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The First Record of the Smooth Lump-Sucker, *Cyclopterichthys ventricosus* (Pallas), in British Columbia Waters

By W. A. CLEMENS AND G. V. WILBY
University of British Columbia, Vancouver, B.C.

(Received for publication May 17, 1951)

A SPECIMEN of the above species of fish was brought by Mr. Grant Robertson to the Department of Zoology, University of British Columbia for identification and proved to be a new record for British Columbia waters. Mr. Robertson kindly permitted the writers to prepare the description and our thanks are extended to him for this privilege. Subsequently a second individual was forwarded by Fisheries Inspector J. A. Summers, to whom we are greatly indebted.

The account has been prepared in the form used in the bulletin on the marine fishes of British Columbia (Clemens and Wilby, 1946). The illustration is the work of Mr. F. L. Beebe.

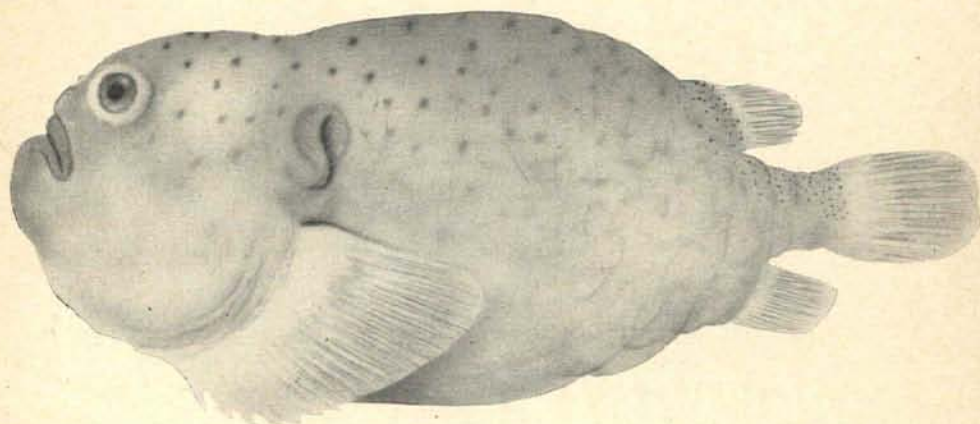


FIGURE 1

SMOOTH LUMP-SUCKER—*Cyclopterichthys ventricosus* (Pallas) 1769 (Figure 1)

Body short, deep, stout anteriorly, compressed posteriorly. Head globular, bluntly rounded; mouth terminal, wide, oblique; teeth in two rows anteriorly, outer small continuous, inner larger, irregular; snout broad, profile curved; nostrils paired, anterior tubular; eyes small; interorbital space flat, broad. Opercular opening very small, entirely above base of pectoral fin. Skin smooth, thick, loose. Fins: dorsal (1), 8 or 9, far back on body; anal, 7 to 9; pelvics thoracic, modified into moderate adhesive disc, with thickened margin; caudal rounded. Lateral line: absent. Scales: absent. Cirri: absent. Colour: brownish gray, spotted with black on dorsal surface; muddy gray on ventral surface.

Length to 5½ inches.

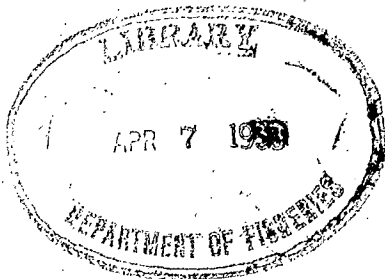
Distinguished by the short body and globular head, the absence of tubercles, the smooth loose skin, the single, rayed dorsal fin.

The smooth lump-sucker was first taken in British Columbia waters on August 1st, 1950, in Dean Channel in a salmon seine. A second individual was discovered in early September, 1951, in a salmon purse seine on the west coast of Moresby Island by Fisheries Inspector J. A. Summers. This specimen is in the Department of Zoology, University of British Columbia. These are the only records for British Columbia and apparently the only records south of the Bering Sea.

Range: Northern British Columbia to Northwestern Alaska.

REFERENCE

CLEMENS, W. A., AND G. V. WILBY. Fishes of the Pacific coast of Canada. *Bull. Fish. Res. Bd. Can.*, No. 68, 1-368, 1946.



The Agonid Fish *Pallasina barbata aix* (Starks), from British Columbia

BY W. E. BARRACLOUGH

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(Received for publication September 19, 1951)

FIVE SPECIMENS of the agonid fish *Pallasina barbata aix* (Starks) have been recovered from three localities in British Columbia waters. The first was caught in a small beach seine, July 24, 1947, in Whitesand Cove, on Flores Island off the west coast of Vancouver Island, by Mr. K. S. Ketchen of the Pacific Biological Station. A second specimen was recovered from a pan of frozen herring bait by Mr. A. L. Murray, fishery officer of District No. 1, Vancouver, B.C., on April 10, 1948, and donated to the University of British Columbia. The precise location of capture of this specimen is uncertain but it was known to have been caught by a herring seiner fishing in shallow water near Alert Bay on the east coast of Vancouver Island. A third specimen was caught by Captain George Gerbrandt of the shrimp trawler "Guillotte A," while trawling at a depth of 30 fathoms on the west side of Turnour Island in Johnstone Straits. Mr. R. M. Wilson of the Pacific Biological Station recovered this specimen for identification on April 10, 1948. Two specimens were collected by the author in a beach seine on the east side of Vargas Island off the west coast of Vancouver Island on August 31, 1951. The size and other characteristics of the five specimens are given in Table I, and Figure 1 is an illustration of the species drawn by Mr. D. Denbigh.

TABLE I. Length, fin rays, and number of unpaired plates on a median line of the breast in front of the pelvic fins, for the five specimens.

Origin of specimen	Whitesand Cove	Alert Bay	Turnour Island	Vargas Island	
Standard length, mm.	68	83	91	65	63
Dorsal fin rays	VII, 8	VII, 8	VI, 7	VI, 8	VII, 7
Anal fin rays	12	12	11	11	11
Pectoral fin rays	11, 12	12, 12	12, 12	11, 12	11, 11
Prepelvic plates	2	2	2	2	2

This species was first described by Steindachner (1876, p. 188, pl. 5) as a new species and named *Siphagonus barbatus*. It was collected from the Arctic region just north of the Bering Strait. Steindachner also recorded the species from Hakodai and Nagasaki, Japan. Bean (1882, p. 248; 1883, p. 25) records *S. barbatus* from Port Mulgrave, Yakutat Bay, Unalaska and Port Clarence, Alaska. Jordan and Gilbert (1882, p. 725) list the species from the coast of Alaska and Japan. Jordan (1885, p. 901) places the species among the Arctic

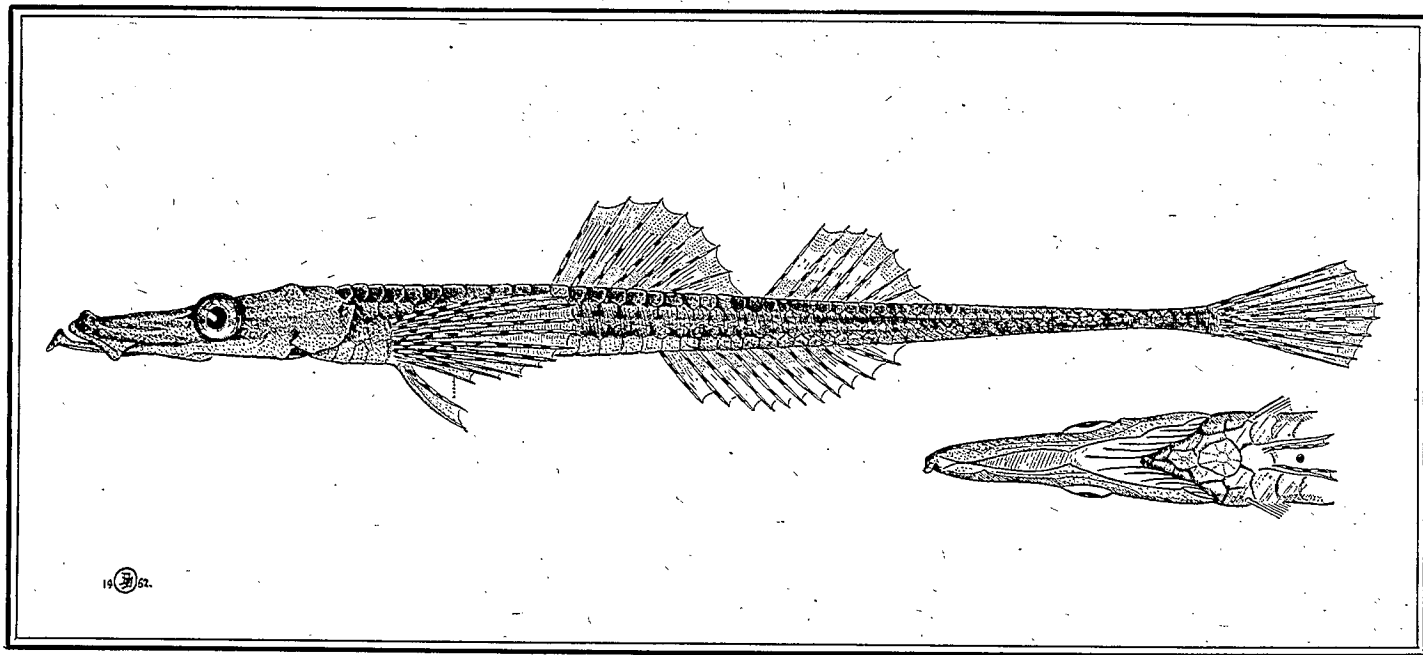


FIGURE 1. General appearance of *Pallasina barbata aix* (Starks), drawn by Mr. D. Denbigh.

fauna. Turner (1886, p. 94) lists the species from Iliuliuk, Unalaska. Gilbert (1895, p. 435) obtained *S. barbatus* in the ichthyological collections of the steamer "Albatross" at seven stations in Bristol Bay, at depths from 4.5 to 70 fathoms. He also collected the species during the summer of 1891 with a seine at Port Angeles, Washington. The species is tabulated by Schmidt (1903, p. 58) from the Sea of Japan, the Sea of Okhotsk, and the Bering Sea.

Most of the species formerly included in the genus *Siphagonus* are now placed in *Pallasina* by Cramer (in Jordan and Starks, 1895, p. 815), because *Siphagonus* was based on *Agonus segalienis*, which seems to be a true *Brachyopsis*. *Pallasina* was named for Petrus Simon Pallas, naturalist and explorer, the author of *Zoographia Rosso-Asiatica*, 1811. It is distinguished from *Brachyopsis* by the long slender body, syngnathous snout, and by the presence of a long barbel on the chin.

Jordan and Snyder (1901, p. 368) include *P. barbata* in a list of fishes collected in Japan by Keinosuke Otake, and the United States steamer "Albatross". Additional specimens of *P. barbata* are described by Jordan and Starks (1904, p. 588) from Aomori, Nemuro, and Mororan, Japan. The authors state that this species is the most abundant of the Agonidae of Japan, occurring in eel grass in shallow bays. Later, Snyder (1912, p. 436) records *P. barbata* as being collected by the United States Bureau of Fisheries steamer "Albatross" from Mori, Mororan, and Hakodate, Japan. Everman and Goldsborough (1907, p. 328) record 12 specimens seined in Funter Bay; 1 seined in Kilisut Harbor, 2 seined in Cleveland Passage; all collected by the "Albatross" in 1903 in Alaska. They also record specimens of *P. aix* that were collected by Scofield (1899, p. 504) from Chignik Bay, Alaska.

Pallasina aix was described as a new species by Starks (1896, p. 558, pl. 75), on the basis of its shorter barbel and 2 instead of 3 prepelvic plates. This species was reported to have been taken with a seine in great abundance in Puget Sound near Port Ludlow, Washington. Starks' characters were incorporated into a key by Jordan and Evermann (1898, p. 2049). Jordan and Gilbert (1899, p. 471) record two specimens of *Pallasina barbata* from Shana Bay, Iturup Island, Japan, and one from Tareinsky Bay, Kamchatka, and mentioned that Dr. Stejneger found the species at Petropaulski, Kamchatka. These specimens typically had 3 prepelvic plates as described for *barbata*, not 2 as in *aix*. Scofield (1899, p. 504) records six specimens of *P. barbata* from Port Clarence, Alaska, and finds that the specimens have much longer barbels and slightly longer pectoral fins than specimens from Bristol Bay. Scofield also lists two specimens as *P. aix*, taken at Chignik Bay, Alaska; one had 3 prepelvic plates, the other had 2.

Starks (1911, p. 194) still considered *P. aix* to be specifically distinct from *P. barbata*, on the basis that the length of the mandibular barbel was less variable in specimens from Puget Sound than in Alaskan specimens. He states in addition that either 2 or 3 prepelvic plates may occur among both species: but for *aix* 2 is the usual number and 3 the exception, while for *barbata* 2 is the exception.

Gilbert and Burke (1912, p. 65) suggest that *P. aix* be reduced to subspecific rank. Their suggestion resulted from a comparison of many specimens previously collected from Kamchatka, Alaska and Puget Sound. They found that the number of dorsal rays, anal rays, dorsal spines, pectoral rays and the number of unpaired prepelvic median plates show a marked overlapping and intergradation between different localities. Specimens from each locality seem to take on slightly distinctive combinations of the above characteristics.

It would appear that probably the best subspecific characteristic for distinguishing *Pallasina barbata aix* from *Pallasina barbata barbata* is the presence of 2 unpaired plates on the median line of the breast in front of the pelvic fins. The length of the barbel on the chin is evidently not a reliable characteristic for distinguishing the two subspecies, although a shorter mandibular barbel seems to occur more uniformly in specimens of *P. b. aix*. The suggestion of Gilbert and Burke is therefore used in recording this new record of five specimens of *Pallasina barbata aix* from British Columbia.

Most sincere thanks are due Dr. W. A. Clemens, Head of the Department of Zoology at the University of British Columbia for lending the specimen from the collection of the museum at the University for examination. The author wishes to thank Mr. K. S. Ketchen and Mr. R. M. Wilson for kindly presenting the two specimens to the author for examination. These two specimens are now in the collection of fishes in the Museum of the Pacific Biological Station, Nanaimo, B. C. The helpful suggestions of Dr. Carl L. Hubbs are gratefully acknowledged, and also his examination of the specimens with the author.

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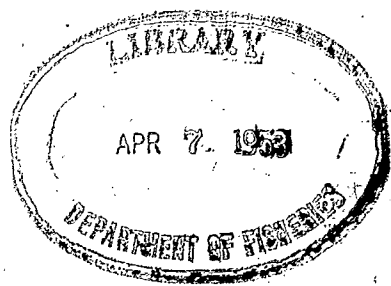
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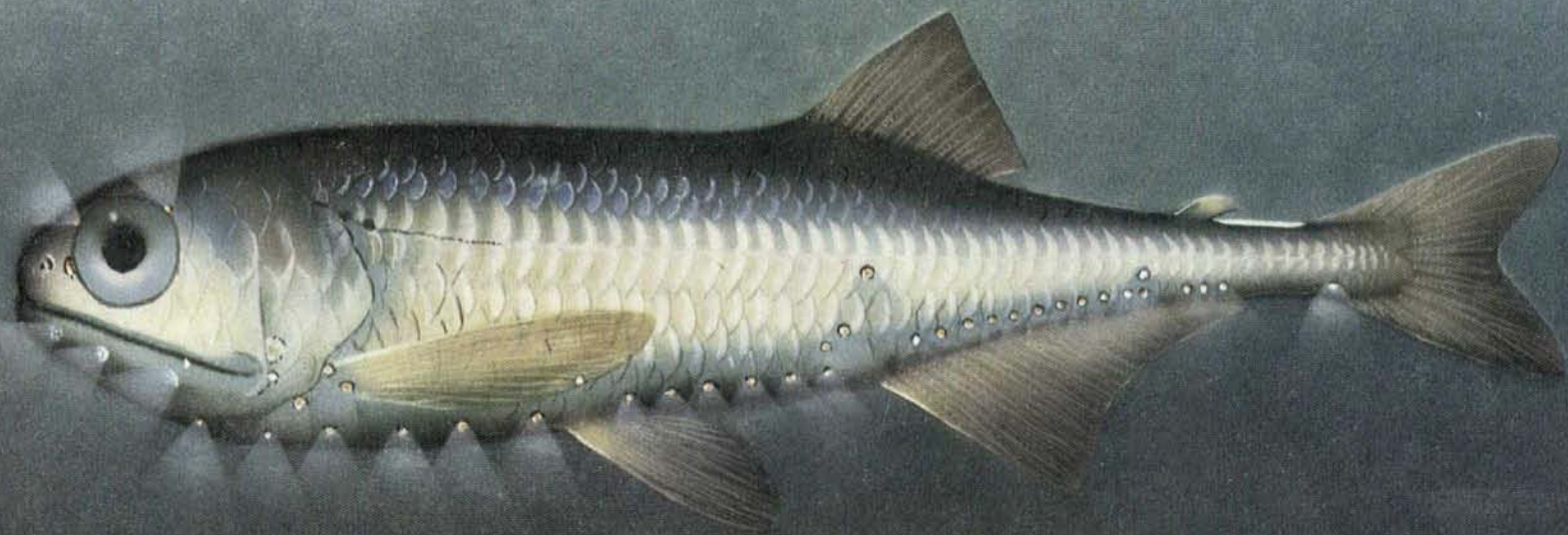
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BULLETIN No. LXVIII

FISHES OF THE PACIFIC COAST OF CANADA

BY

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and

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FISHES OF THE PACIFIC COAST OF CANADA

By W. A. CLEMENS AND G. V. WILBY
University of British Columbia

PREFACE

The aim of the authors has been to provide a concise and generally useful publication for both scientific and non-scientific persons interested in the marine fishes of the Pacific coast of Canada. The difficulty of attempting to meet all needs and desires will be realized. Since fishes occupy an aquatic habitat, collections and observations present certain difficulties and the accumulation of knowledge requires considerable effort and time. The information assembled in the following pages represents the results of the patient endeavours of many students over a long period of years. Much remains to be obtained and it is hoped that this account may be the means of stimulating the study of the fishes of British Columbia waters, particularly in regard to distribution and life histories.

ACKNOWLEDGEMENTS

The work was commenced at the Pacific Biological Station at Nanaimo, British Columbia, and to the Fisheries Research Board of Canada the authors wish to express their appreciation and thanks for facilities provided and the allotment of funds for the preparation of the illustrations. The authors also wish to make grateful acknowledgement to the University of British Columbia for facilities given and a grant from research funds to aid with a portion of the work.

To the following they extend their sincere thanks for much and varied assistance: Mr. G. J. Alexander, Provincial Fisheries Department, Victoria, B.C.; Dr. H. B. Bigelow, Harvard University, Cambridge, Mass.; Dr. R. L. Bolin, Scripps Institution of Oceanography, La Jolla, Cal.; Dr. G. C. Carl, Provincial Museum, Victoria, B.C.; Dr. W. M. Chapman, California Academy of Sciences, San Francisco, Cal.; Mr. H. A. Dunlop, International Fisheries Commission, Seattle, Wash.; Professor J. R. Dymond, Royal Ontario Museum of Zoology, Toronto, Ont.; Dr. R. E. Foerster, Pacific Biological Station, Nanaimo, B.C.; Dr. C. McLean Fraser, University of British Columbia, Vancouver, B.C.; Mr. E. C. Hart, Victoria, B.C.; Dr. J. L. Hart, Pacific Biological Station, Nanaimo, B.C.; Dr. C. L. Hubbs, Scripps Institution of Oceanography, La Jolla, Cal.; Mr. J. L. McHugh, Pacific Biological Station, Nanaimo, B.C.; Dr. G. C. Myers, Natural History Museum, Stanford University, Cal.; Mr. P. H. Nasmyth, North Vancouver, B.C.; Mr. F. Neave, Pacific Biological Station, Nanaimo,

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B.C.; Mr. J. R. Norman (deceased), British Museum, London, Eng.; Dr. A. L. Pritchard, Pacific Biological Station, Nanaimo, B.C.; Dr. L. P. Schultz, United States National Museum, Washington, D.C.; Mr. W. C. Schroeder, Harvard University, Cambridge, Mass.; Dr. L. A. Walford, Stanford University, Cal.; Mr. A. D. Welander, University of Washington, Seattle, Wash.; Mr. L. P. Woods, Field Museum, Chicago, Ill.; and the following firms in Vancouver, B.C.: British Columbia Packers Limited; Canadian Fishing Company Limited; Edmunds and Walker Limited; Shannon Brothers and Vancouver Shell Fish Company.

The authors have been fortunate in obtaining the services of Mr. F. L. Beebe for the preparation of the illustrations. These have been made under the direction of the authors, from actual specimens in the great majority of cases, otherwise from photographs and in a few instances as reconstructions from illustrations in publications by: D. S. Jordan and B. W. Evermann, E. C. Starks, R. L. Bolin and W. M. Chapman.

INTRODUCTION

The composition of the marine fish fauna of the Pacific coast of Canada is interesting in several respects. A few northern, or arctic, fishes have their southern limits of distribution on the British Columbia coast, as for example: the capelin, *Mallotus catervarius*, which spawns annually in Departure bay and which has only been reported occasionally from as far south as the vicinity of Victoria; the long-snouted blenny, *Lumpenella longirostris*, which has been taken in Burrard inlet at Bedwell bay, the most southern record for the species; the crested sculpin, *Histiocottus bilobus*, known south of Alaskan waters in Dean channel, and the yellow-fin sole, *Limanda aspera*, which extends southward into northern British Columbia only.

On the other hand certain southern forms tend to reach their northernmost distribution on the British Columbia coast, notably the pilchard, *Sardinops caerulea*, which appears along the west coast of Vancouver island during the summer months. In some years numbers have been observed farther northward, even in Alaskan waters, but in general the northern range limit may be said to be cape Scott. On the west coast of Vancouver island five bottom forms, hitherto considered as distinctly southern, have been found, namely, the spotted kelp-fish, *Gibbonsia elegans montereyensis*; the striped kelp-fish, *Gibbonsia metzi*; the big-finned eel-pout, *Aprodon corteziana*; the warty sea-poacher, *Occa verrucosa*; and the slender cling-fish, *Rimicola eigenmanni*. A few individuals of pelagic fishes of southern distribution are taken occasionally, such as: the silvery hatchet-fish, *Argyropelecus olfersii*; the king-fish, *Genyonemus lineatus*; the skipjack, *Katsuwonus pelamis*; the albacore, *Thunnus alalunga*; the California pompano, *Peprilus simillimus*; the barracuda, *Sphyræna argentea*; the ocean sun-fish, *Mola mola*; and the whale-sucker, *Remilegia australis*.

Several unique fishes living at great depths along this coast have become known as the result of the voyages of the *Albatross* and the work of the Inter-

national Fisheries Commission. Among these may be mentioned the deep-sea skate, *Raja abyssicola*, obtained at a depth of 1,588 fathoms off the Queen Charlotte islands; the abyssmal liparid, *Careproctus ovigerum*, also from the same depth and locality; the barrel-eye, *Macropinna microstoma*, to a depth of 487 fathoms; the bulb-fish, *Oneirodes bulbosus*, from over 379 fathoms.

Four species have been introduced from eastern points: the shad, *Alosa sapidissima*, in 1871 into the Sacramento and Columbia rivers, reaching Canadian waters off Vancouver island in 1876; the Atlantic salmon, *Salmo salar*, in 1905 and subsequently; the speckled char, *Salvelinus fontinalis*, in 1908 and later; the brown trout, *Salmo trutta*, in 1932, 1933 and 1934. The latter three species have been liberated in lakes and streams on Vancouver island but only the brown trout has been taken in salt water.

The number of species reported herein is 245. Of these 24 were described from types taken in British Columbia waters, as follows: the deep-sea skate, *Raja abyssicola*; the barrel-eye, *Macropinna microstoma*; the fanged viper-fish, *Chauliodus macouni*; the smooth-scaled grenadier, *Dolloa cyclolepis*; the filamented grenadier, *Chalinura filifera*; the rough-scaled grenadier, *Macrurus acrolepis*; the brown sea-perch, *Brachyistius brevipinnis*; the large-scaled goby, *Rhinogobiops nicholsii*; the arrow goby, *Clevelandia ios*; the Y-blenny, *Allo-lumpenus hypochromus*; the soft eel-pout, *Bothrocara mollis*; the cusk-pout, *Derepodichthys alepidotus*; the prow-fish, *Zaprora silenus*; the rough-spined sculpin, *Prionistius macellus*; Taylor's sculpin, *Asemichthys taylori*; the manacled sculpin, *Synchirus gilli*; the tadpole sculpin, *Psychrolutes paradoxus*; the grunt-fish, *Rhamphocottus richardsoni*; the smooth sea-poacher, *Anoplagonus inermis*; the spiny lump-sucker, *Eumicrotremus orbis*; Günther's liparid, *Liparis cyclopus*; Green's liparid, *Polypera greeni*; the abyssmal liparid, *Careproctus ovigerum*; and the bulb-fish, *Oneirodes bulbosus*. The following have been obtained only in these waters: the deep-sea skate, *Raja abyssicola*; the smooth-scaled grenadier, *Dolloa cyclolepis*; the filamented grenadier, *Chalinura filifera*; the Y-blenny, *Allo-lumpenus hypochromus*; the cusk-pout, *Derepodichthys alepidotus*; Taylor's sculpin, *Asemichthys taylori*; the abyssmal liparid, *Careproctus ovigerum*; and the bulb-fish, *Oneirodes bulbosus*.

The fact that 77 families of fishes are represented indicates something of the varied character of the fauna. Undoubtedly records of additional species will be added in the future in view of the fact that some 50 species, other than those described herein, have been recorded from Washington or Alaska or both. Furthermore there is the likelihood of the discovery of a number of species new to science.

A HISTORY OF MARINE ICHTHYOLOGICAL COLLECTIONS ON THE PACIFIC COAST OF CANADA

The history of scientific recordings of western Canadian marine fishes begins with the voyage of H.M.S. *Herald* in the northern Pacific ocean. A pink salmon was obtained in Observatory inlet and was described in 1836 by Sir John Richard-

son as the type of a new species, *Salmo scouleri*. This scientific name later was found to be a synonym of *Salmo gorbuscha* Walbaum, predescribed in 1792. In 1861 the genus *Oncorhynchus* was proposed by Suckley to include the Pacific salmon so the scientific name of this species is now *Oncorhynchus gorbuscha* (Walbaum).

The first collections of any size to be made were obtained by various members of the staff and crew of H.M.S. *Plumper*, which was sent out from England under Lieut.-Colonel Hawkins to continue the geodetic survey of the north-eastern Pacific ocean begun by Captain Vancouver. From November, 1857, to January, 1861, collections of fishes were made and shipped to the British Museum under the auspices of the Lords of the Admiralty, particularly Lord, later Earl, Russell. The specimens, in many cases dried skins only, were studied by Dr. Albert Günther who described them in his *Catalogue of the Fishes in the British Museum*. The eight volumes were published between 1860 and 1870. (Five of Günther's types from British Columbia waters are still valid.)

In 1866 J. K. Lord published his *A Naturalist in Vancouver island and British Columbia*, in two volumes, in which he listed and described to some extent the fishes that he encountered in his capacity as naturalist on the British America Boundary Commission. Since these collections were deposited in the British Museum they also were studied and referred to by Dr. Günther.

In 1880 Drs. D. S. Jordan and C. H. Gilbert collected and made observations in and around Victoria and recorded their findings in 1881.

