles strongly striate concentrically; gill rakers much reduced in size and number, only 4 to 6+13 to 16 on first arch; anal fin elongate with 17 to 22 rays (usually 20 or 21); spawning in freshwater streams. Range: Bering Sea to Klamath River, California. Marine and freshwater. Common.

Columbia River Smelt. Eulachon. Oolachan. Candle Fish.....
.....52. *Thaleichthys pacificus* (Richardson)

2b. Teeth on the vomer not canine-like, rather numerous and forming a convex series along the entire head of the bone; teeth not deciduous, all small, or scarcely canine-like. Fig. 18.

5a. Mouth large (as in all preceding genera and species) 1.8 to 2.2 times in the head; the maxillary reaching at least to posterior edge of the pupil, its upper surface concave; teeth larger, always evenly uniserial on vomer and palatine bones.

6a. Fins less elongate, the pectoral not longer than the head, and not reaching pelvic insertion; pectoral fin, 1.25 to 1.4 in head; gill rakers 11 to 13+23 to 28; upper jaw, 1.8 to 1.9 in head; eye 3.6 to 4.4 in head; head in length to caudal 4.0 to 4.2; pigmentation on top of head and under chin rather coarse and scattered in the young; spawning at night in ocean surf. Range: La Push, Washington, to Monterey Bay, California. Marine. Abundant.

Night Surf Smelt.....53. *Spirinchus starksi* (Fisk)

6b. Fins much enlarged, the pectoral almost as long or longer than the head, and often extending beyond the pelvic insertion; pectoral fin 1.0 to 1.25 in head; gill rakers 11 to 13+28 to 31; upper jaw 2.0 to 2.15 in head; eye 4.4 to 4.8 in head; head in standard length 4.35 to 4.6; spawning in freshwater, the breeding males have the rows of scales along the lateral line greatly dilated. Range: British Columbia to Tillamook Head, Oregon. Marine and freshwater. Common.

Long-finned Smelt. Puget Sound Smelt.....
.....54. *Spirinchus dilatus* Schultz and Chapman

5b. Mouth much smaller, about 2.5 to 3.0 in the head, the maxillary not reaching beyond the middle of the pupil, its upper edge convex; teeth minute, in biserial arrangement or nearly so, on vomer and palatine bones

7a. Scales larger than in *pretiosus,* 54 to 62 along lateral line; pelvic fins usually inserted a little before origin of dorsal; fins all larger than in *pretiosus,* the pectoral reaching more than

half-way to pelvic insertion; color darker; breeding at small size in fresh water. Range: Japan to Alaska southward to San Francisco. Spawning in freshwater. Common.

Freshwater Smelt.....55. *Hypomesus olidus* (Pallas)

7b. Scales smaller, 66 to 76 along lateral line; pelvic fins usually inserted behind origin of dorsal; fins all shorter than in *olidus*, the pectoral not reaching half-way to pelvic insertion; color more silvery; breeding at larger size in the surf. Range: Alaska to central California. Marine. Abundant.

Silver Smelt. Surf Smelt..56. *Hypomesus pretiosus* (Girard)

1b. Scales of small size, over 150 in the lateral line; scales on sides forming two villous bands in the breeding males; mouth large, teeth small. Range: North Pacific southward to Str. Juan de Fuca, and North Atlantic Ocean. Marine. Abundant.

Capelin.....57. *Mallotus villosus* (Müller)

Family 24. Argentinidae. Deep Sea Smelt

Range: Unalaska, *Albatross* Station 3330, and to California. Marine. Rare.
.....58. *Leuroglossus stilbius* Gilbert

Family 25. Microstomidae. Deep Sea Fish

Range: Coast of Washington in deep water. Marine. Rare.
.....59. *Bathylagus pacificus* Gilbert

Family 26. Chauliodontidae. Viper Fishes

Range: Queen Charlotte Islands, B. C., to California. Marine. Not rare.
.....60. *Chauliodus macouni* Bean

Family 27. Gonostomidae

Range: Atlantic and Pacific oceans. Oregon to Panama (Jordan, Evermann, & Clark 1930)
.....61. *Cyclothone microdon* (Günther)

Family 28. Nemichthyidae. Thread Eels. Snipe Eels

Range: Puget Sound, Washington to Oregon. Marine. Rare.
.....62. *Nemichthys avocetta* Jordan and Gilbert

Family 29. Catostomidae. Suckers

1a. Mouth terminal, lower jaw oblique, lips thin, without papillae.

2a. Gill rakers short and shaped like the Greek letter Delta, Δ, with edges unarmed and entire; snout long, the premaxillary spines forming a distinct projecting nose; scales about 12+80+9; dorsal rays about 11; anal 9. Range: Klamath Lakes Drainage. Freshwater. Common.

Lost River Sucker.....63. *Deltistes luxatus* (Cope)

2b. Gill rakers long and not like the Greek letter Delta, Δ.

3a. Mouth inclined at an angle of about 15°; upper profile of snout smooth without conspicuous hump caused by premaxillary spines. Range: Klamath Lake, Oregon. Freshwater. Common.

Sucker of Klamath Lake.....64. *Chasmistes brevirostris* Cope

3b. Mouth inclined at an angle of 40° or over.

4a. Mouth inclined at an angle of about 40°; head about 3.9 to 4 in body; snout 2⅔ to 2⅘ in head; premaxillary spines more protruding than in *copei*. Range: Upper Klamath Lake, Oregon. Freshwater. Common.

Sucker of Upper Klamath Lake.....65. *Chasmistes stomias* Gilbert

4b. Mouth inclined at an angle of 45°; head 3⅔ in body; snout less prominent, 2.5 in head; premaxillary spines less protruding than in *stomias*. Range: Upper Klamath Lakes, Oregon. Freshwater. Common.

Sucker of Upper Klamath Lake.....
.....66. *Chasmistes copei* Evermann and Meek

1b. Mouth inferior; lips thick with many papillae.

5a. A distinct notch at the corner of the mouth between upper and lower lips, fig. 37; upper lip recurved; lower lip but little incised, 3 or 4 rows of papillae crossing the mid-line; edge of jaw inside the lower lip with a hard cartilaginous sheath; scales about 16 +90 to 100+14; scales before dorsal about 48; fontanelle not fully closed, (fig. 36); dorsal 10 or 11; anal 7. Range: Columbia River basin and Upper Missouri. Freshwater. Common.

Mountain Sucker.....67. *Pantosteus jordani* Evermann

5b. No distinct deep notch at the corner of the mouth between upper and lower lips, occasionally a very slight indentation appears on a few individuals, fig. 13; upper lip not recurved but nearly flat; edge of jaw inside the lower lips without a hard cartilaginous sheath, the sheath if present rather flexible; fontanelle present or absent.

6a. Lower lip not very deeply incised, at least 1 or 2 rows of papillae are continuous across the mid-line.

7a. Fontanelle present. Fig. 36.

8a. Scales 20 to 22+97 to 111+19 to 22; scales before dorsal 53 to 58; dorsal rays 11 to 13 (usually 12); peritoneum nearly jet black, the color showing through the body wall in the young. Range: Columbia River in eastern Washington, Oregon and Idaho. Freshwater. Abundant.

Fine-scaled Sucker of the middle and lower Columbia River
.....68. *Catostomus syncheilus* Hubbs and Schultz

8b. Scales 15 to 19+73 to 79+14 to 15; scales before dorsal 37 to 42; dorsal rays 10 or 11; 2 or more rows of papillae cross the mid-line of the lower lip; peritoneum dusky, not jet black. Range: Oregon Lakes and tributaries. Freshwater. Common.

Coarse-scaled Sucker of Warner Lake Basin.....
.....69. *Catostomus warnerensis* Snyder

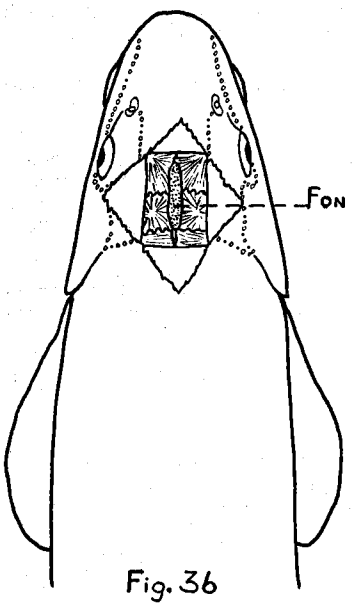


Fig. 36

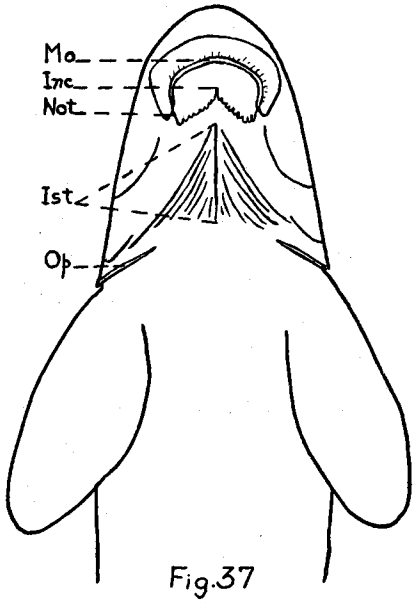


Fig. 37

Fig. 36. A view of the dorsal side of the head of *Catostomus syncheilus,* showing the fontanelle (dotted) surrounded by ossified bones. Fon—fontanelle. Drawn by Arthur D. Welander.

Fig. 37. A view of the ventral side of the head of *Pantosteus delphinus,* showing the overhanging upper lip and the notches at the corner of the lips where the upper and lower meet. Drawn by Arthur D. Welander.

7b. Fontanelle closed in adults and nearly closed in young; at most represented by a narrow slit; scales 14 to 18+80 to 93 +11 to 13; scales before dorsal 37 to 52, usually about 40 to 42; anal rays 6 to 7; dorsal rays 10 to 12; eye 6½ to 8 in head; peritoneum dusky; scales little if any increased in size posteriorly.

9a. Lower lip deeply incised, so that not more than 1 row of papillae extend across the symphysis. Range: Upper Sacramento River and Goose Lake Drainage. Freshwater. Not common.

.....70. *Catostomus microps* Rutter

9b. Lower lip not deeply incised, so that 2 or more rows of papillae extend across the symphysis. Range: Rouge and Klamath rivers, Oregon and California. Freshwater. Common.

Fine-scaled Klamath River Sucker.....
.....71. *Catostomus rimiculus* Gilbert and Snyder

6b. Lower lips very deeply incised, no row of papillae crossing the mid-line or at most only a rudiment of a row; fontanelle present.

10a. Fewer than 80 scales along the lateral line.

11a. Species of the Columbia River and coastal streams of Washington and Oregon except the Klamath; scales 12 to 16+65 to 79+8 to 10; scales before dorsal 30 to 40; dorsal rays 12 to 15; caudal peduncle very slender in young and half grown; peritoneum white to dusky, the color not showing through the body wall in the young as observed in *syncheilus*. Range: Puget Sound drainage, Columbia River, Coasts of Oregon and Washington as far south as the Sixes River, Oregon. Freshwater. Abundant.

Coarse-scaled Sucker of Columbia River.....
.....*72. Catostomus macrocheilus* Girard

11b. Species of the Klamath River basin; scales 13 to 14 +69 to 77+10 to 11; scales before dorsal about 32; dorsal rays about 11; caudal peduncle not slender in young and half grown. Range: Klamath Basin, Oregon. Freshwater. Not common.

Coarse-scaled Sucker of Klamath River.....
.....*73. Catostomus snyderi* Gilbert

11c. Species of the Goose Lake drainage and the Sacramento River; scales 13 to 17 (usually 14 to 16)+62 to 75 (usually 64 to 72)+8 to 10; scales before dorsal 29 to 36; dorsal rays 11 to 15 (usually 12 or 13); this species is very much like *macrocheilus* from which it may not be distinct. Range: Goose Lake and tributaries. Freshwater. Common.

Coarse-scaled Sucker of Goose Lake and Tributaries
..*74. Catostomus occidentalis lacus-anserinus* Fowler

10b. Scales in the lateral line 95 to 115; 18 to 21 scales above and 15 to 18 scales below the lateral line; dorsal rays 9 to 11; peritoneum dusky, seldom whitish, but never jet black. Range: Upper portions of the Missouri, Saskatchewan, and Columbia rivers. Freshwater. Common.

Long-nosed Sucker.....
.....*75. Catostomus catostomus griseus* Girard

Family 30. Cyprinidae. Minnows. Dace. Chubs

1a. A spine, usually serrated, is developed at front of dorsal and anal fins; the dorsal fin is very long, usually the anterior rays much longer than those behind middle of fin.

2a. Barbels in 2 pairs on the side of the upper jaw. Range: Introduced into North America. Freshwater. Abundant.

Common Carp.....*76. Cyprinus carpio* Linnaeus

2b. No barbels on the side of the upper jaw. Range: Introduced into North America. Freshwater. Abundant.

Common Goldfish.....*77. Carassius auratus* (Linnaeus)

1b. No spines developed in the dorsal or anal fins; sometimes in very large specimens the first simple ray is very hard but it is not a sharp spine.

3a. More than 100 scales along the lateral line; a barbel terminal on posterior tip of maxillary. Range: Introduced into the Columbia River system, Puget Sound drainage and Vancouver Island. Freshwater. Abundant.

Tench. Green Tench. Yellow Tench.....78. *Tinca tinca* (Linnaeus)

3b. Fewer than 100 scales along the lateral line.

4a. A single row of pharyngeal teeth, the lesser row never developed.

5a. Lower jaw with a conspicuous, broad, straight-edged, horny plate; alimentary canal at least twice the length of body, with more than 1 main loop; teeth usually 4-5, seldom 5-5, hooked and short; peritoneum jet black; young with a black spot at the base of the caudal fin rays in the mid-line. Range: Lower Columbia River system, and Malheur Lake drainage, Oregon. Freshwater. Common.

Chiselmouth. Square Mouth.....
.....79. *Acrocheilus alutaceus* Agassiz and Pickering

5b. Jaws without straight edged horny plate as above; alimentary canal about equal to or shorter than length of body, with but a single main loop.

6a. Scales with radii on all fields appearing like the spokes of a wheel; 8 to 9 (usually 9) short blunt gill rakers on first gill arch; origin of dorsal fin posterior to base of pelvic fins; head about 4.7; depth 4.7; eye in head 4.6; scales 12 to 15+54 to 61 +8; dorsal 8, anal 7; scales before dorsal 32 to 38; pharyngeal teeth usually 4 on right side and 5 on the left; peritoneum black to dusky. Range: Streams tributary to the north end of Goose Lake. Freshwater. Common.

Northern Roach.....80. *Hesperoleucus mitrulus* Snyder

6b. Scales without radii in all fields, if radii are present; 13 to 20 gill rakers on first arch, not very blunt; origin of dorsal fin above base of pelvic fins; peritoneum dusky to white ventrally; (the species of *Siphateles* usually recognized are not clearly differentiated except by drainage systems; the differences when studied statistically are probably significant).

7a. Individuals inhabiting the Columbia River and Malheur Lake drainage; scales 11 to 13 (11.6)+41 to 53 (46)+5 to 7 (6); scales before the dorsal 24 to 29 (26); anal 8 to 9 (8.2). Freshwater. Common.

Roach of the Columbia River System.....
.....81. *Siphateles bicolor columbianus* (Snyder)

7b. Individuals inhabiting the Klamath River and Klamath Lakes drainage systems; scales 10 to 12 (10.6)+43 to 53 (48)+5 to 7 (6.2); scales before the dorsal 22 to 27 (25); anal 7 to 8 (7.7). Freshwater. Common.

Roach of the Klamath System.....
.....82. *Siphateles bicolor bicolor* (Girard)

7c. Individuals inhabiting the Sacramento-San Joaquin system, Goose Lake and tributaries; scales 10 to 13 (11.0)+44 to 54 (49)+5 to 7 (5.8); scales before the dorsal fin 22 to 28 (25); anal 7 to 9 (8.4). Freshwater. Common.

Roach of the Sacramento System.....
.....83. *Siphateles bicolor formosus* (Girard)

7d. Individuals inhabiting the lakes of southeastern Oregon, namely lakes Abert, Summer, Silver, Alkali, Warner, and their tributaries; scales 11 to 14 (12.2)+45 to 60(52)+6 to 9 (6.8); scales before dorsal fin 24 to 33 (29); anal 7 to 11 (7.8). Freshwater. Common.

Roach of Southeastern Oregon Lakes.....
.....84. *Siphateles bicolor oregonensis* (Snyder)

7e. Individuals inhabiting the lakes and streams of the Lahontan Basin; scales 12 to 16+50 to 60 (usually 53 to 56)+7 to 8; scales before the dorsal 27 to 33 (usually 29 to 31); gill rakers 8 to 20 (usually 10 to 18); anal rays 7 to 8; dorsal 8. Freshwater. Common.

Roach of the Lahontan Basin.....
.....85. *Siphateles bicolor obesus* (Girard)

4b. Pharyngeal teeth present, in 2 rows, the lesser row occasionally absent on one side.

8a. Teeth in main row blunt, molar or stump shaped in adult, but often slightly hooked in the young; the teeth never tapering evenly to a hooked point as in 8b.

9a. Premaxillary not protractile but bound to snout by a frenum; no barbels on maxillary; scales between occiput and dorsal fin 45 to 55; (found only south of Oregon). Range: Sacramento River system. Freshwater. Abundant.

Hardhead. (Sacramento River system).....
.....86. *Mylopharodon conocephalus* (Baird and Girard)

9b. Premaxillary proctractile; barbel present on maxillary; 28 to 35 scales between occiput and dorsal fin; peritoneum dusky to black in very young; young without a jet black spot at base of caudal fin rays as found in *Ptychocheilus*, the spot in *Mylocheilus* at most is very pale. Range: Drainage systems from the Columbia to the Fraser. Freshwater. Common.

Columbia River Chub.....
.....87. *Mylocheilus caurinus* (Richardson)[5]

8b. Teeth in main row hooked and usually compressed, tapering to a more or less hooked point; never blunt and without grinding surface.

10a. A barbel on the posterior angle of maxillary, usually small and seldom obsolete except on very young individuals.

11a. Premaxillary protractile.

12a. Between occiput and dorsal fin 16 scales; 35 to 40 scales in the lateral line. Range: Willamette and Umpqua rivers. Freshwater. Common.

Oregon Chub or Minnow.....
.....88. *Oregonichthys crameri* (Snyder)

12b. Between occiput and dorsal fin 28 to 34 scales and more than 43 scales in the lateral line.

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[5]Reasons for changing name see Hubbs and Schultz 1931, Occ. Pap. Mus. Zool. Univ. Mich. No. 232: 1-6.

13a. Barbel just anterior to tip of maxillary; 55 to 58 scales in the lateral line; 10 to 11 scales above and 6 to 8 below the lateral line; teeth 2:4-4:2. Range: Stuart Lake, headwaters of Fraser River, B. C., and Lake Pend d'Oreille, Idaho. Freshwater. Abundant.

Chub Minnow. Lake Chub.....89. *Couesius greeni* Jordan

13b. Barbel terminal on maxillary; 43 to 90 scales in the lateral line (usually 52 to 75); 13 to 15 scales above and 9 to 11 below the lateral line; teeth 2:4-4:2 to 0:4-4:1.

14a. Dorsal fin with the distal edge concave, sometimes strongly falcate; innerside of rays of ventral fins with more or less conspicuous membraneous stays joining them to the body; sides of body with blackish-brown blotches, sharply contrasting with lighter color of body.

15a. Scales 63 to 70 in lateral line; least depth of caudal peduncle more than half postrostral length of head. Range: Columbia River basin east of Cascade Range and in Payette and Salmon rivers, Idaho. Freshwater. Common.

Dace.....90. *Apocope umatilla* (Gilbert and Evermann)

15b. Scales 50 to 57; least depth of caudal peduncle less than half postrostral length of head. Range: Columbia River Basin east of Cascade Range. Freshwater. Locally abundant.

Dace.....91. *Apocope falcata* (Eigenmann and Eigenmann)

14b. Dorsal fin with the distal edge not concave and never falcate, instead rounded; sides of body without large dark blotches, instead the sides are speckled with numerous small brownish-black spots which cover about 2 or 3 scales.

16a. Scales 47 to 70 in the lateral line.

17a. Intense dark lateral band; streams of coastal area. Range: Lower Columbia River and coastwise streams of Washington and Oregon. Freshwater. Common.

Black-nosed Dace. Black-sided Dace.....92. *Apocope oscula nubila* (Girard)

17b. Lateral band faint; body speckled; streams east of the coast range, usually in non-forest areas. Range: Middle and upper Columbia River basin, the Great Basin, and Coast Range of southeastern Oregon. Freshwater. Abundant.

Speckled Dace.....93. *Apocope oscula carringtoni* Cope

16b. Scales 68 to 80 in the lateral line. Range: Klamath basin. Freshwater. Common.

Klamath Dace.....94. *Apocope klamathensis* (Evermann and Meek)

11b. Premaxillary not protractile, a broad frenum present binding it to the snout; mouth inferior, the snout projecting over the mouth; teeth 1:4-4:1.

18a. Dorsal rays 9 or 10; scales 57 to 59 in lateral line; depth of caudal peduncle 10 times in standard length. Range: Umpqua River, Oregon. Freshwater. Common.

Long-nosed Dace of Umpqua River System..... .....95. *Rhinichthys evermanni* Snyder

18b. Dorsal rays 8, seldom 9; scales 62 to 75 in lateral line; depth of caudal peduncle about 8.3 in standard length. Range: Streams of northwestern United States. Freshwater. Abundant.

Long-nosed Dace..... .....96. *Rhinichthys cataractae dulcis* (Girard)

10b. No barbel on maxillary; premaxillary always protractile.

19a. Anal rays 7 to 10; mouth terminal, horizontal.