In 1881 and 1882 Captain H. E. Nichols, U.S.N., commander of the U.S. Coast and Geodetic Survey vessel *Hassler* made rather extensive collections of shore and shallow-water fishes along the central and northern portions of the British Columbia coast, areas from which very few specimens have been obtained since, resulting in the discovery of three new species and many first records of species for these waters. The collections were recorded in 1881 and 1883, respectively, by Dr. T. H. Bean and are deposited in the United States National Museum at Washington, D.C.

In 1885 Dr. G. M. Dawson collected in the Queen Charlotte sound area and the fishes obtained were recorded in 1887 by J. F. Whiteaves.

Under the auspices of the U.S. Fisheries Commission the survey steamer *Albatross* was built and commissioned for the collection of marine flora and fauna and equipped for operations at great depths. After some preliminary work in the Atlantic ocean the vessel began a series of collections on the Pacific coast with the purpose of obtaining information on the fishing potential of the Pacific ocean. In 1888 a voyage was made in northern waters and upon the return trip from Alaska three successful hauls were made off the Queen Charlotte and Vancouver islands. In 1890, while en route from Alaska to California, a single haul was completed off Moresby island at a depth of 1,588 fathoms providing a remarkable collection of deep-sea fishes. In 1891 many trawl hauls were made in the Juan de Fuca strait area, twelve of which were in Canadian territorial waters and fishes were obtained at ten of these stations. In 1903 fourteen stations were

worked in the strait of Georgia and in Queen Charlotte sound, from which fishes were obtained at ten. In addition to the trawling and dredging operations many shore collections also were made in these waters. The fishes collected in 1888 were recorded in 1891 by T. H. Bean; those taken in 1890 and 1891 were recorded in 1895 by C. H. Gilbert, for the most part, and the 1903 collections were recorded in 1907 by B. W. Evermann and E. L. Goldsborough. All specimens obtained are now in the collections of the United States National Museum. From these *Albatross* collections several type specimens were obtained, two species of which have not since been taken.

The first extensive collections of fishes to be made by a Canadian in British Columbia waters were those of Mr. Ashdown Green, a civil engineer, who collected in the vicinity of Victoria. He published his records in 1891 and 1893 in the *Proceedings of the British Columbia Natural History Society*, the first volume of which (1891) has been out of print for many years and only a few copies are extant. Mr. Green's contribution to the literature included some nine first records for the Province and in recognition of his discovering a liparid new to science Drs. D. S. Jordan and E. C. Starks honoured him by naming it *Neoliparis greeni*, now known as *Polypera greeni*. Mr. Green's collections were the nucleus of the fish collection of the Provincial Museum at Victoria.

In 1898, John Fannin, first curator of the Provincial Museum, listed the fishes in the Museum, largely collected by Mr. Green, and added eight new records.

In 1900 a considerable shore collection was made on the Queen Charlotte islands and this was listed in 1901 by W. H. Osgood, United States Department of Agriculture, Biological Survey, on the identification of Mr. Edmund Heller.

On September 8 and 9, 1908, and from May to August, 1909, Messrs. C. H. Young and W. Spreadborough collected at Departure bay and on Barkley sound in the vicinity of Ucluelet, adding several new distribution records. The results of these collections, and some miscellaneous ones by Dr. G. M. Dawson, Messrs. J. H. Keen and A. Halkett, and Prof. E. E. Prince, were recorded in 1920 by B. A. Bean and A. C. Weed, and the specimens obtained are now in the United States National Museum.

During the years from 1912 to 1923 Dr. C. McLean Fraser made observations on a number of fishes in the Departure bay area and laid the foundations of the fish collection at the Pacific Biological Station. From 1924 to 1940, the present authors added to this collection and accumulated information which is now incorporated in this publication.

In 1928 Professor J. R. Dymond collected extensively along the south portion of the east coast of Vancouver island and the fishes are now in the Royal Ontario Museum of Zoology. The records have generously been made available to the authors.

Between 1929 and 1932 the International Halibut Commission made extensive tow-net hauls at considerable depths in the vicinity of the west coasts of Vancouver and the Queen Charlotte islands in search of the eggs and young of the halibut. Many fishes were obtained and these were recorded in part in 1939

and 1940 by W. M. Chapman, who described several species new to science in the 1939 publication. The type specimens are now in the United States National Museum and the remainder are in the collections of the International Fisheries Commission at Seattle, Washington.

In 1927 and 1930 Dr. H. C. Williamson recorded observations on sharks and rays and several fishes which he had seen at various points along the coast of British Columbia, chiefly along the west coast of Vancouver island.

In 1933 and 1934 the second author collected extensively in the vicinity of Nanaimo, English bay and in Burrard inlet. In the last two regions several new first records were obtained and are recorded herein. The collections are now in the Museum of the University of British Columbia.

In 1934 and 1935, through the cooperation of the Canadian Hydrographic Service, accommodation was arranged on the survey ship *Wm. J. Stewart* for a biologist and an oceanographer from the Pacific Biological Station. In the former year, operations were carried out off the west coast of Vancouver island and Mr. E. C. Hart supervised the collections of fishes and invertebrates, taken in shore-seines, dredge and trawl hauls and by shore collecting in tide-pools. Altogether 623 fishes were taken, extending the known distribution of many and adding eight new records for the Province. In 1935 the biological collection was continued under the direction of Dr. C. McLean Fraser in the Queen Charlotte islands area and 166 fishes were added to the *Wm. J. Stewart* collections.

For the most part the collections mentioned above have been quite extensive numerically. In addition a considerable number of isolated records have been published by various persons, and the present text includes twenty species not previously reported as occurring in western Canadian marine waters.

EXTERNAL CHARACTERS

Selachians and fishes are recognized by certain external characteristics. In referring to the various parts and describing their differences it is necessary to use definite terms. The glossary on page 340 gives the meanings of these terms as used in this text and should be referred to in all cases of doubt in using the key or the text.

Diagrams (figs. 2-7) on succeeding pages show the parts referred to in the descriptions which follow.

The following descriptions of certain parts are given to assist in the use of the key and of the specific descriptions which follow.

MEASUREMENTS

The measurements given in the text such as: Length of body; length of head; tip of snout to origin of dorsal fin, etc., are the distances between the vertical projections from these points, not over the curvature of the body or head.

Length of fish—standard. The distance from the tip of the snout, not including the premaxillaries when protracted, to the end of the vertebral column.

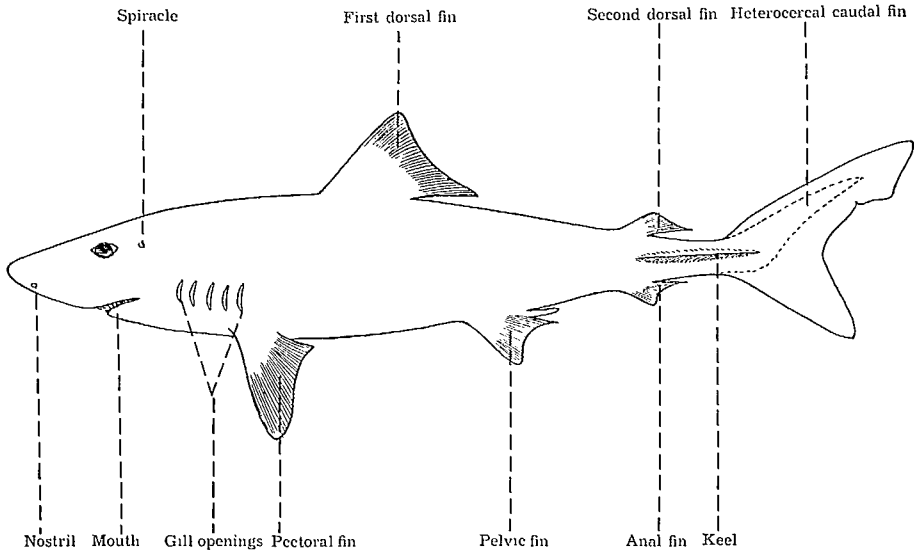


FIGURE 2. A hypothetical shark showing the external characters.

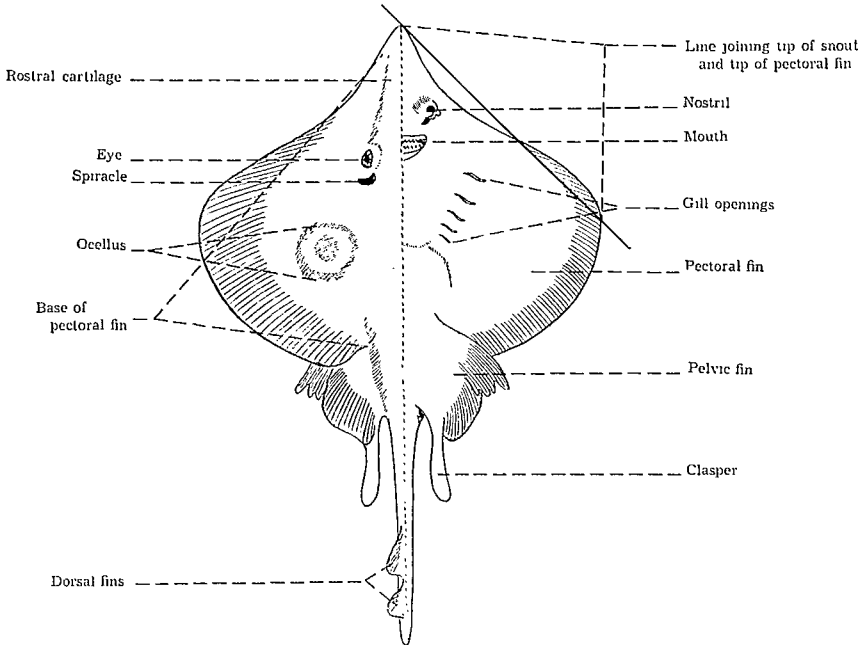


FIGURE 3. A hypothetical skate. Dorsal view on left. Ventral view on right.

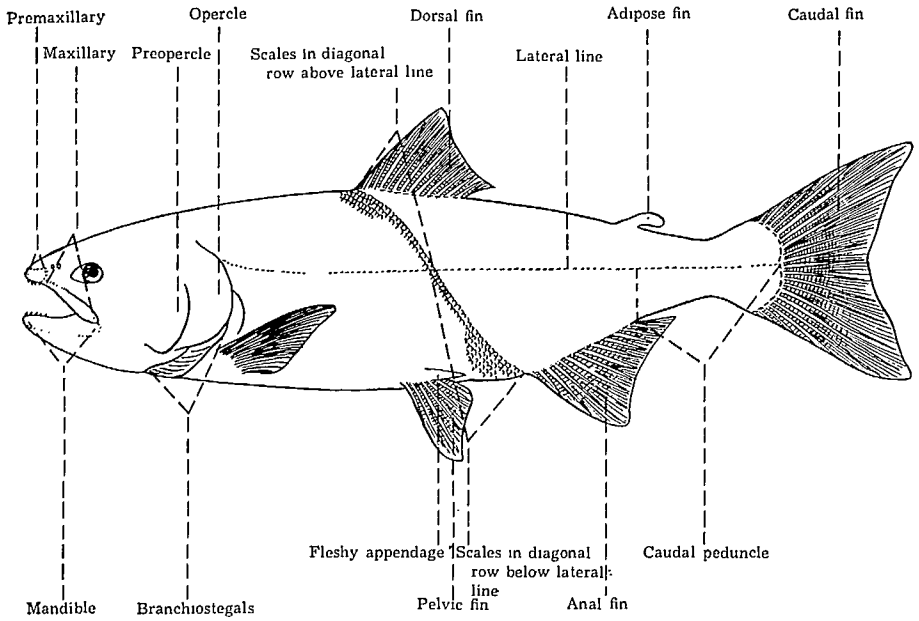


FIGURE 4. A hypothetical salmon showing the external characters.

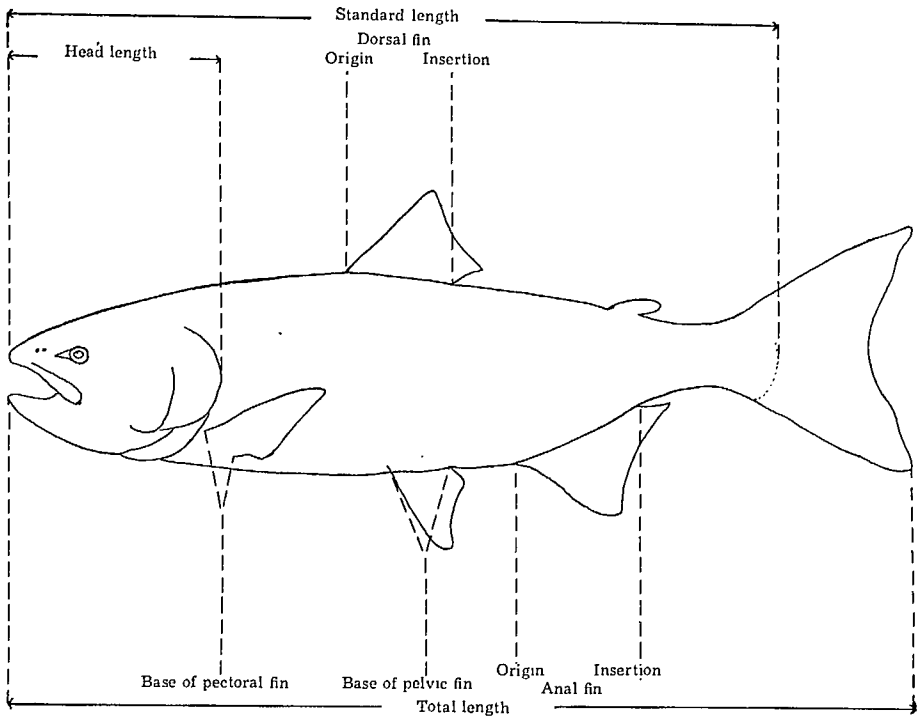


FIGURE 5. A hypothetical salmon showing methods of making measurements.

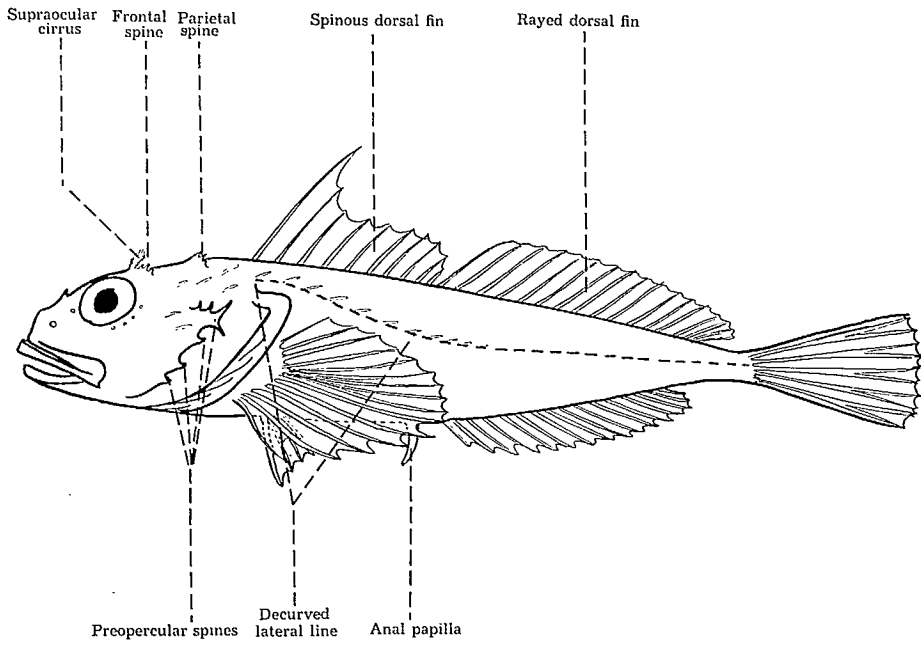


FIGURE 6. A hypothetical sculpin showing external characters.

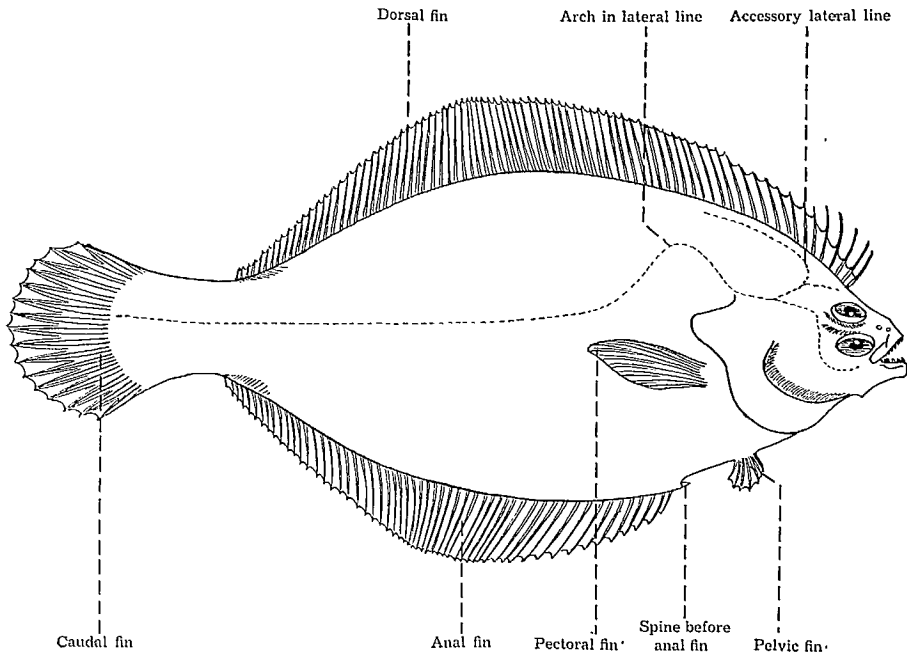


FIGURE 7. A hypothetical flounder showing external characters.

Length of fish—total. The distance between the verticals from the most anteriorly projecting part of the head and the most posterior portion of the body including the caudal fin, when present.

Length of head. The distance from the tip of the snout to the most posterior point of the opercular membrane.

Length of snout. The distance from the tip of the snout to the anterior margin of the orbit.

Length of upper jaw. The distance from the most anterior point of the premaxillary to the posterior point of the maxillary.

Length of fin. The length of the dorsal or anal fin is the distance between the origin and the insertion of the fin; the length of the pectoral, pelvic or caudal fin is the distance from the base to the tip of the longest ray.

Height of fin. The length of the longest ray or spine in the fin; applicable to the dorsal and anal fins.

FINS

I. PAIRED FINS

The paired fins of fishes, when present, are the pectorals and pelvics.

Pectoral fins. These are situated, one on each side of the body, each close to the head and usually behind the gill opening or openings and are supported by a pectoral girdle. In the skates and rays the pectoral fins are greatly expanded while the gill openings are ventral. In one family, the Oneirodidae, the pectoral fins are in front of the gill openings.

Pelvic fins. These occur in various positions on the lower surface of the body, on each side of the midventral position, in front of the anus. They are called ventral fins by some authors.

In the more generalized types of fishes the pelvic fins are situated in the posterior half of the region between the pectoral girdle and the anus and supported by a pelvic girdle. These are said to be *abdominal* in position, e.g., herrings, salmons, trouts, etc.

In many of the fishes the pelvic fins have their bases under, or almost under the pectoral fins, with the pectoral and pelvic girdles attached or in close proximity. They are then said to be *thoracic* in position, e.g. cods, mackerels, barracudas, rock-fishes, sculpins, flounders, etc. Some of the fishes in this group have the pelvic fins united to form a hollow cone, e.g. gobies. In some fishes the pelvic fins are united and modified into a flattened adhesive disk, e.g. lump-suckers and liparids, while in others the pelvic fins are united and, together with a fold of skin from the ventral surface of the body, form a laterally-cleft adhesive disk, e.g. cling-fishes.

II. VERTICAL FINS

The vertical fins of fishes are the dorsal, the anal and the caudal. In some species there may be a small fin behind the dorsal fin without rays called the adipose. In others there may be one or more finlets behind the dorsal and anal fins.

Dorsal fin. This may be in one or more portions, extending to a greater or lesser distance along the dorsal surface of the body. Fishes with the pelvic fins abdominal in position usually have a dorsal fin, or fins, composed of soft rays. In the majority of fishes with the pelvic fins thoracic in position the anterior portion of the dorsal fin is composed of more or less spinous rays. If two fins are present, the anterior fin usually is spinous.

In the Echeineidae the first dorsal fin is divided longitudinally and each half of the spine is depressed laterally, the whole fin forming part of an adhesive disk on the top of the head and the anterior portion of the dorsal surface of the body.

An extreme modification of the dorsal fin is found in the order Pediculati. Here the first spine of the dorsal fin consists of a single, elongate, complicated structure (the illicium), usually much divided at the tip and frequently luminous.

Anal fin. This, when present, lies along the posterior median ventral surface of the body. The origin usually is immediately behind the anus but in some species the anus occurs very much in advance of the fin, e.g. some liparids. Two anal fins may be present, e.g. cods.

Finlets. These occur on certain pelagic fishes such as the mackerels and usually are separate and pennant-shaped. Each is supported by a much divided ray and stream-lined by having the anterior margin thickened and the posterior portion thin and tapered.

Caudal fin. This, when present, is extremely variable in size and shape.

III. COUNTING FIN RAYS

In the enumeration of fin rays Roman numerals are used for spines, Arabic numerals for rays.

Dorsal fin. A simplified formula has been adopted, thus: dorsal (3), 11 to 13—16 to 18—12 to 14, indicates that there are three separate dorsal fins, the first with eleven to thirteen rays, the second with sixteen to eighteen, and the third with twelve to fourteen; dorsal (2), V - I, 9, indicates that there are two fins, the first composed of five spines, the second of a spine and nine rays; dorsal (1), XXI or XXII, 27 to 33, indicates that there is a single fin, the anterior portion of which is composed of twenty-one or twenty-two spines and the posterior portion of twenty-seven to thirty-three rays.

Anal fin. The fin formula is similar to that of the dorsal fin.

Pectoral fin. Counts are made of the rays from above downward.

Pelvic fin. When the fin is pulled forward counts are made from the anterior to the posterior margin, e.g. I, 5, indicates one spine and five rays. In some families, such as the Cottidae, the spine and the first ray are closely adherent and enclosed in a fold of skin so that the first ray may be overlooked if examination is not critical.

Caudal fin. Counts are made from the dorsal to the ventral margin, e.g. in the

family Melamphaidae, III, 19, III, indicates three dorsal spines, 19 rays and three ventral spines.

THE LATERAL LINE

The lateral line, as its name implies, is usually in a longitudinal median position on the side of the body from the upper margin of the operculum to the base of the caudal fin. It is a tube and along it at more or less regular intervals are pores, sometimes at the ends of short tubes, which open from an internal series of sensory nerve endings. The function of the lateral line is the detection of vibrations of very low frequency. Apparently the movements of the fish produce vibrations which are reflected from its surroundings and the fish is thus able to avoid collisions.

In some species the lateral line may be high, following the dorsal contour of the body. In others, the lateral line may be strongly decurved continuing below the median position to or toward the caudal fin. Occasionally the lateral line may be extremely irregular and wavy, as in the Scombridae. A prominent arch may be present over the pectoral fin in some of the flat-fishes.

Some fishes have no visible lateral line. Others have it partially developed and others may have multiple lateral lines on each side of the body. In some of the blennies with multiple lateral lines there may be short vertical extensions, as in the Xiphisteridae.

An accessory dorsal branch may be present in some of the flat-fishes from above the gill opening extending along the base of the dorsal fin, in addition to which shorter branches may extend onto the head region.

SCALES

In selachians and fishes most species develop hard protective structures in the skin known as scales.

In the selachians the scales are in the form of "thumb-tack" plates, each usually with a spine, which may be straight upward from the plate or slightly curved backward. These scales are known as *placoid* scales. The placoid scale has a dentine base and spine derived from the dermis, the inner layer of the skin. The spine is capped, like a tooth, with hard enamel which develops from the epidermis, the outer layer of the skin. In fact, in sharks and skates, the scales are modified to form teeth. The separate scales do not overlap.

In the fishes the scales are derived entirely from the inner layer of the skin, the dermis, and are of two kinds. In the fishes of the subclass Palaeopterygii, represented by the sturgeons and other forms, and in the garpikes and bowfin of the subclass Neopterygii, the scales consist of a basal plate with a hard outer covering called ganoin and the scales are known as *ganoid* scales. In the sturgeons the scales are mostly large thick isolated scutes from which the ganoin has been lost but small ganoid scales often persist on the upturned portion of the tail.

In the fishes of the subclass Neopterygii, represented by the great majority of modern fishes, the scales, other than those mentioned above, lie in pockets

of the skin with their posterior portions projecting posteriorly. These scales are usually overlapping, or imbricated, like shingles on a roof, and thin for flexibility and freedom of movement of the body. They are referred to frequently as "true" scales. These are of two types, *cycloid* and *ctenoid*, basically the same in origin and structure and sometimes both kinds are found on the same fish.

The cycloid scales have smooth posterior margins and are more frequently found in fishes with soft dorsal fin rays. The ctenoid scales have comb-like or spinous posterior margins and are more frequently found in fishes with hard, or spinous dorsal fin rays. In certain species, e.g. cottids, liparids, etc., the ctenoid scale may be much reduced in size becoming a mere rim with a spinous margin or even a single spine. These are known as *reduced ctenoid* scales.

Cycloid and ctenoid scales increase in area and thickness with the growth of the fish. In the majority of fishes the growth of a scale is marked by the formation of a more or less concentric series of ridges, known as *circuli*, which are especially evident on the portion within the scale-pocket. When growth is rapid the circuli are far apart and when growth is slow they are close together. When growth is arrested, as in winter conditions, the circuli are closely grouped and known as winter "checks." These winter checks are readily distinguishable in the salmons and several other species of fishes and are used in age determination.

COUNTING SCALES AND SCALE FORMULAE

The number of scales, as counted from one part of the body to another, is of value in the identification of many fish species and enumeration is made as follows:

Scales on lateral line. The number of scales on the lateral line, from above the opercular opening to the base of the caudal fin.

Scales in oblique rows above midline of body. Counted from the operculum to the base of the caudal fin.

Scales in first row above lateral line. In certain groups the scale count on the lateral line is impractical or difficult to make so the count of the first longitudinal row above is used.

Scales in diagonal row above lateral line. Usually in a diagonal row from the origin of the dorsal fin to the lateral line, downward and backward.

Scales in diagonal row below lateral line. Usually in a diagonal row from the origin of the anal fin, upward and forward to the lateral line.

Scale formula. A conventional formula "scales 7 + 70 + 11," would indicate seven scales in a diagonal row above the lateral line, seventy in the lateral series and eleven in a diagonal row below the lateral line.

CIRRI

Cirri (singular, cirrus), are fleshy extensions of the skin and may be simple, bifid, multifid, etc. They are distributed on various parts of the head and body. The principal locations on the head are designated as follows:

Nasal. In the region of the nostril.

- Preopercular.* Above and before the middle of the eye.
Supraocular. Above the middle of the eye.
Postocular. Above and behind the eye.
Occipital. In the occipital region.
Maxillary. On the posterior end of the maxillary.

BONES AND SPINES OF THE HEAD AND HEAD REGION

In the rock-fishes, certain of the bones of the head and anterior portion of the body immediately behind the head may bear spines which penetrate through the skin to the outside. The first series of bones is composed of the nasal, the prefrontal, the frontal and the parietal, along the top of the head from the snout to the anterior portion of the body. The nasal is small, forming the anterior portion of the snout region, and bears a single spine; the prefrontal is small, lying immediately in front of the eye, and bears a single spine; the frontal extends from the anterior margin of the orbit to a short distance behind the orbit and bears the frontal and median frontal spines; the parietal lies behind the frontal and usually bears a single spine at the posterior end of a long ridge. A second series of bones extends from behind the posterior margin of the eye, the sphenotic and pterotic bones, each of which may bear spines. These are in line with the anterior portion of the lateral line. At the anterior end of the lateral line are two bones which form part of the pectoral girdle. The upper is the supracleithrum which may bear one or two spines, and the lower is the cleithrum, usually bearing one spine, occasionally two. On the posterior margin of the gill cover is a bone, the operculum, with two slightly diverging spines, the opercular spines. The curved bone immediately in front of the operculum, is the preoperculum, on which are five spines, the preopercular spines. Below the eye and extending partly behind it is a series of three suborbital bones. The third of these forms a more or less prominent bony structure which reaches to the preoperculum and is referred to as the "bony stay." This usually is not observable without dissection. The first bone of this series is the lacrymal which usually is expanded in an antero-posterior direction, the lower margin lying immediately above the maxillary bone. In some species the lower margin of the lacrymal bone may be enlarged to form one or two distinct lobes which may bear spines.

LOCATION OF SPINES IN THE HEAD REGION (FIG. 8)

- Nasal.* Immediately above the nostril.
Prefrontal. At the upper anterior margin of the orbit (preocular—of authors).
Frontal. Along the upper margin of the orbit and immediately behind. One to three may be present behind the prefrontal spine to a short distance behind the eye, designated as frontals I, II, III. Frontal I (supraocular), above posterior margin of pupil. Frontal II (postocular), above posterior margin of orbit. Frontal III (tympanic), immediately behind frontal II.
Median frontal. Between the midline of the frontal bone and the margin of the orbit, usually on a well defined ridge. When present, varying from a single

spine at the posterior end of the ridge to numerous rugosities along the whole ridge (coronal).

Parietal. Usually on the posterior end of an elongate ridge behind and slightly median to the frontal series. The parietal ridge frequently is slightly curved away from the midline of the head posteriorly and the spine is approximately at a point midway between the upper posterior margin of the eye and the origin of the dorsal fin. In a few species a second parietal spine may be present (nuchal).

Sphenotic. At the posterior margin of the orbit.

Pterotic. Immediately behind the sphenotic.

Supracleithral. Immediately above the anterior end of the lateral line. In some species two spines may be present.

Cleithral. Immediately below the anterior end of the lateral line. Sometimes two spines may be present.

Opercular. Near the posterior tip or margin of the operculum, usually two spines are present.

Preopercular. On the posterior margin of the preoperculum. Five spines usually are present, sometimes the fifth very small, and in some species the individual spines may be multifid.

Lacrymal. At the lower anterior margin of the eye on the lacrymal bone. The lower margin of the bone may have one or two lobes on which spines occur. Usually not more than one on the anterior lobe but one to several on the posterior (preorbital).

For convenience the spines on one side only of the head are used but it must be remembered that they are really paired.

For the identification of fishes, "keys" are used. In these the identity of a specimen is determined by the "true and false" method. The first statement in the key is considered. If it applies exactly to the specimen, that is, is true, the second statement is considered. If this is correct, the next statement is taken and as long as the statements apply each succeeding statement is taken until a name is given at the end of the line. On the other hand, if the first statement does not apply, that is, is false, the alternative indicated by the number in brackets must apply. The number with its alternative statement is then located and the system continued with the true or false method until a name is given at the end of a statement when the identification is complete. No fish fits two alternatives in the key; every fish must fit one or the other. If a case arises where a fish does not seem to have the characters to fit either alternative, an error has been made and it is necessary to go back to the beginning and re-check each statement. After the specimen being examined is keyed carefully until a definite name appears at the end of a statement, reference should be made to the figure and description in the following portion of the book in order to verify the determination.

It may be pointed out that owing to the convenient use of the presence and absence of pelvic fins in the construction of the key, some families such as the Stichaeidae, Pholidae, Cottidae, Liparidae, etc., appear in two sections. The key therefore does not present a complete systematic arrangement of the families.

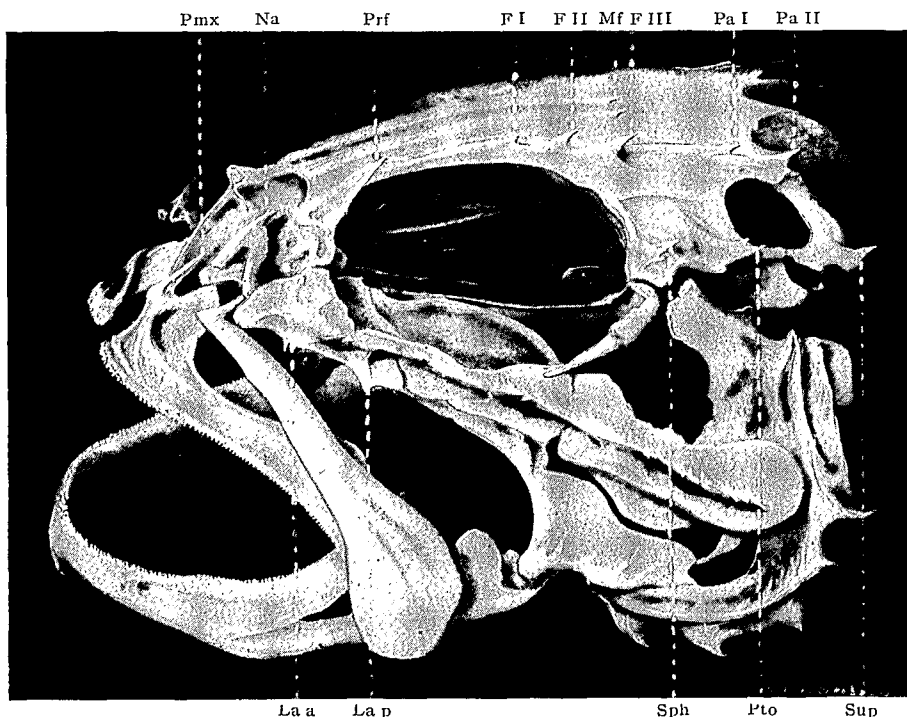


FIGURE 8. A hypothetical rock-fish skull showing the cranial spines. Pmx—premaxillary; Na—nasal; Prf—prefrontal; FI, II, III—frontals; Mf—median frontal; Pa I, II—parietals; La a—anterior lacrymal; La p—posterior lacrymal; Sph—sphenotic; Pto—pterotic; Sup—supraclithral.

A KEY TO THE ADULT MARINE FISHES AND FISH-LIKE VERTEBRATES IN WESTERN CANADIAN WATERS

- 1 (4) Mouth in a circular sucking disk; jaws absent; nostril, 1, median.
- 2 (3) Gill pores on each side of body, 7, first close behind eye; eyes not covered with skin; barbels around mouth or nostril, none.

Family **PETROMYZONIDAE**—Lampreys
Pacific lamprey *Entosphenus tridentatus*
- 3 (2) Gill pores on each side of body, 10 to 14, first remote from eye; eyes covered with skin; barbels around mouth and nostril, 8, long.

Family **MYXINIDAE**—Hag-fishes
Hag-fish *Polistotrema stoutii*

- 4 (1) Mouth not in a circular disk; jaws present; nostrils, 2.
 5 (38) External gill openings on each side of body, 5 to 7, or on ventral surface, in 5 pairs.
 6 (25) External gill openings on each side of body, 5 to 7; pectoral fins not expanded at bases.
 7 (10) Dorsal fin (1); external gill openings, 6 or 7.

Family **HEXANCHIDAE**—Cow sharks

- 8 (9) External gill openings, 7.
 Spotted cow shark *Notorynchus cepedianus*

- 9 (8) External gill openings, 6.
 Mud shark *Hexanchus griseus*

- 10 (7) Dorsal fins (2); external gill openings, 5.
 11 (22) Anal fin present.
 12 (17) Large keel on each side of caudal peduncle; or, if keels absent, caudal fin half total length of shark.

Family **LAMNIDAE**—Mackerel sharks

- 13 (16) Large keel on each side of caudal peduncle; caudal fin much less than half total length of shark.
 14 (15) Gill slits moderate, first about equal in length to distance from tip of snout to posterior margin of eye; teeth large, sharp.
 Mackerel shark *Isurus nasus*

- 15 (14) Gill slits very long, first more than twice as long as distance from tip of snout to posterior margin of eye; teeth very small.
 Basking shark *Cetorhinus maximus*

- 16 (13) No keels on caudal peduncle; caudal fin about half total length of shark.
 Thresher shark *Alopias vulpinus*

- 17 (12) No keels on caudal peduncle; caudal fin much less than half total length of shark.
 18 (19) Anal fin large, length of base about twice that of first dorsal fin.

Family **SCYLLIORHINIDAE**—Cat sharks

- Brown shark *Apristurus brunneus*

- 19 (18) Anal fin small, length of base much less than that of first dorsal fin.

Family **CARCHARINIDAE**—Blue sharks

- 20 (21) Length of pectoral fin only slightly greater than height of first dorsal fin, fin not sabre-shaped; black spot on each dorsal fin.
 Soup-fin shark *Galeorhinus galeus*

- 21 (20) Length of pectoral fin twice height of first dorsal fin, fin sabre-shaped; no black spot on either dorsal fin.
 Blue shark *Prionace glauca*

- 22 (11) Anal fin absent.

Family **SQUALIDAE**—Dog-fishes

- 23 (24) Large spine in anterior margin of each dorsal fin.
 Dog-fish *Squalus suckleyi*

- 24 (23) No spine in anterior margin of either dorsal fin.
 Sleeper shark *Somniosus microcephalus*
- 25 (6) External gill openings on ventral surface of body in 5 pairs; pectoral fins expanded at bases, each extending from snout to pelvic fin.
- 26 (37) Snout acutely pointed anteriorly.
- 27 (36) Body elongate posteriorly, not forming whip-like extension and without large spine above; dorsal fins (2), near tip.
- Family **RAJIDAE**—Skates
- 28 (31) Outline between tip of snout and tip of pectoral fin concave so that a line drawn between these two points lies almost wholly without margin; snout supported by firm cartilage.
- 29 (30) Pelvic fins deeply notched when extended; colour on upper surface of body nearly plain brown, on lower surface, muddy blue.
 Long-nosed skate *Raja rhina*
- 30 (29) Pelvic fins with slight concavity when extended; colour on upper surface of body brown to gray with scattered pale spots, large "eye-spot" surrounded by ring of light spots at base of each pectoral fin, on lower surface, nearly white.
 Big skate *Raja binoculata*
- 31 (28) Outline between tip of snout and tip of pectoral fin more or less convex so that a line drawn between these two points lies almost wholly within margin; snout supported by weak cartilage.
- 32 (35) Spines present on shoulder girdle.
- 33 (34) Spines on shoulder girdle, about 6; on orbital rim, in row.
 Prickly skate *Raja stellulata*
- 34 (33) Spines on shoulder girdle, 1 or 2; on orbital rim, none.
 Black skate *Raja kincaidii*
- 35 (32) Spines on shoulder girdle, none.
 Deep-sea skate *Raja abyssicola*
- 36 (27) Body greatly elongate posteriorly, forming whip-like extension with large sharp spine above; dorsal fins, absent.
 Family **TRYGONIDAE**—Sting rays
 Rat-tailed sting ray *Dasyatis dipterurus*
- 37 (26) Snout bluntly rounded anteriorly.
 Family **TORPEDINIDAE**—Electric rays
 Electric ray *Tetranarce californica*
- 38 (5) External gill opening on each side of body, 1.
- 39 (436) PELVIC FINS PRESENT.
- 40 (115) PELVIC FINS ABDOMINAL IN POSITION.
- 41 (42) Dorsal fins (2), spine at anterior margin of first dorsal fin stout, grooved, serrate; caudal fin long, lanceolate; pectoral fins large, paddle-shaped; teeth incisor-like, on

upper jaw, 4, on lower jaw, 2, formed by union of several teeth. (*The adipose fin of salmon, trout, etc., is not regarded as a dorsal fin in this key.*)

Family **CHIMAERIDAE**—Chimaeras

Rat-fish

Hydrolagus colliciei

- 42 (41) Dorsal fin (1), no spine at anterior margin (dorsal fin preceded by a series of bony plates in the silvery hatchet-fish); caudal fin not lanceolate; pectoral fins not paddle-shaped; teeth, if present, not incisor-like.
43 (114) Dorsal fin not followed by 5 or more free finlets.
44 (47) Bony shields on body, in 5 widely separated rows; mouth ventral, protrusible; barbels under snout, 4, in transverse row; upper lobe of caudal fin much longer than lower.

Family **ACIPENSERIDAE**—Sturgeons

- 45 (46) Lateral shields, 38 to 48; barbels nearer tip of snout than mouth; colour, gray.
White sturgeon *Acipenser transmontanus*
46 (45) Lateral shields, 23 to 30; barbels nearer mouth than tip of snout; colour, green.
Green sturgeon *Acipenser medirostris*
47 (44) No bony shields on body, mouth terminal or subterminal, not protrusible; barbels under snout, none; caudal fin, not as above.
48 (113) Base of dorsal fin shorter than head, rays in dorsal fin fewer than 26.
49 (92) Neither photophores nor luminous spots present.
50 (57) Dorsal fin not followed by adipose fin.

Family **CLUPEIDAE**—Herrings

- 51 (56) Mouth moderate, terminal.
52 (55) Large specialized scales on each side of tail, 2; striae on operculum; black spots on each side of body in row, conspicuous when scales removed.
53 (54) Body deep, much compressed; keels on ventral scutes, strong; striae on operculum coarse, radiating; round black spots on each side of body in row, usually visible when scales in place, decreasing in size posteriorly.
Shad *Alosa sapidissima*
54 (53) Body terete; keels on ventral scutes, weak; striae on operculum fine, almost parallel but slightly curved; round black spots on each side of body in row, sometimes not visible when scales in place, uniform in size.
Pilchard *Sardinops caerulea*
55 (52) No large specialized scales on either side of tail; no striae on operculum; no round spots on sides of body.
Herring *Clupea pallasii*
56 (51) Mouth large, subterminal.
Anchovy *Engraulis mordax*
57 (50) Dorsal fin followed by adipose fin.
58 (91) Eyes lateral, not directed upward; snout not broad or shovel-like.
59 (80) Fleshy appendage at base of each pelvic fin.

Family **SALMONIDAE**—Salmons

60 (69) Rays in anal fin, 12 to 19.

Genus *Oncorhynchus*—Pacific salmon

61 (66) Large black spots on back and caudal fin.

62 (63) Spots on back and caudal fin, large; scales in first row above lateral line, 170 or more, small.

Pink salmon

Oncorhynchus gorbuscha

63 (62) Spots on back and caudal fin, small, irregular; scales in first row above lateral line, fewer than 155, moderate.

64 (65) Black spots, when present on caudal fin, usually on upper lobe only; pyloric caeca, 45 to 80.

Coho salmon

Oncorhynchus kisutch

65 (64) Black spots on both lobes of caudal fin; pyloric caeca, 140 to 185.

Spring salmon

Oncorhynchus tshawytscha

66 (61) No large black spots on back or caudal fin, small black speckling usually present.

67 (68) Rakers on first gill arch, 19 to 26, short, stout, smooth, widely spaced.

Chum salmon

Oncorhynchus keta

68 (67) Rakers on first gill arch, 30 to 39, long, slender, rough, closely set.

Sockeye salmon

Oncorhynchus nerka

69 (60) Rays in anal fin, 8 to 12. (Trouts and chars.)

70 (77) Teeth on head and shaft of vomer; spots black (sparse in *S. salar*). (Spots may be faint if fish has been in salt water for some time.)

Genus *Salmo*—Trouts

71 (72) Teeth on back of tongue; red dash on under side of lower jaw (conspicuous in freshwater specimens, frequently absent in marine individuals).

Coastal cut-throat trout

Salmo clarkii clarkii

72 (71) No teeth on back of tongue; no red dash on under side of lower jaw.

73 (74) Black spots on body large, in many cases each surrounded by halo of pink or red.

Brown trout

Salmo trutta

74 (73) Black spots on body small, without halos.

75 (76) Caudal peduncle stout; rays in anal fin, 10 or 11 usually, 9 or 12 occasionally; continuous red band, varying in width, along side of body, always present in mature fish; usually spots on caudal fin.

Steelhead trout

Salmo gairdnerii gairdnerii

76 (75) Caudal peduncle slender; rays in anal fin, 9 usually, 8 or 10 occasionally; never continuous red band along side of body; seldom spots on caudal fin.

Atlantic salmon

Salmo salar

77 (70) Teeth on head of vomer only; spots yellow and red, never black (frequently yellow or red spots may be faint if fish has been in salt water for some time).

Genus *Salvelinus*—Chars

- 78 (79) Spots on back, pale yellow; no vermiculations on back or dorsal fin.
Dolly Varden *Salvelinus malma*
- 79 (78) No spots on back; prominent dark green vermiculations on back and dorsal fin.
Speckled char *Salvelinus fontinalis*
- 80 (59) No fleshy appendage at base of either pelvic fin.
- 81 (88) Lateral line present.
Family **OSMERIDAE**—Smelts
- 82 (83) Scales on lateral line, more than 150, small (2 villous bands of scales along each side of body in breeding male); adipose fin large, length of base about half that of dorsal fin; pectoral fin broad, rays, 16 to 20.
Capelin *Mallotus catervarius*
- 83 (82) Scales on lateral line, fewer than 85, large (no villous band of scales along each side of body in male); adipose fin rather small, length of base much less than half that of dorsal fin; pectoral fin narrow, rays, 15 or fewer.
- 84 (85) Origin of dorsal fin slightly in front of origin of pelvic fins.
Silver smelt *Hypomesus pretiosus*
- 85 (84) Origin of dorsal fin above or slightly behind origin of pelvic fins.
- 86 (87) Striae on opercular bones following contour, well defined; pectoral fins distinctly shorter than length of head; black stippling on back sparse, fine.
Eulachon *Thaleichthys pacificus*
- 87 (86) No striae on opercular bones; pectoral fin as long as head, or longer; black stippling on back and head dense, prominent.
Long-finned smelt *Spirinchus dilatatus*
- 88 (81) Lateral line absent.
Family **BATHYLAGIDAE**—Black smelts
- 89 (90) Rays in anal fin, 18 to 20; scales in oblique rows above midline of body, more than 30.
Slender black smelt *Bathylagus pacificus*
- 90 (89) Rays in anal fin, 23 to 27; scales in oblique rows above midline of body, fewer than 30.
Big-scaled black smelt *Bathylagus milleri*
- 91 (58) Eyes on cylindrical bases, high, directed upward; snout broad, shovel-like.
Family **MACROPINNIDAE**—Barrel-eyes
Barrel-eye *Macropinna microstoma*
- 92 (49) Photophores or luminous spots present.
- 93 (112) Photophores present on body; no luminous spots on eyes.
- 94 (101) Photophores in 2 more or less parallel rows on each side of abdomen.
- 95 (98) Teeth on jaws small.
- 96 (97) Body elongate, slender, little compressed.
Family **GONOSTOMATIDAE**—Angle-mouths
Veiled angle-mouth *Cyclothone microdon*

- 97 (96) Body short, deep, very greatly compressed.
 Family **STERNOPTYCHIIDAE**—Hatchet-fishes
 Silvery hatchet-fish *Argyropelecus olfersii*
- 98 (95) Teeth on jaws large, fang-like.
 99 (100) Scales, adipose and pectoral fins, present.
 Family **CHAULIODONTIDAE**—Viper-fishes
 Fanged viper-fish *Chauliodus macouni*
- 100 (99) Scales, adipose and pectoral fins, absent.
 Family **STOMIATIDAE**—Stomiatis
 Arrow-fish *Tactostoma macropus*
- 101 (94) Photophores not in 2 parallel rows on each side of abdomen.
 Family **MYCTOPHIDAE**—Lantern-fishes
- 102 (103) Anal photophores (AO), in continuous series; posterolateral (Pol), photophore, none.
 Big-eyed lantern-fish *Electrona thompsoni*
- 103 (102) Anal photophores (AO), in 2 series (AO_a - AO_p), separated by an interspace; posterolateral (Pol), photophores, 1 or 2.
- 104 (105) Lateral line very short, pores on only few anterior scales; suprapectoral (PLO), photophore never above base of pectoral fin; precaudal (Prc), photophore, 1, well separated from posterior anal (AO_p), photophore series.
 Blue lantern-fish *Tarletonbeania crenularis*
- 105 (104) Lateral line extending to base of caudal fin; suprapectoral (PLO), photophore always above and slightly anterior to base of pectoral fin; precaudal (Prc), photophores, 2 or 4 (counted as 4 when in continuous series with posterior anal (AO_p), photophore series).
- 106 (107) Tip of pectoral fin reaching well behind insertion of pelvic fin; precaudal (Prc), photophores, 2, distinctly separated from posterior anal (AO_p), photophore series; luminous organs on caudal peduncle, either supracaudal (male), or infracaudal (female), never both present on same fish.
 Big-finned lantern-fish *Myctophum californiense*
- 107 (106) Tip of pectoral fin not reaching behind insertion of pelvic fin; precaudal (Prc), photophores, 4, sometimes in continuous series with posterior anal (AO_p), photophores; luminous organs, if present on caudal peduncle, both supra- and infracaudal on same fish.
- 108 (109) Suprapectoral (PLO), photophore markedly nearer base of pectoral fin than lateral line; suprapectoral luminous organ large, conspicuous; dorsonasal (Dn), photophore very large, prominent; suborbital (So), photophore large, elongate; no luminous organs on caudal peduncle.
 White-spotted lantern-fish *Diaphus rafinesquii*
- 109 (108) Suprapectoral (PLO), photophore equidistant between lateral line and base of pectoral fin or markedly nearer lateral line than base of pectoral fin; no suprapectoral luminous organ; no dorsonasal (Dn), or suborbital (So), photophores developed; both supra- and infracaudal luminous organs present.

- 110 (111) Eye large, diameter 3.5 to 4.5 in length of head; fourth precaudal (Prc₄), photophore distinctly below posterior end of lateral line.
Small-finned lantern-fish *Lampanyctus leucopsarus*
- 111 (110) Eye small, diameter 5.4 to 6.5 in length of head; fourth precaudal (Prc₄), photophore on posterior end of lateral line.
Small-eyed lantern-fish *Lampanyctus regalis*
- 112 (93) Photophores absent from body; a luminous spot on each eye.
Family **SCOPELARCHIDAE**—Scopelarchids
Pearl-eye *Neoscopelarchoides dentatus*
- 113 (48) Base of dorsal fin longer than head, rays more than 28.
Family **ALEPIDOSAURIDAE**—Lancet-fishes
Handsaw-fish *Alepidosaurus aesculapius*
- 114 (43) Dorsal fin followed by 5 to 7 free finlets.
Family **SCOMBERESOCIDAE**—Sauries
Saury *Cololabis saira*
- 115 (40) PELVIC FINS THORACIC IN POSITION.
- 116 (117) Large oblong vertical bony plates on sides of body; spine in pelvic fin large, serrated, capable of being locked in position when fully extended.
Family **GASTEROSTEIDAE**—Sticklebacks
Three-spined stickleback *Gasterosteus aculeatus*
- 117 (116) No large oblong vertical bony plates on sides of body; spine, if present in pelvic fin, not large or serrated, or capable of being locked in position when fully extended.
- 118 (119) Head prolonged into tubular snout with small jaws at tip.
Family **AULORHYNCHIDAE**—Tube-snouts
Tube-snout *Aulorhynchus flavidus*
- 119 (118) Head never prolonged into tubular snout with small jaws at tip.
- 120 (135) Dorsal fins (2), or (3), supported by rays only, barbel usually present on tip of lower jaw.
- 121 (130) Caudal fin well developed.
- 122 (123) Dorsal fins (2), second deeply notched.
Family **MERLUCCIIDAE**—Hakes
Hake *Merluccius productus*
- 123 (122) Dorsal fins (3), or (2), if two, second not deeply notched.
Family **GADIDAE**—Cods
- 124 (129) Mouth terminal.
- 125 (126) Lower jaw projecting; eye large; barbel on lower jaw, absent or minute; anus below interspace between first and second dorsal fins.
Whiting *Theragra chalcogramma*
- 126 (125) Lower jaw included; eye moderate; barbel on lower jaw well developed; anus not below interspace between first and second dorsal fins.