20a. Eye 1 times in the length of snout; scales 13 to 15+60 to 67+7; body less slender, the dorsal contour more arched; depth 3¾ in length; eye 5 to 5½ in head; dorsal 8; anal 7 to 9; about 9 short blunt gill rakers; peritoneum black; mouth 3¼ to 3½ in head; maxillary barely reaches to vertical below front of eye; interorbital much convex. Range: Klamath Lake and tributaries. Freshwater. Not rare.

Chub.....97. *Tigoma bicolor* Girard

20b. Eye 1½ in snout; eye 7½ in head; interorbital flattened; scales 13 to 24+67 to 86+7 to 9; head and body long and tapering; dorsal outline not abruptly curved or arched; depth 4.6 to 5.2 in standard length; dorsal 10; anal 8; 5 to 8 short blunt gill rakers on first gill arch; teeth scarcely hooked, but strong and set wide apart; always 2 teeth in the lesser row as 2:5-4:2; peritoneum silvery and usually speckled with black; mouth deeply cleft, the maxillary reaching to under the eye; young with a jet black spot at base of caudal fin rays.

21a. Scales fewer than 45 (usually 36 to 41) on back before the dorsal fin; scales 13 to 15 above the lateral line. Range: Sacramento River system. Freshwater. Common.

Sacramento Pike. Squawfish..... .....98. *Ptychocheilus grandis* (Ayres)

21b. Scales more than 45 on the back before the dorsal fin; 16 to 24 scales above the lateral line.

22a. Scales 46 to 56 before the dorsal; 16 to 20 above the lateral line and 67 to 75 scales in the lateral line. Range: Puget Sound drainage, Columbia River drainage and coastal streams of Oregon and Washington. Freshwater. Abundant.

Squawfish. Oregon Pike.....
.99. *Ptychocheilus oregonensis* (Richardson)

22b. Scales 55 to 68 before the dorsal; 19 to 24 (21) above the lateral line; 73 to 85 (75) in lateral line. Range: Coastal streams of Oregon—Siuslaw and Umpqua rivers only. Freshwater. Common.

Squawfish.100. *Ptychocheilus umpquae* Snyder

19b. Anal rays 10 to 22; mouth oblique; depth 3¼ to 4¼ in standard length; eye 3 to 4 in head; scales 13+55 to 63+6; head 4 to 4½ in length; body much compressed with a wide lateral band of blackish color between two silvery streaks.

23a. Anal rays 10 to 13, usually 11 or 12. Range: Palouse River of eastern Washington; Bovill, Idaho; above falls of the Snake River; and Salt Lake drainage of Utah. Freshwater. Abundant.

Red-sided Shiner or Bream...101. *Richardsonius balteatus hydrophlox* (Cope)

23b. Anal rays 13 to 22, usually 14 to 18. Range: Columbia River system; streams of Washington, of Oregon, and Fraser River. Freshwater. Abundant.

Red-sided Shiner or Bream...102. *Richardsonius balteatus balteatus* (Richardson)

Family 31. Ameiuridae. Catfishes

1a. Caudal fin deeply and sharply forked. Range: Mississippi and Great Lakes drainage. Probably introduced into the Columbia River system.

Channel Cat.....103. *Ictalurus punctatus* (Rafinesque)

1b. Caudal fin emarginate to rounded.

2a. Anal rays 17 to 21 (including rudiments) usually 18 to 20; pectoral spines at all ages entire or only slightly roughened behind; outer ⅔ of inter-radial membranes of anal fin uniformly pigmented, always darker than the rays, the fin never mottled or barred or uniformly pigmented on both membranes and rays as in *nebulosus*. Range: Introduced into western United States. Freshwater.

Black Catfish. Horned Pout.....104. *Ameiurus melas* (Rafinesque)

2b. Anal rays 19 to 24, usually 20 to 23; pectoral spines in the young with long sharp barbs on posterior edge, their length more than half the diameter of the spine, (barbs increasing in number and desceasing in relative size with age); black pigment on anal fin typically densest on the mem-

branes near their margin, or in spots forming an obscure longitudinal bar near base of fin, or in faint mottlings on both rays and membranes (in pale and unmottled specimens, membranes and rays about equally pigmented). Range: Introduced into most of the streams and lakes of United States. Freshwater. Common.

Catfish. Horned Pout.....105. *Ameiurus nebulosus* (LeSueur)

Family 32. Sudidae (=Paralepididae)

Range: Puget Sound. Marine. Rare.

Pelagic Fish.....106. *Arctozenus coruscans* (Jordan and Gilbert)

Family 33. Myctophidae.[6] Lantern Fishes

1a. Luminous scales absent or present in varying numbers and positions; but no large infra.- or supra.- caudal plates, the median luminous tissues or glands above and below the caudal peduncle are, when present, always divided into separate organs, each occupying the space and position of only one single normal scale, in an overlapping series; or the entire tissue may in some cases be confined to the space of only 1 single scale altogether, but never expands as an undivided organ beyond the size of a scale. Fig. 9.

2a. (See 2b and 2c.) Only 2 precaudal organs, usually well separated from the posteroanal series, very rarely confluent with the latter, median luminous scales often present infra.- and supra.- caudally, according to the sex, but only rarely found in both positions on the same specimen; no luminous scales on any other part of the fish, antorbital organs not conspicuously enlarged; photophores without a black dividing septum.

3a. Ventral organs 6; posterior-lateral organ 1; anal organs in 2 separate groups; suprapectoral organ above base of pectoral fins; scales ctenoid. Range: Washington to San Diego. Marine. Not common.

.....107. *Myctophum crenulare* Jordan and Gilbert

3b. Ventral organs 4; postero-lateral organ 1; anal organs in 2 separate groups; supra-anal organs 3; supra-pectoral organ above base of pectoral fin; 2nd ventral organ in a line with rest of the series; scales smooth (cycloid); supra-anal organs angulate; anterior supra-anal organ approximately on the same level as second supra-anal organ, the 2 organs being on a more nearly straight line with the supraventral organ, than with the last (superior) supra-anal organ. Range: Washington to San Diego. Marine. Not common.

.....108. *Myctophum californiense* Eigenmann and Eigenmann

2b. (See 2a and 2c.) Precaudal organ, when separate from the postero-anals, present in the numbers of 3 to 6, never 2 only; the lower precaudals may, however, in many forms be quite confluent with the posterior anals, in which case their numbers can not be made out; median series of luminous scales usually present both infra.- and supra.- caudally in the same specimen; similar scales are also common on other parts of the body, particularly along the bases of dorsal and anal fins; the 2 subpectoral organs rarely or never form a straight series with the 1st thoracic organ; antorbital organs not conspicuously enlarged; photophores without dividing septum; 4th thoracic organ elevated considerably above the rest of this series; subpectoral organs not above the pectoral fin base; luminous scales sometimes found at or before the adipose dorsal fin, but otherwise only on the caudal peduncle; no dorsal glands.

[6]This key has been modified after the publication by A. E. Parr (1928), Bull. Bingham Oceanographic Collection.

4a. No photophores on cheeks or on shoulder; only 2 to 4 precaudal organs, often confluent with the anal organs (always count the last 4 organs in these series as precaudals); pectorals very small or vestigial, not reaching beyond the base of the pelvics, sometimes absent; 33 or more scales in lateral line; dorsal 12 to 19; anal 14 to 25.

5a. Usually 5 ventral organs; only 2nd ventral organ elevated; head 3 to 3½ in standard length; supra-anal organs in a straight, oblique series. Range: North Pacific Ocean in deep water. Marine. Rare.
.....109. *Lampanyctus nannochir* (Gilbert)

5b. Usually 4 ventral organs; supra-anal organs in a straight, oblique series; head 3.6 to 3.8 in standard length; eye 3.5 in head. Range: Alaska to San Diego. Marine. Rare.
.....110. *Lampanyctus leucopsarus* (Eigenmann and Eigenmann)

4b. No photophores on shoulder, one or many minute ones on each cheek; supra-ventral organ twice as far from the base of the pelvic fin as from the lateral line; eye about 5⅘ in head; about 37 or 38 scales in lateral line; numerous minute photophores on each cheek and a somewhat larger organ in the lower posterior corner; anal organs 8+7 to 8; 4 precaudal organs. Range: Coast of Washington. Marine. Rare.
.....111. *Lampanyctus regalis* (Gilbert)

2c. (See 2a, and 2b.) Precaudal organs 4, usually or always distinctly separate from the posteroanals; no supra.- and infra.- caudal luminous scales, except in a few species; luminous scales are also probably always present at the suprapectoral organ, but never along the bases of dorsal and anal fins; the 2 subpectoral organs always form an approximately straight series with the 1st thoracic organ; antorbital organs often greatly enlarged, each of the photophores on the body is divided by a black septum into an upper and a lower part, but this feature may be difficult to make out in poorly preserved specimens. Range: Alaska to San Diego in the Pacific. Marine. Not rare.
.....112. *Diaphus rafinesquei* (Cocco)

Family 34. Alepisauridae. Handsawfishes. Lancet Fishes

Range: North Atlantic and North Pacific oceans. Marine. Not rare.
Lancet Fish.....113. *Alepisaurus ferox* Lowe

Family 35. Esocidae. Pickerels

Range: Mississippi River and tributaries of Great Lakes. Probably introduced into Washington. Freshwater. Locally abundant in eastern Washington.
Little Pickerel.....114. *Esox vermiculatus* LeSueur

Family 36. Novumbridae. Western Mud-minnow

Range: Chehalis River at Satsop, Washington. Freshwater. Rare.
Western Mud-minnow. Fig 38.....115. *Novumbra hubbsi* Schultz

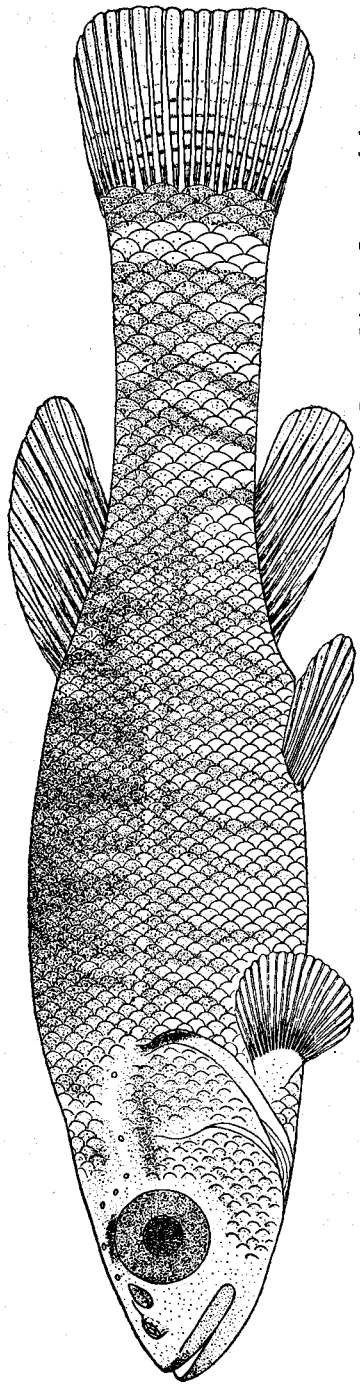

Fig. 38. Washington Mud-minnow. *Novumbra hubbsi*. Type specimen drawn by Dorothea Bowers Schultz. Courtesy of the *University of Washington Publications*.

Family 37. Scomberesocidae. Sauries

Range: North Pacific, Japan to Alaska and to California. Marine. Not rare.

Pacific Saury.....116. *Cololabis saira* (Brevoort)

Family 38. Coryphaenoididae (=Macrouridae). Grenadiers. Rat Tails

1a. Pectoral 20; eye 3½ in head; head 4½ in total length; dorsal about XI, 111+; anal 94+. Range: Alaska to Monterey, California. Marine. Not common.
.....117. *Macrurus acrolepis* Bean

1b. Pectoral 17; eye 4½ to 5 in head; head 6 in total length; dorsal about X, 128; anal about 121. Range: Off the coast of Oregon. Marine. Rare.
.....118. *Albatrossia pectoralis* (Gilbert)

Family 39. Gadidae. Cods

1a. Dorsal fins 3; anal fins 2.

2a. Lower jaw included (upper jaw extends beyond the tip of the lower jaw); barbel present at tip of the chin, always more than ½ the diameter of the pupil; gill rakers on 1st gill arch 16 to 29; caudal fin slightly concave or truncate.

3a. Barbel equal to or longer than the diameter of the eye; transverse processes of vertebrae not swollen at tips; vertebrae 51 to 56; depressed 1st dorsal scarcely reaching to origin of 2nd dorsal; length of depressed 1st dorsal less than the distance from eye to insertion of 1st dorsal; lateral line breaking up into separate tubes under middle of 2nd dorsal; arch in lateral line evenly curved; anus located under base of 2nd dorsal fin (usually near its origin); peritoneum blackish; all vertical fins with their margins whitish, the proximal portion of the fins being pigmented; air bladder with a pair of short horns anteriorly, extending toward the mid-line, with an arm curved forward and a rudimentary tip curved inward. Range: Bering Sea, south to the coast of Oregon. Marine. Abundant.

Pacific Codfish. Gray Cod.....119. *Gadus macrocephalus* Tilesius

3b. Barbel equal to or less than the diameter of the pupil (rarely longer than the pupil).

4a. Transverse processes of vertebrae swollen into hollow balls at tips, the 1st occurring on the 9th abdominal vertebra; vertebrae 60 to 62; 1st dorsal with the posterior margin rounded; depressed 1st dorsal scarcely reaching to origin of 2nd dorsal; peritoneum silvery, stippled with black; lateral line breaking up into separate tubes under

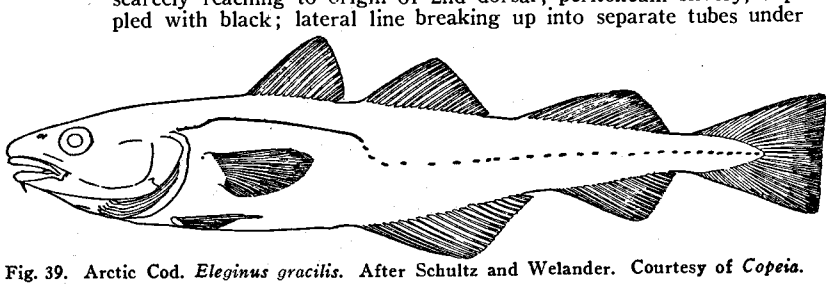

Fig. 39. Arctic Cod. *Eleginus gracilis.* After Schultz and Welander. Courtesy of *Copeia.*

origin of 2nd dorsal; arch in lateral line flat-topped; anus located under the posterior edge of 1st dorsal fin base or under interspace between 1st and 2nd dorsal fins. Range: Siberia to Alaska. Marine. Abundant.

Northern Cod. Wachna Cod. Fig. 39..120. *Eleginus gracilis* Tilesius

4b. Transverse processes of vertebrae flattened and unswollen at tips; vertebrae 55 to 58; 1st dorsal with the posterior margin truncate; depressed 1st dorsal extending for about ⅓ its length beyond the origin of 2nd dorsal; lateral line breaking up into separate tubes below the posterior ¼ of the 3rd dorsal fin; arch in lateral line evenly curved; anus located under the posterior 4th of the 1st dorsal fin base. Range: Alaska to Monterey. Marine. Common.

Pacific Tomcod. Fig. 40.....121. *Microgadus proximus* (Girard)

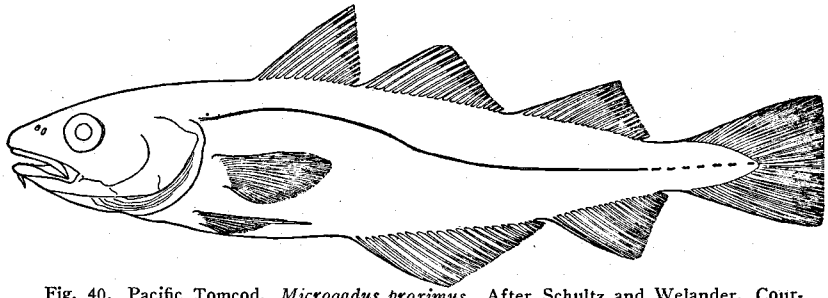

Fig. 40. Pacific Tomcod. *Microgadus proximus*. After Schultz and Welander. Courtesy of *Copeia*.

2b. Lower jaw equal to or longer than the upper jaw; the barbel very small or absent on the tip of the chin; always less than ½ diameter of pupil; gill rakers on first gill arch more than 30; caudal fin distinctly forked or concave behind.

5a. Teeth in upper jaw slender, wide set, in 1 or 2 series; subopercle and postclavicle normal (similar to the other opercular bones), not swollen nor ivory-like in adults; distance from posterior tip of 2nd dorsal to origin of the 3rd dorsal ½ the diameter of the eye; caudal fin forked; gill rakers 9 to 11 above the angle on the 1st gill arch. Range: Arctic Sea, Greenland to Alaska and northern Russia. Marine.

Arctic Cod.....122. *Boreogadus saida* (Lepechin)

5b. Teeth in upper jaw in a villiform band, the outer ones somewhat enlarged and rather wide set; subopercle and postclavicle swollen and ivory-like in the adults (but normal in the young); distance from posterior tip of 2nd dorsal fin to origin of 3rd dorsal from ⅔ as long as to a little longer than eye; caudal fin slightly concave; gill rakers 5 to 7 above the angle on the 1st gill arch. Range: Puget Sound and coast of Washington and British Columbia. Marine. Abundant.

Puget Sound Pollack. Whiting.....
.....123. *Theragra chalcogramma fucensis* (Jordan and Gilbert)

1b. Dorsal fins 2; anal fin single.

6a. Anal fin notched.

7a. The 2nd dorsal and anal fin emarginate; caudal fin truncate behind; barbel absent; teeth in jaws canine-like and depressable on hinge-like ligament; lower jaw longer. Range: Alaska to Gulf of California. Marine. Common.

Pacific Hake.....124. *Merluccius productus* (Ayres)

7b. Dorsal fin scarcely if any emarginate; barbel short, equal to about ½ diameter of eye; snout flat, depressed, and keeled on sides. Range: North Pacific Ocean off Queen Charlotte Islands in deep water. Marine. Rare.

.....125. *Antimora microlepis* Bean

6b. Anal fin not notched; the 2nd dorsal and anal very long but not emarginate; caudal fin rounded; barbel present and longer than the eye; teeth in jaws forming a broad villiform band; lower jaw included. Range: Eastern and central United States, Columbia River system and north to Arctic waters. Freshwater. Common.

Ling. Burbot. Lake Lawyer....126. *Lota maculosa* (LeSueur)

Family 40. Percopsidae. Trout Perches

Range: Columbia River in lower portions. Freshwater. Not common.

Columbia River Trout-perch.....
.....127. *Columbia transmontana* Eigenmann and Eigenmann

Family 41. Trachipteridae. Ribbon fish

Range: Washington to southern California. Marine. Rare.

Ribbon Fish.128. *Trachipterus rex-salmonorum* Jordan and Gilbert

Family 42. Lampridae. Moonfish. Opah

Range: Open seas north to Newfoundland and north to Yakutat, Alaska.

Moonfish. Opah.....129. *Lampris regius* (Bonnaterre)

Family 43. Bothidae.[7] Sand Dabs

1a. Dorsal rays 88 to 102; anal rays about 71 to 81; vertebrae 38 to 39; interorbital space wide, concave, scaly with a high bony ridge above lower eye; gill rakers on lower arch 12 to 16. Range: Kiska Island, Alaska, to Cerros Island, Lower California. Marine. Common.

Mottled Sand Dab.....130. *Citharichthys sordidus* (Girard)

1b. Dorsal rays 79 to 89; anal rays 59 to 70; vertebrae 34 to 37; no high bony ridge above the lower eye; interorbital space not concave and not wide; gill rakers on lower arch 8 to 9. Range: Prince William Sound, Alaska, to San Diego, California. Marine. Common.

Speckled Sand Dab.....131. *Citharichthys stigmaeus* Jordan and Gilbert

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[7]Some of the fin ray and vertebra counts have been taken from L. D. Townsend (1936) Report No. 11, International Fisheries Commission.

Family 44. Pleuronectidae.[7] Halibuts and Flounders

1a. Mouth large, symmetrical, dentition of jaws equal on eyed and blind side or nearly so; length of maxillaries on eyed side contained fewer than 3 times in the head. (*Hippoglossinae,* subfamily, halibut tribe.)

2a. Lateral line with either a distinct arch in front or an accessory dorsal branch or both. Fig. 14.

3a. Lateral line with a distinct arch in front, but without accessory dorsal branch; anterior dorsal rays not elongate or fringe-like; dorsal rays 91 to 107; anal rays 69 to 80; vertebrae 49 to 51. Range: Japan, to Alaska, to northern California. Marine. Abundant.

Pacific Halibut.....132. *Hippoglossus stenolepis* Schmidt

3b. Lateral line without distinct arch in front, but with accessory dorsal branch; eyes small; interorbital space very wide; 1st 10 dorsal rays elongated and fringe-like; dorsal rays 72 to 85; anal 53 to 62; vertebrae 37 to 39; scales about 112. Range: Alaska to Monterey. Marine. Common.

Sand Sole.....133. *Psettichthys melanostictus* Girard

2b. Lateral line without distinct arch in front or accessory dorsal branch.

4a. Mouth very large, the maxillary reaching to below the posterior margin of lower eye; teeth in jaws arrow-shaped in adults; dorsal rays 95 to 111; anal rays 81 to 99; scales about 135; vertebrae 47 to 49. Range: Bering Sea to San Francisco. Marine. Common.

Arrow-toothed Halibut.....
.....134. *Atheresthes stomias* (Jordan and Gilbert)

4b. Mouth moderately large, the maxillary reaching only to about the center of the orbit of the lower eye.

5a. Upper jaw with a single series of small sharp conical teeth; scales small, about 110 to 120 in the lateral line (88 to 92 pores); no scales directly on lateral line; dorsal rays 72 to 90 and anal 57 to 71; vertebrae 42 to 46; principle caudal rays 18. Range: Alaska to Puget Sound. Marine. Common.

Sole. Flathead.135. *Hippoglossoides elassodon* Jordan and Gilbert

5b. Upper jaw with a double row of conical teeth.