- 127 (128) Anus below first dorsal fin; barbel small, length equal to half diameter of eye.
Tomcod *Microgadus proximus*
- 128 (127) Anus below second dorsal fin; barbel well developed, length at least equal to diameter of eye.
Cod *Gadus macrocephalus*
- 129 (124) Mouth subterminal.
Long-finned cod *Antimora rostrata*
- 130 (121) Caudal fin absent.
Family **MACRURIDAE**—Grenadiers
- 131 (132) Interspace between dorsal fins longer than length of base of first dorsal fin; anus below interspace between dorsal fins.
Smooth-scaled grenadier *Dolloa cyclolepis*
- 132 (131) Interspace between dorsal fins shorter than length of base of first dorsal fin; anus below second dorsal fin.
- 133 (134) Interspace between dorsal fins more than half length of base of first dorsal fin; teeth on lower jaw in one row, large.
Filamented grenadier *Chalinura filifera*
- 134 (133) Interspace between dorsal fins less than half length of base of first dorsal fin; teeth on lower jaw in villiform band, none enlarged.
Rough-scaled grenadier *Macrurus acrolepis*
- 135 (120) Dorsal fins (1), or (2), if two, first composed of spines; barbel absent from lower jaw.
- 136 (435) Lateral lines, if present, on each side of body, 1 or more, never 4 accompanied by cirri and photophores.
- 137 (432) Pelvic fins separate, or united forming a hollow cone or a complete circular or oval adhesive disk, never forming together with fold of skin from ventral surface of body a laterally cleft adhesive disk.
- 138 (431) Body never limp, oblong, much compressed with pectoral and caudal fins symmetrically rounded.
- 139 (430) If dorsal fins (2), first not modified to form large adhesive disk on top of head and anterior portion of body.
- 140 (397) Body symmetrical; an eye on each side of head.
- 141 (142) Pelvic fins each with 14 to 17 long rays; deeply ovate body dark bluish gray in colour with numerous round white or silvery spots.
Family **LAMPRIDAE**—Moon-fishes
Opah *Lampris regius*
- 142 (141) Pelvic fins with total number of rays, or spines and rays, not more than 8; if body ovate, colour never dark bluish gray with white or silvery spots.
- 143 (144) Upper lobe of caudal fin very greatly developed, fan-shaped; anal fin absent.
Family **TRACHYPTERIDAE**—Ribbon-fishes
King-of-the-salmon *Trachypterus rex-salmonorum*
- 144 (143) Upper lobe of caudal fin not greatly developed; not fan-shaped; anal fin present.
- 145 (148) Dorsal fin III, 12 to 16, short; pelvic fins separate, each I, 7.
Family **MELAMPHAIDAE**—Melamphids

- 146 (147) Prominent crest on top of head; rostral spine present.
Crested melamphid *Melamphaes rugosus*
- 147 (146) No crest on top of head; rostral spine absent.
High-snouted melamphid *Melamphaes cavernosus*
- 148 (145) Dorsal fin not as above; pelvic fins, if separate, each with 1 spine and 5 rays or fewer, or if spine absent, 6 rays or fewer.
- 149 (150) Dorsal and anal fins each single, anterior portion of each elevated; caudal fin very broadly lunate on slender caudal peduncle.
Family **BRAMIDAE**—Pomfrets
Pomfret *Brama raii*
- 150 (149) Dorsal and anal fins double or single, if each single, never both with anterior portions prominently elevated; caudal fin not broadly lunate on slender caudal peduncle.
- 151 (154) Anal fin short with two weak spines, origin about under posterior half of base of rayed dorsal fin; posterior of preopercle minutely crenulate.
Family **SCIAENIDAE**—Croakers
- 152 (153) Lower jaw projecting; fleshy appendage at base of each pelvic fin.
White sea-bass *Cynoscion nobilis*
- 153 (152) Lower jaw included; no fleshy appendage at base of either pelvic fin.
King-fish *Genyonemus lineatus*
- 154 (151) If anal fin short, with two weak spines, origin not about under posterior half of base of rayed dorsal fin; posterior of preopercle not crenulate.
- 155 (168) Sheath of scales at base of dorsal fin demarked from scales of body by pronounced furrow.
Family **EMBIOTOCIDAE**—Sea-perches
- 156 (159) Scales on lateral line, fewer than 50.
- 157 (158) Rays in dorsal fin, 18 to 23; rays in anal fin, 23 to 25; no frenum between lower lip and symphysis of lower jaw.
Yellow shiner *Cymatogaster aggregatus*
- 158 (157) Rays in dorsal fin, 13 to 15; rays in anal fin, 21 or 22; frenum between lower lip and symphysis of lower jaw.
Brown sea-perch *Brachyistius brevipinnis*
- 159 (156) Scales on lateral line, more than 50.
- 160 (165) Frenum between lower lip and symphysis of lower jaw; none of spines in spinous portion of dorsal fin longer than longest ray.
- 161 (164) Last spine in spinous portion of dorsal fin shorter than first ray.
- 162 (163) Last spine in spinous portion of dorsal fin about three-quarters length of ray following; blue longitudinal stripes on sides of body; no dark spot on preopercle behind posterior tip of upper jaw.
Blue sea-perch *Taeniotoxa lateralis*
- 163 (162) Last spine in spinous portion of dorsal fin about half length of ray following; no blue stripes on sides of body; dark spot on preopercle behind posterior tip of upper jaw, prominent.
Dusky sea-perch *Damalichthys vacca*

- 164 (161) Last spine in spinous portion of dorsal fin about equal in length to ray following.
White sea-perch *Phanerodon furcatus*
- 165 (160) No frenum between lower lip and symphysis of lower jaw; middle spines in spinous portion of dorsal fin longer than longest ray.
- 166 (167) Rakers below angle of first gill arch, about 21; if bands of colour across body, those above lateral line not alternating with those below.
Wall-eyed sea-perch *Hyperprosopon argenteum*
- 167 (166) Rakers below angle of first gill arch, 11 to 13; bands of colour across body above lateral line alternating with those below.
Porgy *Holconotus rhodoterus*
- 168 (155) No sheath of scales along base of dorsal fin.
- 169 (170) Fringes on lips.
Family **TRICHODONTIDAE**—Sand-fishes
Sand-fish *Trichodon trichodon*
- 170 (169) No fringes on lips.
- 171 (174) Dorsal fin (1), composed entirely of rays, first 3 to 20 rays entire, remainder branched; lateral line high, straight from upper margin of opercle to base of caudal fin.
Family **BATHYMASTERIDAE**—Ronquils
- 172 (173) First 3 or 4 rays in dorsal fin entire, remainder branched; scales ctenoid.
Searcher *Bathymaster signatus*
- 173 (172) First 20 to 30 rays in dorsal fin entire, remainder branched; scales cycloid.
Ronquil *Ronquilus jordani*
- 174 (171) Dorsal fin, if single and composed of rays, not with first 3 to 20 rays entire and remainder branched; lateral line, if high, not straight from upper margin of opercle to base of caudal fin.
- 175 (184) Dorsal and anal fins each followed by 1 or more free finlets.
- 176 (177) Dorsal and anal fins each followed by single finlet.
Family **CARANGIDAE**—Carangids
Scad *Decapterus polyaspis*
- 177 (176) Dorsal and anal fins each followed by 5 or more free finlets.
Family **SCOMBRIDAE**—Mackerels
- 178 (179) Finlets following dorsal fin, 5 or 6; stripes across dorsal surface and part way down sides of body, more than 20, wavy, dark.
Pacific mackerel *Pneumatophorus diego*
- 179 (178) Finlets following dorsal fin, 8 or 9; stripes, if present, not as above.
- 180 (183) Pectoral fin shorter than head, not sabre-shaped; stripes along each side of body, either above or below lateral line.
- 181 (182) Spines in first dorsal fin, XVIII; stripes on upper portion of body, 10 or 11.
Bonito *Sarda lineolata*

- 182 (181) Spines in first dorsal fin, XV or XVI; stripes on lower portion of body, 4 or 5.
Skipjack *Katsuwonus pelamis*
- 183 (180) Pectoral fin longer than head, sabre-shaped; no stripes on body.
Albacore *Thunnus alalunga*
- 184 (175) Dorsal and anal fins not followed by finlets.
- 185 (190) Pelvic fins united, forming hollow cone but not flattened adhesive disk.
Family **GOBIIDAE**—Gobies
- 186 (187) Scales large, in oblique rows above midline of body, fewer than 30, usually 25 to 28; black on pelvic fins except at bases.
Large-scaled goby *Rhinogobiops nicholsii*
- 187 (186) Scales small to moderate, in oblique rows above midline of body, more than 60; not entirely black on pelvic fins.
- 188 (189) Mouth moderate, maxillary extending to point below pupil of eye; spines in spinous dorsal fin, VII; scales small, in oblique rows above midline of body, about 86; black on tips of all fins.
Fine-scaled goby *Lepidogobius lepidus*
- 189 (188) Mouth large, maxillary extending to point below posterior margin of eye, or behind; spines in spinous dorsal fin, VI, or fewer; scales moderate, in oblique rows above midline of body, fewer than 75; not black on fins.
Arrow goby *Clevelandia ios*
- 190 (185) Pelvic fins separate; *or*, if united, not forming a hollow cone but a flattened adhesive disk with thickened margin.
- 191 (222) Body elongate, eel-like; scales, if present, small.
- 192 (221) Gill openings extending below bases of pectoral fins; pelvic fins slightly in advance of pectoral fins, not below eyes; scales present.
- 193 (212) Dorsal fin composed entirely of spines, more than 30 in number, or of spines anteriorly followed by 5 to 8 elevated rays; caudal fin clearly demarked from dorsal and anal fins.
- 194 (197) Dorsal fin with first 5 spines longer than those following, posterior portion of fin elevated, supported by 5 to 8 rays; lateral line decurved, then straight.
Family **CLINIDAE**—Kelp-fishes
- 195 (196) Dorsal fin with first 4 or 5 spines evenly spaced, last spine approximately same height as first ray; two conspicuous brownish black ocelli on each side of body.
Spotted kelp-fish *Gibbonsia elegans montereyensis*
- 196 (195) Dorsal fin with first 3 spines closely approximated, last spine approximately half length of first ray; no ocelli on sides of body.
Striped kelp-fish *Gibbonsia metzi*
- 197 (194) Dorsal fin not as above, composed entirely of spines; lateral line, if present, not decurved.
- 198 (205) Gill membranes united, free from isthmus, not extending far forward.
Family **PHOLIDAE**—Gunnels

- 199 (202) Cirri on top of head conspicuous, numerous, fleshy.
 200 (201) Cirri on head low, extending only onto first spine of dorsal fin; rays in anal fin, 37 to 42; ocelli on dorsal fin in male.
 Ornamented blenny *Chirolophis nugator*
- 201 (200) Cirri on head high, plumose, extending onto tips of first 4 to 8 spines of dorsal fin; rays in anal fin, 44 to 61; no ocelli on dorsal fin.
 Decorated blenny *Chirolophis polyactcephalus*
- 202 (199) No cirri on head.
 203 (204) Black markings along base of dorsal fin in series, V- to U-shaped.
 Saddled blenny *Pholis ornatus*
- 204 (203) Black markings along base of dorsal fin in series, bracket-shaped, as ().
 Bracketed blenny *Pholis laetus*
- 205 (198) Gill membranes joined far forward to isthmus, with or without free fold posteriorly.
 Family **LUMPENIDAE**—Eel-blennies
- 206 (207) Gill membranes joined far forward to isthmus, with free fold posteriorly; Y-shaped marks black, in series on each side of body.
 Y-blenny *Allolumpenus hypochromus*
- 207 (206) Gill membranes joined far forward to isthmus, without free fold posteriorly; no Y-shaped black marks on sides of body.
- 208 (209) Spine in anal fin, I, or none; streaks on sides of body short, dark.
 Eel-blenny *Lumpenus anguillaris*
- 209 (208) Spines in anal fin, III to V; streaks, if present on sides of body, not short or dark.
 210 (211) Snout short; cheek not appearing inflated; white vertical bars on sides of body, short; pale cream on lining of mouth.
 White-barred blenny *Poroclinus rothrocki*
- 211 (210) Snout long; cheek appearing inflated; no white vertical bars on sides of body; very dusky to black on lining of mouth.
 Long-snouted blenny *Lumpenella longirostris*
- 212 (193) Dorsal fin composed entirely of rays; caudal fin not demarked from dorsal and anal fins.
 Family **ZOARCIDAE**—Eel-pouts
- 213 (220) Teeth present on palatines.
 214 (219) Teeth present on vomer.
 215 (218) Pectoral fins entire; creamy white to pink on peritoneum.
 216 (217) Cartilaginous folds on ventral surface of head large, prominent, lobed anteriorly; pelvic fins moderate, length 1.25 to 1.5 in diameter of eye; white vertical bars on sides of body usually present, pale in adult, first 2 in front of dorsal fin.
 Wattled eel-pout *Lycodes palearis*
- 217 (216) Cartilaginous folds on ventral surface of head moderate, without lobes; pelvic fins minute, length about 3 in diameter of eye; if vertical white bars present on sides of body, first one only in front of dorsal fin.
 Short-finned eel-pout *Lycodes brevipes*

- 218 (215) Pectoral fins deeply notched; black on peritoneum.
Black-finned eel-pout *Furcimanus diapterus*
- 219 (214) No teeth on vomer.
Big-finned eel-pout *Aprodon corteziana*
- 220 (213) No teeth on palatines.
Black-bellied eel-pout *Lycodopsis pacificus*
- 221 (192) Gill openings reduced to small vertical slits in front of pectoral fins; pelvic fins far forward below eyes; scales absent.
Family **DEREPODICHTHYIDAE**—Cusk-pouts
Cusk-pout *Derepodichthys alepidotus*
- 222 (191) Body not elongate and eel-like; scales, if present, small to large.
- 223 (224) Rays in pelvic fins, 2, elongate, filamentous; lateral line on each side of body in two parts, anterior portion high ending at point above midlateral position, posterior portion nearly straight along midlateral position commencing below posterior end of anterior portion.
Family **BROTULIDAE**—Brotulids
Red brotulid *Brosmophycis marginatus*
- 224 (223) If rays only in pelvic fins, not as above; lateral line, or lines, not divided as above.
- 225 (226) Top of head spongy; fifth ray of pelvic fin long, filamentous.
Family **CENTROLOPHIDAE**—Rudder-fishes
Brown rudder-fish *Icichthys lockingtoni*
- 226 (225) Top of head, if soft, not spongy; fifth ray of pelvic fin, if present, not long or filamentous.
- 227 (228) Body subterete; head very elongate, sharply pointed, with large teeth.
Family **SPHYRAENIDAE**—Barracudas
Barracuda *Sphyaena argentea*
- 228 (227) Body not subterete; head, if elongate, not sharply pointed, not with large teeth.
- 229 (374) Pelvic fins separate, not forming flattened adhesive disk.
- 230 (353) Body not completely enclosed in bony plates.
- 231 (288) Body below lateral line completely covered with unmodified cycloid or ctenoid scales.
- 232 (273) Spines in anal fin, III, conspicuously large, stout, second and third usually much longer and stronger than first; rays, 5 to 9.
Family **SCORPAENIDAE**—Rock-fishes
- 233 (272) Dorsal fin, XIII or XIV, 12 to 16; anal fin, III, 6 to 9; no lobe on pectoral fin; no sharply spinous ridge below eye.
- 234 (245) Interorbital space highly convex; cranial spines, when present, small.
- 235 (236) Dorsal fin deeply notched, membranes between spinous and rayed portions so low that fin almost separated into two fins; rays in pectoral fin, 15; nasal spines, absent.
Bocaccio *Sebastes paucispinis*
- 236 (235) Dorsal fin not deeply notched; rays in pectoral fin, 17 or more; nasal spines present.
- 237 (242) Parietal spines not developed.

- 238 (239) Depth of body 2.9 to 3.5 in standard length; membranes of spinous portion of dorsal fin deeply incised; dusky yellow on caudal fin.
Yellow-tailed rock-fish *Sebastodes flavidus*
- 239 (238) Depth of body 2.5 to 2.9 in standard length; membranes of spinous portion of dorsal fin moderately to slightly incised; no yellow on caudal fin.
- 240 (241) Diameter of eye, 4 to 4.5 in length of head; prefrontal spine, absent; white on peritoneum.
Black rock-fish *Sebastodes melanops*
- 241 (240) Diameter of eye, 4.5 to 5 in length of head; prefrontal spine, present; black on peritoneum.
Priest-fish *Sebastodes mystinus*
- 242 (237) Parietal spines developed.
- 243 (244) Spine on each lobe of lacrymal bone; scales on mandible smooth; colour chiefly orange; black blotch on spinous portion of dorsal fin, from seventh to tenth spines, large; pale red with dusky mottling on lining of mouth; black on peritoneum.
Orange rock-fish *Sebastodes pinniger*
- 244 (243) No spines on lobes of lacrymal bone; scales on mandible rough; colour chiefly vermilion; no black blotch on spinous portion of dorsal fin, membranes may be somewhat black on posterior margins; red on lining of mouth; white to dusky on peritoneum.
Vermilion rock-fish *Sebastodes miniatus*
- 245 (234) Interorbital space not highly convex, usually flat or concave; cranial spines usually developed.
- 246 (257) Interorbital space slightly convex to flat, never concave; cranial spines usually slender, sharp.
- 247 (252) Pores on lateral line, 41 or more.
- 248 (249) Pores on lateral line, fewer than 45.
Wilson's rock-fish *Sebastodes wilsoni*
- 249 (248) Pores on lateral line, 47 or more.
- 250 (251) Lower jaw little projecting; frontal spines II and III only, present.
Red-striped rock-fish *Sebastodes proriger*
- 251 (250) Lower jaw much projecting; frontal spines I, II, III, present.
Long-jawed rock-fish *Sebastodes alutus*
- 252 (247) Pores on lateral line, 39 or fewer.
- 253 (254) Spines on lacrymal lobes minute, sometimes absent; dentigerous lobes on upper jaw little developed.
Olive-backed rock-fish *Sebastodes saxicola*
- 254 (253) Spines on lacrymal lobes well developed; dentigerous lobes on upper jaw well developed.
- 255 (256) Spines on lacrymal bone, 2, 1 on anterior lobe, 1 on posterior lobe; upper 2 preopercular spines not closely approximated; no black on isthmus.
Lobe-jawed rock-fish *Sebastodes diploproa*

- 256 (255) Spines on lacrymal bone, 4 to 6, 1 on anterior lobe, 3 to 5 on posterior lobe; upper 2 preopercular spines closely approximated; large black area on isthmus.
Black-throated rock-fish *Sebastes introniger*
- 257 (246) Interorbital space concave (sometimes flat in *S. dallii*), usually narrow; cranial spines strongly developed.
- 258 (271) Median frontal ridges and spines absent or very weakly developed; colour not gray to pale rose with 5 carmine vertical bars, or bright orange red with 5 jet black vertical bars, on each side of body.
- 259 (260) Preopercular spines broad, third multifold; frontal spines, I, II, III, present on head; colour nearly uniform deep vermilion.
Red snapper *Sebastes ruberrimus*
- 260 (259) If preopercular spines broad, third not multifold; frontal spines, II and III only, present on head; if red colour present, not uniform deep vermilion.
- 261 (264) Body slender, depth 3.1 or more in standard length; dusky to black on peritoneum.
- 262 (263) Eye small, diameter about 4 in length of head; stripes on body olive green, irregular, longitudinal, interrupted; dusky on peritoneum.
Green-striped rock-fish *Sebastes elongatus*
- 263 (262) Eye large, diameter about 3 in length of head; brown blotches on body, .5; jet black on peritoneum.
Big-eyed rock-fish *Sebastes zacentrus*
- 264 (261) Body deep, depth 3 or less in standard length; pale to white on peritoneum.
- 265 (268) Spine present on posterior lobe of lacrymal bone; no yellow wedge or stripe from spinous dorsal fin to lateral line.
- 266 (267) Pores on lateral line, about 49; scales in oblique rows above lateral line, 61 or 62; rakers on first gill arch, 25 or fewer; somewhat dusky on pelvic fins.
Brown rock-fish *Sebastes dallii*
- 267 (266) Pores on lateral line, 44 or fewer; scales in oblique rows above lateral line, 40 to 48; rakers on first gill arch, 27 or more; coppery black on pelvic fins.
Copper rock-fish *Sebastes caurinus*
- 268 (265) No spine on posterior lobe of lacrymal bone; yellow wedge or stripe from spinous dorsal fin to lateral line.
- 269 (270) Membranes of dorsal fin between first and fifth spines incised to more than half length of spines; longest spine about 1.8 in length of head; colour yellow to brown; small round spots of clear orange brown closely covering anterior portion of body.
Orange-spotted rock-fish *Sebastes maliger*
- 270 (269) Membranes of dorsal fin between first and fifth spines not incised to half length of spines; longest spine about 2 in length of head; colour blue black; small white or yellow speckling everywhere on body.
Yellow-striped rock-fish *Sebastes nebulosus*
- 271 (258) Median frontal ridges and spines well developed, high; colour gray to pale rose with 5 carmine vertical bars, or orange red with 5 jet black vertical bars, on each side of body.
Banded rock-fish *Sebastes nigrocinctus*

272 (233) Dorsal fin, XV to XVII, 9 or 10; anal fin, III, 5; lower 7 to 9 rays in pectoral fin thickened, extended to form distinct lobe; ridge below eye long, knife-like, sharply spinous.

Spiny-cheeked rock-fish

Sebastolobus alascanus

273 (232) Spines in anal fin, 0 to IV; if three, not large or stout, sometimes buried in flesh; rays more than 10.

274 (285) Gill membranes entirely free from isthmus; multifid cirrus above each eye.

Family **HEXAGRAMMIDAE**—Greenlings

275 (280) Lateral lines on each side of body, more than 1.

276 (277) Multifid cirrus above each eye prominent, another on each side of occiput, very small (latter may be located in slight depression almost midway on straight line from middle of front of eye to origin of dorsal fin); spine closely applied to first ray in anal fin, short, stout.

Kelp greenling

Chiropsis decagrammus

277 (276) Multifid cirrus above each eye present, none on occiput; no spine before anal fin.

278 (279) Cirrus above each eye small, length less than 2 in diameter of eye; caudal peduncle slender, depth 3 or more in length of head; first lateral line short, not extending beyond middle of spinous portion of dorsal fin; fourth lateral line short, not extending beyond middle of pelvic fin; caudal fin slightly emarginate.

White-spotted greenling

Hexagrammos stelleri

279 (278) Cirrus above each eye large, slender, densely fringed, length equal to, or greater than, diameter of eye; caudal peduncle stout, depth about 2 in length of head; first lateral line long, extending beyond middle of rayed portion of dorsal fin; fourth lateral line long, extending to about middle of anal fin; caudal fin rounded.

Fringed greenling

Lebias superciliosus

280 (275) Lateral line on each side of body, 1.

281 (282) Maxillary not reaching anterior margin of eye; distinct dark bars on each side of body and caudal fin, 7, vertical.

Painted greenling

Oxylebius pictus

282 (281) Maxillary reaching to point well behind anterior margin of eye; no distinct dark bars on sides of body.

283 (284) Anterior spines of spinous portion of dorsal fin elongate, second spine very elongate; teeth on jaws small.

Long-spined greenling

Zaniolepis latipinnis

284 (283) Anterior spines of spinous portion of dorsal fin not elongate; teeth on jaws large, canine-like.

Lingcod

Ophiodon elongatus

285 (274) Gill membranes either narrowly or completely joined to isthmus; no cirrus above either eye.

Family **ANOPILOPOMIDAE**—Skil-fishes

286 (287) Dorsal fins, XVII to XXII - I, 16 to 19, interspace between fins about twice diameter

of eye; anal fin, III, 15 to 19, origin below that of rayed dorsal fin; scales in oblique rows above lateral line, about 190.

Sable-fish

Anoplopoma fimbria

287 (286) Dorsal fins, XII to XIV - I or II, 15 to 17, interspace between fins about equal to diameter of eye (in some individuals, fins may be touching); anal fin, III, 11 to 14, origin posterior to that of rayed dorsal fin; scales in oblique rows above lateral line, 122 to 134.

Giant skil-fish

Erilepis zonifer

288 (231) Body below lateral line never completely covered with unmodified cycloid or ctenoid scales.

289 (352) Length of head much less than half standard length.

290 (349) Preopercular spines present; spinous portion of dorsal fin not low, its spines not concealed in loose skin; rayed portion anteriorly readily distinguishable from spinous portion.

Family **COTTIDAE**—Sculpins

291 (296) Dorsal fin (1), notched between spinous and rayed portions.

292 (293) Gill membranes free from isthmus; scales absent.

Giant marbled sculpin

Scorpaenichthys marmoratus

293 (292) Gill membranes joined to isthmus; scales on body above and below lateral line in bands, band above lateral line continuous around anterior of dorsal fin.

294 (295) Band of scales above lateral line in 6 or 7 rows at widest part; gill membranes broadly joined to isthmus.

Brown Irish lord

Hemilepidotus spinosus

295 (294) Band of scales above lateral line in about 4 rows at widest part; gill membranes narrowly joined to isthmus.

Red Irish lord

Hemilepidotus hemilepidotus

296 (291) Dorsal fins (2), first spinous, second rayed.

297 (300) Cirri large, on snout, 3, one median, two lateral; on lower jaw, 6, three on each side.

298 (299) Spinous dorsal fin emarginate, first 3 or 4 spines elevated; large silvery white areas on body naked.

Silver spot

Blepsias cirrhosus

299 (298) Spinous dorsal fin entire, first spines not elevated; body completely covered with minute spines embedded in thick conical fleshy papillae.

Crested sculpin

Histiocottus bilobus

300 (297) Cirri, if present on head, not as above.

301 (306) Scales between dorsal fins and lateral line in band of 7 to 10 sharply defined rows.

302 (305) Band of scales on each side of body meeting behind rayed dorsal fin.

303 (304) Supraocular cirri present; uppermost preopercular spine broad or weakly bifid.

White-spotted sculpin

Artedius harringtoni

304 (303) Supraocular cirri absent; uppermost preopercular spine antler-like, spinules, 3.

Padded sculpin

Artedius fenestralis

- 305 (302) Band of scales on each side of body not reaching posterior end of rayed dorsal fin.
Round-nosed sculpin *Artedius lateralis*
- 306 (301) Scales, if present between dorsal fins and lateral line, not in band of 7 to 10 rows.
- 307 (316) Preopercular spines, 3 or 4, uppermost large, antler-like, with 3 to 6 upwardly directed spinules.
- 308 (315) Scales present on body above lateral line, either completely covering area or in band two scales in width.
- 309 (310) Scales between dorsal fins and lateral line completely covering body.
Rough-backed sculpin *Chitonotus pugetensis*
- 310 (309) Scales between dorsal fins and lateral line in band two scales in width.
- 311 (312) Rows of scales below bases of dorsal fins extending behind rayed dorsal fin; neither first nor second spine in spinous dorsal fin elongate.
Northern sculpin *Icelinus borealis*
- 312 (311) Neither row of scales below bases of dorsal fins extending to posterior end of rayed dorsal fin; first 1 or 2 spines of spinous dorsal fin elongate.
- 313 (314) First 1 or 2 spines in spinous dorsal fin elongate, not reaching rayed dorsal fin when depressed; rows of scales below dorsal fins short, 9 to 14 in each row.
Lesser filamented sculpin *Icelinus tenuis*
- 314 (313) First 2 spines in spinous dorsal fin very much elongate, reaching to middle of rayed dorsal fin when depressed; rows of scales below dorsal fins long, 28 to 31 in each row.
Filamented sculpin *Icelinus filamentous*
- 315 (308) Scales absent from body.
Cabezon *Leptocottus armatus*
- 316 (307) Preopercular spines, 4, 3, 2, or 1, simple or weakly bifid.
- 317 (318) Uppermost preopercular spine elongate, length 2 or 3 times diameter of eye; large tuberculated plates on lateral line, 29 to 33.
Buffalo sculpin *Enophrys bison*
- 318 (317) None of preopercular spines elongate as above; no large tuberculated plates on lateral line.
- 319 (346) Scales or pores on lateral line more than 30.
- 320 (321) Head broad, depressed; scales on body widely scattered, embedded, each usually with minute projecting spine.
Great sculpin *Myoxocephalus polyacanthocephalus*
- 321 (320) Head if broad, not greatly depressed; scales on body, if present, not scattered or embedded with minute projecting spine.
- 322 (327) Skin below lateral line in many oblique folds; posterior margins of folds sharply spinous with modified ctenoid scales.
- 323 (324) Supraocular cirri, 2, large; spinous dorsal fin long, spines more than 16.
Long-finned sculpin *Jordania zonope*
- 324 (323) Supraocular cirri, absent; spinous dorsal fin short, spines fewer than 13.

- 325 (326) Scales between dorsal fins and lateral line very small, of uniform size; lower rays in pectoral fin greatly exerted.
Rough-spined sculpin *Prionistius macellus*
- 326 (325) Scales between dorsal fins and lateral line of various sizes, in row below bases of dorsal fins enlarged, upright, sharply spinous; rays in pectoral fin not exerted.
Ribbed sculpin *Triglops beani*
- 327 (322) Skin below lateral line not in oblique folds.
- 328 (333) Ctenoid scales in single row contiguous with lateral line; or in 4 rows, lowermost contiguous with lateral line; or in single row near bases of dorsal fins.
- 329 (332) Pectoral fins separate.
- 330 (331) Dorsal surface of body flattened, forming prominent sharply angular ridge with lateral surface at lateral line; row of scales above and contiguous with lateral line extending forward to midpoint of posterior area of interorbital space, clearly evident; occipital area naked.
Darter sculpin *Radulinus asprellus*
- 331 (330) Dorsal surface of body arched, not forming prominent ridge with lateral surface at lateral line; row of scales above and contiguous with lateral line, if extending forward onto head, not clearly defined; occipital area scaly.
Taylor's sculpin *Asemichthys taylori*
- 332 (329) Pectoral fins united anteriorly and ventrally.
Manacled sculpin *Synchirus gilli*
- 333 (328) Ctenoid scales, if present, of reduced type, not in rows.
- 334 (335) Spinous dorsal fin very high; gill membranes broadly joined to isthmus; caudal fin asymmetrical, lower rays longest.
Sailor-fish *Nautichthys oculo-fasciatus*
- 335 (334) Spinous dorsal fin little, if any, elevated; gill membranes free from isthmus; caudal fin symmetrically rounded.
- 366 (341) Origin of anal fin below spinous dorsal fin.
- 337 (338) Body everywhere covered with slender spines.
Prickly sculpin *Oligocottus rimensis*
- 338 (337) Body naked; no tubercles or spines present.
- 339 (340) Cirri on body single or paired, those on lateral line confined to anterior portion.
Tide-pool sculpin *Oligocottus maculosus*
- 340 (339) Cirri on body in bunches of 3 or 4, on lateral line and in 2 rows above.
Fluffy sculpin *Oligocottus snyderi*
- 341 (336) Origin of anal fin below rayed dorsal fin.
- 342 (343) Head blunt, anterior profile broadly rounded.
Globe-headed sculpin *Clinocottus globiceps*
- 343 (342) Head acute, anterior profile pointed.
- 344 (345) Cirri on head multifold, large.
Mossy sculpin *Clinocottus embryum*

- 345 (344) Cirri on head simple, small.
Sharp-nosed sculpin *Clinocottus acuticeps*
- 346 (319) Pores on lateral line, 14 or 15; skin soft and thick at bases of dorsal and anal fins.
347 (348) Gill membranes free from isthmus; cranial spines large, upright.
Spiny-headed sculpin *Dasycottus setiger*
- 348 (347) Gill membranes broadly joined to isthmus; cranial spines absent.
Black-finned sculpin *Malacocottus kincaidi*
- 349 (290) Preopercular spines absent; spinous portion of dorsal fin very low, its slender spines not evident, concealed in loose skin; rayed portion anteriorly indistinguishable from spinous portion.
Family **PSYCHROLUTIDAE**—Mud-sculpins
- 350 (351) Rays in pectoral fin, 20 to 23; jaws equal; anus midway between insertion of pelvic fins and origin of anal fin.
Tadpole sculpin *Psychrolutes paradoxus*
- 351 (350) Rays in pectoral fin, 16 or 17; lower jaw projecting; anus immediately in front of anal fin.
Soft sculpin *Gilbertidia sigalutes*
- 352 (289) Length of head about half standard length.
Family **RHAMPHOCOTTIDAE**—Big-headed sculpins
Grunt-fish *Rhamphocottus richardsoni*
- 353 (230) Body completely enclosed in close-fitting bony plates.
Family **AGONIDAE**—Sea-poachers
- 354 (373) Dorsal fins (2).
355 (358) Gill membranes free from isthmus.
356 (357) Spines on top of head, 4, prominent; body short, deep; lower jaw slightly projecting.
Four-horned sea-poacher *Hypsagonus quadricornis*
- 357 (356) No spines on top of head; body elongate, slender; lower jaw prominently projecting.
Warty sea-poacher *Occa verrucosa*
- 358 (355) Gill membranes joined to isthmus, sometimes with short free fold posteriorly.
359 (362) Spines on snout pointing forward, 2, either free or covered with skin; no rostral plate.
360 (361) Mouth ventral, with cluster of large cirri at each angle; spines pointing forward on snout naked, sharp; caudal fin entirely dusky.
Sturgeon-like sea-poacher *Agonus acipenserinus*
- 361 (360) Mouth subterminal, without cluster of cirri at each angle; spines pointing forward on snout covered with skin; caudal fin black with semi-transparent light spot not reaching margin.
Window-tailed sea-poacher *Averruncus emmelane*
- 362 (359) Spines on snout pointing forward, none; rostral plate with or without upturned spine or spinules.

- 363 (364) Snout broad, flat; lower jaw projecting; intensely blue black on all fins.
Black-finned sea-poacher *Bathyagonus nigripinnis*
- 364 (363) Snout not as above; jaws about equal; not blue black on fins.
- 365 (370) Rostral plate terminal, with single upright spine or none.
- 366 (369) Definite pit on top of head.
- 367 (368) Body slender, plates spinous; rostral plate with upright spine; occipital pit not nearly half depth of head.
Pigmy sea-poacher *Odontopyxis trispinosus*
- 368 (367) Body stout anteriorly; plates smooth; rostral plate without spine; occipital pit nearly half depth of head.
Deep-pitted sea-poacher *Bothragonus swanii*
- 369 (366) No pit on top of head.
Black-tipped sea-poacher *Xenopyxis latifrons*
- 370 (365) Rostral plate terminal, spines forming star with 5 or more points.
- 371 (372) Origin of anal fin below interspace between dorsal fins; spines absent from lower margin of lacrymal bone.
Gray star-snout *Asterotheca alascana*
- 372 (371) Origin of anal fin below interspace between dorsal fins; spines well developed on lower margin of lacrymal bone.
Spiny-cheeked star-snout *Asterotheca infraspinata*
- 373 (354) Dorsal fin (1), (rayed fin only).
Smooth sea-poacher *Anoplagonus inermis*
- 374 (229) Pelvic fins united, forming flattened adhesive disk with thickened margin.
- 375 (376) Body short, covered with spinous conical tubercles.
Family **CYCLOPTERIDAE**—Lump-suckers
Spiny lump-sucker *Eumicrotremus orbis*
- 376 (375) Body elongate, not covered with spinous conical tubercles.
Family **LIPARIDAE**—Liparids
- 377 (390) Posterior margin of adhesive disk below or behind vertical from gill openings.
- 378 (389) Dorsal fin connected to caudal fin for one-fifth or less length of caudal fin.
- 379 (382) Gill opening entirely above pectoral fin, or not extending below first ray.
- 380 (381) Adhesive disk large, length less than 2 in length of head; white band across base of caudal fin.
Ring-tailed liparid *Liparis rutteri*
- 381 (380) Adhesive disk moderate, length more than 2 in length of head; no white band across base of caudal fin.
Pallas's liparid *Liparis callyodon*
- 382 (379) Gill opening extending below upper 3 or more rays of pectoral fin.
- 383 (386) Rays in pectoral fin, fewer than 35.

- 384 (385) Greatest depth of body slightly behind origin of anal fin; adhesive disk oval.
Shore liparid *Liparis florae*
- 385 (384) Greatest depth of body slightly behind posterior margin of disk; adhesive disk circular.
Günther's liparid *Liparis cyclopus*
- 386 (383) Rays in pectoral fin, more than 35.
- 387 (388) Anal fin extending onto caudal fin for less than one-fifth length of caudal fin; rays in pectoral fin more numerous than in dorsal fin; lower lobe of pectoral fin usually extending to point behind anus.
Juan de Fuca liparid *Liparis fucensis*
- 388 (387) Anal fin extending onto caudal fin for one-fifth or more length of caudal fin; rays in pectoral fin equal to or fewer in number than in dorsal fin; lower lobe of pectoral fin usually not extending to anus.
Denny's liparid *Liparis dennyi*
- 389 (378) Dorsal fin connected to caudal fin for more than four-fifths length of caudal fin.
Continuous-finned liparid *Liparis pulchellus*
- 390 (377) Posterior margin of adhesive disk in front of vertical from gill openings.
- 391 (392) Nostrils double; anal fin barely reaching caudal fin.
Green's liparid *Polypera greeni*
- 392 (391) Nostril single; anal fin extending onto caudal fin for at least two-fifths length of caudal fin.
- 393 (394) Adhesive disk large, length less than 3 in length of head, larger than diameter of eye; eye small, diameter more than 6 in length of head; dorsal and anal fins high anteriorly.
Abyssal liparid *Careproctus ovigerum*
- 394 (393) Adhesive disk small, length more than 6 in length of head, smaller than diameter of eye; eye moderately large, diameter less than 5 in length of head; dorsal and anal fins low anteriorly.
- 395 (396) Gill opening extending down to about upper 14 rays of pectoral fin; length of adhesive disk 7.3 to 9 in length of head; pale to dusky on caudal fin.
Small-disked liparid *Careproctus gilberti*
- 396 (395) Gill opening not extending down to pectoral fin; length of adhesive disk 6.4 to 6.9 in length of head; black on caudal fin.
Black-tailed liparid *Careproctus melanurus*
- 397 (140) Body asymmetrical; both eyes on same side of head.
- 398 (401) Pelvic fins asymmetrically placed, that of eyed side of body on ridge of abdomen, that of blind side not on ridge; eyes and colour on left side of body.
Family **BOTHIDAE**—Sand dabs
- 399 (400) Diameter of lower eye longer than length of snout; ridge above lower eye high, bony; interorbital space concave; scales on lateral line, 61 or more.
Mottled sand dab *Citharichthys sordidus*

400 (399) Diameter of lower eye equal to length of snout; no ridge above lower eye; interorbital space flat or convex; scales on lateral line, 58 or fewer.

Speckled sand dab

Citharichthys stigmaeus

401 (398) Pelvic fins symmetrically placed, one on each side of abdominal ridge; eyes and colour usually on right side. (Except in *Platichthys stellatus*, which may have eyes and colour on either right or left side.)

Family **PLEURONECTIDAE**—Flounders

402 (413) Mouth nearly symmetrical, gape usually, but not always, wide; teeth nearly equally developed on both sides of both jaws.

403 (406) Caudal fin lunate; no spine preceding anal fin.

404 (405) Maxillary extending to point well behind eye; teeth arrow-shaped; scales large, rough; no distinct arch in lateral line over pectoral fin.

Long-jaw flounder

Atheresthes stomias

405 (404) Maxillary extending to point below eye; teeth not arrow-shaped; scales small, smooth; distinct arch in lateral line over pectoral fin.

Halibut

Hippoglossus stenolepis

406 (403) Caudal fin truncate or rounded; exposed spine preceding anal fin.

407 (408) Dorsal branch to lateral line close to base of dorsal fin, short; first rays in dorsal fin elongate, mostly free from membranes.

Sand sole

Psettichthys melanostictus

408 (407) No dorsal branch to lateral line; first rays in dorsal fin not elongate, not free from membranes.

409 (410) Scales on both sides of body large, readily deciduous; on lateral line, 65 to 73; in diagonal row between dorsal fin and lateral line at widest part of body, fewer than 25.

Slender sole

Lyopsetta exilis

410 (409) Scales on blind side of body small, not deciduous; on lateral line, more than 80; in diagonal row between dorsal fin and lateral line at widest part of body, more than 25.

411 (412) Teeth on upper jaw in 1 row; scales in diagonal row between dorsal fin and lateral line at widest part of body, about 45.

Flat-head sole

Hippoglossoides classodon

412 (411) Teeth on upper jaw in 2 rows; scales in diagonal row between dorsal fin and lateral line at widest part of body, about 30.

Brill

Eopsetta jordani

413 (402) Mouth asymmetrical, gape usually narrow; teeth chiefly on blind sides of jaws.

414 (423) Dorsal branch to lateral line, near base of dorsal fin.

415 (416) Prominent arch in lateral line above pectoral fin.

Rock sole

Lepidopsetta bilineata

416 (415) No prominent arch in lateral line above pectoral fin, slight bend sometimes present.

417 (420) Scales embedded.

418 (419) Origin of dorsal fin on blind side of body at angle of mouth, first 9 to 12 rays on blind side.

Curly-fin sole

Pleuronichthys decurrens

- 419 (418) Origin of dorsal fin on blind side of body opposite anterior margin of upper eye; first 5 or 6 rays only on blind side.
C-O sole *Pleuronichthys coenosus*
- 420 (417) Scales imbricated, free.
- 421 (422) Scales on eyes side of body smooth; no scales on fins.
Lemon sole *Parophrys vetulus*
- 422 (421) Scales on eyed side of body roughened; rough scales on fins.
Butter sole *Isopsetta isolepis*
- 423 (414) No dorsal branch to lateral line.
- 424 (425) Prominent arch in lateral line above pectoral fin.
Yellow-fin sole *Limanda aspera*
- 425 (424) No arch in lateral line above pectoral fin.
- 426 (427) Body covered with rough scattered stellate plates; alternating bands of black and white or orange yellow on dorsal and anal fins.
Starry flounder *Platichthys stellatus*
- 427 (426) Body covered with smooth scales without stellate plates; no bands on dorsal or anal fins.
- 428 (429) Gill opening extending above base of uppermost pectoral fin ray; pectoral fin on eyed side of body very elongate, longer than that of blind side.
Rex sole *Glyptocephalus zachirus*
- 429 (428) Gill opening not extending above base of uppermost pectoral fin ray; pectoral fin on eyed side of body not elongate, length about equal to that on blind side.
Dover sole *Microstomus pacificus*
- 430 (139) Dorsal fins (2), first modified to form large adhesive disk on top of head.
Family **ECHENEIDAE**—Remoras
Whale-sucker *Remilegia australis*
- 431 (138) Body limp, oblong, much compressed; pectoral and caudal fins symmetrically rounded.
Family **ICOSTEIDAE**—Rag-fishes
Fan-tailed rag-fish *Icosteus aenigmaticus*
- 432 (137) Pelvic fins united forming together with fold of skin from ventral surface of body a laterally cleft adhesive disk.
Family **GOBIESOCIDAE**—Cling-fishes
- 433 (434) Body stout, tadpole-shaped; head large, broad; rays in dorsal fin, 13 or 14.
Common cling-fish *Sicyogaster maeandricus*
- 434 (433) Body elongate, slender; head small, narrow; rays in dorsal fin, 4 to 6.
Slender cling-fish *Rimicola eigenmanni*
- 435 (136) Lateral lines on each side of body, 4, accompanied by cirri and photophores.
Family **BATRACHOIDIDAE**—Toad-fishes
Midshipman *Porichthys notatus*

- 436 (39) PELVIC FINS ABSENT.
- 437 (488) Gill openings in front of pectoral fins; body not globular; no jointed appendage on snout.
- 438 (485) Body slender to deep; if much compressed, scales present.
- 439 (442) Jaws greatly prolonged, very slender, with recurved tips.
 Family **NEMICHTHYIDAE**—Thread-fishes
- 440 (441) Anus remote from head, distance behind more than 9 times length of pectoral fin; pores on lateral line, in single row.
 Snipe eel *Avocetta gilli*
- 441 (440) Anus near head, below pectoral fins; pores along lateral line, in 3 rows.
 Thread-fish *Nemichthys avocetta*
- 442 (439) Jaws not prolonged, slender or tapering to points with recurved tips.
- 443 (444) Body completely enclosed in small bony plates; head prolonged into tubular snout with small toothless jaws at end; anal fin, minute or absent.
 Family **SYNGNATHIDAE**—Pipe-fishes
 Pipe-fish *Syngnathus griseo-lineatus*
- 444 (443) Body not enclosed in bony plates; head not prolonged into tubular snout; anal fin large, rays 13 or more.
- 445 (446) Skin on body in many oblique folds passing downward and backward.
 Family **AMMODYTIDAE**—Sand-lances
 Sand-lance *Ammodytes tobianus personatus*
- 446 (445) Skin on body not in oblique folds.
- 447 (448) Body greatly elongate, ending in deeply furcate caudal fin on very slender caudal peduncle.
 Family **TRICHIURIDAE**—Hair-tails
 Frost-fish *Benlhodesmus atlanticus*
- 448 (447) Body, if elongate, not ending in deeply furcate caudal fin on very slender caudal peduncle.
- 449 (482) Gill opening on each side of body extending well below base of pectoral fin.
- 450 (481) Total number of spines (if present), and rays in anal fin, 24 or more.
- 451 (480) Spines, if present in dorsal fin, more than 50; pectoral fin never long or falcate.
- 452 (479) Body elongate, slender; rays in anal fin, 32 or more.
- 453 (472) Dorsal fin composed entirely of hard spines, or of about 90 small hooked spines followed by over 130 unsegmented, unbranched, rays.
- 454 (471) Dorsal fin composed entirely of hard spines.
- 455 (456) Teeth large, developed as crushing molars.
 Family **ANARRHICHADIDAE**—Wolf-fishes
 Wolf-eel *Anarrhichthys ocellatus*
- 456 (455) Teeth moderate, not developed as crushing molars.
- 457 (466) Gill membranes free from isthmus.
- 458 (463) Lateral lines, 4.
 Family **XIPHISTERIDAE**—Belted blennies
- 459 (460) Spines in anal fin, II or III.
 Belted blenny *Phytichthys chirus*

- 460 (459) No spines in anal fin.
- 461 (462) Distance from tip of snout to occiput greater than distance from occiput to origin of dorsal fin; dorsal fin, LXXI to LXXVII; bands radiating from eye pale, margined with black; no white bar across base of caudal fin.
 Rock blenny *Xiphister mucosus*
- 462 (461) Distance from tip of snout to occiput less than distance from occiput to origin of dorsal fin; dorsal fin, LXV to LXVIII; bands radiating from eye black or dark, abruptly margined with white or pale olive; white bar across base of caudal fin.
 Black blenny *Epigeichthys atro-purpureus*
- 463 (458) Lateral line, absent.
 Family **PHOLIDAE**—Gunnels
- 464 (465) Spines in anal fin, II, small, anterior spine short, rounded. (If one spine only, never grooved like pen-point.)
 Fucus blenny *Xerorpes fucorum*
- 465 (464) Spine in anal fin, I, large, grooved anteriorly like pen-point.
 Pen-point blenny *Apodichthys flavidus*
- 466 (457) Gill membranes joined to isthmus.
 Family **STICHAEIDAE**—Northern blennies
- 467 (468) Lower jaw included; fleshy crest on top of head, conspicuous.
 Crested blenny *Anoplarchus purpureus*
- 468 (467) Lower jaw projecting; no crest on top of head.
- 469 (470) Maxillary extending at least one diameter of eye behind eye; scales on posterior portion of body.
 Wry-mouth *Delolepis giganteus*
- 470 (469) Maxillary not extending behind eye; no scales on body.
 Red devil *Lyconecles aleutensis*
- 471 (454) Dorsal fin composed of about 90 small hooked spines anteriorly, followed by over 130 unsegmented, unbranched rays.
 Family **PTILICHTHYIDAE**—Quill-fishes
 Quill-fish *Ptilichthys goodei*
- 472 (453) Dorsal fin composed entirely of soft rays.
- 473 (478) Body deeper in front of anus than behind.
 Family **ZOARCIDAE**—Eel-pouts
- 474 (475) Upper jaw projecting; lateral line in two parts, upper anterior high, lower posterior in midlateral position.
 Soft eel-pout *Bothrocara mollis*
- 475 (474) Upper jaw not projecting; lateral line, absent.
- 476 (477) Lower jaw projecting; snout angular; upper outline of head concave in lateral view.
 Pearly eel-pout *Lycodapus fierasfer*

- 477 (476) Jaws equal; snout rounded; upper outline of head straight in lateral view.
Pale eel-pout *Lycodapus mandibularis*
- 478 (473) Body deeper behind anus than in front.
Family **SCYTALINIDAE**—Burrowing blennies
Burrowing blenny *Scytalina cerdale*
- 479 (452) Body moderately elongate, stout; rays in anal fin, 30 or fewer.
Family **ZAPRORIDAE**—Prow-fishes
Prow-fish *Zaprora silenus*
- 480 (451) Spines in dorsal fin, 3; pectoral fin long, falcate.
Family **STROMATEIDAE**—Butter-fishes
California pompano *Peprilus simillimus*
- 481 (450) Rays in anal fin, fewer than 18.
Family **COTTIDAE**—Sculpins
Rosy-lipped sculpin *Ascelichthys rhodorus*
- 482 (449) Gill opening on each side of body not extending below upper 15 or 16 rays of pectoral fin.
Family **LIPARIDAE**—Liparids
- 483 (484) Gill opening extending down to about upper 10 to 14 rays of pectoral fin; anus below vertical from gill openings, opening downward.
Prickly liparid *Paraliparis deani*
- 484 (483) Gill opening small, entirely restricted to front of pectoral fin; anus below vertical from eyes, opening forward.
Tadpole liparid *Nectoliparis pelagicus*
- 485 (438) Body deep, greatly compressed; scales absent.
- 486 (487) Body ovate; length of base of dorsal fin much less than height of fin.
Family **MOLIDAE**—Ocean sun-fishes
Ocean sun-fish *Mola mola*
- 487 (486) Body elliptical; length of base of dorsal fin much greater than height of fin.
Family **ICOSTEIDAE**—Rag-fishes
Brown rag-fish *Acrotus willoughbyi*
- 488 (437) Gill openings behind pectoral fins; body globular; large jointed appendage on snout.
Family **ONEIRODIDAE**—Sea-devils
Bulb-fish *Oneirodes bulbosus*

PLAN OF DESCRIPTIVE ARRANGEMENT

The fishes and fish-like vertebrates comprise groups or classes, three of which are represented in British Columbia waters. The first, Cyclostomata, or cyclostomes, includes the lamprey and the hag-fish. The second class, Selachii

(Elasmobranchii), or selachians, includes the sharks, rays and chimaeras. The third class, Pisces, or fishes, includes all the true fishes.

Each of the above classes is further divided into various groups and sub-groups, the sequence of which is subclass, order, suborder and family. The various genera and species are arranged according to the above classification without the inclusion of generic descriptions which would involve many unnecessary discussions. The classification used herein follows essentially that adopted by C. Tate Regan of the British Museum.

The figures, with the exception of that of *Mola mola*, were drawn 8 inches in total length regardless of the original total length of the specimen and reduced to the sizes in the text.

For each species described there is a given common name followed by the scientific name, the name of the describer and the date of original description.

The scientific description has been made as concise as possible. Many technical terms have had to be used in order to obtain brevity and accuracy but these should present little difficulty if the glossary is consulted.

The length given is the greatest known to the authors through observation or by reference to the literature.

The paragraph "distinguished by" has been included to facilitate rapid recognition of the species.

The section on general information includes: the first record, distribution within the Provincial waters, the habitat, the abundance, the life history as far as known, the economic importance, etc.

In the review of the literature for occurrence it has been found that authentic first records are frequently difficult to trace. Throughout these pages the term "first taken" has been adopted to indicate the first specimen or specimens taken by any collector and studied by a competent authority.

Statements concerning the life history are brief, in many cases necessarily so because of the paucity of information.

The range as given for each species has been limited to that portion of the Pacific coast of North America from southern California to northwestern Alaska with little attempt to indicate the distribution in other regions.

Class I. **CYCLOSTOMATA**

The cyclostomes form a small group of fish-like animals most of which are predaceous on fishes. The body is elongate, almost cylindrical anteriorly, and is supported by a ribless cartilaginous skeleton which anteriorly forms an imperfect cranium. The skin is naked and is extended to form a median vertical fin fold supported by very slender cartilaginous rays. Paired fins and supporting girdles are never developed. The mouth is without jaws and is surrounded by a sucking disk with or without horny multicuspid plates. The tongue also bears similar plates. A single nostril, dorsal and median in position, is situated anterior to the eyes. The gill openings form a series of pores along each side of the body behind

the eye. They open from gill pouches which are lined with branchial folds and supported by a lateral network of cartilage, known as the branchial basket.

The class Cyclostomata comprises two orders: Hyperoartia, lampreys; Hyperotreta, hag-fishes.

Order HYPEROARTIA

In this order the nostril is on the dorsal surface of the head and opens into a naso-pituitary passage which does not open into the pharynx. The eyes are rudimentary in the young but well developed in the adult. The gill pores are 7 in number on each side of the body, the first close behind the eye.

Family PETROMYZONIDAE

Lampreys

In the lampreys the body is elongate and cylindrical and the mouth is surrounded by a circular suctorial disk armed with horny multicuspid plates.

Some species of lampreys attach themselves to fishes by means of the disk and by a rasping motion of the horny plates of the tongue cut into the flesh and feed upon the soft parts and body fluids. All young live in streams, are not predaceous, and after a metamorphosis descend to lakes or to the sea where they complete their development. However a number of species are restricted to fresh water. In certain lakes of British Columbia there occurs the small lamprey, *Lampetra planeri* Bloch, which is not predaceous and does not feed after attaining maturity.

Pacific lamprey

Entosphenus tridentatus (Gairdner) 1836

Body elongate, somewhat cylindrical, compressed posteriorly. Head short; mouth surrounded by large circular horny sucking disk; horny plates: (a) on disk radiating from mouth, cusps numerous; (b) immediately surrounding mouth, 2, anterior tricuspid, prominent, posterior multicuspid, cusps small; (c) on tongue, prominent, rough, cusps small; jaws absent; barbels around mouth, none; nostril single, median, slightly anterior to eyes, without opening into pharynx; eye small. Gill pores, 7, first close behind eye. Anus below point posterior to origin of second dorsal fin fold. Paired fins absent. Fin folds: dorsal (2), median, high, distinctly separated; anal, (1), median, low, continuous around posterior end of body with caudal fin fold; caudal, somewhat rounded. Colour: dark bluish or brownish gray.

Length to 2 feet 3 inches.

Distinguished by the large horny sucking disk around the mouth, the horny plates with many cusps on the disk, mouth and tongue and the 7 gill pores on each side of the body commencing close behind each eye.

The Pacific lamprey was first recorded from British Columbia waters in 1891 by Ashdown Green as *Lampetra tridenata* (evidently a misprint for *tridentata*). The species is abundant along the entire coast. In August, 1936, an individual 24 inches in length was captured 20 miles off Barkley sound. The adults, 12

inches and upward in length, pass up the streams from the sea in large numbers during the spring months. They show great agility in overcoming obstructions such as waterfalls. Holding onto the smooth surface of a rock face, they let go at a favourable opportunity, swim vigorously upward and renew the hold. The procedure is repeated until eventually the obstruction is passed. They continue upstream until they reach riffles over gravel beds toward or near the headwaters, where they prepare nests. Here, by rapid movements of their bodies, they make a small mound of gravel in which their eggs are intermixed. Death usually occurs soon after spawning. The eggs hatch in a few weeks. The young, known as an *ammocoete*, burrows into the mud along the margin of the stream where it feeds upon vegetable material. It spends probably two or more years as a larva in the fresh water. During this period the larva differs in many structural



FIGURE 9. Pacific lamprey. *Entosphenus tridentatus* (Gairdner) 1836

respects from that of the adult, particularly in the presence of a projecting oral hood instead of a horny sucking disk surrounding the mouth. Toward the end of the fresh-water period the body changes to the adult form. Migration then takes place to the sea where begins a predaceous life of unknown duration. The Pacific lamprey attacks various fishes, salmon and steelhead trout in particular, attaching itself to the under side of the fore part of the body and sucking the body fluids. Many salmon and trout are taken each year showing the circular disk impressions of lampreys on fins and gill covers. These markings are sometimes mistaken by fishermen for "brands." While the Pacific lamprey is not marketed commercially there is no reason to believe that it is less edible than the European lamprey, which in early times was considered a great delicacy, and known as the diet of kings.

Range southern California to northwestern Alaska.

Order HYPEROTRETA

In this order the nostril is at the anterior dorsal tip of the head, surrounded by 4 barbels, and opens into a naso-pituitary passage which in turn opens into the pharynx. The eyes are poorly developed. The gill pores are 10 to 14 in number on each side of the body, the first commencing remote from the eye.

Family MYXINIDAE

Hag-fishes

In the hag-fishes the body is elongate and cylindrical and the mouth is surrounded by a fleshy sucking disk without horny multicuspid plates.

These animals burrow into the bodies of fishes and feed upon the internal parts. They inhabit the colder waters of the Pacific and do not enter fresh water.

Only one species is known from British Columbia waters but a second species, *Polistotrema deani* Evermann and Goldsborough, is recorded from off cape Flattery and from southeastern Alaska and will probably be taken in the future. This species differs from *P. stoutii* in having a much shorter head, a greater interspace between the anus and the ventral fin fold and more numerous horny plates in the mouth.