6a. Scales large, about 68 to 73 in the lateral line; scales located directly upon lateral line contain pores; dorsal rays 72 to 88; anal 57 to 64; vertebrae 42 to 45. Range: Alaska to San Diego, California. Marine. Common.

Rough Sole.....136. *Lyopsetta exilis* (Jordan and Gilbert)

6b. Scales small, about 88 to 100 along lateral line; no scales located directly upon the lateral line; dorsal rays 87 to 101; anal rays 67 to 79; vertebrae 41 to 44; principle caudal rays usually 19, seldom 18 or 20. Range: Puget Sound to San Diego Bay. Marine. Common.

Sole. English Sole.....137. *Eopsetta jordani* (Lockington)

1b. Mouth asymmetrical, dentition and cleft extending much further on blind side than on the eyed side; total length of maxillaries on eyed side usually contained more than 3 times in the head. (*Pleuronectinae,* subfamily; flounder tribe).

7a. An arched lateral line and accessory dorsal branch present; dorsal rays 67 to 82; anal 51 to 62; vertebrae 38 to 41. Range: Japan, Alaska to southern California. Marine. Abundant.

Rock Sole. Flounder.....138. *Lepidopsetta bilineata* (Ayres)

7b. Arch of lateral line absent, accessory dorsal branch present.

8a. First 5 to 10 dorsal rays on blind side; body covered with smooth scales, mostly cycloid; scales not imbricated, scarcely touching each other; interorbital space narrow and very high; anal rays 46 to 56; dorsal rays 66 to 77.

9a. Origin of dorsal fin on blind side on a level with the upper lip, the 1st 5 or 6 dorsal rays occur on the blind side; dorsal rays 65 to 78; anal 46 to 55; vertebrae 36 to 38. Range: Alaska to San Diego. Marine. Common.

Sole. "C-O" Sole...139. *Pleuronichthys coenosus* Girard

9b. Origin of dorsal on blind side on a level with the lower lip, the 1st 9 rays occur on the blind side; dorsal rays 68 to 79; anal 46 to 52; vertebrae 37 to 39. Range: Alaska to Santa Barbara Islands. Marine. Common southward.

Sole. Turbot.....
.....140. *Pleuronichthys decurrens* Jordan and Gilbert

8b. Origin of the dorsal fin either on the mid-line or slightly on the eyed or blind side, not more than 1 or 2 of the 1st few dorsal rays occur slightly on the blind side.

10a. Scales smooth, mostly cycloid, closely imbricated, about 94 to 104 along the lateral line; upper eye situated on dorsal outline; interorbital space narrow and low; dorsal rays 72 to 89; anal 54 to 70; vertebrae 42 to 44. Range: Alaska to San Diego. Marine. Common.

Sole. English Sole.....141. *Parophrys vetulus* Girard

10b. Scales rough ctenoid on one or both sides of the body.

11a. Dorsal rays 65 to 76; anal rays 50 to 61; scales 76 to 86. Range: Puget Sound. Marine. Rare.

Bastard Sole. Hybrid Sole.....
.....142. *Inopsetta ischyra*[8] (Jordan and Gilbert)

11b. Dorsal rays 84 to 90; anal rays 63 to 68; scales about 87 to 90. Range: Puget Sound to Point Conception. Marine. Common.

Rock Sole. Scaly-finned Flounder.....
.....143. *Isopsetta isolepis* (Lockington)

7c. Lateral line with neither an anterior arch over pectoral fin nor an accessory dorsal branch.

12a. Body covered with ordinary smooth fine scales, not stellate; body elongate; scales about 130 to 145.

13a. Pectoral fins very long, that of the eyed side longer than length of head; dorsal rays 87 to 110; anal rays 79 to 93; vertebrae 62 to 65; opercular opening extending much above pectoral

[8]Schultz, L. P., and Smith, R. T., have found this to be a hybrid between *Platichthys* and *Parophrys*.

fin base. Range: North Pacific south to San Pedro Bay. Marine. Common.

Rex Sole. Long-finned Sole.....
.....144. *Glyptocephalus zachirus* Lockington

13b. Pectoral fin much less than length of head; dorsal rays 94 to 116; anal 80 to 96; vertebrae 51 to 54; opercular opening barely extending above pectoral fin base; body less elongate. Range: Alaska to San Diego, California. Marine. Common.

Slippery Sole. Chinese Sole. Slime Sole.....
.....145. *Microstomus pacificus* (Lockington)

12b. Body with rough scattered stellate tubercles; bases of dorsal and anal on each side with a single row of stellate tubercles; no stellate scales on lateral line; vertical fins marked with wide black bars; dorsal rays 52 to 66; anal 38 to 47; vertebrae 34 to 37. Range: Alaska to Santa Barbara County, California. Marine. Common.

Starry Flounder.....
.....146. *Platichthys stellatus rugosus* Girard

Family 45. Melamphaidae. Deep Sea Fishes

1a. Dorsal III, 13; anal II, 9; scales 23. Range: Alaska to Oregon. Marine. Rare.
.....147. *Plectromus cristiceps* (Gilbert)

1b. Dorsal III, 15; anal I, 8; scales 26. Range: Bering Sea to Panama. Marine. Rare.
.....148. *Plectromus lugubris* (Gilbert)

Family 46. Gasterosteidae. Sticklebacks

1a. Dorsal fin with fewer than 12 separate spines.

2a. Dorsal fin with 2 to 4 spines.

3a. Body wholly covered with plates on sides. Range: Europe, Asia and North America. Marine, brackish and entering freshwater. Common.

Three-Spined Stickleback.....
.....149. *Gasterosteus aculeatus aculeatus* Linnaeus

3b. Body with no plates or only a few developed anteriorly. Range: Europe, Asia, and North America. Freshwater. Common.

Three-Spined Stickleback.....
.....150. *Gasterosteus aculeatus microcephalus* Girard

2b. Dorsal fin with 8 to 11 spines. Range; Europe and northern North America. Freshwater and brackish water. Common.

Northern Stickleback.....151. *Pungitius pungitius* Linnaeus

Family 47. Aulorhynchidae. Marine Sticklebacks

Range: Alaska to southern California. Marine. Abundant.

Tube-snout. Many-spined Stickleback.....
.....152. *Aulorhynchus flavidus* Gill

Family 48. Syngnathidae. Pipefishes

Range: Southeastern Alaska to Monterey Bay, Marine. Common.
Pipefish.....153. *Syngnathus griseo-lineatus* Ayres

Family 49. Atherinidae. Silversides

1a. Teeth bifid at tip, forked, on premaxillaries; about 63 scales in the lateral series. Range: Northern Oregon to southern California. Marine. Common.
Bay-smelt.....154. *Atherinops affinis oregonia* Jordan

1b. Teeth all normal, the tips not divided into horns; about 75 scales in a lateral series. Range: Northern Oregon to Lower California. Marine. Common.
Jack Smelt.....155. *Atherinopsis californiensis californiensis* Girard

Family 50. Sphyraenidae. Barracudas

Range: Puget Sound to Gulf of California. Marine. Common southward.
Barracuda.....156. *Sphyraena argentea* Girard

Family 51. Scombridae. Mackerels

Range: Prince William Sound, Alaska to Lower California. Marine. Common southward.
Pacific Mackerel.....157. *Pneumatophorus diego* (Ayres)

Family 52. Thunnidae. Tunny and Albacore

1a. Pectoral fin reaching to anal fin or beyond; pectoral fin longer than the head. Range: Puget Sound to Lower California. Marine. Common southward.
Albacore.....158. *Germo alalunga* (Gmelin)

1b. Pectoral fin not reaching to anal fin and shorter than the head.

2a. Color markings of longitudinal stripes on upper half of body; dorsal of about XVIII-I, 12 and 8 or 9 finlets; anal II, 11 and 6 finlets. Range: Puget Sound to Chile. Marine. Common southward.
Bonito. Skipjack.....159. *Sarda chilensis* (Cuvier and Valenciennes)

2b. Color of body without conspicuous stripes; dorsal XII to XV-I, 13 and 8 to 10 finlets; anal I, 12 and 8 finlets. Range: Oregon to Guadalupe Islands. Marine. Common southward.
Tuna. Bluefin Tuna.....160. *Thunnus thynnus* (Linnaeus)

Family 53. Trichiuridae. Hairtails. Cutlass Fishes

Range: North Atlantic and North Pacific Oceans. Marine. Not common.
Cutlassfish. Hairtail.....
.....161. *Benthodesmus atlanticus* Goode and Bean

Family 54. Bramidae. Pomfret

Range: Alaska to Santa Catalina Island. Marine. Not common.
Pomfret.....162. *Brama raii* (Bloch)

Family 55. Stromateidae

Range: Puget Sound to San Diego. Marine. Common southward.
California Pampano.....163. *Peprilus simillimus* (Ayres)

Family 56. Icosteidae. Ragfishes

Range: British Columbia to California. Marine. Rare.
Ragfish.....164. *Icosteus aenigmaticus* Lockington

Family 57. Acrotidae. Pelagic Fish

Range: Petersburg, Alaska to San Pedro, California. Marine. Not rare.
Ragfish.....165. *Acrotus willoughbyi* Bean

Family 58. Percidae. Perch

Range: Eastern United States, introduced into the western United States. Freshwater. Common.
Yellow Perch.....166. *Perca flavescens* (Mitchill)

Family 59. Centrarchidae. Bass and Sunfish

1a. Body not elongate but sunfish-shaped, depth about ½ to ⅔ the standard length; scales 35 to 55; pyloric caeca unbranched, 5 to 11; anal spines strong, the longest more than half as high as the soft fin.

2a. Anal III (rarely IV), 8 to 12; anal fin less than half as long as dorsal; dorsal IX to XII, 9 to 13; ctenii of scales well developed.

3a. Tongue, hyoid and pterygoids toothed; preorbital serrate; the upper jaw extending beyond middle of eye; supplementary maxillary well developed; lower pharyngeal narrow, with conic teeth; operculum scarcely produced, with stiff margin; caudal vertebrae 17; gill rakers well developed. Range: Introduced into western United States. Freshwater. Not common.
Warmouth Bass.167. *Chaenobryttus gulosus* (Cuvier and Valenciennes)

3b. Tongue, hyoid, and pterygoids toothless; preorbital strickly smooth; mouth smaller, the upper jaw not extending to middle of eye; supplementary maxillary reduced or absent.

4a. Upper jaw extending nearly to (rarely a little beyond) middle of eye; supplementary maxillary well developed; ctenii of scales obsolescent; anal spines low, little more than half as high as the soft fin; lower pharyngeals narrow, with conic teeth; operculum scarcely produced, with stiff margin; caudal vertebrae usually 17; gill rakers about ½ as long as eye; usually a blackish spot on posterior part of soft dorsal. Range: Introduced into western United States. Freshwater. Common.
Green Sunfish.....168. *Apomotis cyanellus* (Rafinesque)

4b. Upper jaw not nearly reaching to middle of eye; supplementary maxillary variously reduced or absent; ctenii of scales well developed; anal spines higher, more than ⅔ as high as the soft fin.

5a. Lower pharyngeals narrow, the width about ⅓ the length of the toothed portion, the outer margin straight or nearly so, the teeth long, slender and more or less conic; operculum more or less pro-

duced as a flap, the latter thin and flexible toward the margin; membranous border without a distinct red spot; pectoral fins pointed, about as long as head; caudal vertebrae usually 17, gill rakers about ⅓ as long as eye. Range: Introduced into western United States. Freshwater. Common.

Bluegill Sunfish.169. *Helioperca incisor* (Cuvier and Valenciennes)

5b. Lower pharyngeals broad, about ½ the length of the toothed portion, the outer margin strongly gibbous, the teeth short, broad molars; operculum scarcely produced, the margin stiff, contrasting sharply with the membraneous border, which always bears a conspicuous red spot; caudal vertebrae 18, gill rakers rudimentary. Range: Introduced into western United States. Freshwater. Common.

Pumpkinseed Sunfish.....170. *Eupomotis gibbosus* (Linnaeus)

2b. Anal V to VII, 16 to 19; anal fin about as long as dorsal; dorsal V to VIII (rarely IX), 13 to 16; tongue, hyoid, and pterygoids toothed; mouth large; supplementary maxillary well developed; preopercle strongly serrate on entire lower margin as well as around angle; gill rakers long and slender, more than 20.

6a. Dorsal VI (rarely V or VII); caudal vertebrae usually 18; origin of dorsal farther back so that a line perpendicular to upper jaw passes in front of 1st dorsal spine; dark markings arranged to form vertical bands. Range: Introduced into western United States. Freshwater. Common.

White Crappie.....171. *Pomoxis annularis* Rafinesque

6b. Dorsal spines VII or VIII (usually VII), rarely VI, IX, or X; caudal vertebrae usually 19; origin of dorsal farther back so that a line perpendicular to upper jaw passes behind the third dorsal spine; dark markings not forming bands. Range: Introduced into western United States. Freshwater. Common.

Black Crappie.....172. *Pomoxis sparoides* (Lacépède)

1b. Body elongate, bass-shaped, the depth about ⅓ the length; scales small, 60 to 85 along the lateral line; pyloric caeca 11 or more; anal spines III (rarely II or IV) and very small, the longest less than ½ the longest soft ray; opercle bilobed; supplementary maxillary well developed.

7a. Pyloric caeca typically unbranched; preopercle scaleless; fins better scaled; dorsal fin shallowly emarginate, the shortest spine more than ⅔ as long as longest, the top of the spinous portion being gently rounded; dorsal soft rays 14 (rarely 13 or 15); caudal vertebrae 17 (rarely 16); scales on cheek much reduced in size; mouth of moderate size (the upper jaw extending beyond middle of pupil but not to hind margin of eye); color pattern consisting chiefly of short vertical bars. Range: Introduced into western United States. Freshwater. Not common.

Small-mouth Black Bass..173. *Micropterus dolomieu* Lacépède

7b. Most of the pyloric caeca in any one fish always bifid; preopercle partially scaled; dorsal and anal scaled only at very base; dorsal soft rays 12 or 13; caudal vertebrae 17 or 18; scales on cheek only moderately reduced in size; mouth large (upper jaw extending beyond hind margin of eye in adult); color pattern consisting chiefly of a dark lateral streak. Range: Introduced into western United States. Freshwater. Common.

Large-mouth Black Bass.....
174. *Aplites salmoides* Rafinesque (=*Huro floridana* LeSueur)

Family 60. Moronidae. Sea Bass

Range: Introduced on Pacific Coast; northern Oregon to southern California. Marine and Freshwater. Common.

Striped Bass.....175. *Roccus saxatilis* (Walbaum)

Family 61. Otolithidae

Range: Coast of California, occasionally taken as a visitor as far north as southeastern Alaska. Marine. Rare northward.

White Sea Bass.....176. *Atractoscion nobilis* (Ayres)

Family 62. Trichodontidae

Range: Kamchatka to Oregon. Marine. Common northward.

Sand Fish.....177. *Trichodon trichodon* (Tilesius)

Family 63. Scorpaenidae.[9] Rockfish

1a. Dorsal spines XIV to XVII; top of head scaly; vertebrae 29; palatine teeth present; anal III, 5; pectorals with lower rays broadened or prolonged into linguiform lobe.

2a. Dorsal spines XV to XVII (usually XVI) gill rakers 18 to 22 on 1st gill arch; longest spines of dorsal, the 4th or 5th are contained 2.9 to 3.5 in head; light vertical lines or rows of spots across the dark pectoral blotch; branchiostegals naked. Range: Alaska to California. Marine. Not common.

Spiny-headed Rockfish. Lobe-finned Rockfish.....
.....178. *Sebastolobus alascanus* Bean

2b. Dorsal XIV to XVI (usually XV); gill rakers 21 to 24 on 1st gill arch; longest spine of dorsal, the 3rd, is contained 1.7 to 3.0 in head; no light vertical rows or lines of spots across the dark pectoral blotch; branchiostegals scaly. Range: Aleutian Islands to San Diego in deep water. Marine. Not common.

Spiny-headed Rockfish. Lobe-finned Rockfish.....
.....179. *Sebastolobus altivelis* Gilbert

1b. Dorsal spines XIII (very rarely XIV); vertebrae 27; palatine teeth present.

3a. Interorbital space more or less convex (never concave), broad, less than 3½ in base of skull; cranial ridges very low or obsolete, the spines when present, delicate; base of skull strongly curved, mesethmoid processes not elevated (not directed upward), ventral process of basisphenoid rudimentary (or fairly developed only in young); anal rays III, 6 to 9; gill rakers usually long and slender; snout, preorbitals and jaws more or less scaly.

4a. Cranial ridges (except parietal) all obsolete or very slightly developed, cranial spines absent or very inconstant and minute (regularly present only in young; preocular spines usually present in *mystinus*); lower jaw much projecting.

5a. Parietal bones not meeting; mesethmoid processes weak and depressed; scales small, in 90 to 100 transverse series above lateral line, 65 to 80 tubes; lower jaw much projecting, entering profile,

[9]Modified after Jordan and Evermann, Bull. 47, U.S.N.M. 1896-1900, and after Hubbs and Schultz, Univ. Wash. Pub. Biol. 1932.

a large symphyseal knob, directed forward; peritoneum white or with dark dots; depth about 3⅔ length; anal rays III, 9; color light olivaceous-red; young olivaceous, somewhat mottled. Range: Barclay Sound, B. C., to San Diego. Marine. Common southward. Bocaccio. Grouper.....180. *Sebastodes paucispinis* (Ayres)

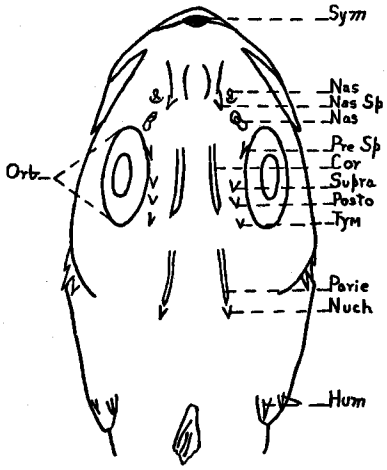

Fig. 41. A view of the dorsal side or top of the head of a rockfish, *Sebastodes*, showing the arrangement of the cranial spines and ridges. Cor—coronal spine; Nas—nasal opening; Nas Sp—nasal spine; Hum — humeral spines; Nuch — nuchal spine; Parie—parietal spine or ridge; Pre Sp—preocular spine; Post—postorbital spine; Supra—supraocular spine; Sym—symphyseal knob; Tym — tympanic spine. Drawn by Arthur D. Welander.

5b. Parietal bones usually meeting; mesethmoid processes better developed, straight, not elevated; smaller symphyseal knob. Fig. 41.

6a. Peritoneum white to dusky; dorsal fin deeply emarginate.

7a. Body usually more slender (depth in adult 2.9 to 3.5 in standard length); snout sharply pointed; symphyseal knob conspicuous; lower jaw strongly and sharply projecting; pectoral rays 17 or 18 (rarely 19 in *flavidus*); dark specks on body few and relatively inconspicuous, and not extended onto the dorsal fins; light blotches near base of dorsals well developed; caudal fin more or less yellow; anal fin truncated; unbranched pectoral rays less thickened than in *melanops;* no light band along mid-sides; size moderate, usually less than 15 inches long; adults living offshore; young not normally inhabiting the tide pools.

8a. Tips of nasal spines concealed (except rarely); occipital ridges very inconspicuous; spinous dorsal long and low (highest spine 2.8 to 3.0 in head); dorsal soft rays 15 or 16; anal 9, rarely 8; pectoral 17 or 18, usually 17; unbranched pectoral rays 8 or 9, usually 8; body usually more slender (depth 3.2 to 3.5), and anterior profile less steep; profile of snout more arched; upper profile of symphyseal knob forming an angle of about 45° with horizontal axis; eye smaller (in adults about one foot long 1.3 in snout, 1.2 in interorbital and 4.5 in head); color much darker, blackish olive on head and back; dark specks on body difficult to discern; light blotches along dorsal base usually more conspicuous; vertical fins not margined with blackish; caudal fin blackish olive-yellow. Range: California, from San Francisco to Mexican boundary. Marine. Common.

.....181. *Sebastodes serranoides* Eigenmann and Eigenmann

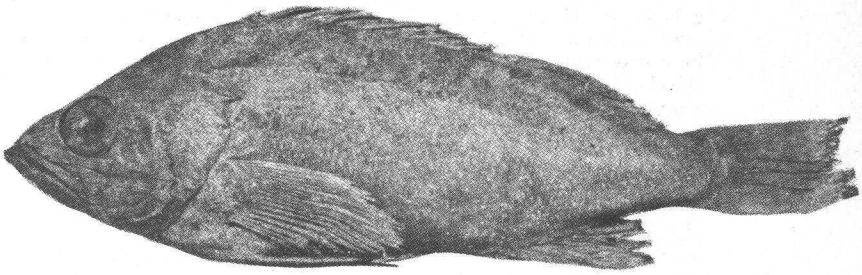

Fig. 42. Yellowtail Rockfish. *Sebastodes flavidus.* After Hubbs and Schultz. Courtesy of *University of Washington Publications.*

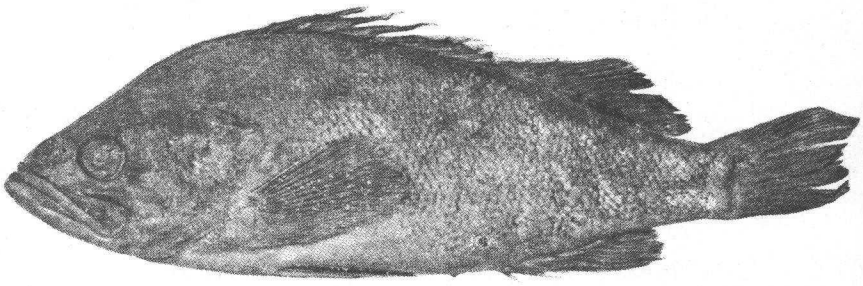

Fig. 43. *Sebastodes columbianus.* After Hubbs and Schultz. Courtesy of the *University of Washington Publications.*

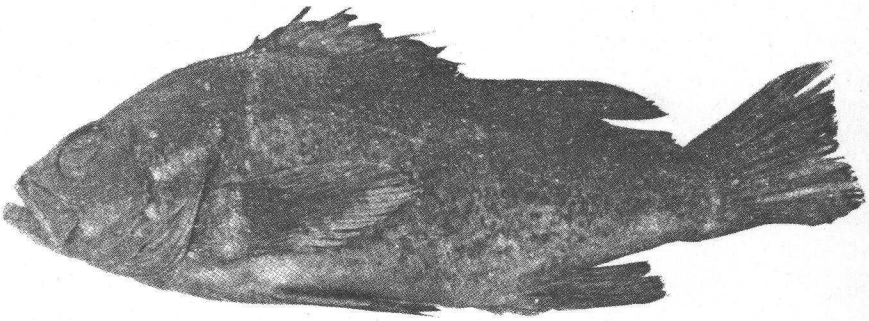

Fig. 44. Black Bass. *Sebastodes melanops.* After Hubbs and Schultz. Courtesy of *University of Washington Publications.*

8b. Tips of nasal spines exposed and sharp; occipital ridges moderately well developed; spinous dorsal higher (highest spine 2.4 to 2.7 in head); dorsal soft rays 14 or 15; anal 8 rarely 7; pectoral 17 to 19, usually 18; unbranched pectoral rays 7 to 10, usually 9; body usually less slender (depth 2.9 to 3.3 usually about 3.0); anterior profile steep; profile of snout less arched; upper profile of symphyseal knob forming an angle of much less than 45° with horizontal axis; eye larger (in adults about one foot long about equal to snout or interorbital, 4.0 in head); color much lighter, brownish on head and back; dark specks distinctly evident; light blotches along dorsal base usually less conspicuous; vertical soft fins usually margined with blackish; caudal fin bright yellow. Range: Washington to Lower California. Marine. Common.