Hag-fish

Polistotrema stoutii (Lockington) 1878

Body elongate, cylindrical, compressed posteriorly. Head short; snout pointed, depressed; mouth surrounded by small fleshy disk; horny plates with cusps on roof of mouth and on tongue; jaws absent; nostril single, large, median, terminal, with opening into pharynx; barbels around mouth, 4, around nostril, 4;



FIGURE 10. Hag-fish. *Polistotrema stoutii* (Lockington) 1878

eyes not visible but locations often marked by whitish areas. Gill pores, 10 to 14, first remote from eye. Skin: thin, smooth, loose. Anus large, near posterior end of body. Paired fins: absent. Fin folds: dorsal (1), far back, median, low, continuous with caudal; ventral, median, low, origin slightly posterior to last gill pore, insertion at anus; caudal broad, rounded. Mucus sacs numerous, in single series along each side of body. Colour: dark brown, often tinted with blue or purple (light brown in preservative); white on margins of fin folds.

Length to 2 feet 1 inch.

Distinguished by the flat pointed snout bearing 8 barbels, the small fleshy sucking disk, the covered eyes, the 10 to 14 gill pores on each side of the body commencing remote from the eye and the large anus very remote from the head.

The hag-fish was first taken in British Columbia waters in July, 1898, off the west coast of Vancouver island and was recorded in the same year by J. Fannin as *Polistotrema stouti* Lockington (evidently a misprint for *stoutii*). The specimen is now in the Provincial Museum at Victoria. The species is obtained occasionally along the west coast of Vancouver island. It has been captured in California waters at a depth of 455 fathoms. Little is known concerning the life history. Each egg is enclosed in a horny capsule which is spindle-shaped and approximately $1\frac{1}{4}$ inches in length and $\frac{3}{8}$ of an inch in width. At each end there is a tuft of short hooked spines by which the egg cases are held together and attached to seaweeds. The hag-fish is a predaceous animal attacking large

fishes into which it burrows and completely consumes the softer parts. Rock-fishes, lingcod, flounders and sea-perches are recorded as being eaten and attacks on salmon have been reported.

Range southern California to southeastern Alaska.

Class II. **SELACHII**

The selachians are considerably diversified in their external shapes but actually are fundamentally similar. The skeleton is cartilaginous with primitive ribs and a complete braincase, or chondrocranium. Vertical and paired fins are present and are supported by cartilaginous rods at their bases from which radiate numerous unsegmented horny rays. The paired fins are attached to simple girdles. In the males, parts of the pelvic fins are modified to form claspers by means of which fertilization of the eggs within the bodies of the females is made possible. The mouth is ventral with well-developed jaws, the upper of which is not fused with the cranium. The nostrils are paired and located on the ventral surface of the head. The gill openings are elongate. The gill pouches are supported by cartilaginous arches.

The class Selachii comprises four subclasses, two of which embrace the living species, the Euselachii, sharks and rays, and the Holocephali, chimaeras and rat-fishes.

Subclass **EUSELACHII**

The members of this subclass have from 5 to 7 pairs of lateral or ventral exposed elongate gill openings. There is usually a small opening behind the eye, the spiracle, which is a remnant of a gill opening. The skin is very tough and has embedded in it numerous small placoid scales whose spines project and produce a roughened surface. These scales are covered with enamel and on the jaws are greatly enlarged and constitute the teeth.

This subclass is divided into two orders, the Pleurotremata, sharks, and the Hypotremata, skates and rays.

Order **PLEUROTREMATA**

In this order the body is elongate, spindle-shaped and approximately round in cross section. The caudal fin is heterocercal, that is, having lobes of unequal size surrounding the upturned end of the vertebral column. The pectoral fins have narrow bases and are free from the head and pelvic fins. A pair of spiracles is present, usually small in pelagic forms. The gill slits are on the sides of the body in front of the pectoral fins. The young are liberated from the bodies of the females after the yolk-sacs have been absorbed except in a few species which deposit eggs in flattened oblong horny cases on the sea bottom.

Suborder **NOTIDANOIDEA**

The sharks of this suborder have 6 or 7 gill slits on each side of the body and a single dorsal fin above the anal fin.

The cow sharks are bottom-living forms, mostly of warm seas; only six or seven species exist today but fossil species were numerous.

Spotted cow shark*Notorynchus cepedianus* (Péron) 1807

Body elongate, slender, rounded. Head depressed; snout broad, rounded; mouth, ventral. Spiracle large, nearer first gill slit than eye; gill slits, 7. Fins: dorsal (1), far back on body; anal, moderate; pelvic, abdominal; caudal heterocercal, elongate, upper lobe about 3 in total length from tip of snout to tip of caudal fin. Scales: placoid, minute. Colour: sandy gray to reddish brown with scattered round black spots.

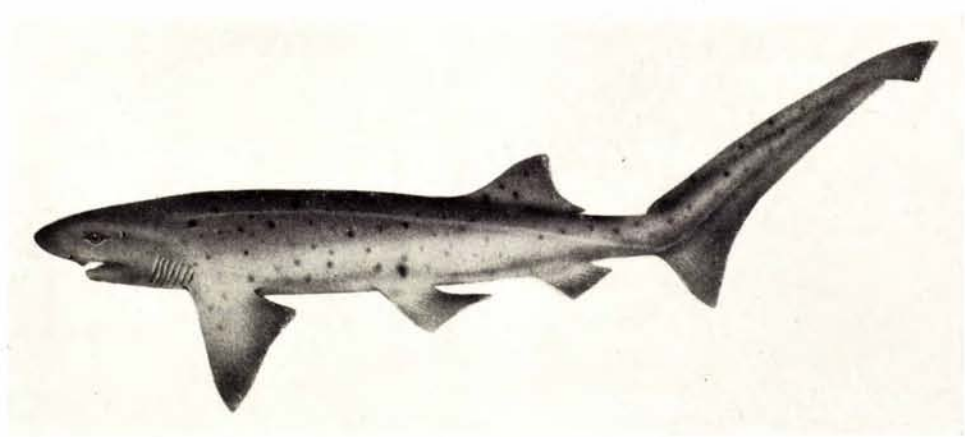


FIGURE 11. Spotted cow shark. *Notorynchus cepedianus* (Péron) 1807

Length to 8 feet.

Distinguished by the presence of 7 gill slits on each side of the body and the single dorsal fin.

The spotted cow shark was first taken in British Columbia waters in the spring of 1934 near Pender island by Mr. J. Shannon. This information was supplied by the second author to L. P. Schultz and A. C. DeLacy who recorded in 1935, in the errata to their *Fishes of the American Northwest*, under the name *Notorynchus maculatus* Ayres, this northward extension of the range. The species is obtained occasionally in otter trawls in the southern portion of the strait of Georgia, particularly in the vicinity of Pender island. In 1937 a specimen was caught near Butedale and in 1942 another was taken southwest of Bonilla island in 20 to 25 fathoms. Nothing is known concerning the life history.

Range southern California to northern British Columbia.

Mud shark

Hexanchus griseus (Bonnaterre) 1788

Body elongate, stout, rounded. Head large, depressed; snout broad, blunt; mouth ventral. Spiracle large, nearer first gill slit than eye; gill slits, 6. Fins: dorsal (1), far back on body; anal, moderate; pelvic, abdominal; caudal, heterocercal, moderately elongate, upper lobe more than 3 in total length from tip of snout to tip of caudal fin. Scales: placoid, minute. Colour: dark gray, almost black in some instances, pale streak along side of body.

Length to 26 feet 5 inches.

Distinguished by the 6 gill slits on each side of the body and the single dorsal fin.

The mud shark was first taken in British Columbia waters in August, 1925, at Departure bay on a set-line. This specimen, a female $8\frac{1}{4}$ feet in length, was

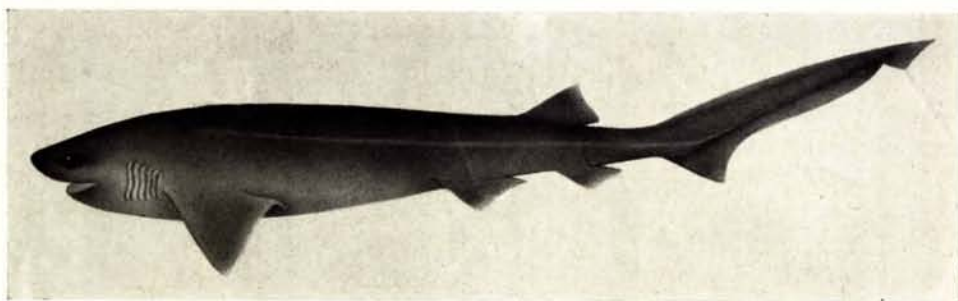


FIGURE 12. Mud shark. *Hexanchus griseus* (Bonnaterre) 1788

recorded in 1926 by C. H. O'Donoghue and L. L. Bolton as *Hexanchus corinus*. The species is particularly abundant in the strait of Georgia. The food consists of herring and various other fishes. The mud shark is captured frequently in purse-seines, especially during the herring fishing season, and is taken also on set-lines and in sunken nets, trawls and salmon-traps. It is made use of in reduction plants in the manufacture of meal and oil. It is known also as the shovel-nosed shark of California and the six-gilled shark or griset of European waters.

Range southern California to northern British Columbia.

Suborder GALEOIDEA

The sharks of this suborder have 5 gill slits on each side of the body, 2 dorsal fins and 1 anal fin.

Family LAMNIDAE

Mackerel sharks

The mackerel sharks receive the name because of the possession of certain body characteristics somewhat similar to those of the mackerels, such as, the slender caudal peduncle usually with a strong keel on each side and a streamlined form of body which makes possible very swift movement. They are pelagic sharks of wide distribution particularly in the northern seas.

Mackerel shark

Isurus nasus (Bonnaterre) 1788

Body elongate, somewhat stout, rounded; caudal peduncle rather slender, keel on each side, prominent. Head moderate; snout prominent, pointed, slightly depressed; mouth ventral; teeth large, sharp; eye large, placed high. Spiracle minute, partially covered with fleshy flap, behind eye and above angle of mouth; gill slits, 5, length moderate, equal to distance from tip of snout to posterior margin of eye, fifth in front of pectoral fin. Fins: dorsal (2), first large, origin above pectoral fins, second small; anal, very small, length much less than that of first dorsal; pelvic, abdominal; caudal, heterocercal, lunate. Scales: placoid, minute. Colour: dark bluish gray on dorsal surface; abruptly white on ventral surface.

Length to 10 feet.

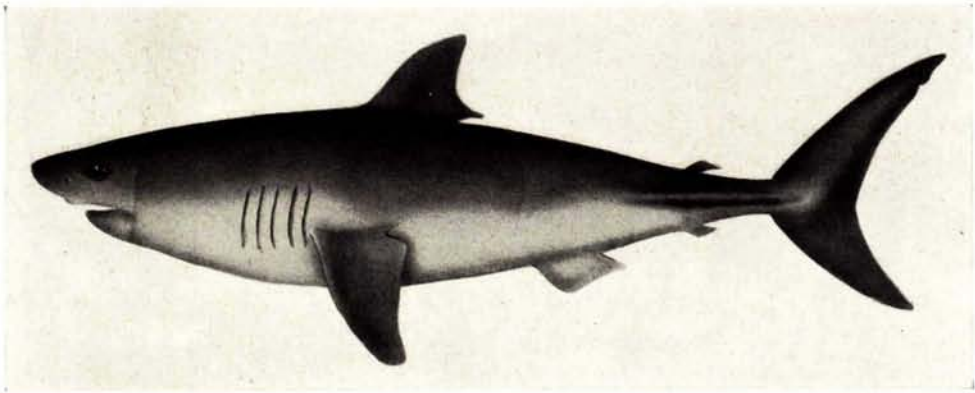


FIGURE 13. Mackerel shark. *Isurus nasus* (Bonnaterre) 1788

Distinguished by the keel on each side of the caudal peduncle and the gill slits of moderate length.

The mackerel shark was first taken in British Columbia waters in 1925 at Hippa island on a salmon-spoon and was recorded in 1930 by H. C. Williamson as *Lamna cornubica* Gmelin. This shark apparently is common along the coast from the strait of Georgia to Hecate strait. Individuals up to 8½ feet in length are abundant during the summer months off Mistaken island, near Parksville, where sportsmen have taken them on light tackle using salmon for bait. It is pelagic, swift swimming and said to be the most voracious of the northern sharks, feeding extensively upon salmon and other fishes. Although this shark has been called "man-eater" by some fishermen of the coast there is no authentic record of it having attacked a human being. It probably is the species which causes much damage to fishermen's nets.

Range northern California to northwestern Alaska.

Basking shark

Cetorhinus maximus (Gunner) 1765

Body elongate, stout, rounded; caudal peduncle moderately slender, keel on each side prominent. Head moderate; snout blunt; mouth ventral; teeth numerous, very small, conical; eye small, placed low. Spiracle small, behind eye and above angle of mouth; gill slits, 5, very long, extending from back nearly to median line of ventral surface, fifth in front of pectoral fin; gill rakers long (4 to 6 inches in large individuals), slender, closely set, horny, somewhat resembling whalebone. Skin coarse, divided into irregular rectangles. Fins: dorsal (2), first large, pointed, about midlength of body; anal, very small, length much less than that of first dorsal; pelvic, abdominal, large; pectoral, large; caudal,

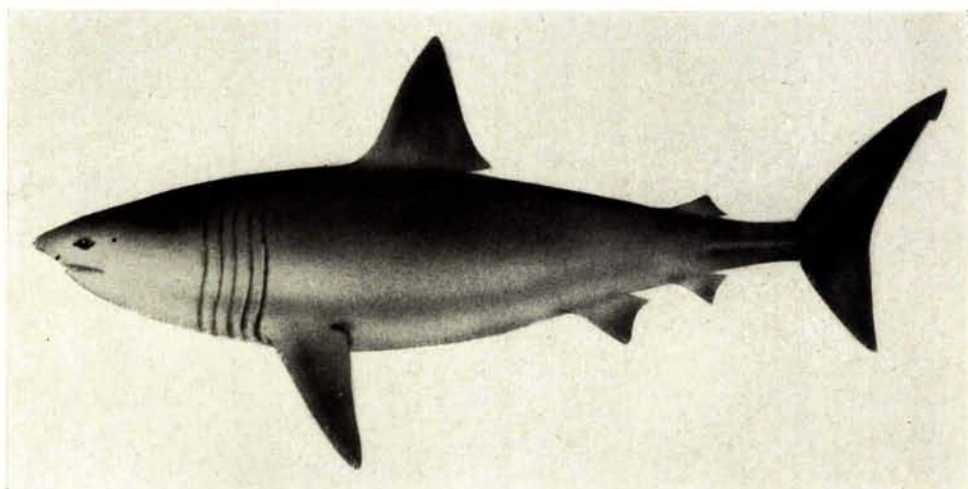


FIGURE 14. Basking shark. *Cetorhinus maximus* (Gunner) 1765

heterocercal, lunate. Scales: placoid. Colour: bluish gray to brownish gray on dorsal surface; paler on ventral surface.

Length to 40 feet.

Distinguished by the keel on each side of the caudal peduncle, the large gill slits and the long slender horny gill rakers.

The basking shark was first recorded from British Columbia waters in 1891 from Queen Charlotte sound by Ashdown Green who stated that the species was well known to the Indians who occasionally killed individuals in this area. The cartilaginous skeletons are found rather frequently on beaches along the Pacific coast and are usually mistaken for remains of sea-serpents, particularly when the lower jaw is missing. In fact the name *Halsydrus* was given in 1809 to the remains of an unknown animal, believed to be a sea-serpent, cast up on the beach at Stronsay in the Orkney islands. A portion of the skeleton was preserved and

later identified as possibly the vertebrae of a large basking shark. The species is fairly common in the open sea off the coast and is world-wide in its distribution. At certain times it is somewhat gregarious. Although of large size the basking shark is not ferocious. It swims through the water and, opening its large mouth, strains out small crustaceans and other animals by means of the array of closely set gill rakers. The common name has come from its habit of lying quite motionless at the surface in calm water with the large dorsal fin projecting.

Range southern California to northern British Columbia.

Thresher shark

Alopias vulpinus (Bonnaterre) 1788

Body elongate, rounded; caudal peduncle short, stout, keel absent. Head moderate; snout somewhat blunt; mouth ventral; teeth small, flat, triangular,

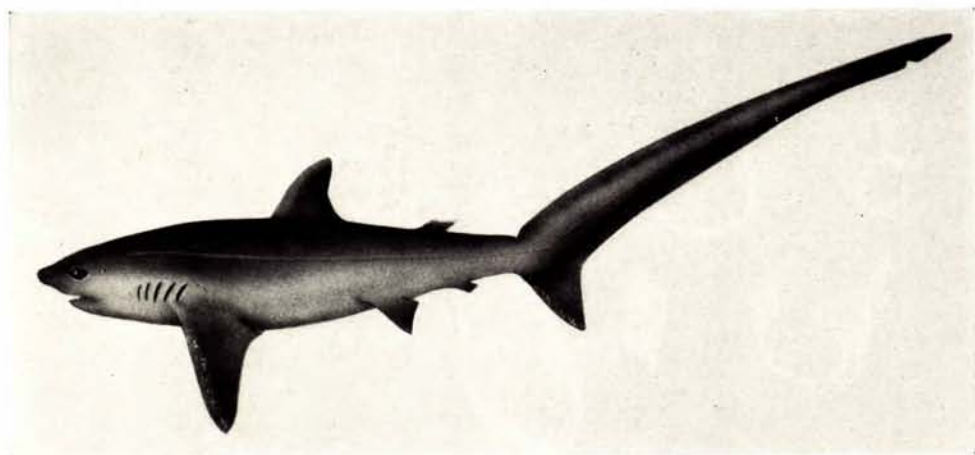


FIGURE 15. Thresher shark. *Alopias vulpinus* (Bonnaterre) 1788

edges smooth; eye small. Spiracle minute, close behind eye; gill slits, 5, short, fifth above pectoral fin. Fins: dorsal (2), first large, pointed, second very small; anal, very small; pelvic, abdominal, moderate; pectoral large, falcate; caudal, heterocercal, exceedingly elongate, length about half total length from tip of snout to tip of caudal fin. Scales: placoid, minute. Colour: dark brownish gray to black on dorsal surface; white on ventral surface.

Length to 25 feet.

Distinguished by the exceedingly elongate caudal fin.

The thresher shark was first taken in British Columbia waters July 19, 1937, at Otter point near Sooke. It was caught in a fish trap and was recorded in 1938 by I. McT. Cowan as *Alopias vulpes* (Gmelin). This specimen was 5 feet 8½ inches in length and is now in the Provincial Museum at Victoria. Other occurrences have been reported from time to time. This shark is a swift swimmer,

feeding at or near the surface upon schooling fishes for the most part such as herring and pilchards. In feeding, it is said to swim in circles around the fish which become more or less concentrated because of the threshing movements of the tail. In spite of its large size the thresher shark is not known to be dangerous to human beings.

Range southern California to Juan de Fuca strait.

Family SCYLLIORHINIDAE

Cat sharks

The cat sharks are small selachians characterized by having the upper lobe of the caudal fin in a straight line with the body instead of being turned upward as in other species, and by having the first dorsal fin above the pelvic fins. These sharks inhabit the southern seas and the species recorded from British Columbia apparently reaches its northern distribution in this area.

Brown shark

Apristurus brunneus (Gilbert) 1891

Body elongate, rather slender, compressed; caudal peduncle very short, keel absent. Head elongate, much depressed; snout prominently angled above nostril; mouth ventral; teeth small, tricuspid, cusps slender. Spiracle large, close behind

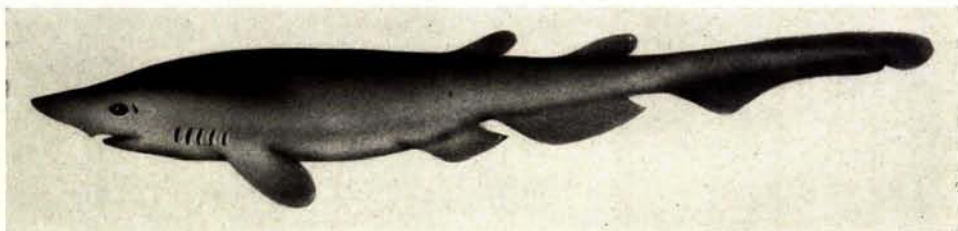


FIGURE 16. Brown shark. *Apristurus brunneus* (Gilbert) 1891

eye; gill slits, 5, fifth above pectoral fin. Fins: dorsal (2), close together, first over posterior of pelvic fins; anal large, length of base about twice that of first dorsal; pelvic, abdominal; caudal, modified heterocercal, not pointed upward. Scales: placoid, minute. Colour: dark brown; black on margins of fins.

Length to 2 feet.

Distinguished by the posterior position of the first dorsal fin over the pelvic fins, the large anal fin and the non-upturned caudal fin.

The brown shark was first taken in British Columbia waters in 1907 near Nanaimo and the single specimen obtained was recorded in 1913 by F. Kermode as being in the collection of the Provincial Museum at Victoria. In April, 1941, several of these sharks were caught in the area south of Porlier pass and one was sent to the Pacific Biological Station for identification. A specimen $3\frac{1}{8}$ inches in length was secured September 1, 1941, in English bay in a shrimp trawl. Another individual was caught on a dog-fish set-line in December, 1944, in

Howe sound at a depth of approximately 170 fathoms. Small numbers are taken on dog-fish gear in the strait of Georgia off the mouth of the Fraser river at depths of approximately 100 fathoms. From studies made in California waters it is known that the egg-case is slightly over two inches in length, oblong, compressed, with a long tendril at each of the four corners; the light brown covering is translucent so that the single white egg may be seen within.

Range southern California to strait of Georgia.

Family CARCHARINIDAE

Blue sharks

The blue sharks are pelagic, usually bluish above and whitish below. They are widely distributed, very active and voracious. One member of the family, *Carcharinus nicaraguensis*, inhabits lake Nicaragua and is the only known strictly fresh-water shark.

Soup-fin shark

Galeorhinus galeus (Linnaeus) 1758

Body elongate, slender, rounded; caudal peduncle short, slender, keel absent. Head depressed; snout long, pointed; mouth ventral. Spiracle small, close behind eye; gill slits, 5, fifth above pectoral fin. Fins: dorsal (2), size moderate; anal, small, length less than that of first dorsal; pelvic, abdominal; pectoral, length less than twice height of first dorsal, not sabre-shaped; caudal, heterocercal,

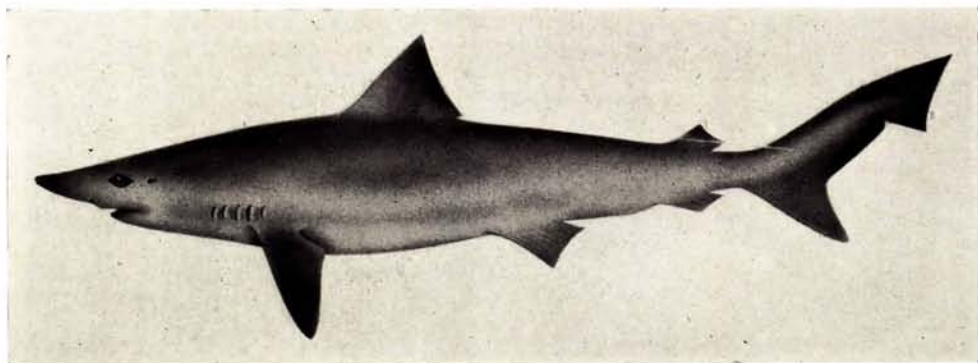


FIGURE 17. Soup-fin shark. *Galeorhinus galeus* (Linnaeus) 1758

upper lobe broad, lobule large. Scales: placoid, small. Colour: dark bluish to dusky gray on dorsal surface; paler on ventral surface; black on anterior portions of both dorsal fins, most of pectorals and tip of caudal fin.

Length to 6 feet.

Distinguished by the dark fins, the large lobule on the upper lobe of the caudal fin, the relatively short pectoral fins and the fifth gill slit on each side of the body above the pectoral fin.

The soup-fin shark was first recorded from British Columbia waters in 1891

by Ashdown Green who reported it to be rather common along the coast. When this shark was discovered in California it was described in 1883 as *Galeorhinus zyopterus* by Jordan and Gilbert. Dr. W. F. Thompson states that a specimen 5 feet 7 inches in length was obtained in October, 1914, off Banks island. A female 5 feet 9 inches in length, weighing 85 pounds and containing 19 young was caught August 18, 1926, in a salmon-trap near Sooke. Captures of considerable numbers by commercial fishermen have been reported from the west coast of Vancouver island since 1939. An individual taken off southern California contained 28 eggs, 14 in each oviduct, each about 4 inches in diameter and covered with a thin brownish membrane. The food is stated to consist in part of pilchards, anchovies, salmon, sea-perch, rock-fish and squid. The fins of this shark, because of their gelatinous rays, make a soup much prized by the Chinese in California and hence the common name. Recently the vitamin "A" content of the liver oil has been found to be very high and the fishery for this shark has greatly developed along the entire coast from California to British Columbia. Fishing takes place in about 25 fathoms with gill-nets or with set-lines baited with herring, suspended about 6 feet from the bottom. In European waters this shark is known as the tope.

Range southern California to northern British Columbia.

Blue shark

Prionace glauca (Linnaeus) 1758

Body elongate, slender, rounded; caudal peduncle short, slender, keel absent. Head depressed; snout long, pointed; mouth ventral. Spiracle small, inconspicuous.

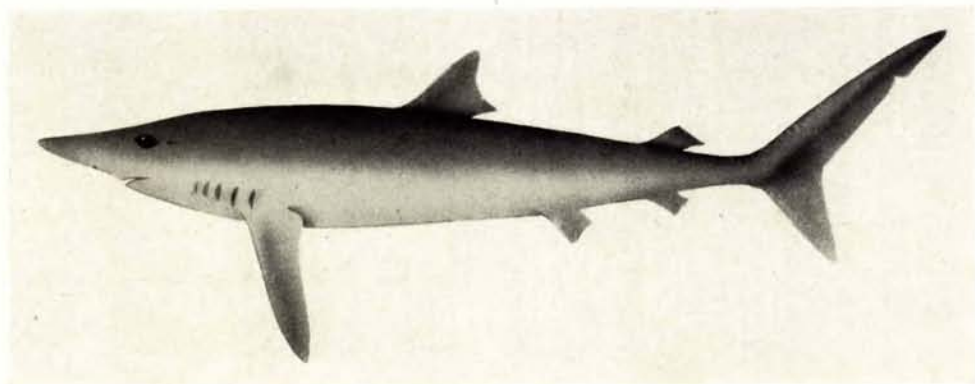


FIGURE 18. Blue shark. *Prionace glauca* (Linnaeus) 1758

ous, close behind eye; gill slits, 5, fifth above pectoral fin. Fins: dorsal (2), size moderate; anal small, length less than that of first dorsal; pelvic, abdominal; pectoral large, length equal to twice height of first dorsal, sabre-shaped; caudal

heterocercal, upper lobe slender, lobule small. Scales: placoid, small. Colour: bluish gray on dorsal surface and on fins; almost white on ventral surface.

Length to 25 feet.

Distinguished by the long sabre-shaped pectoral fin, the small lobule on the upper lobe of the caudal fin and the fifth gill slit above the pectoral fin.

The blue shark apparently was first recorded from British Columbia waters in 1930 by H. C. Williamson who reported observing a blue shark, "probably *Prionace glauca*", and who stated that individuals were frequently caught in 1925 by trollers along the west coast of Vancouver island. It would seem to be rather common along the west coast of Vancouver island as it is taken frequently during the herring and pilchard operations. Little is known of the life history but the young are born, as many as 30 at a time. Since it is a very active shark it feeds upon whatever fishes it may encounter, even those in fishermen's nets and hence is considered extremely voracious.

Range southern California to southern British Columbia.

Suborder SQUALOIDEA

The sharks in this suborder have 5 gill slits on each side of the body, 2 dorsal fins and no anal fin.