Yellowtail Rockfish. Fig. 42..182. *Sebastodes flavidus* Ayres

7b. Body usually deeper (depth in adult, 2.6 to 2.9 in standard length); snout blunter; symphyseal knob less conspicuous; lower jaw less strongly and more bluntly projecting; pectoral rays 19, rarely 18 or 20; dark specks on body numerous and very conspicuous, and extended onto vertical fins; light blotches near base of dorsal inconspicuous; caudal fin dusky, not yellow; tips of nasal spines exposed; upper profile of symphyseal knob forming an angle of 45° or more with the horizontal axis.

9a. Body more ovate, the anterior profile steeper; eye (in largest available adults) smaller, 4.7 to 4.9 in head; interorbital space averaging narrower, 4.0 to 4.3 in head; dorsal spines higher (highest 2.3 to 2.6 in head); anal truncate behind; unbranched pectoral rays less thickened and leathery, and fewer, 8 to 10 (usually 9); soft rays of vertical fins averaging fewer (dorsal 14, sometimes 13; anal 7 or 8); color much paler; dark spots smaller; no light band along mid-sides; larger, commonly about 20 inches long; inhabiting sandy river mouth; young not occurring in tide pools of reefs. Range: Columbia River mouth. Marine. Not rare. Fig. 43.

.....183. *Sebastodes columbianus* Hubbs and Schultz

9b. Body more elliptical, the anterior profile less abrupt; eye (in largest available adults) larger, 4.1 to 4.2 in head; interorbital space averaging wider 3.8 to 4.2 in head; dorsal spines lower (highest 2.6 to 3.1 in head); anal rounded with 8, rarely 7 or 9 soft rays; unbranched pectoral rays thick and leathery, typically 10 (rarely 9 or 11); soft rays of vertical fins averaging more numerous, dorsal 13 to 16, most frequently 15; color very dark, almost black above; a rather prominent light band along mid-sides (just below lateral line anteriorly, along lateral line posteriorly); smaller adults usually less than 15 inches long, inhabiting rocky shores; the young developing in the tide pools. Range: Southern Alaska to Pt. Arguello, California. Marine. Common.

Black Bass. Fig. 44...184. *Sebastodes melanops* (Girard)

6b. Peritoneum dusky to black; colors dusky, fins blackish; dorsal fin not very deeply emarginate; anal rays III, 9 to 11, usually 10; gill rakers 9 or 10+24 to 26; besides the nasal spines, the preocular ridges are present, usually ending in spines; frontal region between them bulging. Range: Alaska to San Diego. Marine. Common.

Black Bass.....185. *Sebastodes mystinus* (Jordan and Gilbert)

6c. Peritoneum dusky to black, usually black; upper parts of body brownish black, profusely spotted with black on the posterior margin of the scales; inside of mouth and gill cavity light dusky; fins blackish; anal rays III, 8, sometimes III, 9; gill rakers 9 or 10+22 to 25, seldom 25; cranial spines, except nasal, absent. Range: Alaska to Neah Bay. Marine. Common.

Black Bass.....185a. *Sebastodes ciliatus* (Tilesius)

4b. Cranial ridges somewhat developed; preocular, postocular, tympanic, and parietal spines usually present, delicate (supraocular also present in some species); fig. 41; lower jaw projecting; parietal bones usually not meeting.

10a. Lower jaw much projecting; scales rather small; lateral line 50 to 75; anal rays III, 7 to 9; dorsal fin not deeply emarginate, soft dorsal low; 2nd anal spine notably longer than 3rd; peritoneum black or dusky.

11a. Supraocular spines usually present; body elongate, depth more than 3 in length; pores of lateral line 50 to 52; pectorals reaching vent; anal III, 8; body dusky above, with faint traces of darker blotches along back. Range: Bering Sea to Santa Barbara, California. Marine. Not common.

Long-jawed Rockfish.....
.....186. *Sebastodes alutus* (Gilbert)

11b. Supraocular spines absent, body rather elongate; anal III, 7; color chiefly red; lateral line with about 52 to 55 pores, vertical scale rows about 100 to 110. Range: Puget Sound to San Diego. Marine. Not rare.

Red-striped Rockfish.....
.....187. *Sebastodes proriger* (Jordan and Gilbert)

10b. Lower jaw little projecting; anal III, 6 or 7.

12a. Supraocular spine present; scales 45 to 55 in lateral line; anal 7; color red or orange.

13a. Scales on mandible smooth; color chiefly orange. Range: Hecate Str. to Lower California. Marine. Common.

Orange Rockfish. 188. *Sebastodes pinniger* (Gill)

13b. Scales on mandible very rough; color chiefly brick red, color above, deep vermilion, mottled with flesh color on sides, belly light red. Range: Oregon to San Diego. Marine. Common.

Vermilion Rockfish.....
..189. *Sebastodes miniatus* (Jordan and Gilbert)

12b. Supraocular spine absent; scales 41 to 45 in the lateral line; anal III, 7, the 2nd spine longer than 3rd. Range: Puget Sound. Marine. Common.

.....190. *Sebastodes emphacus* Starks

3b. Interorbital space flat or slightly concave, of medium width; mesethmoid processes but little or not at all elevated, ventral process of basisphenoid rudimentary; cranial ridges and spines moderately strong; lower jaw moderately or not much, sometimes not at all, projecting; gill rakers usually long and slender; anal III, 6 to 8; deep water species.

14a. Supraocular spine absent; base of skull strongly curved.

15a. Premaxillaries without prominent dentigerous knobs; lower jaw somewhat projecting; parietals not meeting.

16a. Gill rakers 10+22 to 23, the longest ⅗ orbit; dark bars on sides faint becoming obsolete with age; lower jaw much projecting; peritoneum black. Range: Southeastern Alaska and southern California. Marine.

Olive-backed Rockfish....191. *Sebastodes saxicola* (Gilbert)

16b. Gill rakers 10+21, slender, 2⅓ in orbit; no distinct dark cross bars; lower jaw scarcely projecting; peritoneum dark brown. Range: Coast of Oregon. Marine. Rare.

.....192. *Sebastodes crameri* Jordan

16c. Gill rakers 12 or 13+29 or 30, the longest ½ orbit; anal III, 6 or 7; peritoneum black. Range: Swiftsure Shoal, B. C., to Monterey, California. Marine. Not common.

.....193. *Sebastodes wilsoni* Gilbert

15b. Premaxillaries with prominent dentigerous knobs, between which the tip of the lower jaw fits; mandible not projecting; gill rakers very long and slender, ½ orbit, 9 to 11+22 to 25. Range: Nanaimo, B. C., to Coronado Islands. Marine. Not common.

Lobe-jawed Rockfish.....194. *Sebastodes diploproa* (Gilbert)

14b. Supraocular spine present, fig. 41, quite strong; coronal and nuchal spines usually present; 2nd anal spine equaling 3rd in length; anal III, 7; lining of mouth and gill cavity largely black. Range: Bering Sea to Santa Barbara, California. Marine.

Alaskan Red Rockfish.....195. *Sebastodes introniger* (Gilbert)

3c. Interorbital space as a rule concave and narrow; the cranial ridges and spines well developed; base of skull straight or nearly so; mesethmoid processes directed upward; ventral processes of basisphenoid well developed; gill rakers usually short.

17a. Supraocular spine present; interorbital space concave.

18a. Second anal spine scarcely longer than 3rd; color red, nearly plain; cranial ridges broken and armed with accessory spines, except in the young (the ridges begin to break up into separate spines at about 20 cm. standard length); interorbital space nearly flat in adult (ridges smooth, interorbital space concave in young, as in *Sebastodes rosaceus*); peritoneum white; the distal ⅓ to ½ of the ventral, anal, and caudal fins of the young are black in color, fading proximally; the pectorals and soft dorsal fins are generally blackish; the black color of the fins is still evident on 20 cm. specimens. Range: Southeastern Alaska to San Diego. Marine. Common.

Red Rockfish. Red Rockcod. Red Snapper.....
.....196. *Sebastodes ruberrimus* Cramer

18b. Second anal spine much longer, usually stronger than 3rd; cranial ridges smooth; fins of young without the dense black pigmentation.

19a. Color more or less rosy, with 3 to 5 round blotches of pink on sides of back; dorsal spines usually low, the highest less than ½ the length of head; no small green spots on sides of back; body without stellate spots; mandible naked; pale blotches on sides surrounded by purple shades; head with purplish above; supraorbital ridge rather high with spines; peritoneum blackish; nuchal spines absent. Range: Puget Sound to Cerros Island, Lower California. Marine. Common.

.....197. *Sebastodes rosaceus* (Girard)

19b. No round blotches of pink on sides of back, nuchal spines present; peritoneum black. Range: Southeastern Alaska and Cerros Island, Lower California. Marine.

.....198. *Sebastodes rupestris* (Gilbert)

17b. Supraocular spine wanting, fig. 41; interorbital space somewhat concave.

20a. Mandible scaly; peritoneum dusky to black.

21a. Lower jaw only slightly projecting; peritoneum jet black; roof of mouth, dusky posteriorly, buccal and branchial cavities otherwise white; dorsal XIII, 14 or 15; anal III, 7 or 8. Range: Puget Sound to Santa Barbara, California. Marine.

.....199. *Sebastodes zacentrus* (Gilbert)

21b. Lower jaw much projecting and entering profile; peritoneum dusky; roof of mouth, buccal and branchial cavities whitish; sides above with irregular horizontal interrupted olive-green bands; dorsal XIII, 12 or 13; anal III, 6 or 7. Range: Puget Sound to Lower California. Marine. Not common.

Green-striped Rockfish.....
.....200. *Sebastodes elongatus* (Ayres)

20b. Mandible naked; peritoneum pale or white; body usually deep.

22a. Scales on head mostly cycloid; lower jaw projecting; head large, pointed; 2nd anal spine 2½ in head, much stronger than 3rd; color pinkish white, banded with deep crimson. Range: British Columbia and southern California. Marine.

Spanish Flag.....
..201. *Sebastodes rubrivinctus* (Jordan and Gilbert)

22b. Scales on head ctenoid; lower jaw usually included; 2nd anal spine little enlarged.

23a. Nuchal spines absent; body not barred with black; interorbital space widening markedly from before backward.

24a. Coronal spines usually present, color brownish, mottled. Range: Puget Sound to San Martin, Lower California. Marine.

Brown Rockfish.....
.....202. *Sebastodes auriculatus* (Girard)

24b. Coronal spines none; ridges with entire edges.

25a. Gill rakers much higher than wide; dorsal spines high over ⅓ of length of head; interorbital somewhat convex posteriorly, so that the postocular spines do not enter the profile; profile but slightly indented behind nasal spines; mouth small, upper jaw usually not extending beyond vertical from hind border of orbit, and contained 5.3 to 5.7 times in standard length; ridges of head narrower; dorsal spines scarcely excised posteriorly; a pale area along posterior ⅔ of lateral line more or less distinctly evident. Range: Sitka, Alaska, to Yaquina Bay, Oregon. Marine. Common.

Yellow-backed Rockfish.....
.....203. *Sebastodes caurinus* (Richardson)

25b. Gill rakers and dorsal spines the same as in 25a; interorbital more or less concave, so that the postorbital spines may enter the profile (tips of spines sometimes not entering profile in *maliger*); profile deeply and widely indented behind nasal spines.

26a. Interorbital only moderately concave; the orbital rims not greatly thickened and elevated, not abruptly entering the profile; 4 posterior interspinal membranes of dorsal rather deeply incised to about ⅓ or ¼ height of spine; body deep and ovate; depth 2.3 to 2.7 in standard length; caudal peduncle decidedly more than half as deep as long; tips of caudal fin broadly rounded; interorbital with median pair of ridges inconspicuous; most conspicuous element of color pattern consisting of pale wedge (more or less disrupted) below first dorsal; anterior parts usually heavily spotted with orange, brown in preserved specimens; opercular blotch merely dusky; cheek stripes pale; no oblique bands on pectoral fin; no blackish spots on pectoral or caudal fin rays, these spots may occur on base of pectorals; no dark-bordered light streak along lateral line posteriorly; size large, to 20 inches. Range: Sitka, Alaska to Monterey, California, in moderate depths. Marine. Common.

Speckled or Brown Rockfish. Orange-spotted Rockfish.....
204. *Sebastodes maliger* (Jordan and Gilbert)

26b. Interorbital deeply concave; the orbital rims greatly thickened, and sharply elevated, abruptly entering profile; 4 posterior interspinal membranes of dorsal scarcely incised; body deep and ovate; depth 2.3 to 2.75 in standard length; size medium; rarely exceeding 12 inches.

27a. Spines of head less strong; parietal ridges less elevated; anal ravs 6; pale blotches on sides not forming a continuous lateral band; body and fins not speckled with pale; fin spines stronger; highest dorsal spines distinctly less than half as long as head; unbranched pectoral rays greatly thickened; dark markings black; light markings orange. Range: Central California. Said to range from Puget Sound to San Diego but we know of no northern record. Marine.

Black and Yellow Rockfish.....
205. *Sebastodes chrysomelas* (Jordan and Gilbert)

27b. Spines of head stronger; parietal ridges very high; anal rays 7; pale blotches on sides forming a very conspicuous and continuous streak along the lateral line; body and fins profusely speckled with pale; fin spines very strong; highest dorsal spine usually nearly half as long as head; unbranched pectoral rays excessively thickened; dark markings black; light markings yellow. Range: Vancouver Island to central California. Marine. Common.

Chinese Rockfish. Yellow-spotted Rockfish....206. *Sebastodes nebulosus* (Ayres)

23b. Nuchal spines present, sometimes coalescent with parietals; cranial ridges high, arranged nearly in a straight line on each side of the narrow top of head; the cranial ridges with the surface broken and spinous; frontal ridges elevated; color bright red, with black bands or cross bars overlaid by red, some red at least on head. Range: Alaska to Monterey, California. Marine. Common.

Black-banded Rockfish.....
.....207. *Sebastodes nigrocinctus* (Ayres)

Family 64. Anoplopomidae

Range: Alaska to southern California. Marine. Common.
Sablefish. Skil Fish. Coalfish. Black Cod.....
.....208. *Anoplopoma fimbria* (Pallas)

Family 65. Erilepidae

Range: Alaska to Monterey, California. Marine. Not common.
Giant Sea Bass. Priest-fish...209. *Erilepis zonifer* (Lockington)

Family 66. Hexagrammidae. Greenlings. Rock Trout

1a. Anal fin with 3 spines.

2a. Gill membranes very narrowly joined together, but free from isthmus; 2nd dorsal spine very high and long; a black streak before eye; dermal flaps on top of head small or absent; color of body not of vertical stripes. Range: North Pacific southward to San Diego, California. Marine. Common.

Long-spined Greenling. Broad-finned Greenling.....
.....210. *Zaniolepis latipinnis* Girard

2b. Gill membranes broadly united; 2nd dorsal spine not long; no black streak before the eye; 2 pair of dermal flaps on head; 6 vertical stripes on body. Range: Puget Sound to San Miguel Island, Lower California. Marine. Common.

Convict Fish. Painted Greenling.....211. *Oxylebius pictus* Gill

1b. Anal fin without spines; gill membranes broadly united; 4 or 5 lateral lines on each side.

3a. Dermal flaps 2, 1 above eye, the other small and located on each side of the nape. Range: Kodiak Island to Pt. Conception. Marine. Common.

Kelp Greenling.....212. *Chiropsis decagrammus* (Pallas)

3b. A single pair of dermal flaps above eye only.

4a. Fourth lateral line ends at about middle of anal fin base; supraocular flaps large; least depth of caudal peduncle equal to distance from tip of snout to about posterior edge of eye. Range: Bering Sea to Monterey Bay, California. Marine. Common. Fig. 45.

Red Greenling.....213. *Lebius superciliosus* (Pallas)

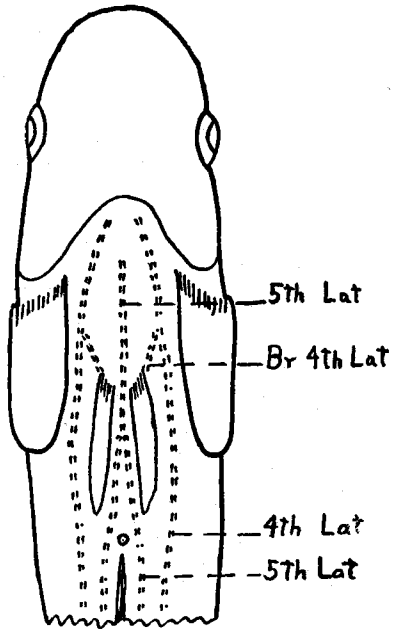

Fig. 45. A view of the ventral side of the head region of a greenling, *Hexagrammos*, showing the possible positions of the 4th and 5th lateral lines. Br 4th Lat—ventral fin branch of the 4th lateral line; 4th Lat—fourth lateral line; 5th Lat—fifth lateral line.

4b. Fourth lateral line ends near middle of length of ventral fin rays.

5a. Fourth lateral line unbranched; dermal flaps 2 times in diameter of eye. Range: Kamchatka to San Francisco. Marine. Common.
Greenling.....214. *Hexagrammos stelleri* Tilesius

5b. Fourth lateral line branched, lower branch running to base of ventral fin insertion, the other continuing to about under the middle of pelvic fin rays; a pigment spot above base of pectoral; dermal flaps less than 2 times in the eye. Range: Alaska, westward to Petropaulski and Robben Islands. Marine. Common.
Alaska Greenling.....215. *Hexagrammos octogrammus* (Pallas)

Family 67. Ophiodontidae. Ling Cod

Range: Alaska to San Diego, California. Marine. Abundant.
Ling Cod. Cultus Cod.....216. *Ophiodon elongatus* Girard

Family 68. Cottidae. Sculpins. Bullheads

1a. Spinous dorsal not evident, its spines slender and hidden in loose skin or indistinguishable from soft rays; head and body hidden in smooth lax skin; gill membranes broadly joined to the isthmus; no teeth on vomer or palatines; ventrals I, 3 the base adnate to body.

2a. Spinous dorsal of short, slender flexible spines entirely embedded in the skin and not visible without dissection. Range: Kodiak Island to Puget Sound. Marine. Common.
Tadpole Sculpin.....217. *Psychrolutes paradoxus* Günther

2b. Anterior spinous dorsal rays not bound down by the skin of body, the 1st apparent ray nearly over gill opening. Range: Puget Sound. Marine. Common.
.....218. *Gilbertidia sigalutes* (Jordan and Starks)

1b. Spinous dorsal evident and not concealed in the flesh or hidden by loose skin; spines, bones, or tubercles of head not all hidden in lax skin.

3a. Pelvic fins entirely absent; skin perfectly smooth; no slit behind the 4th gill; gill membranes free from isthmus; teeth on vomer and palatines. Range: Sitka, Alaska to Fort Bragg, California. Marine. Common.
.....219. *Ascelichthys rhodorus* Jordan and Gilbert

3b. Pelvic fins present and well developed.

4a. Pectoral fins continuous around the throat and joined together; back with spinous scales; gill membranes free from isthmus; no slit behind last gill; teeth on vomer and palatines; preopercle with a short bifid spine; ventrals inserted far back. Range: Vancouver Island and Puget Sound. Marine. Rare.
Manacled Sculpin.....220. *Synchirus gilli* Bean

4b. Pectoral fins not continuous around the throat and not joined to each other.

5a. Pelvic fin rays I, 5; vomer and palatines with teeth; gill membranes broadly united but free from the isthmus.

6a. Body more or less scaly above, or with rough plates or prickles.

7a. Dorsal fin very long, with about 17 spines; no slit behind last gill arch; back with rough scales; sides with oblique, serrated folds; ventral fins well behind pectorals. Range: Puget Sound to central California. Marine. Not rare.
.....221. *Jordania zonope* Starks

7b. Dorsal fin of XII or XIII spines; body very long, sides of back with rough plates.

8a. Chin with 2 barbels; last gill arch without slit behind it. Range: Off Oregon to Cortez Banks. Marine. Rare.
.....222. *Paricelinus hopliticus* Eigenmann and Eigenmann

8b. Chin without barbels; last gill arch with slit behind it. Range: Northern California. Marine. Rare.
.....223. *Alcidea thoburni* (Gilbert)

6b. Body covered with smooth skin, a slit behind 4th gill; dorsal spines XI; body very robust. Range: Washington to San Diego. Marine. Common.
Blue Cod. Marbled Sculpin. Bull Cod.....
.....224. *Scorpaenichthys marmoratus* (Ayres)

5b. Ventral rays not I, 5, usually I, 2, I, 3, or I, 4; spinous dorsal with fewer than XIII spines and always shorter than soft dorsal.

9a. Body definitely more or less scaly above, the scales sometimes arranged in bands, or sometimes modified as bony plates, these usually placed along the lateral line or at base of dorsal fin; in no case is the skin entirely naked.

10a. Sides of body below lateral line with oblique serrated folds of skin; vomer with teeth; palatines without teeth; last gill arch with a distinct slit or pore behind it; preopercular spines small, simple or bifid; gill membranes wholly free from isthmus; spinous dorsal not emarginate; body slender.

11a. A series of bony tubercles along back a short distance away from base of dorsal fin; breast naked with cross folds of skin, containing mucous tubes; lower pectoral rays little extending beyond membranes; dorsal rays about X or XI, 23 to 26; anal 24 to 26. Range: Alaska to Puget Sound. Marine. Common.
.....225. *Triglops beani* Gilbert

11b. Back without bony tubercles along or near base of dorsal fin; breast not as above; lower rays of pectoral much produced beyond membranes; dorsal rays about XI, 29; anal about 29. Range: British Columbia and Puget Sound. Marine. Not common.
.....226. *Prionistius macellus* Bean

10b. Sides of body below lateral line without oblique serrated folds of skin.

12a. Vomer with teeth; palatines without teeth; if rows or bands of scales occur along the back they do not meet each other in front of the spinous dorsal fin.

13a. Preopercular spine simple, very long and strong, longer than eye; body robust, its greatest depth less than 4 times in standard length; gill membranes broadly united to isthmus; dorsal rays VIII, 9; anal rays 9. Range: Alaska to Pt. Conception, California. Marine. Abundant.

Buffalo Sculpin.....227. *Aspicottus bison* Girard

13b. Preopercular spine bifid (sometimes simple) shorter than eye; body long and slender, its greatest depth about 8 to 9 in the standard length; dorsal VIII to X, 21 or 22; anal 23 or 24.

14a. Eye small 3⅔ in head; interorbital space scaly. Range: Puget Sound to Santa Catalina Island. Marine. Rare.
.....228. *Radulinus boleoides* Gilbert

14b. Eye larger 2.6 to 3.3 in head; interorbital space naked. Range: Puget Sound to Farallon Islands, California. Marine. Common.
.....229. *Radulinus asprellus* Gilbert

12b. Vomer with teeth; palatines with teeth.

15a. Body with 2 separate bands of coarse rough scales, the dorsal band meeting its fellow in front of spinous dorsal; last gill arch with distinct slit or pore behind it; lateral line without bony plates; spinous dorsal notched; preopercular spine shorter than eye.

16a. Gill membranes not wholly free from isthmus, there being only a broad fold across it, which is not attached; upper band of scales in about 4 rows; skin in interspace firm and thick. Range: Kamchatka to Monterey Bay, California. Marine. Common.

Red Irish Lord.....
.....230. *Hemilepidotus hemilepidotus* (Tilesius)

16b. Gill membranes wholly united to isthmus, not forming a free fold across it (sometimes the skin is shriveled and forced forward artificially making it appear like a fold on poorly preserved fish); upper band of scales in about 7 rows at its widest part; skin in interspace thin and lax. Range: Cape Johnson, Washington to Santa Barbara Islands, California. Marine. Common.

Yellow Irish Lord.....
.....231. *Calycilepidotus spinosus* Ayres

15b. If 2 or fewer rows or bands of scales occur on the body, the dorsal band does not meet its fellow in front of the spinous dorsal fin; last gill arch without slit or pore behind it (a minute pore may occur in *Astrolytes*); gill membranes united but free from the isthmus.

17a. Preopecular spine with 1 to 5 enlarged hooks or antler-like processes above, besides the 2 on the tip.

18a. Back above lateral line evenly scaly; spinous dorsal emarginate, III-VII, 15; anal 14; pelvic fin rays I, 3. Range: Puget Sound to San Diego, California. Marine. Common.

Rough-backed Sculpin.....
.....232. *Chitonotus pugetensis* (Steindachner)

18b. Back above lateral line with a series of enlarged plates or scales, the space above and below this naked.

19a. Lateral line armed with a series of bony plates which catch on the finger when the latter is run forward; preopercular spines more than 3 (1 at the angle is long with from 2 to 4 strong spines or barbs directed upward and 2 or 3 spines on the lower margin of the preopercle which are directed downward).

20a. Dorsal fin with 1 or more of the anterior spines elevated and filamentous; scattered plates behind axil of pectoral fin; pelvic fin rays I, 2.

21a. First 2 dorsal spines filamentous, about equally produced; dorsal series of plates much longer than head, reaching end of soft dorsal; nasal filament present; dorsal rays X, 16 to 17; anal 14 or 15. Range: Alaska to Santa Barbara Islands. Marine. Not rare.

Long-rayed Sculpin.....
..233. *Tarandichthys filamentosus* (Gilbert)

21b. First dorsal spine filamentous, the 2nd little if at all produced; dorsal series of plates usually shorter than head, not reaching middle of soft dorsal; no nasal filament; dorsal rays X, 17 to 19; anal 15 to 17. Range: Alaska to southern California. Marine. Not rare.

.....234. *Tarandichthys tenuis* (Gilbert)

20b. Dorsal fin without filamentous spines; no plates behind axil of pectoral; preopercular spine with 3 or 4 antler-like processes; pelvic fin rays I, 2.

22a. Dorsal series of scales continuous and joined together behind soft dorsal fin; the lower edge of preopercle with 2 small spines; the lower one longest and sharpest pointing downward and curved forward above a smaller spine directed downward; rarely an obsolete spine above these 2 strong ones; nasal spines well developed and nasal tentacles present, slender. Range: Alaska to Puget Sound. Marine. Common.

.....235. *Icelinus borealis* Gilbert
(=*I. strabo* Starks)

22b. Dorsal series of scales ending 1 to 3 rays before end of soft dorsal and never meeting its fellow behind; the lower edge of the preopercle with 3 well developed spines; the lower strong one directed downward and curved forward; the middle one pointing backward and downward; the upper one directed backward; nasal spines short and obscure; nasal tentacles obsolete. Range: Alaska to Santa Barbara Islands. Marine. Rare.

.....236. *Icelinus burchami* Evermann and Goldsborough

19b. Lateral line with scales unarmed; body robust; no filamentous spines; top of head scaly; preopercular spines 3 or fewer (that is, 1 small one in addition to the bifid tip); outer margin of preopercle with 1 blunt spine or only small prominences covered by skin.

23a. Dorsal band of scales meeting its fellow beyond the dorsal fin; 31 to 35 oblique rows in the longitudinal series along base of fin; a small pore behind 4th gill arch; pectoral rays 15 or 16. Range: Unalaska to San Francisco Bay. Marine. Common northward.

237. *Astrolytes fenestralis* (Jordan and Gilbert)

23b. Dorsal band of scales not meeting its fellow posteriorly, not extending beyond dorsal fin; no pore behind the 4th gill; pectoral rays 16. Range: Str. of Juan de Fuca southward to southern California. Marine. Rare northward.

.....238. *Parastrolytes notospilotus* (Girard)

17b. Preopercular spine bifid or simple, without the extra hooks or antler-like processes above the bifid or simple spine at tip of preopercle.

24a. Back with a distinct band of scales on each side above the lateral line; the interorbital space flat or concave.

25a. Top of head depressed; lateral profile somewhat pointed anteriorly; scales in 26 to 29 oblique series along base of dorsal but not meeting behind dorsal fin. Range: British Columbia to Pt. Conception, California. Marine. Common.

.....239. *Artedius lateralis* (Girard)

25b. Top of head not depressed; lateral profile bluntish; scales in 31 to 60 oblique series at base of dorsal.

26a. Scales in 31 to 35 oblique rows in the longitudinal series of scales along the base of dorsal fin; ventral side of chin unmarked. Range: Unalaska to San Francisco Bay. Marine. Common southward.

237. *Astrolytes fenestralis* (Jordan and Gilbert)

26b. Scales in 40 to 60 oblique rows in the longitudinal series of scales along the base of dorsal fin.

27a. Preorbital cirrus (on front of rim of eye) a large plumose tentacle about twice length of eye; postorbital cirrus about 5/6 eye; dorsal IX, 16; anal 13; pectoral 14. Range: Vancouver Island. Marine. Rare.

240. *Pterygiocottus macouni* Bean and Weed

27b. Preorbital cirrus less than diameter of the eye; postorbital cirrus very small; under side of chin marked with cross bars; dorsal IX to X, 17 to 18; anal 13. Range: Vancouver Island to Monterey Bay, California. Marine. Common.

.....241. *Axyrias harringtoni* Starks

24b. Back covered with rough scales above lateral line; spinous dorsal without a notch; head very rough; preopercular spine more or less evidently bifurcate; a small cirrus above eye; dorsal X, 14; anal 12. Range: Puget Sound. Marine. Common.

.....242. *Ruscarius meanyi* Jordan and Starks

9b. Body not definitely scaly above and no bony armature to the lateral line; the skin smooth, prickly, villous, or with scattered scaly processes.

28a. First dorsal not elevated in front, all the spines of about the same length as those following; the skin smooth or velvety, sometimes warty but not covered generally above and below lateral line with stiff prickles.

29a. Gill membranes united to the isthmus and not forming a free fold across it.

30a. Head weakly armed, the preopercular spine simple at the angle or absent.

31a. Palatine teeth absent, or weakly developed in males.

32a. Preopercular spines absent, the preopercle entire, without spines.

33a. Soft dorsal with 17 rays, anal 12. Range: Wood River, Shoshone, Idaho. Freshwater. Not common.

.....243. *Cottus leiopomus* Gilbert and Evermann

33b. Soft dorsal with 21 to 23 rays; anal 16 to 18. Range: Upper Klamath Lake, Oregon. Freshwater. Not common.

.....244. *Cottus princeps* Gilbert

32b. Preopercular spines present.

34a. One spine at angle of preopercle, none below this one or at most only an elevation where spine usually occurs.

35a. Anal rays 18; soft dorsal 21. Range: Lost River, tributary to Klamath Lake, Oregon. Freshwater. Not common.

.....245. *Cottus evermanni* Gilbert

35b. Anal rays 10 to 15, soft dorsal 15 to 20 (usually 15 to 19); depth in the length 3.5 to 5.5.

36a. Posterior nostril not at all tubular; anal rays 11 to 14 (usually 12 or 13); body smooth; caudal vertebrae 20 to 23. Range: East of Cascade Mountains in the Columbia River drainage and south to Lake Lahonton. Freshwater. Common.

Smooth Bullhead.....246. *Cottus beldingii* Eigenmann and Eigenmann

36b. Posterior nostril tubular.

37a. Caudal vertebrae 20 to 23 (usually 21 or 22).

38a. Anal rays 11 or 12 (seldom 13); soft dorsal rays 16 or 17. Range: Tributary of Clearwater River near Bovill, Idaho. Freshwater. Not common.

..247. *Cottus tubulatus* Hubbs and Schultz

38b. Anal rays 13 to 16 (usually 15); soft dorsal rays 17 to 20 (usually 19). Range: Klamath River system, Oregon. Freshwater. Not common.

.....248. *Cottus klamathensis* Gilbert

37b. Caudal vertebrae 25 or 26; anal rays 12 to 16 (usually about 14); dorsal rays usually about 18 or 19. Range: Coastal streams from Unalaska to Monterey, California. Freshwater. Common.

.....249. *Cottus aleuticus* Gilbert

34b. Preopercular spine single at angle, and 1 or 2 below; posterior nostril not tubular.

39a. Depth in length 7 times; pelvics I, 3. Range: Upper Klamath Lake, Oregon. Freshwater. Not common.

.....250. *Cottus tenuis* (Evermann and Meek)

39b. Depth in length 4 to 5.5; caudal vertebrae 21 to 23 (usually 22 or 23).

40a. Pelvics I, 4; anal rays 14 to 17 (usually 15 or 16); soft dorsal rays 17 to 20 (usually 18 or 19). Range: Alaska to California. Freshwater. Common.

Bullhead.....251. *Cottus gulosus* (Girard)

40b. Pelvics I, 3; anal rays 14 to 16 (usually 15); soft dorsal rays 17 to 19, (usually 18). Range: Mill Creek and Walla Walla River, Washington. Freshwater. Common locally.

.....252. *Cottus marginatus* (Bean)

31b. Palatine teeth present and strong.

41a. Soft dorsal rays 20 to 23 (seldom 19); caudal vertebrae 25 to 29 (usually 25 or 26); preopercular spine at angle less than ½ diameter of eye; lateral line complete; caudal peduncle of the round constricted type, little if any compressed; anal rays 16 to 19; body and head usually with prickles. Range: Coastal streams from Alaska to Ventura County, California. Freshwater and in brackish water. Abundant.

Prickly Bullhead.....253. *Cottus asper* Richardson

41b. Soft dorsal rays 14 to 20; caudal vertebrae 20 to 23.

42a. Preopercular spine at angle long and slender, its length contained from ½ to ⅔ in the diameter of the eye; lateral line complete; pelvic fin rays commonly I, 3 and I, 4; anal rays 11 to 14 (usually 12); body and head usually with prickles; dorsal rays VII to VIII, 15 to 17 (usually 16); anus behind middle of body; caudal peduncle only moderately compressed; width of mouth about ½ length of head, rather large as in *rhotheus*. Range: Rattlesnake Creek near Camp Harney, Oregon. Freshwater. Common.

.....254. *Cottus bendirei* (Bean)

42b. Preopercular spine at angle shorter and heavier, and less than ½ diameter of the eye; pelvic fin rays I, 4, rarely I, 3.

43a. Lateral line complete, occasionally 2 or 3 pores absent on caudal peduncle; no definite black spot in the spinous dorsal; mouth large; anal rays 12 to 14; caudal peduncle round and slender; posterior nostril slightly elevated and slightly tubular. Range: Puget Sound drainage, Columbia River, and Kootenay River, British Columbia. Freshwater. Common.

Bullhead....255. *Cottus rhotheus* (Rosa Smith)

43b. Lateral line incomplete, ending under soft dorsal; anal rays 11 to 13 (usually 12); usually a black spot in the spinous dorsal; caudal peduncle of the moderately compressed type and about equal to the diameter of eye; dorsal VII to VIII, 16 to 18. Range: Headwaters of the Columbia and Missouri Rivers and the Green River of the Colorado system. Freshwater. Common.

Rocky Mountain Bullhead.....256. *Cottus punctulatus* (Gill) [=*C. semiscaber* (Cope)]

30b. Head strongly armed, the preopercular spine not simple, but with 2 spines or more, or else the skin is loose and lax and nearly obscures the spinous dorsal except the tips of the spines.

44a. Vomer and palatine with teeth; preopercular spines antler-like; head depressed; skin smooth and firm. Range: Kodiak Island to San Diego, California. Marine. Abundant.

Bullhead.....257. *Leptocottus armatus armatus* Girard

44b. Vomer and palatine without teeth; preopercular spines not antler-like, but short, there being 2 diverging spines at angle of preopercular bone; skin loose and lax; head of normal shape. Range: Puget Sound. Marine. Not rare.

.....258. *Malacocottus kincaidi* Gilbert and Thompson

29b. Gill membranes free from the isthmus or else forming a broad fold across it.

45a. Palatine without teeth; vomer with teeth.

46a. Maxillary reaches to under pupil but not to the posterior margin of the eye; skeleton spongy; lower jaw equal to upper or a little projecting; preopercular spines 3 or 4, the one at the angle sharp and curved upward.

47a. Dorsal IX, 15; anal 13; pelvics I, 3; head with bony tubercles; body with bony tubercles along base of dorsal. Range: Bering Sea to Puget Sound. Marine. Not rare.

Woolly Sculpin.....259. *Dasycottus setiger* Bean

47b. Dorsal VI or VII, 13; anal 8 to 11; pelvics I, 2; pectoral 20; body and head smooth, no granulations, tubercles, or filaments present. Range: Bering Sea, Alaska and in great depths off California. Marine. Rare.

.....260. *Zesticelus profundorum* (Gilbert)

46b. Maxillary reaches beyond eye; skeleton hard and firm; lower jaw equal to or a little shorter than upper, included; preopercular spines straighter, the one at the angle without a distinct upward curve. Range: Bering Sea to Puget Sound. Marine. Common.

Great Sculpin. Fig. 12.....

.....261. *Myoxocephalus polyacanthocephalus* (Pallas)

45b. Palatine teeth present; vomer with teeth.

48a. Anus immediately in advance of the anal fin (in very young *Blennicottus globiceps* the anus is located about ⅓ of the distance in front of the anal fin between the origin of the anal and the insertion of the pelvic fin); penis very slender and flexible; the first 1 to 3 anal rays enlarged in the male.

49a. Preopercular spine unbranched.

50a. Body covered with prickly scales at all ages; head pointed anteriorly; cirri of head single or rarely doubled; no cirri on body above lateral line; dorsal spines IX; first 2 anal rays of male enlarged, sub-

equal, not separated from the other rays. Range: British Columbia to Monterey County, California. Marine. Not rare.

.....262. *Rusciculus rimensis* Greeley

50b. Body naked; head very blunt anteriorly; (young of this species). Range: Kodiak Island to Pt. Conception, California. Marine. Common.

Round-headed Sculpin.....
.....263. *Blennicottus globiceps* (Girard)

49b. Preopercular spine branched; body scaleless at all ages; dorsal spines usually VIII, cirri of head multifid.

51a. First 3 or 4 anal rays of male enlarged, subequal, grading into and not separated from the normal rays; body without developed cirri above lateral line; snout slightly blunter; nasal spines somewhat weaker; preopercular spine bifid or rarely trifid; soft dorsal rays 16 or 17. Range: Okhotsk Sea and southern Alaska to near Tunitas, San Mateo County, California. Marine. Common.

Tide Pool Johnny.....
.....264. *Oligocottus maculosus* Girard

51b. First anal ray of male much larger than the 2nd, the 2nd ray not at all enlarged but normal, wholly separated from rest of fin in adult; membrane between the 1st 2 rays thin and little folded; soft dorsal usually 17 to 19; preopercular spine normally bifid (rarely trifid); light spots on throat conspicuous. Range: Queen Charlotte Islands, British Columbia, to Pt. Loma, San Diego County, California. Marine. Common.

Cirrated Sculpin.....
.....265. *Dialarchus snyderi* Greeley

48b. Anus in advance of normal position before anal fin, located in middle ⅓ of distance between orgin of anal and insertion of pelvic fin; penis thick and more rigid, conic or cylindric; lateral line with a slight anterior curve.

52a. Intestine short and little coiled; teeth of jaws conic, without definite arrangement; head rather sharply pointed anteriorly; mouth terminal with wide lateral gape; skin not especially thickened.

53a. Penis conic, without terminal appendages; anus of female about midway between origin of anal and insertion of pelvic fin; dorsal spines usually IX; body scaleless; preopercular spines small and simple; banner-like flaps never developed on dorsal spines; cirri mossy, on body reduced to a series along the anterior portion of the lateral line; not developed along preopercular margin. Range: Aleutian Islands to Pt. Lobos, California. Marine. Not common.

....266. *Allocottus embryum* (Jordan and Starks)

53b. Penis cylindric, bearing at its end a pair of short lateral horns anteriorly and a median horn between them; anus of female much nearer pelvic insertion than anal origin; dorsal spines usually VIII, preopercular spine simple; banner-like flaps usually developed on dorsal spines; cirri on lateral line not mossy. Range: Aleutian Islands south to Sausalito, Marine County, California. Marine. Common.

.....267. *Oxycottus acuticeps* (Gilbert)

52b. Intestine elongate and considerably coiled; teeth of jaws triangular, more or less definitely arranged in straight rows; head very blunt and broadly rounded, suborbital decidedly narrower than orbit; mouth inferior, with restricted lateral gape; skin leathery; penis cylindric abruptly constricted into a slender median appendage at tip; anus in adult nearer anal origin than pelvic insertion; dorsal spines IX; nasal spines moderately strong; preopercular spine unbranched, well developed and curved upward; cirri of head and scapular region dense and mossy. Range: Kodiak Island to Pt. Conception, California. Marine. Common.

Round-headed Sculpin.....
.....263. *Blennicottus globiceps* (Girard)

28b. First dorsal with the 1st 2 or 3 spines elevated, at least or more than twice the length of the longest of the last 3 dorsal spines; skin rough with small bluntish prickles almost everywhere except in small but well defined areas.

54a. Gill membranes free from isthmus; pelvics small; spinous dorsal deeply notched. Range: Alaska to San Francisco. Marine. Common.

Silver Spot.....268. *Blepsias cirrhosus* (Pallas)

54b. Gill membranes united to the isthmus; pelvics long; spinous dorsal not notched. Range: Alaska to Monterey, California. Marine. Common.

Sailor Fish.....269. *Nautichthys oculofasciatus* (Girard)

Family 69. Rhamphocottidae

Range: Sitka, Alaska, Puget Sound to Monterey, California. Marine. Common in Puget Sound.

Northern Sea Horse. Gruntfish.....
.....270. *Rhamphocottus richardsonii* Günther

Family 70. Agonidae. Sea Poachers. Alligator Fishes

1a. Dorsal fins 2.

2a. Gill membranes free from the isthmus.

3a. Body short and high, compressed; vomer and palatines without teeth; dorsal fin long and high. Range: Bering Sea to Puget Sound. Marine. Common.

Four-horned Sea Poacher.....
.....271. *Hypsagonus quadricornis* (Cuvier and Valenciennes)

3b. Body elongate, more or less depressed.