Family SQUALIDAE

Dog-fishes

The dog-fishes are small sharks abounding in all seas and frequently occurring in very large schools. There is a stout sharp spine in front of each dorsal fin. The sleeper shark, which is included in this family, is a large sluggish selachian of world-wide distribution. No spines precede the dorsal fins of this species.

Dog-fish

Squalus suckleyi (Girard) 1854

Body elongate, rather slender, rounded; caudal peduncle long, slender. Head depressed; snout pointed; mouth ventral. Spiracle large, close behind eye; gill slits, 5. Fins: dorsal (2), each with large spine anteriorly; anal, absent;

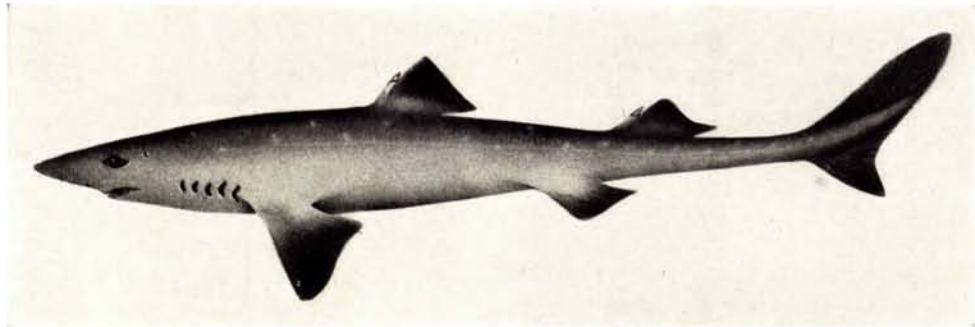


FIGURE 19. Dog-fish. *Squalus suckleyi* (Girard) 1854

pelvic, abdominal; caudal, heterocercal, upper lobe broad. Scales: placoid, minute. Colour: gray or light brown on dorsal surface; dirty white on ventral surface; white spots on back of young.

Length to 5 feet 3 inches.

Distinguished by the presence of a large spine in front of each dorsal fin and the absence of an anal fin.

The dog-fish was first recorded from British Columbia waters in 1866 without date or locality of capture by J. K. Lord as *Acanthius Suckleyi* (evidently a misprint for *Acanthias*). The first specific record is that of a specimen taken July 27, 1881, at Drew harbour by Capt. H. E. Nichols and recorded in the same year by T. H. Bean as *Squalus acanthias* Linnaeus. The species is exceedingly abundant along the whole coast, appearing in large numbers where herring school and occasionally may be observed swimming at the surface with the dorsal fins exposed, particularly where "pink" feed is abundant. The female attains a greater length and weight than does the male and produces from 3 to 14 young at a time in alternate years. The dog-fish feeds upon practically all of the smaller fishes, especially herring, pilchards, anchovies, smelts, sand-lances, and occasionally young dog-fish, squid as well as pelagic crustaceans when they occur in large numbers. It is also a scavenger, feeding upon offal from fish canneries and reduction plants and refuse dumped at sea. It is caught with gill-nets and set-lines and is used extensively for the production of oil and meal. Since the oil from the liver has been found to have a high vitamin "A" content the capture of dog-fish has developed into a very profitable fishery. The nitrogen content of the meal makes it particularly valuable as a fertilizer. It may be of interest to know that prior to 1880 a reduction plant was in operation at Skidegate for the manufacture of oil from dog-fish livers. This shark is sometimes referred to as gray-fish.

Range southern California to northwestern Alaska.

Sleeper shark

Somniosus microcephalus (Schneider) 1801

Body elongate, stout, deep anteriorly, rounded. Head large; snout blunt; mouth ventral. Spiracle large, close behind eye; gill slits, 5. Fins: all relatively small; dorsal (2), not preceded by spines, second elongate, flabby; anal, absent; pelvic, abdominal; caudal heterocercal, lobes broad. Scales: placoid, minute. Colour: gray to sooty black.

Length to 25 feet.

Distinguished by the flabby second dorsal fin, the absence of an anal fin and the absence of a spine from the anterior margin of each dorsal fin.

The sleeper shark was first recorded from British Columbia waters in 1881 from Victoria by D. S. Jordan and C. H. Gilbert who observed a specimen 8 feet in length. A second specimen 11 feet 6 inches in length was found January 29, 1934, on Comox spit. Since the latter date a number of individuals have been reported from various parts of the strait of Georgia. The sleeper shark is a large

and sluggish denizen of the bottom. Little is known of the early life history and whether it deposits eggs or liberates young is uncertain. It is rapacious, feeding upon almost anything of an animal nature as well as upon carrion.

Range southern California to northwestern Alaska.

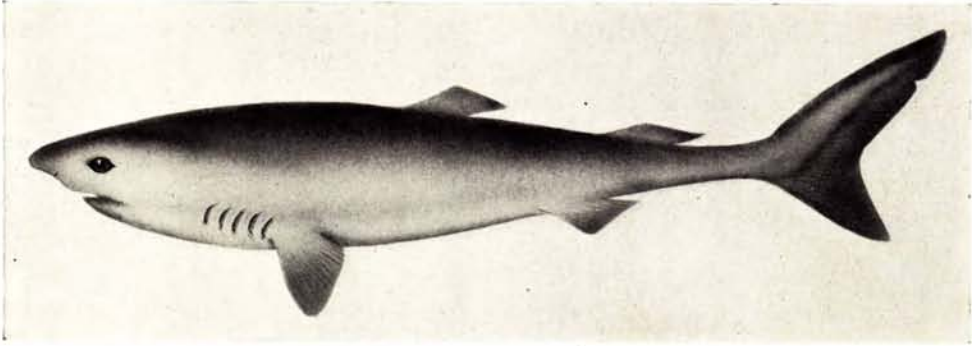


FIGURE 20. Sleeper shark. *Somniosus microcephalus* (Schneider) 1801

Order HYPOTREMATA

In this order the body proper is elongate, depressed and almost elliptical in cross section. The pectoral fins have wide bases which are greatly extended and each is attached along the side of the body from the tip of the snout to the anterior margin of the pelvic fin. The rhythmical wave-like motion of these fins produces fairly rapid movements. There is no anal fin. A pair of large spiracles is present and dorsal in position. The gill slits are on the ventral surface of the body. The eggs are fertilized internally. In the skates (Rajidae), the eggs are laid in horny cases, while in the sting and electric rays the young develop within the female and are released at or about the time the yolk-sac is absorbed.

Suborder BATOIDEA

The rays in this suborder have the body extended posteriorly to form a long slender tail, usually without a caudal fin. The pectoral fins are attached to the snout but are not continuous around it. Scales are usually present. Electric organs, if present, are small, weakly developed and situated on the body at the base of the tail.

The term ray is applied to all members of the suborder Batoidea, while the term skate is usually restricted to the members of the family Rajidae.

In this suborder there are two families, the Rajidae, or skates, and the Trygonidae, or sting rays.

Family RAJIDAE

Skates

In the skates the body is extended posteriorly into a long slender tail on each side of which is a longitudinal fold. There are two dorsal fins placed far back on the tail.

The skates are represented by many species, all inhabiting cool seas and sometimes extending into very deep water. They live, for the most part, on muddy bottoms where they may lie motionless or with gentle undulations of the pectoral fins. When swimming they may attain considerable speed.

✓ **Long-nosed skate**

Raja rhina Jordan and Gilbert 1880

Body elongate, slender, depressed; tail slender. Outline between tip of snout and tip of pectoral fin concave so that a line drawn between these two points lies almost wholly without fin outline. Head depressed; snout long,

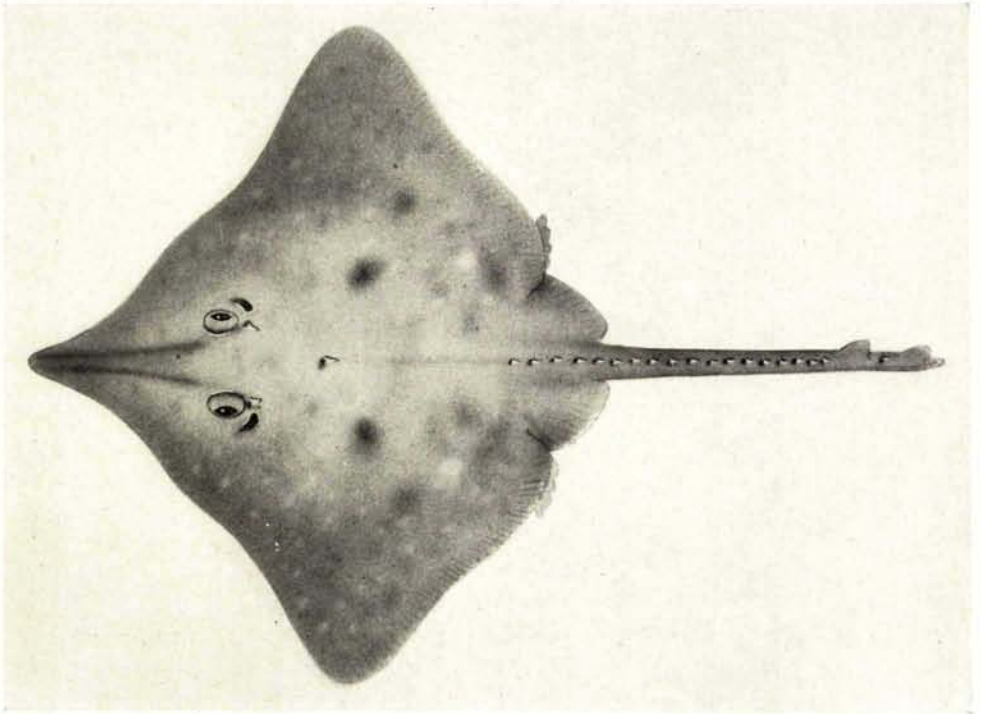


FIGURE 21. Long-nosed skate. *Raja rhina* Jordan and Gilbert 1880

sharply pointed, supported by firm cartilage; mouth ventral. Spiracle large, close behind eye; gill slits, 5, on ventral surface. Fins: dorsal (2), far back on tail; anal, absent; pelvic, abdominal, each with deep acute notch when extended; pectoral broad, attached to snout; caudal, absent. Scales: placoid, minute. Spines: on mid-dorsal line large, confined to tail except for single stout spine short distance behind eyes; in male, in patch near tip of each pectoral fin extending near margin towards snout, large, sharp. Colour: mostly uniform brown on

dorsal surface; muddy blue on ventral surface; black ring at base of each pectoral fin; small white spot posterior to each ring.

Length to 4 feet 6 inches.

Distinguished by the long pointed snout, the angular outline of the body, the deep acute notch in each pelvic fin when extended and the muddy blue colour on the ventral surface of the body.

The long-nosed skate was first recorded from British Columbia waters in 1891 by Ashdown Green, although Jordan and Gilbert, in 1881, gave the range as from Monterey to Vancouver island. The egg-cases are 3 to 5 inches in length, possess tendrils, and usually contain one egg only. The pectoral fins of long-nosed skates are sold as "wings." Although these appear on the market they are generally considered as less palatable than those of the big skate.

Range southern California to southeastern Alaska.

Big skate

Raja binoculata Girard 1854

Body elongate, slender, depressed; tail slender. Outline between tip of snout and tip of pectoral fin slightly concave so that a line drawn between these two points lies almost wholly without fin outline. Head depressed; snout long,

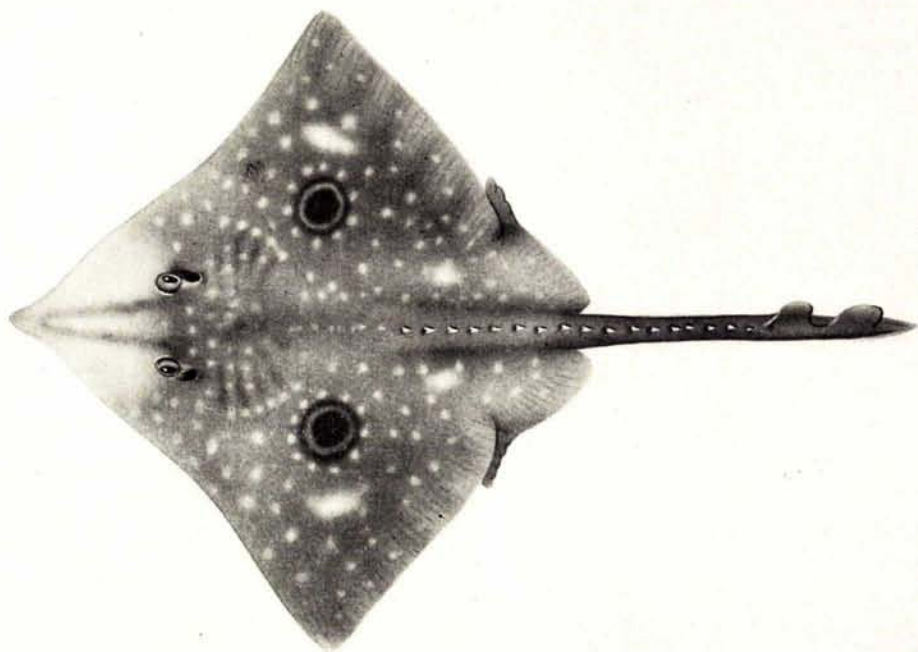


FIGURE 22. Bigskate. *Raja binoculata* Girard 1854

somewhat pointed, supported by firm cartilage; mouth ventral. Spiracle large, close behind eye; gill slits, 5, on ventral surface. Fins: dorsal (2), far back on tail; anal, absent; pelvic, abdominal, with slight obtuse concavity when extended; pectoral broad, attached to snout; caudal, absent. Scales: placoid, minute. Spines: on mid-dorsal line large, confined to tail except for single stout spine short distance behind eyes; in male, in patch near margin of each pectoral fin extending from snout to beyond tip, large, sharp. Colour: dull olive brown or gray to nearly black in large individuals, on dorsal surface; white on ventral surface; large dark ocellus, or "eye-spot", at base of lighter area which in turn contains a central darker area; light spots as large as eye scattered over body and smaller light spots forming ring around each ocellus; in young, light ring of ocellus conspicuously red.

Length to 8 feet.

Distinguished by the shallow obtuse concavity in each pelvic fin, the ocellus at the base of each pectoral fin and the white ventral surface of the body.

The big skate was first taken in British Columbia waters in 1880 at Victoria and recorded in the same year by D. S. Jordan and C. H. Gilbert as *Raia cooperi*. It is abundant along the whole coast. The egg-cases of large individuals are about 1 foot in length, do not possess tendrils, and may contain from 2 to 7 eggs. A case obtained January 1, 1939, in Active pass at a depth of approximately 40 fathoms contained 4 eggs which were in the very early stages of segmentation. On October 5, 1941, a female, about 5 feet in length, laid two egg-cases in the Vancouver Aquarium and on the 9th she deposited two more, but none of the eggs hatched. There would seem to be some evidence that egg deposition may take place throughout the year, since freshly deposited egg-cases have been dragged up in trawls from early January to late summer in the strait of Georgia. It is likely that the young remain in the cases for approximately a year. The food of this skate consists in part of crustaceans and fishes, including the great sculpin, *Myoxocephalus polyacanthocephalus*, two specimens of which, each about one foot in length, were taken from the first recorded individual mentioned above. The big skate is the largest of the skates in these waters and is important commercially as its "wings" are sold in considerable quantities.

Range southern California to northwestern Alaska.

Prickly skate

Raja stellulata Jordan and Gilbert 1880

Body elongate, slender, depressed; tail slender; outline between tip of snout and tip of pectoral fin convex so that a line drawn between these two points lies wholly within fin outline. Head depressed; snout bluntly pointed, supported by weak cartilage; mouth ventral. Spiracle large, close behind eye; gill slits, 5, on ventral surface. Fins: dorsal (2), far back on tail; anal, absent; pelvic, abdominal, each with deep notch; pectoral broad, attached to snout; caudal, absent. Scales: placoid, small, stellate. Spines: on mid-dorsal line in continuous row from slightly behind eyes to first dorsal fin, large; on shoulder girdle near

middle of body, about 6, large; on orbital rim in row, small; stout; in male, in patch near tip of each pectoral fin extending near margin towards snout, large, sharp. Colour: grayish brown; black spots numerous, small, of various sizes, scattered over body; pair of large "eye-spots", somewhat as in *Raja binocularata*, may be present in some specimens.

Length to 2 feet 6 inches.

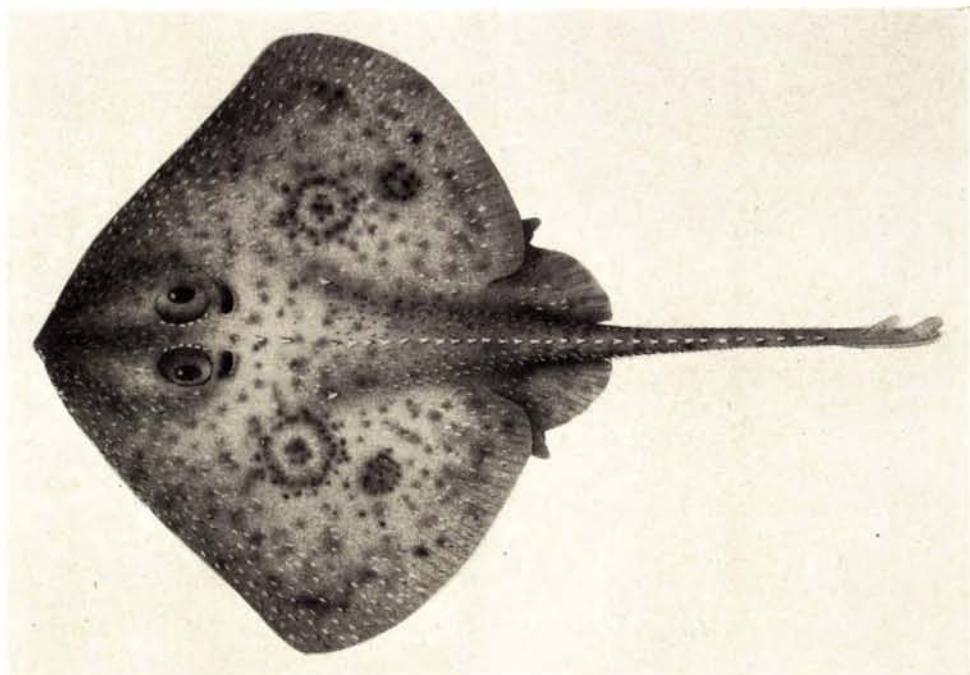


FIGURE 23. Prickly skate. *Raja stellulata* Jordon and Gilbert 1880

Distinguished by the weak snout, the continuous row of spines on the mid-dorsal line of the body, the row of spines on each orbital rim and the small stellate scales on the body.

The prickly skate was first taken in British Columbia waters August 28, 1891, west of Port San Juan by the *Albatross*, station 3447, lat. $48^{\circ} 30' N.$, long. $124^{\circ} 36' W.$, depth 116 fathoms, and recorded in 1895 by C. H. Gilbert. This skate has also been secured in the strait of Georgia, at Ucluelet and off the Queen Charlotte islands. Little is known of the life history but two small individuals, less than five inches in length with the yolk-sac still attached, were obtained in June and July, 1909, at Ucluelet.

Range southern California to northwestern Alaska.

Black skate

Raja kincaidii Garman 1908

Body elongate, slender, depressed; tail slender. Outline between tip of snout and tip of pectoral fin convex so that a line drawn between these two points lies wholly within fin outline. Head depressed; snout bluntly pointed, supported by weak cartilage; mouth ventral. Spiracle large, close behind eye; gill slits, 5, on ventral surface. Fins: dorsal (2), far back on tail; anal, absent; pelvic, abdominal, each with moderate notch; pectoral broad, attached to snout; caudal, absent. Scales: placoid, closely set, small. Spines: on mid-dorsal line, in

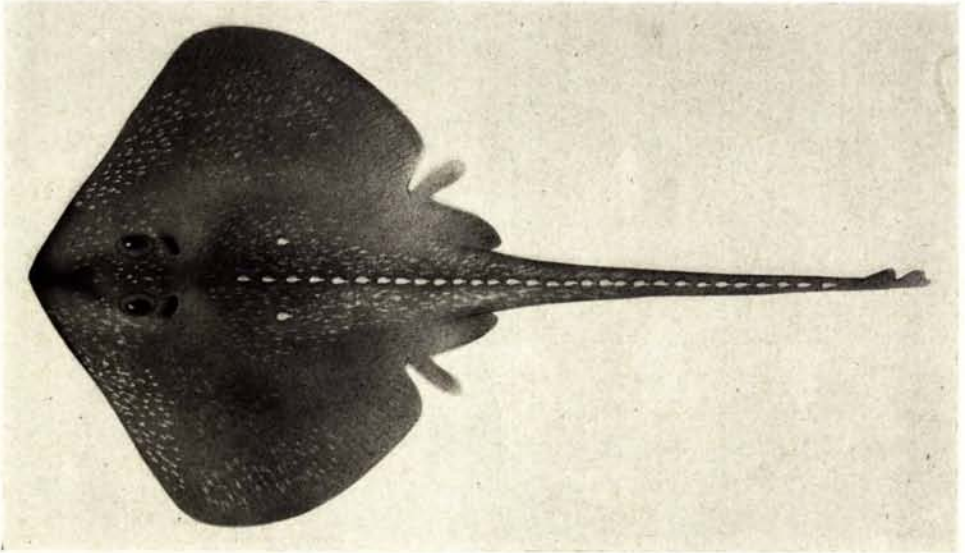


FIGURE 24. Black skate. *Raja kincaidii* Garman 1908

continuous row from behind head to first dorsal fin, 27 to 33, very large; on shoulder girdle near middle of body, 1 or 2, large; on orbital rim, none; in male, in patch near tip of each pectoral fin extending near margin towards snout, large, sharp. Colour: slaty black in adult, leaden brown in young with small brown to black spots, on dorsal surface; white on ventral surface; white spot on each side of tail near seventeenth to nineteenth spines, which may not be evident in larger specimens.

Length to 2 feet 9 inches.

Distinguished by the weak snout, the continuous row of spines on the mid-dorsal line, the 1 or 2 spines on the shoulder girdle and the absence of spines from each orbital rim.

The black skate was first taken in British Columbia waters December 11, 1936, in Trincomali channel, near Porlier pass, in an otter trawl by Dr. J. L. Hart and the specimen is now in the collection of the Pacific Biological Station. Two

individuals obtained from Porcher island in Oval bay by Dr. W. F. Thompson, and now in the collection of the United States National Museum at Washington, D.C., were recorded in 1937 by L. P. Schultz. A fourth individual was secured February 26, 1941, in Satellite channel by Dr. G. C. Carl and is now in the Provincial Museum at Victoria.

Range southern California to northern British Columbia.

Deep-sea skate

Raja abyssicola Gilbert 1895

Body elongate, slender, depressed; tail slender. Outline between tip of snout and tip of pectoral fin convex so that a line drawn between these two points lies wholly within fin outline. Head depressed; snout bluntly pointed, supported by weak cartilage; mouth ventral. Spiracle large, close behind eye; gill slits, 5,

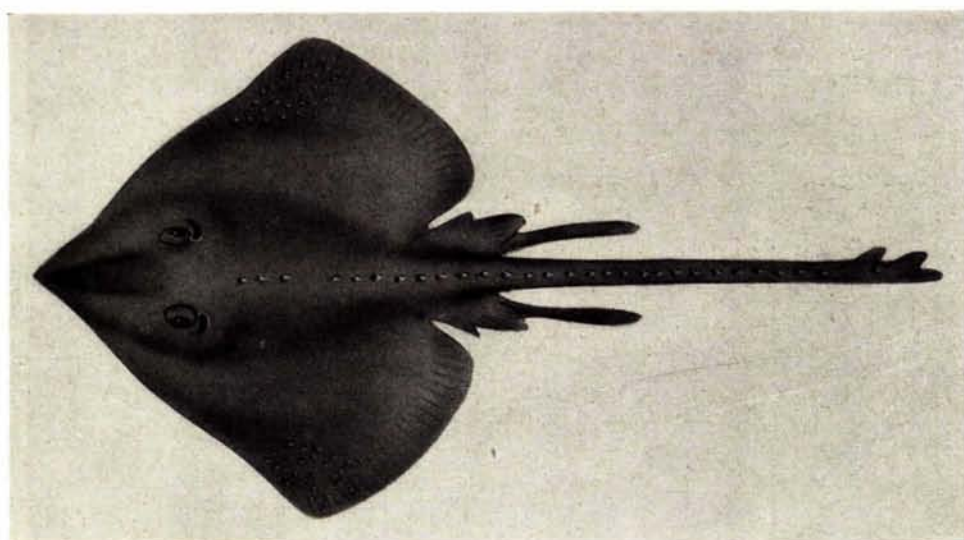


FIGURE 25. Deep-sea skate. *Raja abyssicola* Gilbert 1895

on ventral surface. Fins: dorsal (2), high, far back on tail; anal, absent; pelvic, abdominal, each with moderate notch; pectoral broad, attached to snout; caudal, absent. Scales: placoid; on dorsal surface of body, closely set, with long slender bristle-like spines. Spines: on mid-dorsal line, large; confined to tail except for three stout spines near middle of body; on shoulder girdle, none; on orbital rim, none; in male, in patch near tip of each pectoral fin. Colour: uniform brown.

Length to 4 feet 6 inches.

Distinguished by the weak snout, the continuous row of spines on the mid-dorsal line of the tail only, the three stout spines on the mid-dorsal line of the body and the absence of large spines from each shoulder girdle.

The deep-sea skate is represented by a single specimen taken September 3, 1890, west of Moresby island by the *Albatross*, station 3342, lat. 52° 39' N., long. 132° 38' W., depth 1,588 fathoms, recorded in 1895 by C. H. Gilbert. This individual is the type (a male), the only one known and is deposited in the United States National Museum. Dr. Gilbert remarked that this was the greatest depth recorded for any species of skate.

Range off the west coast of the Queen Charlotte islands.

Family TRYGONIDAE

Sting rays

In the sting rays the body is extended posteriorly into a very long slender tail which is whip-like with a sharp serrated spine on its dorsal surface; lateral longitudinal folds are usually absent. Dorsal and caudal fins are usually absent.

In some species, at least, a powerful poison is secreted along the side of the tail spine and may cause serious illness.

The species are numerous in the warm seas and some may even ascend rivers for some considerable distances.

Rat-tailed sting ray

Dasyatis dipterurus Jordan and Gilbert 1880

Body greatly elongate, depressed anteriorly; very slender posteriorly, produced into whip-like tail one and a half times length of body; outline between tip of snout and tip of pectoral fin convex so that a line drawn between these two

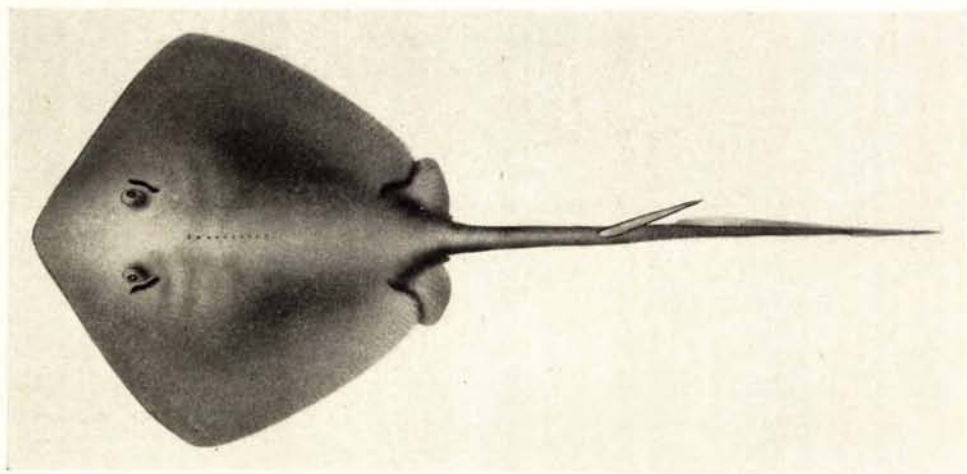


FIGURE 26. Rat-tailed sting ray. *Dasyatis dipterurus* Jordan and Gilbert 1880

points lies wholly within fin outline. Head depressed; snout somewhat pointed; mouth ventral. Spiracle large, close behind eye; gill slits, 5, on ventral surface. Skin: on tail, in small fold above, in conspicuous fold below. Fins: dorsal, absent; anal, absent; pelvic, abdominal, notch absent; pectoral broad, attached

to snout. Scales: placoid, minute. Tubercles: on mid-dorsal line of body in short row, large. Spine: on dorsal surface of tail, about one-third distance from body to tip of tail, long, stout, sharp, serrate. Colour: bluish brown.