4a. Snout produced into a tube; single long barbel on tip of lower jaw; plates of body slightly keeled, without spines; dorsal VI to IX (VII or VIII), 6 to 9 (average 7 or 8); anal 10 to 14 (average 11 or 12); pectoral 10 to 13 (average 11 or 12); plates in front of pelvics 2 or 3 (usually 2). Range: Aleutian Islands, Puget Sound to coast of Oregon. Marine. Common.
.....272. *Pallasina barbata aix* Starks

4b. Snout not produced into a tube.

5a. Teeth on vomer and palatines; plates on breast large. Range: Cold Bay, Alaska, to Oregon. Marine. Not common.
.....273. *Occa verrucosa* (Lockington)

5b. No teeth on vomer and palatines; no median rostral plate; breast prickly. Range: Coast of California and Oregon. Marine. Not common.
.....274. *Stellerina xyosterna* (Jordan and Gilbert)

2b. Gill membranes joined to isthmus, often with a free fold across isthmus.

6a. Tip of snout without median plates or spine, but with paired plates or spines.

7a. Vomer and palatines without teeth; mouth located on ventral side; gill membranes without barbels. Range: Alaska to Puget Sound. Marine. Common.
Sturgeon Sea Poacher. Alligatorfish.....
.....275. *Podothecus acipenserinus* (Tilesius)

7b. Vomer and palatines with teeth; eye with 4 or 5 (usually 4) spines anteriorly and 1 triangular shaped spine posteriorly; branchiostegal rays with cirri or small dermal tentacles; the tentacles on branchiostegals not present in young which have a large knife-like spine over middle of eye (named by Jordan and Starks *Xystes axinophrys*). Range: Alaska, Puget Sound to Monterey, California. Marine. Common. Fig. 48.
Window-tail Sea Poacher.....
.....276. *Averruncus emmelane* Jordan and Starks

6b. Tip of snout with median plate, and with paired spines or plates besides the median plate; teeth on jaw, vomer and palatines.

8a. Tip of snout with median plate without a spine; occipital pit deep, nearly ½ as deep as head. Range: Vancouver Island, Puget Sound and coast of Washington. Marine. Rare.
.....277. *Bothragonus swanii* (Steindachner)

8b. Tip of snout with terminal rostral plate bearing one or more spines directed upward; occipital pit if present not ½ depth of head.

9a. A single upright spine on terminal rostral plate, besides the lateral ones.

10a. Occiput with pit with longitudinal division; dorsal ridges not converging in front of dorsal fin; no spines below eyeball; 4 or 5 plates on branchiostegal membranes under the chin; pectoral fin rays not exserted. Range: Alaska to Pt. Loma, California. Marine. Common. Fig. 46.
.....278. *Odontopyxis trispinosus* Lockington

10b. No occipital pit as above.

11a. Cheek below suborbital crest naked, without plates; only 1 spine developed on preopercular margin; gill membrane with a wide free fold; 3 to 5 spines on eyeball; spinous dorsal with distal margin of membrane black. Range: Washington to San Diego, California. Marine. Common.

.....279. *Xenopyxis latifrons* (Gilbert)

11b. Cheek below suborbital crest with 3 plates; 2 preopercular spines developed; gill membranes without free fold; no spines on eyeball. Range: Washington to off San Diego. Marine. Common.

.....280. *Xeneretmus triacanthus* (Gilbert)

9b. Upright spines on rostral plate 3, besides the 2 lateral ones.

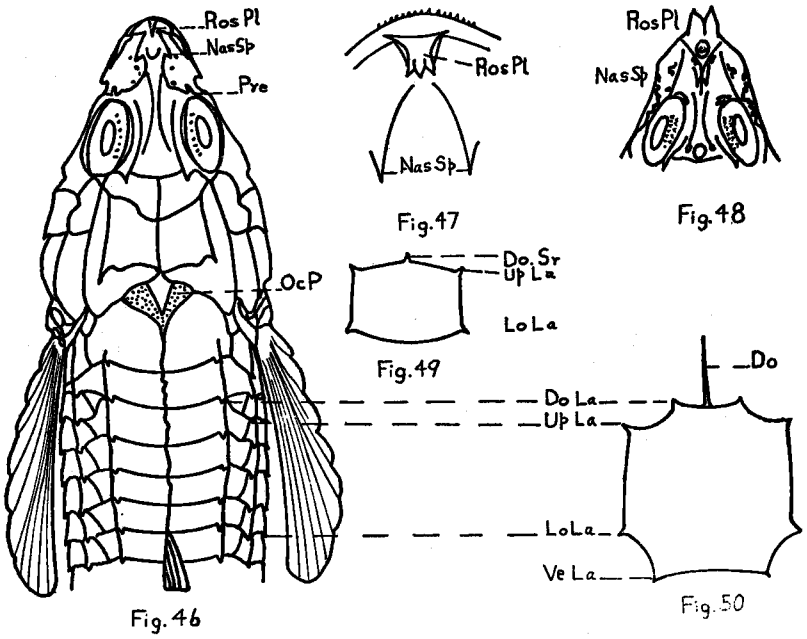

Fig. 46. A dorsal view of *Odontopyxis trispinosus.*
Fig. 47. The rostral plate of *Asterotheca infraspinata.*
Fig. 48. The rostral plate of *Averruncus emmelane.*
Fig. 49. A cross-section of the plates in the region of the caudal peduncle.
Fig. 50. A cross-section of the plates in the region of the dorsal fin.

Diagrams showing the anatomical features of the sea poachers, *Agonidae.* Drawn by Arthur D. Welander.

Do—dorsal fin; Do La—dorsal lateral series of plates; Do Sr—dorsal series of plates; Lo La—lower lateral series of plates; Nas Sp—nasal spines; Oc P—occipital pit; Pre—preorbital; Ros Pl—rostral plate; Up La—upper lateral series of plates; Ve Lat—ventral lateral series of plates.

12a. Lower jaw produced beyond maxillaries; lower 4 or 5 rays of the pectoral fin not thickened and not separated from the other rays by a notch. Range: Aleutian Islands to coast of Washington. Marine. Common.

Black Sea Poacher.....
.....281. *Bathyagonus nigripinnis* Gilbert

12b. Lower jaw not produced beyond maxillaries; terminal rostral plate with 5 small spines; origin of 1st dorsal on 8th plate of dorsal series.

13a. Plates on cheeks thick, inflexible, immovably united with each other and with the interopercle; lower 5 pectoral rays thickened; a single median pair of plates in front of pelvics, the remaining plates of median series unpaired, (the plates of the 2nd pair fused)[10]

14a. Margin of preorbital not spinous, ventrolateral series of plates smooth throughout (without spines); spines of lower lateral series weak or obsolescent, this especially marked on caudal peduncle; deep nuchal depression; space between dorsal ridges deeply concave; plates on cheeks, in adults, without spines or tubercles; gill membranes without posterior free margin; lower pectoral rays much exserted beyond the membrane, a distinctly deeper notch between the two portions of the fin. Range: Alaska to Puget Sound. Marine. Common.

Gray Star-snout.....
.....282. *Asterotheca alascana* (Gilbert)

14b. Lower margin of preorbital strongly spinous in adults; anterior plates of ventrolateral series with short but evident spines; lower lateral plates all strongly spinous, figs. 49 and 50, except the anterior 5 or 6, which are smooth as in other species; plates on cheeks with minute spines; nuchal depression shallow; space between dorsal ridges shallowly concave; gill membranes with a narrow free margin posteriorly; lower pectoral rays comparatively little exserted, no conspicuous notch between the 2 portions of the fin. Range: Washington. Marine. Common. Fig. 47.
.....283. *Asterotheca infraspinata* (Gilbert)

13b. Plates on cheeks thin, flexible, not fused, readily movable, all (or the posterior 2) bearing each a strong backwardly directed spine; ventrolateral series of plates sharply spinous throughout as is the lower lateral series, with the exception of the first 5 or 6; 2 median pairs of plates in front of pelvics; lower 4 pectoral rays thickened, a deep notch between the two portions of the fin; eye very large; spines on eyeball weak or obso-

[10]This part of the key is modified after C. H. Gilbert (1917), Proc. U.S.N.M.

lescent; palatine patches of teeth narrower than those on mandible. Range: Str. of Juan de Fuca to San Diego. Marine. Not common.
.....284. *Asterotheca pentacantha* (Gilbert)

1b. Dorsal fin single (spinous dorsal absent). Range: Alaska to Columbia River Mouth. Marine. Common.
Smooth Sea Poacher.....285. *Anoplagonus inermis* (Günther)

Family 71. Cyclopteridae. Lumpsuckers

1a. Head and body nearly naked, only a few scattered spines over it; dorsal V, 7; anal 6; color red in life. Range: Puget Sound. Marine. Rare.
Smooth Lumpsucker or Lumpfish.....
.....286. *Eumicrotremus vinolentus* (Jordan and Starks)[11]

1b. Head and body covered with spiny conical tubercles, the largest in a group of 7 or 8 on the flank behind the pectorals; dorsal VI to VII, 9 to 11; anal 8 to 10. Range: Aleutian Islands to Puget Sound. Marine. Common.
Spiny Lumpsucker.....287. *Eumicrotremus orbis* (Günther)

Family 72. Liparididae.[12] Sea Snails. Rock suckers

1a. Nostril double; pseudobranchiae present; pectoral typically with more rays than anal.

2a. Pyloric caeca fewer than 150 (not matted); probably always fewer than 100; peritoneum pale or silvery, usually with scattered brown or black dots.

3a. Caudal free from the dorsal or connected for not more than 1/5 its length.

4a. Dorsal notched; gill opening either above the pectoral or extending down in front of not more than 6 rays; anal fewer than 30 rays; dorsal not more than 35.

5a. Gill slit above the pectoral, sometimes appearing to extend down in front of the upper ray.

6a. Disk 2 or less in head; pyloric caeca less than 50 (15 to 37); anterior dorsal rays often elevated; pectoral rays 30 to 33; a white bar across base of caudal fin. Range: Alaska to Oregon. Marine. Not rare.
.....288. *Liparis rutteri* (Gilbert and Snyder)

6b. Disk more than 2 in head. Fig. 17. Range: Aleutian Islands to Washington. Marine. Common.
.....289. *Liparis callyodon* (Pallas)

5b. Gill slit extending down in front of 3 to 5 pectoral rays.

7a. Body deepest below origin of 1st dorsal; disk more than half as long as head; anus nearer anal fin than disk; eye 5 to 7 in head; 1st dorsal fin is low and broadly rounded, not incised behind. Range: Cape Johnson to central California. Marine. Rare.
.....290. *Liparis mucosus* Ayres

[11]Probably this is the young of some species of Lumpsucker.
[12]This key is modified after V. Burke (1930), Bull. U. S. Nat. Mus.

7b. Body deepest below front part of 2nd dorsal; disk less than half as long as head; anus nearer disk than anal fin; eye 8 to 9 in head; 1st dorsal a high, distinct lobe, incised behind. Range: Vancouver Island to Monterey County, California. Marine. Abundant.

.....291. *Liparis florae* Jordan and Starks

4b. Dorsal unnotched, or if notched the gill slit extends down in front of more than 6 pectoral rays.

8a. Pectoral with 29 to 32 rays, and less than the number of dorsal rays; gill slit in front of 10 or fewer, usually 3 to 5, pectoral rays. Range: Alaska to Washington. Marine. Common in Puget Sound.

.....292. *Liparis cyclopus* Günther

8b. Pectoral 37 to 43 with more rays than dorsal; gill slit in front of 12 to 16 pectoral rays. Range: Alaska to Crescent City, California. Marine. Common.

.....293. *Liparis fucensis* Gilbert

3b. Caudal connected to the dorsal for more than 1/5 and less than 3/4 of its length; the number of pectoral rays greater than the number of anal rays; pectoral usually notched in adult and young; gill slit extending down in front of more than 10 pectoral rays; caeca fewer than 55; dorsal 37 to 40; no prickles. Range: Alaska to Washington. Marine. Common.

.....294. *Liparis dennyi* Jordan and Starks

3c. Caudal connected to the dorsal for 3/4 or more of its length; pectorals notched; the number of pectoral rays equal to or fewer than the number of anal rays; gill opening above pectoral or in front of 1 to 4 rays; dorsal rays 48 to 53; anal 40 to 41. Range: Alaska to California. Marine. Common.

.....295. *Liparis pulchellus* Ayres

2b. Pyloric caeca more than 150, probably always more than 200 and matted or close together; dorsal rays 40 or fewer; anal 30 or fewer; pectoral 37.

9a. Color light brown with the epidermis removed; gill slit either above the pectoral or in front of 1 to 4 rays; dorsal connected to less than 1/5 the caudal fin. Range: Alaska to Puget Sound. Marine. Not common.

.....296. *Polypera greeni* (Jordan and Starks)

9b. Color pale gray; gill opening above the pectoral or in front of the upper ray. Range: Alaska to Puget Sound. Marine.

.....297. *Polypera beringianus* (Gilbert and Burke)

1b. Nostril single; pseudobranchiae present; coloration not variegated; pectoral typically with fewer rays than anal; dorsal unnotched or if notched the pupil is round.

10a. Disk present; disk perfect; gill slit well developed; no barbels on snout; pupil round or but slightly oval, never reduced to a horizontal slit; no color blotches on the body; dorsal unnotched; teeth elongate, slender, simple, sometimes arrow-shaped, the lateral lobes hardly evident; peritoneum pale or black.

11a. Gill slit above the pectoral; pectoral with more than 25 rays; disk smaller than the eye, rarely equal to it; usually distinctly cupped or triangular.

12a. Caudal not forked; pectoral distinctly notched; peritoneum black, rarely silvery and dotted; mouth and gill cavity dusky to black; no prickles. Range: British Columbia to southern California. Marine. Not rare.

.....298. *Careproctus melanurus* Gilbert

12b. Caudal forked; pectoral notch hardly evident; depth 4.5 in length; pyloric caeca 29. Range: Okhotsk Sea, Bering Sea to off coast of Washington. Marine.

299. *Careproctus cypselurus* (Jordan and Gilbert)

11b. Gill slit extending down in front of the pectoral fin.

13a. Disk well developed, not over 4 in head; depth of body not over 4 in length; vent near disk. Range: Off Queen Charlotte Islands, B. C. Marine. Rare.

.....300. *Careproctus ovigerum* (Gilbert)

13b. Disk small, 7 to 9 in head; gill slit in front of 10 or more pectoral rays. Range: Southeastern Alaska and British Columbia. Marine.

.....301. *Careproctus gilberti* Burke

10b. Disk absent.

14a. Branchiostegals 6; vent vertical; gill slit at least partly above the pectoral fin.

15a. Snout without barbels.

16a. Teeth trilobed; gill slit in front of 4 pectoral rays; pyloric caeca 13 to 18; pectoral rays 30 or more. Range: Alaska and California. Marine. Rare.

.....302. *Paraliparis dactylosus* Gilbert

16b. Teeth simple, conical and in bands; middle pectoral rays not rudimentary; pectoral with fewer than 30 rays.

17a. Mouth horizontal; middle pectoral rays widely spaced.

18a. Gill slit extending down in front of 10 pectoral rays; dorsal 56; anal 46. Range: Alaska and California. Rare.

.....303. *Paraliparis deani* Burke

18b. Gill slit above pectoral fin; pectoral 25; the upper edge on a level with the upper margin of the eye; color black, including mouth and gill cavity. Range: Bering Sea and Gulf of California. Marine.

.....304. *Paraliparis ulochir* Gilbert

17b. Mouth oblique.

19a. Snout to vent 5.5 times in length; pectoral 14; the upper edge of the pectoral fin above the angle of the mouth; symphysis behind the front of the eye. Range: Bering Sea to Gulf of California. Marine. Rare.
...305. *Paraliparis cephalus* Gilbert

19b. Snout to vent 9.8 times in length; pectoral 16; depth 6 times in length; the upper edge of the pectoral fin below the angle of the mouth; symphysis in front of the eye. Range: Washington to California. Marine. Rare.
.....306. *Paraliparis mento* Gilbert

15b. Snout with barbels.

20a. Gill slit extending down in front of 5 pectoral rays; pyloric caeca 7. Range: Bering Sea, Okhotsk Sea and California. Marine.
.....307. *Rhinoliparis barbulifer* Gilbert

20b. Gill slit above pectoral fin; pyloric caeca 12. Range: Bering Sea and Monterey Bay. Marine. Rare.
308. *Rhinoliparis attenuatus* Burke

14b. Branchiostegals 5; vent forward on throat, opening forward; gill slit restricted to in front of the pectoral fin; pectoral lobes separated. Range: North Pacific from Hokkaido, Japan, to southern California. Marine. Rare.
309. *Nectoliparis pelagicus* Gilbert and Burke

Family 73. Embiotocidae. Viviparous perches. Surf-fishes

1a. Scales large, about 38 (36 to 50) in lateral line.

2a. Lower lip without frenum; dorsal fin IX or X, 18 to 21; caudal peduncle short and slender, least depth about 8½ in body. Range: Southern Alaska to Todos Santos Bay, Lower California. Marine. Common.
Perch. Shiner. Viviparous Perch.....
.....310. *Cymatogaster aggregatus* Gibbons

2b. Lower lip with frenum; dorsal fin VIII, 15; least depth of caudal peduncle 7 in body; depth 3 in body; head 3.3 in body. Range: Vancouver Island to San Diego, California. Marine. Common.
.....311. *Brachyistius frenatus* Gill

1b. Scales small, more than 50 in the lateral line.

3a. Lower lip with a frenum, the groove not continuous across the tip of chin; dorsal fin X or XI.

4a. Gill rakers 15 or 16 below angle of first arch (seldom 14); least depth of caudal peduncle 6½ to 7½ times in body; scale formula about 10+65+20; body with numerous narrow almost parallel blue lines. Range: Vancouver Island to San Benito Island, Lower California. Marine. Common.

Blue Perch.....312. *Taeniotoca lateralis* (Agassiz)

4b. Gill rakers fewer than 14 below angle of 1st arch (usually 11 to 13).

5a. Dentigerous surface of lower pharyngeals convex; dorsal X, 21 to 24; anal III. about 25 to 29; dark blotch below posterior corner of jaw just back of maxillaries; gill rakers 13 below angle (rarely 12); least depth of caudal peduncle about 7 to 8 in body; scales about 8+56 to 64+18. Range: Vancouver Island to Todos Santos Bay, Lower California. Marine. Common.

Pile or Silver Perch.....313. *Damalichthys vacca* Girard (=*D. argyrosomus*)

5b. Dentigerous surface of lower pharyngeals flat or concave; dorsal X or XI, 22 to 26; anal III, 29 to 34; no dark blotch just behind maxillaries; least depth of caudal peduncle 8 to 9½ in body; gill rakers about 11 or 12 below angle of 1st arch; scales 66 to 69 in lateral line. Range: Vancouver Island to San Diego, California. Marine. Common.

Splittail Perch. White Surf-fish. Forktail Perch.....
.....314. *Phanerodon furcatus* Girard

3b. Lower lip without a broad frenum, the groove continuous across chin; dorsal spines VIII to X (usually IX).

6a. Gill rakers 15 or more below angle of 1st arch.

7a. Below angle of 1st arch 15 to 19 rakers; 65 scales in lateral line; eye ⅓ head; anal III, 29 to 35; dorsal IX or X, 25 to 29. Range: Cape Johnson, Washington to southern California. Marine. Common.

Silver Perch or Porgy...315. *Tocichthys ellipticus* (Gibbons)

7b. More than 20 rakers below angle of 1st arch; 72 scales in the lateral line; eye ⅖ head; anal III, 32; dorsal IX, 27; characteristic black tips to pelvic fins. Range: Columbia River mouth to Lower California. Marine. Common.

White Perch. Wall-eyed Perch.....
.....316. *Hyperprosopon argenteum* Gibbons

6b. Gill rakers fewer than 15 below angle of 1st arch, usually 6 or 7+11 to 13; about 60 to 69 scales in the lateral line; anal III, 26 to 30; about 9 to 10 orange to brassy colored vertical bars on sides of body. Range: Washington to Monterey, California. Marine. Common.

Porgy.....317. *Holconotus rhodoterus* Agassiz

Family 74. Gobiidae. Gobies

1a. Pelvics united to form a sucking disk but free from the belly posteriorly. Fig. 16.

2a. Dorsal IV or V, 14 to 17; anal 15 to 17 soft rays; scales 45 to 70 and about 18 in a transverse series.

3a. Cutaneous flaps 2 or 3 on inner edge of shoulder girdle; anal 15; scales in about 50 cross series. Range: Vancouver Island to Guaymas, Sonora. Marine. Not rare.

.....318. *Quietula y-cauda* (Jenkins and Evermann)

3b. No cutaneous flaps as above; anal 16 or 17; scales in about 70 cross series. Range: Vancouver Island to San Diego, California. Marine and in brackish water. Common.

.....319. *Clevelandia ios* (Jordan and Gilbert)

2b. Dorsal VI or VII, 12 to 18; anal 10 to 15 (rarely 16); scales if present in more than 70 or in fewer than 45 cross series.

4a. Anal 10 or 11; dorsal VI, 12 or 13 or VI-I, 12 to 14; scales if present in fewer than 40 cross series, or indistinct; no dermal flaps on shoulder.

5a. Eye 6 or 7 in head; interorbital space larger than eye. Range: Puget Sound to Guaymas, Sonora. Marine. Not rare.

Long-jawed Goby.....320. *Gillichthys mirabilis* Cooper

5b. Eye 3 or 4 in head; interorbital space about equal to pupil. Range: British Columbia to southern California. Marine. Not rare. Fig 16.

.....321. *Rhinogobiops nicholsii* (Bean)

4b. Anal 15; dorsal VII, 16 to 18; scales about 86 in lateral line; shoulder girdle with 2 to 4 dermal flaps under gill cover. Range: Vancouver Island to San Diego, California. Marine. Common.

.....322. *Lepidogobius lepidus* (Girard)

Family 75. Ammodytidae. Sand Launces or Lances

Range: Alaska to southern California. Marine. Abundant.

Sand Launce.....323. *Ammodytes tobianus personatus* Girard

Family 76. Bathymasteridae. Ronquils

Range: Alaska to Puget Sound. Marine. Common.

Ronquil.....324. *Ronquilus jordani* (Gilbert)

Family 77. Zaproridae. Flaccid Fishes

Range: Sitkalidak Island, Alaska, to Puget Sound. Marine. Rare.

Highbrow.....325. *Zaprora silenus* Jordan

Family 78. Clinidae. Blennies

1a. Dorsal rays XXXIV to XXXVI, 5 to 8; a slight emargination at about the 5th spine; anal II, 23 to 28. Range: Vancouver Island and southern California. Marine. Common in California.

Spotted Kelpfish.....326. *Gibbonsia elegans montereyensis* Hubbs

1b. Dorsal rays V-XXXIII, 13; a deep notch following the 5th spine; anal rays II, 34. Range: British Columbia and southern California. Marine. Common in California.

Kelpfish.....327. *Heterostichus rostratus* Girard

Family 79. Pholididae. Blennies

1a. Anal spines 2, small and unmodified; origin of anal fin under the 34th to the 41st dorsal spine; pelvic fins present, but small.

2a. Dorsal spines LXXX to LXXXIX; anal soft rays 40 to 44; head less than ⅛ total length; pectoral fin about 2.5 in head. Range: Coast of Washington to Del Norte County, California. Marine. Common.

.....328. *Pholis*[13]

2b. Dorsal spines LXXIV to LXXIX; anal soft rays 33 to 37; head more than ⅛ total length.

3a. Black markings along base of dorsal, ornate spots as ( ); pectoral fin 2.4 to 3.0 in head. Range: Alaska to Del Norte County, California. Marine. Common.

Bracket Blenny.....329. *Pholis laetus* (Cope)

3b. Black markings along base of dorsal more spread apart ventrally as) (; pectoral fin 2.0 to 2.3 in head. Range: Alaska to San Francisco. Marine. Common.

Saddled Blenny.....330. *Pholis ornatus* (Girard)

1b. Anal spine single, enlarged, recumbent and fitting into a dermal sheath; origin of anal fin under the 42nd to 55th dorsal spine; pelvic fins wholly undeveloped.

4a. Anal spine single, very large and channeled along the anterior edge; origin of anal fin under about the 45th or 46th dorsal spine; dorsal about XC to XCIV; anal soft rays about 40 to 42; vertebrae 97 or 98. Range: Southeastern Alaska to Pt. Conception. Marine. Common.

Blenny.....331. *Apodichthys flavidus* Girard

4b. Anal spine small, not channeled, (another smaller spine is usually obsolete); origin of anal fin under about the 53rd to 55th dorsal spine; dorsal about LXXXIV; anal about 36. Range: Puget Sound to San Clemente Island. Marine. Not rare.

Fucus Blenny.....332. *Xerepes fucorum* (Jordan and Gilbert)

Family 80. Stichaeidae. Northern Blennies

1a. Pelvic fins present.

2a. Gill membranes broadly united, free from the isthmus, the gill slit not continued forward below.

[13]This species appeared as a *nomen nudum* in the check-list by C. L. Hubbs (1928) Jour. Pan-Pacific Research Inst., and again in this key when first mimeographed. It is to be described by Hubbs in the near future.

3a. Top of head covered with many fleshy cirri; origin of anal fin under the 12th to 15th dorsal spine; no anal spines; head blunt.

4a. Snout 6 to 8 in head; the fleshy cirri of head extend to the origin of dorsal fin but they are not developed on the rays, cirri smaller and less mossy than in *decoratum*. Range: Washington to Fort Bragg, California. Marine. Not common.

Ornamented Blenny..333. *Bryostemma nugator* Jordan and Williams

4b. Snout 4 to 5 in head; the fleshy cirri of head extend back to the 6th dorsal spine. Range: Bering Sea, Petersburg, Alaska to Puget Sound region. Marine. Not rare.

Decorated Blenny...334. *Bryostemma decoratum* Jordan and Snyder

3b. Top of head without cirri; origin of anal fin under the 19th to 21st dorsal spines; 2 anal spines; head pointed. Range: Washington and Oregon. Marine. Not common.

Barred Blenny.....335. *Plectobranchus evides* Gilbert

2b. Gill slit carried forward below, the gill membranes joined to isthmus with or without a free fold across it.

5a. Pectoral fin with the lower rays longer than middle and upper rays; teeth on vomer and palatines. Range: North Atlantic; North Pacific southward to Puget Sound.

.....336. *Leptoclinus maculatus* (Fries)

5b. Pectoral fins with the lower rays not as above, the middle rays are longer than upper or lower rays.

6a. Anal spine I; sides of body with black markings on a lighter background of color.

7a. Dorsal spines about LXXII, anal soft rays 45 to 50; about 21 gill rakers on 1st arch; gill membranes without a free fold across isthmus; no teeth on vomer, those on palatines small or wanting. Range: Alaska to San Francisco. Marine. Common.

Snake Eel.....337. *Lumpenus anguillaris* (Pallas)

7b. Dorsal spines XLIX; anal soft rays 31; gill rakers present; gill membranes with free fold across isthmus; no teeth on vomer or palatines. Range: Nanaimo, B. C. Marine. Rare.

.....338. *Allolumpenus hypochromus* Hubbs and Schultz

6b. Anal spines III to V; sides of body plain or with white cross bars on a dark background of color; anal soft rays 38 to 42.

8a. No teeth on vomer or palatines; body without white cross bars; dorsal spines LXII to LXXI; gill rakers about 16 or 17; snout long and fleshy overhanging the premaxillary. Range: Alaska to Nanaimo, B. C. Marine. Not common.

339. *Lumpenella longirostris* (Evermann and Goldsborough)

8b. Vomerine and palatine teeth present; sides of body with 10 to 12 narrow white cross bars; dorsal spines LVII to LX; gill rakers rudimentary; snout normal. Range: Alaska to San Diego. Marine. Rare.

.....340. *Poroclinus rothrocki* Bean

1b. Pelvic fins absent.

9a. Gill membranes attached to the isthmus.

10a. Eye small, 10 to 13 in the head.

11a. Maxillary extending behind orbit, a distance equal to 3 or 4 times the diameter of the eye; depth 7 in length. Range: Alaska to southern Oregon. Marine. Common.

"Congo Eel".....341. *Delolepis giganteus* (Kittlitz)

11b. Maxillaries ending below or before the orbit; depth 14 or 15 in length. Range: Aleutian Islands to Puget Sound. Marine. Not common.

Red Devil.....342. *Lyconectes aleutensis* Gilbert

10b. Eye in head 4 to 6 times; origin of dorsal about over the insertion of pectoral fin; evident crest of flesh on top of head; dorsal about LVI; anal 36 to 40. Range: Southeastern Alaska to San Francisco. Marine. Common.

Crested Blenny.....
.....343. *Anoplarchus purpurescens purpurescens* Gill

9b. Gill membranes free from the isthmus.

12a. Anal spines present, distinct.

13a. Dorsal with soft rays posteriorly, XXII to XXV, 40 to 43; anal I or II, 41 or 42. Range: California. Marine. Common.

.....344. *Cebidichthys violaceus* (Girard)

13b. Dorsal without soft rays, LXIX to LXXIV; anal II (rarely III), 40 to 50. Range: British Columbia to central California. Marine. Common.

Belted Blenny....345. *Phytichthys chirus chirus* (Jordan and Gilbert)

12b. No anal spines.

14a. Pectoral slightly longer than diameter of eye; median teeth of premaxillary canine-like and separated by smaller teeth between the 2 large ones; dark color bands below and posterior to eye bordered by a black line. Range: Southeastern Alaska to central California. Marine. Common.

.....346. *Xiphister mucosus* (Girard)

14b. Pectoral slightly shorter than eye; median teeth of premaxillary canine-like but not separated by smaller teeth between the 2 canines; dark color bands on cheek and head bordered by narrow whitish lines. Range: Alaska to Santa Barbara. Marine. Common.

Rock Blenny.....
....347. *Epigeichthys atropurpureus* (Kittlitz)

Family 81. Anarrhichthyidae. Wolf Fishes

Range: Alaska to Monterey. Marine. Common.
Wolf Eel.....348. *Anarrhichthys ocellatus* Ayres

Family 82. Scytalinidae. Burrowing Blennies

Range: Aleutian Islands to Monterey County, California. Marine. Not common.
Burrowing Blenny.....349. *Scytalina cerdale* Jordan and Gilbert

Family 83. Ptilichthyidae

Range: Alaska to Puget Sound. Marine. Rare.
Quill Fish.....350. *Ptilichthys goodei* Bean

Family 84. Zoarcidae. Eel Pouts

1a. Pelvics present; upper jaw overlaps mandible.

2a. Vomer without teeth; palatines without teeth.

3a. Body slender, depth 12 to 16 in length; lateral line short, faint, and ventral in position, incomplete; upper jaw greatly overlaps lower; cheeks much projecting laterally, a series of 7 pores along mandible and preopercle, series of 7 or 8 pores extending from snout alongside of head above premaxillary; lateral line single, faint, running obliquely downward to near base of anal, thence backward, not reaching base of caudal; lining of mouth, gill cavity, and peritoneum jet black; a broad light band across head behind eyes extending to cheeks. Range: North Pacific and off Santa Barbara Islands. Marine. Rare.
.....351. *Embryx crotalinus* (Gilbert)

3b. Body more robust, depth 8 to 9 in length; upper jaw about twice the horizontal diameter of orbit; lateral line lateral in position; pelvics ½ length of orbit; pectoral ½ length of head; small embedded scales on body and vertical fins; upper jaw slightly overlaps mandible; mouth and gill cavity lined with dark epithelium; peritoneum black; no scales on head, nape and axil of pectoral; vertical fins margined with black, scales paler than skin. Range: Central Alaska to central California. Marine. Common.
.....352. *Lycodopsis pacificus* (Collett)

2b. Vomer and palatines with teeth.

4a. Lower jaw included, the upper overlapping lower less than ½ pupil; middle rays of pectoral fin longest; pelvic fins about 1 to 1.5 in eye; dorsal rays about 116; anal rays about 93; no vertical color bars evident (at least on adults); margins of vertical fins darker than rest of fin; scales lighter than general color of body giving the appearance of white specks. Range: Southeastern Alaska and northern California. Marine. Rare.
.....353. *Lycodes jordani* Evermann and Goldsborough

4b. Lower jaw included, the upper overlapping the lower as much as or more than the diameter of the pupil.

5a. Peritoneum, jaws and gill cavity, jet black or nearly so; middle rays of pectoral shortest; lateral line ventral and single; pectoral rays 20 or 21; pelvics short and inserted under middle of opercle; scales small, embedded, and covering entire body and vertical fins; eye large only 3 to 3⅔ in head; whitish color bars, if present usually double and expanding ventrally like an inverted V; second color bar behind origin of dorsal fin. Range: Unalaska to California. Marine. Not rare.
.....354. *Furcimanus diapterus* (Gilbert)

5b. Peritoneum reddish slightly dusky to white, never jet black; middle rays of pectoral longest.

6a. Pelvics minute, about 3 in eye; dorsal rays about 85; anal rays about 74; peritoneum reddish or pale in preserved specimens; upper jaw overlaps mandible about ⅓ horizontal distance of orbit; labial folds fairly conspicuous; narrow light band across nape, and 9 to 11 across back, which become obscure in adults; the 2nd bar being behind the origin of dorsal fin; the dorsal and anal have dark margins. Range: Aleutian Islands to Puget Sound. Marine. Not common.
.....355. *Lycodes brevipes* Bean

6b. Pelvics longer, about equal to diameter of eye; dorsal rays 105; anal rays 90; peritoneum pinkish or pale in preserved specimens; upper jaw greatly overlaps lower, equal to ⅘ horizontal diameter of orbit; labial folds very conspicuous (membranous lobes on middle of each mandible); 14 to 16 light vertical color bands across body except sometimes absent in adults; the 2nd bar is in front of the origin of dorsal fin. Range: Alaska to Puget Sound. Marine. Not common.
.....356. *Lycodes palearis* Gilbert

1b. Pelvics wanting, teeth on vomer, palatines and jaws.

7a. Body without scales; peritoneum, gill cavity, and mouth jet black; iris silvery; mouth oblique, lower jaw slightly the longer; skull thin, papery, translucent; dorsal and anal joined with caudal; dorsal rays about 82 to 85; anal rays 70 to 74. Range: Southeastern Alaska to Gulf of California. Marine. Not common.
.....357. *Lycodapus fierasfer* Gilbert

7b. Body with scales.

8a. Two distinct lateral lines, the anterior running high on sides, parallel with back, discontinued at a point about 1 orbital diameter behind vent, the posterior line beginning below and slightly in advance of this point and running along middle of sides to the tail; dorsal rays about 107 (without caudal); anal rays about 92; pectoral about 17; gill rakers 3+15. Range: Alaska to California. Marine. Not common.
.....358. *Lycogramma brunnea* (Bean)

8b. Lateral line if present single, usually obscure, not double as above.

9a. Dorsal rays about 112 (without caudal); anal about 94; pectoral 13 to 16; gill rakers 4+15; pectoral rays exserted at tips. Range: Washington to California. Marine. Rare.
.....359. *Bothrocara remigera* Gilbert

9b. Dorsal rays 100 to 105 (to middle of caudal); anal 89 to 95 (to middle of caudal). Range: Queen Charlotte Islands and southern California. Marine. Rare.
.....360. *Bothrocara mollis* Bean

Family 85. Brotulidae. Brotulid Fishes

Range: Puget Sound to San Pedro, California. Marine. Not common.
.....361. *Brosmophycis marginatus* (Ayres)

Family 86. Batrachoididae. Toad Fishes

Range: Sitka, Alaska to Gulf of California. Marine. Common.
Singing fish. Midshipman.....362. *Porichthys notatus* Girard

Family 87. Gobiesocidae. Clingfishes

Range: British Columbia to Pt. Arguello, California. Marine. Common.
Clingfish.....363. *Caularchus maeandricus* (Girard)

Family 88. Molidae. Headfishes

Range: Temperate and tropical seas of Atlantic and Pacific, and northward to southeastern Alaska. Marine. Common southward.
Ocean Sunfish.....364. *Mola mola* (Linnaeus)

Family 89. Oneirodidae. Angler Fishes

Range: Santa Barbara Islands.
Angler Fish.....365. *Dolopichthys acanthias* (Gilbert)

GLOSSARY

Explanations of Terms, Counts and Measurements Most Frequently Used in Keys and Descriptions

Abdomen. Belly, the cavity containing the digestive and reproductive organs.

Abdominal. Pertaining to the belly; said of the ventral fins of fishes when inserted considerably behind the pectorals, the pelvic bones to which the ventral fins are attached having no connection with the shoulder girdle.

Abortive. Remaining or becoming imperfect.

Accessory caudal rays. Short, procurrent rays on the upper and lower (rather than posterior) part of the caudal peduncle.

Accessory pelvic scale. An enlarged scale or fleshy appendage on the upper side at the base of the pelvic fin.

Actinosts. A series of bones at the base of the rays of the paired fins.

Acuminate. Tapering gradually to a point.

Acute. Sharp-pointed.

Adipose fin. A fleshy fin-like projection behind the rayed dorsal fin, on the back of certain fishes, usually lacking typical fin rays.

Adnate. Adhering or grown together.

Adult. A mature animal.

Agape. In a gaping state. Jaws open.

Air bladder or swim bladder. A sac filled with gas situated in the body cavity beneath the backbone and corresponding to the lungs of higher vertebrates.

Alisphenoid. A small bone on the anterior lateral wall of the brain case.

Ammocoetes. A name applied to the larval form of lampreys.

Amphicoelian. Double-concave; concave at both ends; said of vertebrae.

Anadromous. Running up; said of marine fishes which run up rivers to spawn; used in a broader sense any fish entering fresh water or going from deeper water to shallow water for the purpose of spawning.

Anal. Pertaining to the anus or vent.

Anal fin. The fin on the ventral median line behind the vent.

Anal fin III, 10 etc.—three spines and ten soft rays.

Anal papilla. A protuberance in front of the genital pore and behind the vent in certain groups of fishes, corresponding to the penis of higher vertebrates.

Anchylosed. Grown firmly together.

Angular. A small bone on the posterior end of the mandible.

Antrorse. Turned forward.

Anus. The external opening of the intestine; the vent.

Arterial bulb. The muscular swelling, at the base of the great artery.

Articular. The bone of the mandible supporting the dentary and attached to the quadrate.

Articulate. Jointed; said of soft fin rays.

Atlas. The first vertebrae.

Atrophy. Non-development. Diminutive in size.

Attenuate. Long and slender, as if drawn out.

Auditory capsule. The ventrolateral swelling of the skull, and containing part of the inner ear.

Axil, as "no scales in axil." The region under or behind the pectoral fin base.

Barbel. An elongate, fleshy projection, usually about the head.

Basal. Pertaining to the base; at or near the base.

Base of skull. The lower or ventral portion of the cranium; the ventral outline of the parasphenoid is said to represent the "base of the skull" in *Sebastodes.*

Basioccipital. A median posteriorily and ventrally located bone of the skull to which the atlas is attached.

Basis cranii. A structure formed by shelves of bone developed from the inner sides of the prootics which meet and form a roof to the myodome and a floor to the brain cavity.

Bicolor. Two-colored.

Bicuspid. Having two points.

Brachial ossicles. See *Actinosts.*

Branchiae. Gills, the respiratory organs of fishes.

Branchial. Pertaining to the gills.

Branchiostegals. The bony rays supporting the branchiostegal membranes, under the head of fishes and below the opercular bones behind the lower jaw, and attached to the hyoid arch.

Breast. The region on the ventral side of the head, anterior to the ventral fins and posterior to the isthmus.

Bristle. A stiff hair or hair-like structure.

Buccal. Pertaining to the mouth.

Caducous. Falling off early or easily.

Caecal or coecal. Of the form or a blind sac.

Caecum, (pl. caeca). An appendage of the form of a blind sac, connected with the alimentary canal at the posterior end of the stomach, or pylorus.

Canines. The teeth behind the incisors—the eye teeth; in fishes any distinctly enlarged conical teeth longer than others.

Cardiform teeth. Teeth coarse and sharp, and arranged like the spikes on wool cards.

Carinate. Keeled; having a ridge along the middle line.

Catadromous. Running down; said of fresh-water species which run down rivers to spawn in the sea.

Caudal. Pertaining to the tail.

Caudal fin. The fin on the tail of fishes.

Caudal peduncle. The tapering portion of the body behind the base of the last ray of the anal fin. Its length is taken from that point to the base of the mid-caudal rays. The least depth of the caudal peduncle is taken at its slenderest part.

Cavernous. Containing cavities, whether empty or filled with mucous secretion.

Centrum. The body of a vertebra.

Cephalic fins. Pertaining to fins on the head as in certain rays; a detached portion of the pectoral.

Ceratobranchials. Bones of the branchial arches just below their angle.

Ceratohyal. One of the hyoid bones.

Chiasma. The union of the trunks of the optic nerves, in ganoid fishes. In teleostean fishes the optic nerves cross or interlace without uniting to form a solid chiasma.

Chin. The space between the rami of the lower jaw.

Chondrocranium. The rudimentary cartilaginous cranial skeleton, corresponding to the primitive skull of cartilaginous fishes, of which traces remain in bony forms.

Ciliated. Fringed with eyelash-like projections.

Cirrus, pl. cirri. Fringes; tendril-like flexible tufts of skin; hair-like.

Claspers. Organs attached to the ventral fins in the male of sharks, etc., the myxopterygia.

Compressed. Flattened laterally or side to side.

Conus arteriosus. A muscular and contractile bulb between the ventricle and the root of the aorta. It is furnished interiorly with one or more transverse rows of packet-shaped valves to prevent a backward flow of the blood.

Coracoid. The principal posterior bone of the shoulder girdle in fishes supporting the pectoral radials.

Cranial. Pertaining to the cranium or skull.

Ctenoid. Rough-edged; said of cycloid-like scales having the posterior margin minutely spinous, or pectinated, or toothed.

Cycloid. Smooth-edged; said of scales concentrically striate, without any trace of minute spines.

Deciduous. Temporary; falling off.

Decurved. Curved downward.

Dentary. The anterior bone of the lower jaw or mandible, usually bearing teeth.

Dentition weak. Teeth scarcely evident.

Dentition strong. Teeth very easily observed and highly developed.

Denticle. A little tooth.

Depressed. Flattened vertically, like the skates and rays.

Depth. The vertical distance through the body at its deepest part, not including the fins.

Dermal. Pertaining to the skin.

Diaphanous. Translucent.

Disk (of skate). The more or less roundish body of the skate excluding the tail, ventral fins, claspers. The pectoral fins which form a part of the body of the skate are a part of the disk.

Distal. Remote from point of attachment.

Dorsal. Pertaining to the back.

Dorsal fin. The fin on the back, in front of the adipose if that is present. In counting the fin rays, the anterior rudimentary rays are omitted in certain groups of fishes such as *Cyprinidae, Catostomidae, Salmonidae,* etc., or are given separately as simple rays in the following formula, 2 + 10, the simple rays being given first. Rudimentary rays are those rays, in general, at the beginning of the fin which are unbranched, membraneless, closely appressed the one to the other, and in ordinary cases not more than half the length of the fully developed rays. The last ray of the dorsal or anal fins is often split nearly or quite to the base and appears as two rays, although counted as one. In all cases, the last two rays are counted as one. In descriptions, etc., Arabic numerals are used to indicate soft rays and Roman numerals to indicate spines. A dash"—" separates elements not connected; a comma those connected.

Emarginate. Slightly forked or notched.

Endoskeleton. The skeleton proper; the inner bony framework of the body.

Enteron. The alimentary canal.

Epibranchials. The bones directly above the angle of the branchial arches.

Epihyal. One of the hyoid bones.

Epipleurals. Rays of bone attached to the ribs and anterior vertebrae.

Erectile. Susceptible of being raised or erected.

Ethmoid. A median anterior bone of the skull, above the vomer.

Exoccipitals. Two bones of the skull; one on each side of the foramen magnum.

Exoskeleton. Hard parts (scales, scutes, bony plates) on the surface of the body.

Exserted. Projecting beyond the general level, as fin rays beyond the membranes.

Extralimital. Beyond the limits (of this key).

Eye. The diameter of the eye, called "eye" in descriptions, is measured lengthwise (horizontal diameter), the form of the orbit not always being round. Most investigators use the greatest diameter of the eye, if the latter is not circular.

Eye in snout. The diameter of the eye is measured in the length of the snout.

Facial. Pertaining to the face.

Falcate. Scythe-shaped, long, narrow and curved.

Falciform. Curved, like a scythe.

Fauna. The animals inhabiting any region, taken collectively.

Filiform. Any thread-like, slender structure.

Fin height. The height of a fin is the length of the longest ray.

Fin length. The length of a fin is measured along its base unless the length of the depressed fin is specified. The latter is measured from its origin to the most posterior point of the fin.

Finlets. A series of specialized fin rays, usually separate from each other and occurring posteriorly to the dorsal or anal fins.

Fontanel. An unossified space on top of the head, between the parietals, covered with a membrane.

Foramen. A hole or opening.

Foramen magnum. The aperature in the posterior part of the skull for the passage of the spinal cord.

Forehead. Frontal curve of the head.

Forficate. Deeply forked, furcate.

Fossa (nasal). Groove in which the nostril opens, a shallow depression.

Frenum. A small piece of flesh binding the lip to the edge of the jaw.

Frontal bone. Anterior bone on the top of the head, usually paired.

Fulcra (singular fulcrum.) Rudimentary spine-like projections extending on the anterior rays of the fins of the ganoid fishes.

Furcate. Forked.

Fusiform. Spindle-shaped, tapering toward both ends, but more abruptly forward.

Ganoid. Scales or plates of bone covered by enamel.

Gape. Opening of the mouth.

Geniculate. Having knee-like bends or joints or protuberances.

Gibbous. Sharply convex or rounded.

Gill arches. The bony arches to which the gills are attached.

Gill membranes. The thin wall of skin, supported by the branchiostegals, and closing the gill cavity below.

Gill membranes free from the isthmus. Not connected to the isthmus so that a needle can be run across the isthmus and under the membranes if the right and left sides are connected.

Gill openings. Opening leading to or from the branchiae or gills.

Gill rakers. A series of bony appendages, variously placed along the anterior edges of the gill arches. The gill rakers are counted on the first gill arch only, unless otherwise specified. The number of rakers is counted both above and below the angle or bend of the gill-arch, the upper number being mentioned first. All rudiments are counted. The formula, 15 + 25, for example, indicates 15 rakers on the upper and 25 on the lower limb.

Gill slit. The openings between the gill arches. The "slit behind the 4th gill arch" may be pore-like, absent, or a small slit. If pore-like it is a tiny round opening like the letter "o", but if a small slit, it is a small elongate opening. In both cases this opening is very close to the bony arch and not in the loose membraneous tissue behind the 4th arch.

Gills. Organs for breathing the air contained in water.

Glabrous. Smooth.

Glossohyal. The tongue bone.

Graduated spines. Progressively longer backward, the third element being as much longer than the second as the second is longer than the first, etc.

Granulated. Rough with small prominences.

Gular. Pertaining to the gula, in fishes the region between the chin and isthmus.

Gular plate. A single hard plate or plates between the dentary bones of the lower jaw.

Haemal arch. An arch between the haemal spines, for the passage of blood vessels.

Haemal canal. The series of haemal arches as a whole.

Haemal spine. The ventral spine of a caudal vertebra in fishes.

Head length. Usually called "head" in descriptions. The length of the head is measured from the tip of the snout to the extreme hinder margin of the bony portions of the opercle. It includes the opercular spines in percoid fishes, etc., and the opercular membrane in most fishes.

Head width. Measured at the widest part.

Height. Vertical diameter.

Heterocercal. Said of the tail of fishes when vertically unequal, the backbone deflected upward into the upper lobe.

Hispid. Rough with stiff hairs or bristles.

Holotype. See type.

Homocercal. Said of the tail of fishes when not externally unequal, the last vertebrae fusing into a more or less symmetrical plate, the hypural plate.

Humeral spine. A spine above the base of the pectoral fin, attached to the pectoral girdle and directed posteriorly.

Humerus. Bone of the upper arm.

Hyoid. Pertaining to the hyoid bone or arch.

Hyoid apparatus. Formed by a series of bones supporting the tongue.

Hyomandibular. A bone by which the posterior end of the suspensorium is articulated with the skull; the supporting element of the suspensorium, the mandible, the hyoid apparatus, and the opercular apparatus.

Hypercoracoid. The upper of the two bones attached to the cleithrum or clavicle, indirectly bearing the pectoral fin.

Hypurals. The modified plate-like last few vertebrae supporting the caudal fin rays.

Hypobranchials. Bones of the branchial arches below the ceratobranchials.

Hypocoracoid. The lower of the two bones attached to the clavicle behind.

Hypohyals. Small bones, usually 4, by which the respective sides of the hyoid apparatus are joined.

-id (suffix). Indicating membership in a family, thus percid, a member of the *Percidae.*

-idae (suffix). The family name always ends in idae, as *Percidae, Cyprinidae,* etc.

Imbricate. Overlapping like shingles on a roof.

Imperforate. Not pierced through.

-inae (suffix). The subfamily name always ends in inae, as *Percinae,* etc.

Inarticulate. Not jointed.

-ine (suffix). Indicating membership in a subfamily, thus percine, a member of the *Percinae.*

Incisors. Front teeth compressed to form a cutting edge.

Inferior pharyngeals. Synonymous with pharyngeals. Main bones of pharyngeal arch.

Infraoral. Below the mouth. The teeth of the mouth or disk below the oral opening, in lampreys.

Infraorbitals. A chain of small bones below the eye.

Insertion of fin. A term applied to the point where the paired fins begin or arise from the body.

Interhaemal spines. Elements supporting the anal fin rays.

Interhaemals. See interhaemal spines.

Interhyal. Upper hyoid bone attached to hyomandibular.

Intermaxillaries. The premaxillaries.

Interneural spines. Elements supporting the dorsal fin rays.

Interneurals. See interneural spines.

Interopercle. Membrane bone between the preopercle and the branchiostegals, usually anterior to subopercle when latter is present.

Interorbital space. The distance between the eyes on the top of the head. The bony interorbital space is measured unless otherwise specified.

Interspinous bones. The interneurals and interhaemals.

Isocercal. Said of the tail of fishes when the last vertebrae progressively become smaller and smaller and end in the median line of the caudal fin, the hypural plate being nearly obsolete.

Isthmus. The region just anterior to the breast of a fish where the gill membranes converge. The fleshy interspace between gill openings.

Jugular. Pertaining to the lower throat; said of the ventral fins when placed in advance of the attachment of the pectorals.

Keeled. Having a ridge along the middle line.

Lacustrine. Living in lakes.

Lamellae. Plate-like processes like those inside the bill of a duck.

Larva. An immature form, which must undergo change of appearance before becoming adult.

Lateral. Pertaining to the side.

Lateral line. A series of sensory tubes opening to the exterior or a sensory canal along the sides of a fish, sometimes single, sometimes multiple.

Lateral line with an arch in front. The lateral line has a distinct elevation over the pectoral fin in the form of an abrupt arch, not a mere curve.

Lateral line with an accessory dorsal branch. An extra dorsal branch begins on the head and runs posteriorly off the main lateral line.

Lateral processes. See parapophyses.

Lateral Teeth. See teeth lateral.

Laterally. Sidewise.

Length of upper jaw. Often referred to as "maxillary" in descriptions, measured from tip of the upper jaw (premaxillary symphysis) to the posterior end of the maxillary.

Length of body (standard length). Usually this length is measured from the tip of the snout to the base of the caudal rays (end of the last vertebra or hypural plate).

Lingual. Pertaining to the tongue.

Lunate. Form of the new moon; having a broad and rather shallow fork.

Mandible. Lower jaw.

Marbled. Variegated; clouded.

Maxilla or maxillary. Upper jaw. See *length of upper jaw* and see *maxillaries.*

Maxillaries. Outermost or hindmost bones of the upper jaw; in fishes they are joined to the premaxillaries in front or below, and usually extend farther back than the latter. They often lie above the premaxillaries.

Mesocoracoid. Median bone in the form of an arch in front of the coracoids, found only in certain soft rayed fishes.

Mesethmoid. See ethmoid.

Mesopterygoid. A bone of the suspensorium.

Metapterygoid. A bone of the suspensorium, supporting the lower jaw.

Molars. The grinding teeth; posterior teeth in the jaw; flat topped teeth.

Mottled. Color spots running together, blotched.

Mouth inferior. The mouth is located ventrally and a little behind the tip of the projecting snout.

Mouth oblique. The mouth is a modified terminal one in which the jaws usually lie at an angle of about 40 degrees or more to the anterior-posterior axis of the body.

Mouth ventral. The mouth is located much behind and below the tip of the snout, usually a distance equal to or more than length of snout.

Muciferous. Producing or containing mucus.

Mycomma (pl. Mycommata). A septum between two myotomes.

Myodome. Cavity under the brain cavity for reception of the rectus muscles of the eye.

Myotomes. Muscle segments.

Myxopterygia. See claspers.

Nape. Upper part of the neck, next to the occiput.

Nares. Nostrils, anterior and posterior.

Nasal plate. Plate in which the nostrils are inserted.

Neural arch. The dorsal arch of a vertebra for the passage of the spinal cord. See neural spine.

Neural canal. The cavity of the neural arch as a whole.

Neural processes. Two plates rising vertically, one on each side of the centrum of the vertebra, which unite toward their ends and form a spine.

Nictitating membrane. The third or inner eyelid.

Nuchal. Pertaining to the nape or nucha.

Nuchal spine. Posterior to and in line with the parietal spine (at posterior edge of parietal ridge) occurs the nuchal spine. If one of these spines is absent it is the nuchal spine.

Obsolete. Faintly marked, scarcely evident.

Obtuse. Blunt.

Occipital. Pertaining to the occiput.

Occipital condyle. That part of the occipital bone modified to articulate with the atlas.

Occiput. Back of the head. In fishes, specifically the cross line separating the fleshy nape from the head.

Ocellate. With eye-like spots, generally roundish and with contrasting borders.

-oid (suffiix). Like; as percoid, perch-like.

Opercle or operculum. Gill cover; the posterior membrane bone of the side of the head, in fishes.

Opercular flap. Prolongation of the upper posterior angle of the opercle.

Opisthocoelian. Concave behind only, said of vertebrae with ball and socket joints.

Opisthotic. A bone of the skull with which the lower limb of the posttemporal usually articulates.

Orbicular. Circular.

Orbit. Eye socket, (see length of eye).

Origin of fin. The term applied to where the median fins begin on the body.

Osseous. Bony.

Otolith. A bone of the inner ear of fishes lying in the sacculus.

Oviparous. Producing eggs which are developed and hatched after exclusion from the body, as in all birds and most fishes.

Ovovoviparous. Producing eggs, usually with much yolk. Usually hatching occurs before exclusion.

Ovum. Egg.

Palate. The roof of the mouth.

Palatines. Membrane bones of the roof of the mouth, one on each side extending outward and backward from the vomer.

Palustrine. Living in swamps.

Papilla. A small fleshy projection.

Papillose. Covered with papillae.

Parapophyses. The lateral projections on some of the abdominal vertebrae for the support of ribs.

Parietal. A bone on the top and back side of the head.

Parotic process. A posterior lateral process of the skull formed by the pterotic and opisthotic bones.

Parr marks. The vertical color bars found on Salmonoids.

Pectinate. Having teeth-like projections as in a comb.

Pectoral radials. See actinosts.

Pectoral fins. The anterior or uppermost of the paired fins, in fishes, corresponding to the anterior limbs of the higher vertebrates.

Pelagic. Living on or in the high seas.

Pelvic girdle. The bones supporting the ventral or pelvic fins.

Pelvic fin. See ventral fin.

Perforate. Pierced through.

Peritoneum. The membrane lining the abdominal cavity.

Pharyngeal bones. Bones behind the gills and at the beginning of the oesophagus of fishes. They are of various forms and almost always provided with teeth.

Pharyngeal teeth. In *Cyprinidae* the main row of teeth on each pharyngeal bone contains 4 or 5 teeth (seldom more or less); inside of this main row is a so-called "lesser row" which may contain 1 or 2 teeth or none, in the latter case being designated 0 in the formula, as for example, teeth 2:4-4:0 means 4 teeth in each main (outer) row, and 2 teeth in one lesser row of one side and 0 teeth in the other lesser (inner) row.

Pharyngobranchials. Upper elements of the branchial arches with teeth.

Pharyngognathous. Having the lower pharyngeal bones united.

Photophores. Small bead-like organs, light colored, for production of light.

Physostomous. Having the air bladder connected by a tube with the oesophagus.

Physoclistic. Having no open duct to air bladder.

Pituitary body. A small organ in the ventral part of the brain.

Plicate. Folded; showing transverse folds or wrinkles.

Plumbeous. Lead colored; dull bluish gray.

Polygamous. Mating with more than one female.

Polyphyodont. Said of teeth which are shed and new ones immediately take their place from beneath.

Postclavicle. A ray-like bone composed of one or two elements attached to the inner upper surface of the clavicle and extending downward.

Postorbital. Behind eye. In measurments, the greatest length of head between hindermost edge of orbit and opercular edge.

Postrostral. Behind the snout.

Post-temporal. The bone by which the shoulder girdle is suspended to the cranium in fishes.

Precoracoid arch. See mesocoracoid.

Prefrontals. Bones forming lateral projections on the anterior margins of the orbits.

Premaxillaries. The bones, one on either side, forming the front of the upper jaw in fishes.

Preocular. Before the eye.

Preopercle. The membrane bone lying in front of the opercle, nearly parallel with it.

Preorbital. The large membrane bone before the eye, in fishes.

Procoelian. Concave in front only.

Procurrent fin. With the lower rays inserted progressively farther forward.

Profile. The curve from the front of the dorsal fin to the tip of the snout.

Projectile. Capable of being thrust forward.

Prootic. A bone forming an anterolateral ossification of the brain case.

Protractile. Capable of being drawn forward.

Proximal. Nearest; basal.

Pseudobranchiae. Small gills developed on the inner side of the opercle near its junction with the preopercle.

Pterotic. A bone at the posterior lateral process of the skull.

Pterygoids. Bones of the roof of the mouth in fishes, behind the palatines.

Pubic bones. Same as pelvic bones

Pulmonary. Pertaining to the lungs.

Punctate or punctulate. Dotted with points; either of color or structure.

Pyloric caeca or coeca. See caecum.

Pylorus. Passage from stomach to intestine.

Quadrate. A bone of the suspensorium on which the mandible is hinged.

Quincunx. Arrangements in sets of 5, thus, ⁘

Ray. One of the cartilaginous rods supporting the membranes of the fin. Rays are either spiny or soft, the latter are simple or branched.

Recurved. Curved upward or backward.

Reticulate. Marked with a network of lines.

Retrorse. Turned backward.

Rictus. The posterior corner of the mouth.

Rostral plate. A small terminal plate on the tip of the snout.

Rudimentary. Undeveloped.

Rugose. Rough; wrinkled.

Scales above the lateral line. The number of scales is counted forward in an oblique row beginning at lateral line and running anteriorly to just before the dorsal fin.

Scaly appendage. The accessory scale which is a fleshy triangular projection just dorsal to the ventral fin base on certain fishes.

Scales below lateral line. The number of scales is counted in an oblique row beginning at the anterior margin of the ventral fin base and running forward or backward to the lateral line.

Scale formula. A conventional formula, "scales 7+65+12", for example, indicates seven scales in an oblique row above the lateral line, sixty-five scales in the lateral line, and twelve in an oblique series below the lateral line.

Scales in lateral line. Usually the number of scales bearing tubes in the lateral line or the number of oblique series (rows) along the side of the fish. The scales are counted, beginning just above the opercular opening, to the end of the hypural plate of the vertebral column, omitting the scales on caudal fin rays.

Scapula. Shoulder blade; in fishes, a bone of the shoulder girdle, the upper bone of coracoid series.

Scapular arch. Shoulder girdle.

Scute. Any external bony or horny plate, usually more or less spiny or keeled.

Second dorsal. The posterior of two fins, usually the soft rayed dorsal fin of "spiny rayed" fishes.

Septum. Thin partition.

Serrate. Notched like a saw.

Sessile. Without a stem or peduncle; attached.

Setaceous. Bristly.

Setiform. Bristle-like; like bristles of a brush.

Shoulder girdle. Bony structure posterior to the head, pectoral girdle to which the anterior limbs are attached, the pectoral fin.

Snout. The portion of the head which projects beyond the eyes. The snout is measured from the tip of the upper jaw to the anterior margin of the orbit.

Soft dorsal. The part of the dorsal fin in fishes composed of soft or articulated rays.

Soft rays. Fin rays which are articulated like bamboo fish poles.

Spatulate. Shaped like a spatula.

Sphenotic. A lateral bone of the skull.

Spine. A sharp projecting point; of fin rays, technically inarticulated, unpaired (median) rays, regardless of whether or not they are stiff and pungent.

Spinous. Stiff or composed of spines.

Spinous dorsal. Anterior part of dorsal fin of spinous rays; dorsal fin composed of inarticulated rays.

Spiracles. Respiratory openings in the head and neck of sharks and rays and certain other fishes.

Standard length. The distance from the tip of the snout to the base of the caudal fin rays.

Stellate. Star-like, with radiating ridges.

Striate. Striped or streaked.

Sub-. Less than; somewhat, not quite, under, etc.

Subcaudal. Under the tail.

Subopercle. First bone below the opercle, suture often hidden by scales or skin.

Suborbitals. See infraorbitals.

Suborbital stay. One of the suborbital bones in certain fishes, extending across the cheek, to or toward the preopercle.

Subulate. Awlshaped.

Sucking disk. A sucking organ, usually modified paired fins, used for clinging to rocks, etc.

Superpharyngeals. Upper pharyngeals or sometimes a synonym of pharyngobranchials.

Supplemental maxillary. A small bone or bones lying along the upper edge of the maxillary in some fishes.

Supraclavicle. Bone interposed between clavicle and post-temporal. The word cleithrum is in common usage.

Supra-. Above.

Suprascapular, or supracleithrum. A bone lying between the posttemporal and the cleithrum of the shoulder girdle.

Supraorbital spine. The spine above the eye, between the preorbital spine and the postorbital spine. If only two spines are present, the supraorbital is absent in *Sebastodes.*

Supraoral teeth. Teeth on the supraoral plate or lamina of lampreys.

Suspensorium. The chain of bones from hyomandibular to the palatines.

Suspensory bones. Bones by which lower jaw is fastened to the skull.

Suture. Line of union of two ossified bones.

Symphysis. Point of junction of the two parts of lower jaw; tip of chin.

Symplectic. The bone that keys together the hyomandibular and quadrate posteriorly, in fishes.

Synonymy. A list of technical names applied to a certain genus or species.

Swim bladder. See air bladder.

Tail. The part of the body posterior to the body cavity; in fishes applied to the caudal fin only.

Teeth bifid or bicuspid. With two projections.

Teeth deciduous. Said of teeth which are shed. On certain fishes the teeth are shed during spawning season. Certain pharyngeal teeth are attached by flesh or cartilage to the pharyngeal bone and are called deciduous although they may replace the normal teeth when the latter are lost.

Teeth lateral. Said of the series of teeth on each side of the oesophageal opening of lampreys.

Teeth multicuspid. Many cusps or projections on the teeth.

Teeth supraoral. See supraoral teeth.

Terete. Cylindrical and tapering.

Terminal. At the end.

Tessellated. Marked with little checks or squares, like mosaic work.

Thoracic. Pertaining to the thorax or chest; ventral fins are thoracic when attached immediately below the pectorals, the bones being attached to the shoulder girdle.

Transverse. Crosswise.

Transverse processes of vertebrae. Lateral processes of the vertebrae (abdominal) to which the ribs are attached.

Trenchant. Compressed to a sharp edge.

Truncate. Abrupt, as if cut squarely off.

Tubercle. A small excresence, like a pimple.

Type. The particular specimen upon which the original description of a species was based or the species upon which was based the genus.

Type locality. The particular place or locality at which the type was collected.

Ultimate. Last or farthest.

Unicolor. Of one single color or shade.

Vent. The external opening of the alimentary canal.

Ventral fins. Paired fins corresponding to posterior limbs, or pelvics.

Ventral fins, I, 5; I, 4; I, 2, etc.; one spine (Roman) and five soft rays (Arabic), etc.

Ventral plates. A row of plates along the belly between throat and vent.

Ventricle. One of the thick-walled chambers of the heart.

Versatile. Capable of being turned either way.

Vertebra. One of the bones of the spinal column.

Vertebrae, Abdominal. Anterior vertebrae which occur dorsal to the body cavity and to which the ribs are attached. They lack the haemal arch and canal, and the haemal spines on their ventral sides.

Vertebrae, caudal. Posterior vertebrae which possess an arch, canal and spine on the ventral side.

Vertical. Up and down or dorso-ventrally.

Vertical fins. Fins on median line of the body; median fins, the dorsal, caudal and anal.

Villiform. Said of the teeth of fishes when slender and crowded into velvety bands, or compact patches.

Viscous. Slimy.

Viviparous. Bringing forth living young. Usually the mother contributes food to the growth of the embryos.

Vomer. In fishes, the front part of the roof of the mouth; a bone lying immediately behind the premaxillaries, and usually bearing teeth.

Width. The width of a fish is taken at the widest part of the body.

Weberian ossicles. A chain of small bones developed in connection with the modified anterior vertebrae and connecting the air bladder with the ear in the *Ostariophysi*, such as suckers, carps, catfishes, minnows, chubs, etc.

Zygapophyses. Points of bone affording to the vertebrae more or less definite articulation with each other.

INDEX TO THE COMMON NAMES OF FISHES OCCURRING IN THESE KEYS

INDEX TO THE SCIENTIFIC NAMES OCCURRING IN THESE KEYS