Length to 6 feet.

Distinguished by the whip-like tail with the long sharp serrated spine.

The rat-tailed sting ray was first reported from British Columbia waters by Dr. H. C. Williamson as taken at various times during the summer of 1928 off Kyuquot, Vancouver island, on salmon gear. The record was published in 1930 as *Dasyatis* sp. and there would seem to be no doubt of the species being *D. dipterurus*. This ray is much feared by fishermen. The stout spine on the flexible tail is a very dangerous weapon which can produce a wound in which bacterial infections may develop if particular care is not taken. The food consists in part of crabs and molluscs.

Range southern California to Kyuquot, British Columbia.

Suborder NARCOBATOIDEA

The rays in this suborder have the body extended posteriorly to form a short stout tail with a well developed caudal fin. The pectoral fins are confluent around the tip of the snout. Scales are absent. Electric organs are large, located on either side of the head.

There is a single family, the Torpedinidae.

Family TORPEDINIDAE

Electric rays

In the electric rays the body is depressed and broad and produced posteriorly behind the pelvic fins into a short stout portion usually referred to as the tail. On the tail are two large dorsal fins and a well developed caudal fin. The skin is entirely smooth and devoid of scales.

The outstanding peculiarity of these fish is the possession of a pair of large electric organs located on either side of the head and capable of giving a strong electric shock. These organs are derived from certain muscles which have greatly changed in structure and function. This modification apparently is an elaboration of the minute electrical discharge which accompanies all muscular contractions. The following description is based upon that given in "*A History of Fishes*," by J. R. Norman:—The organ is composed of a large number of upright hexagonal tubes or columns, separated from one another by walls of fibrous tissue and containing a clear jelly-like substance. In essence it is a series of electric cells whose combined output of electricity is said to be sufficient to paralyze temporarily the arm of a man or to knock him down if he accidentally steps on one of these fish as it lies partly buried in the sand. The fish must be touched at two points in order to obtain the full effect of the shock. The discharge is given to animals coming in contact with the ray according to the distance apart of the points touched and the size of the area involved. This shocking mechanism is no doubt a protective device but it may also provide the ray with

a portion of its food. In European waters, eels, flounders and Atlantic salmon have been found in the stomachs.

The electric rays have their centre of abundance in warm seas.

Electric ray

Tetranarce californica (Ayres) 1855

Body elongate, somewhat expanded anteriorly, depressed; tail short, stout, compressed posteriorly; outline of body and pectoral fins rounded, very broad, almost truncate anteriorly. Head depressed; snout bluntly rounded; mouth

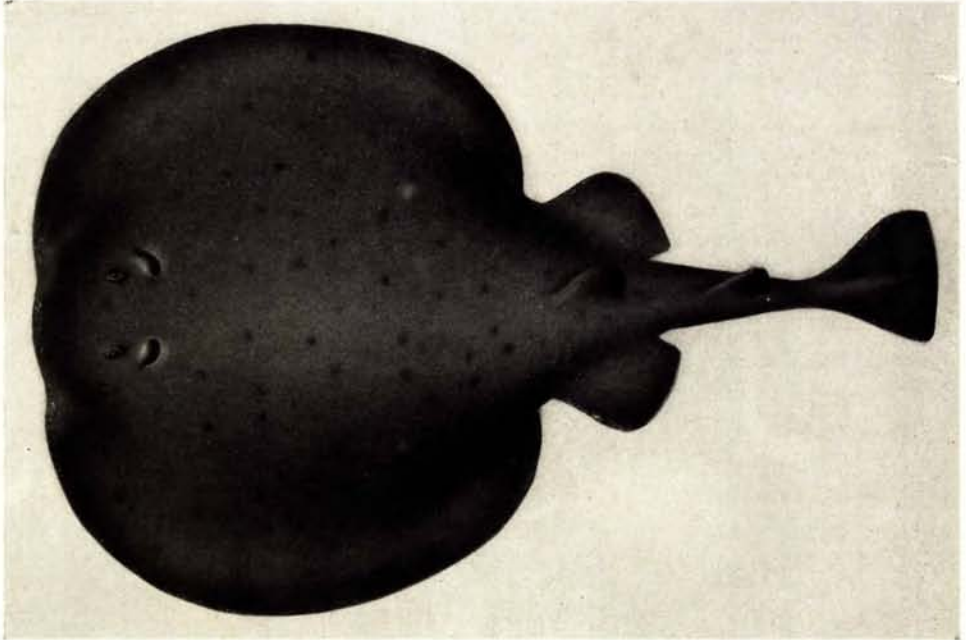


FIGURE 27. Electric ray. *Tetranarce californica* (Ayres) 1855

ventral. Spiracle large, close behind eye; gill slits, 5, on ventral surface. Skin entirely smooth. Fins: dorsal (2), far back on body; anal, absent; pelvic, abdominal; pectoral greatly convex, confluent around tip of snout; caudal, truncate, expanded. Scales: absent. Colour: bluish gray, or brownish gray on dorsal surface with many small round black spots; dusky gray on ventral surface.

Length to 3 feet.

Distinguished by the almost circular body outline, the short stout tail and the smooth bluish gray skin with small round black spots.

The electric ray was first taken in British Columbia waters in July, 1928, at Kyuquot on a salmon-trolling spoon and was recorded in 1930 by H. C. Williamson. A second individual was obtained September 1, 1928, at Nootka,

and is now in the collection of the Pacific Biological Station. In 1938, 1940 and 1941 several other individuals were reported from the west coast of Vancouver island. Two specimens from the west coast of Vancouver island were on display in the Vancouver Aquarium for several weeks during June and July, 1941. Each was about three feet in length. Additional records are: Cowichan bay, 1933; Sattelite channel and Saanich arm, 1942. The food of the individual taken in Cowichan bay consisted entirely of herring. A weight of over 50 pounds has been recorded.

Range southern California to southern British Columbia.

Subclass **HOLOCEPHALI**

The members of this subclass have a single gill opening on each side of the body covered with a fleshy flap, or operculum, which is not supported by bony plates as in the fishes. There are no spiracles. The skin is smooth, without scales. The jaws have teeth confluent into bony plates.

There is but one family in the subclass Holocephali, the Chimaeridae.

Family CHIMAERIDAE

Chimaeras

The chimaeras have large heads, pointed to bluntly rounded snouts, prominent incisor-like teeth, bodies tapering gradually posteriorly and large paddle-like pectoral fins. The eggs are deposited in spindle-shaped horny cases.

The weird appearance of the members of this family has led to the designation chimaera, referring to the fabulous monster with the head of a lion, the body of a goat and the tail of a serpent.

There is only one representative of the family in British Columbia waters, the rat-fish, *Hydrolagus collicii*. The word *Hydrolagus* means water-hare, referring to the somewhat rabbit-like mouth.

Rat-fish

Hydrolagus collicii (Lay and Bennett) 1839

Body elongate, stoutish anteriorly, tapering gradually to point posteriorly. Head large, slightly compressed; snout blunt, projecting; mouth ventral, small, upper lip notched; teeth united into groups of bony plates, incisor-like, on upper jaw, 4, on lower jaw, 2; nostrils, 2, immediately anterior to mouth; eye large; operculum fleshy, forming single opening from gill chamber. Skin: thin, smooth. Fins: dorsal (2), first triangular, with long, stout, grooved, serrate spine at anterior margin, second long, low, broadly notched; anal, absent; pelvic, abdominal; pectoral, large, paddle-shaped; caudal, long, lanceolate. Scales: absent. In male, club-shaped spiny process on head above snout fitting into depression; long clasper behind each pelvic fin, shorter clasper in front of each pelvic fin lying in sheath. Colour: silvery, reflecting golden metallic pale brown and other hues.

Length to 3 feet 2 inches.

Distinguished by the large head with a blunt snout, the incisor-like teeth, the smooth skin, the long lanceolate caudal fin and the fleshy gill covers.

The rat-fish was first recorded from British Columbia waters in 1866 by J. K. Lord as *Chimaera Colleii* (evidently a misprint for *colleii*). This was an adult male from Esquimalt harbour, as recorded subsequently in 1870 by A. Günther. The species is very common along the whole coast usually at depths below 40 fathoms. The eggs are deposited in elongate, ridged, brown capsules about 5 inches in length. These have been observed by Dr. A. L. Pritchard set

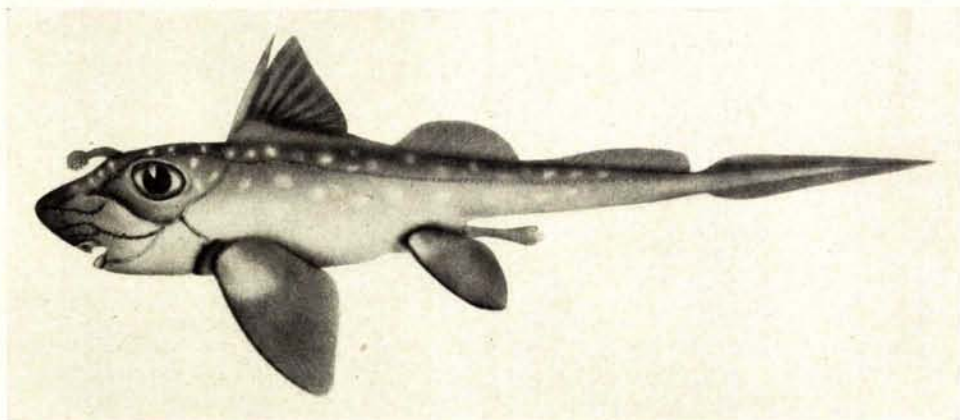


FIGURE 28.—Rat-fish. *Hydrolagus colleii* (Lay and Bennett) 1839

upright in the mud in the intertidal zone in Massett inlet. The young, when they leave the egg-cases, are small replicas of the adults and are commonly obtained in late October and November in shrimp trawls. The adult is taken on set-lines, in purse-seines and by otter trawls, frequently in large numbers, particularly in October. The rate of growth and age attained are unknown. The food of the rat-fish consists largely of fishes, but in part of mussels and other invertebrates. The liver oil is readily extracted by mild heating. It is clear and of a slightly yellowish colour and produces no gummy residue. It is used for cleaning guns and undoubtedly could be used to a considerable extent commercially as it is an excellent lubricant and has no objectionable odour.

Range southern California to northwestern Alaska.

Class III. **PISCES**

The fishes have many structural features which distinguish them from the cyclostomes and selachians. The skeleton is essentially bony, consisting of a vertebral column to which ribs are attached and a skull comprised of many distinct bones. The vertical and paired fins are supported by spines or jointed rays, or both; the paired fins are attached to well developed girdles; in the males

the pelvic fins are not modified to form claspers. The mouth is supported by bony jaws, the upper of which is attached to the skull. The nostrils are paired and located on the dorsal surface of the head, each with one or two openings. The gill opening on each side of the body is covered with a bony operculum.

The class Pisces comprises three subclasses, the Palaeopterygii, the Neopterygii and the Crossopterygii. The last is not represented in these waters.

Subclass **PALAEOPTERYGII**

The members of this subclass have fins in which the supporting structures are generalized in character, hence the name *palaeo*—ancient and *pterygii*—fins. In the dorsal and anal fins the fin rays are more numerous than their basal supports.

Only one order of this subclass, the Chondrostei, is represented in the British Columbia fishes. It includes the family Acipenseridae, the sturgeons.

Family ACIPENSERIDAE

Sturgeons

In the sturgeons the body is elongate with five widely separated rows of pointed bony shields; a pair of spiracles is present and the caudal fin is heterocercal. The head is covered with bony plates joined by sutures; the mouth is inferior and supported by jaws, which are toothless in the adults; the snout is much depressed and below it is a transverse row of four barbels.

The sturgeons are primitive fishes having certain structures superficially resembling those of sharks such as the inferior mouth supported by jaws, the spiracles and the heterocercal caudal fin, but they are not considered to have been derived directly from selachians.

Sturgeons are somewhat sluggish and live to a great extent on the bottom. Using their barbels to distinguish the presence of food they stir up the mud and gravel with their long snouts. They then suck up quantities of debris, separating out the edible materials such as small fishes, crustaceans, worms, etc., and expelling what is not desired. They occur in both fresh and salt water. The marine species enter rivers to spawn.

White sturgeon

Acipenser transmontanus Richardson 1836

Body elongate, somewhat cylindrical. Head depressed; snout short, broad, bluntly rounded, depressed; barbels, 4, in transverse row beneath snout, nearer tip of snout than mouth; mouth ventral, protrusible, sucker-like; teeth, absent. Fins: dorsal (1), 44 to 48; anal, 28 to 31; pelvic, abdominal; caudal, heterocercal. Bony shields: on body in 5 widely separated rows, each with sharp spine more or less developed; dorsal, 11 to 14; lateral, 38 to 48; ventrolateral, 9 to 12. Colour: uniform gray.

Length to 20 feet.

Distinguished by the short broad snout, the 4 barbels in a transverse row placed nearer the tip of the snout than the mouth, the 38 to 48 bony shields in the lateral series on each side of the body and the uniform gray coloration.

The white sturgeon was first recorded from British Columbia waters in 1866 by J. K. Lord as "*Accipenser transmontanus* of Richardson" (evidently a misprint for *Acipenser*). It is generally distributed along the coast and ascends various rivers from the Fraser to the Skeena, particularly at the time of the eulachon run in April. Spawning takes place in the spring and early summer. At one time large numbers entered the Fraser river proceeding to Pitt and Harrison lakes and some even to the north Thompson and upper Fraser rivers as far as Fraser and Stuart lakes where they were captured by means of set-lines,

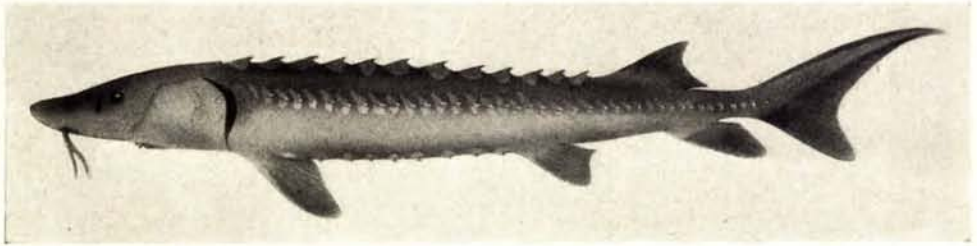


FIGURE 29. White sturgeon. *Acipenser transmontanus* Richardson 1836

spears and gill-nets. The largest specimen known weighed approximately 1,800 pounds and was reported in the "British Columbian" of New Westminster, in the October 14 issue, 1897, as having been taken some years previously at Mission. The white sturgeon is undoubtedly a very slow-growing fish. Due to intensive fishing large specimens are now rarely taken and the species is in danger of extermination. Small individuals in considerable numbers are still caught in salmon gill-nets in the mouth of the Fraser river and a few in purse-seines on the west coast of Vancouver island and in the salmon-traps near Sooke. While information concerning the food is limited, this species is said to feed upon crustaceans and invertebrates in the sea and upon eulachons in the Fraser river. This is a valuable food fish, its flesh and roe commanding high market prices. The eggs, when cured in a special manner, constitute the commercial product "caviar."

Range northern California to northwestern Alaska.

Green sturgeon

Acipenser medirostris Ayres 1854

Body elongate, somewhat cylindrical. Head depressed; snout elongate, narrow, blunt at tip, depressed; barbels, 4, in transverse row beneath snout, nearer mouth than tip of snout; mouth ventral, protrusible, sucker-like; teeth, absent. Fins: dorsal (1), 33 to 36; anal, 22 to 28; pelvic, abdominal; caudal, heterocercal. Bony shields: on body in 5 widely separated rows, each with sharp spine more or less developed; dorsal, 8 to 11; lateral, 23 to 30; ventrolateral, 7 to 10. Colour: olive green; olive stripe on median line of ventral surface, one on each side above ventrolateral plates, stripes ceasing opposite anus.

Length to 7 feet.

Distinguished by the elongate narrow snout, the 4 barbels in a transverse row placed nearer the mouth than the tip of the snout, the 23 to 30 bony shields in the lateral series on each side of the body and the olive green coloration on the body with the olive stripe on each side.

The green sturgeon was first taken in British Columbia waters August 30, 1908, near Victoria, and the specimen, 13½ inches in total length, is now in the

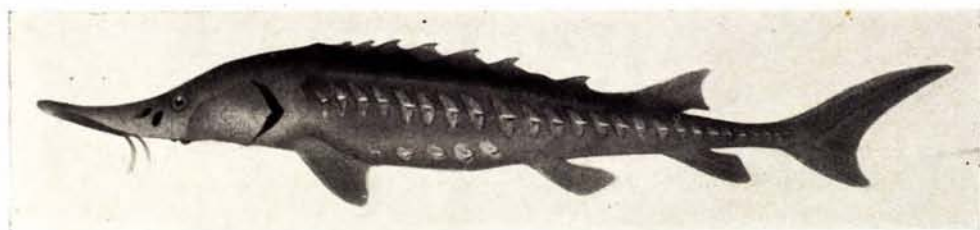


FIGURE 30. Green sturgeon. *Acipenser medirostris* Ayres 1854

Provincial Museum. It was recorded in 1923 by H. W. Fowler. The species is captured occasionally in the Fraser river area in the salmon gill-nets and has been reported off the west coast of Vancouver island by fishermen. Little is known of its habits and the life history is probably much the same as that of the white sturgeon. The largest specimen known from British Columbia waters weighed approximately 350 pounds. As a food fish it is considered very much inferior to the white sturgeon.

Range southern California to northwestern Alaska.

Subclass **NEOPTERYGII**

The members of this subclass have fins which are specialized and characteristic of the modern fishes, hence the name, *neo*—new, *pterygii*—fins. In the dorsal and anal fins the fin rays are equal in number to their basal supports.

There are many orders in this subclass, of which eighteen are represented in British Columbia waters.

Order ISOSPONDYLI

In this order both the premaxillary and maxillary bones form the margin of the upper jaw. The fins have soft rays only. The pelvic fins are abdominal and an adipose fin is present in most species. The scales, when present, are cycloid.

The following suborders are represented in the fauna of the British Columbia coast: Clupeoidea, Salmonoidea, Opisthoproctoidea and Stomiatoidea.

Suborder CLUPEOIDEA

The fishes in this suborder lack an adipose fin and have no photophores or luminous organs on the body or the head.

One family, the Clupeidae, is represented in British Columbia waters.

Family CLUPEIDAE

Herrings

In the herrings the body is elongate and compressed. The scales are large, cycloid and deciduous and may form a serrated edge along the midline of the ventral surface of the body. There is a single dorsal fin situated about the midlength of the body, not followed by an adipose fin, and a large fleshy appendage at the base of each pelvic fin. The lateral line is rarely developed to more than a few pores at the anterior end and for the purposes of this text is considered as absent.

The herring family includes the shads, the pilchards, the herrings and the anchovies. These fishes often occur in enormous schools and, in addition to being of great importance commercially, they are of incalculable value indirectly as a food supply for many commercially important predaceous fishes such as dog-fish, coho and spring salmon, cod and lingcod. Furthermore they are eaten extensively by marine waterfowl and seals.

Shad

Alosa sapidissima (Wilson) 1812

Body elongate, deep, depth 3 to 3.5 in standard length, much compressed. Head compressed; mouth terminal, moderate; maxillary reaching to point below eye; teeth absent; striae on operculum coarse, radiating. Fins: dorsal (1), about

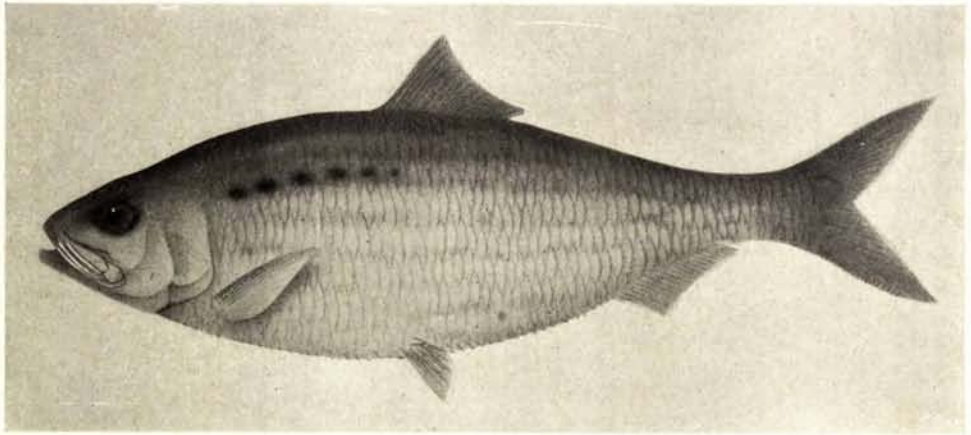


FIGURE 31. Shad. *Alosa sapidissima* (Wilson) 1812

15; anal, about 21; pelvic, abdominal, each with fleshy appendage at base, origin slightly behind that of dorsal; caudal, furcate. Lateral line: absent. Scales: cycloid; in oblique rows above midline of body, about 60; on ventral surface, modified as strongly keeled scutes; on each side of tail, 2, greatly enlarged. Colour: metallic blue on dorsal surface; white on sides; silvery on ventral surface;

black spots round, in row along each side of body, usually visible when scales in place, decreasing in size posteriorly, white on peritoneum.

Length to 2 feet 6 inches.

Distinguished by the coarse radiating striae on the operculum, the row of round black spots on the sides of the body decreasing in size posteriorly and the pair of specialized large scales on each side of the tail.

The shad was introduced in 1871 from the Atlantic coast into the Sacramento and Columbia rivers. It was first taken in British Columbia waters in 1876 near Vancouver island and recorded in 1891 by M. McDonald. By 1891 it had reached the Fraser and Stikine rivers, recorded in 1896 by H. M. Smith. It has established itself on the Pacific coast and has spread to southern California and northward to Cook inlet, Alaska. The shad has been caught in increasing numbers in the Fraser river in gill-nets and considerable quantities have been secured from time to time off the west coast of Vancouver island during the summer months in purse-seines. The shad is an ocean fish which in the spring ascends streams to spawn. A single female may deposit as many as 150,000 eggs, which are not adhesive and barely sink in fresh water. The young hatch in from 7 to 10 days and then go to sea. One fish taken in the Fraser river had reached an age of seven years. Weights up to 13½ pounds have been recorded. The adults are plankton-feeders for the most part. This fish is considered a delicacy when baked and the roe is highly prized.

Range southern California to northwestern Alaska.

Pilchard

Sardinops caerulea (Girard) 1854

Body elongate, terete, depth about 5 in standard length. Head compressed; mouth terminal, moderate; maxillary reaching to point below eye; teeth, absent; striae on operculum fine, almost parallel, slightly curved. Fins: dorsal (1), about 19; anal, about 18; pelvic, abdominal, each with fleshy appendage at base, origin under or behind middle of base of dorsal fin; caudal, furcate. Lateral line: absent. Scales: cycloid; in oblique rows above midline of body, about 53; on ventral surface modified as weakly keeled scutes; on each side of tail, 2, greatly enlarged. Colour: dark blue on dorsal surface; silvery on ventral surface; black spots round, in one or more rows along each side of body, sometimes not visible when scales in place, uniform in size; usually small black dots in rows along dorsal surface; black on peritoneum.

Length to 16¼ inches.

Distinguished by the fine almost parallel striae on the operculum, the uniform round black spots along the sides of the body and the pair of specialized large scales on each side of the tail.

The pilchard was first taken in British Columbia waters in January, 1900, near Nanaimo. The two specimens obtained were deposited in the Provincial Museum at Victoria and were recorded in 1909 by F. Kermode as *Clupanodon caeruleus* Girard. The fish usually appear off the west coast of Vancouver island during early July in very large schools and disappear in late September or early

October, although some individuals may remain in the inlets throughout the winter. In certain years considerable numbers extend into the Queen Charlotte islands area and even into southeastern Alaska. Occasionally a few adults enter the strait of Georgia and Queen Charlotte strait. Early in 1940 and 1941 young pilchards in their second year appeared in large schools in the strait of Georgia and adjoining inlets, remaining throughout the following winter. Tagging experiments, in which small metal tags have been inserted in the body cavities of the pilchards, have shown that there is a definite north and south migration between British Columbia and California waters. Investigations have revealed

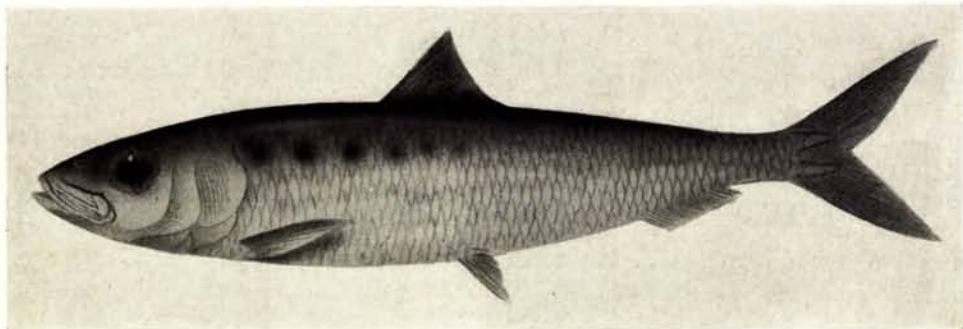


FIGURE 32. Pilchard. *Sardinops caerulea* (Girard) 1854

a region of intensive spawning between point Conception and San Diego, California, and extending offshore for approximately 100 miles. The eggs, which are pelagic, are liberated chiefly in March, April and May in this area. Spawning has not been shown to take place off British Columbia. The food of the pilchard consists largely of minute plants and small crustaceans, collectively known as plankton.

The pilchard is known as the sardine in California where the highest catch of 791,320 tons was taken in 1936-37. Large quantities are canned and marketed as the California sardine but a considerable tonnage is utilized for the production of oil and meal. In recent years rather extensive catches have been made off the Oregon and Washington coasts. In British Columbia, the fish is taken in purse-seines and is used largely for reduction purposes, but considerable quantities are canned. In 1929, 81,250 tons were reduced to oil and meal, 4,900 tons were canned and 150 tons were taken as bait. The total value of the pilchard products in that year was \$2,200,000 and the investment in fishing and plant equipment amounted to over \$3,000,000. In some years pilchards fail to appear off the British Columbia coast as in 1939, or come in small schools providing a catch of only a few thousand tons. Thus there is a considerable fluctuation in the extent of the fishery from year to year, probably associated with the coastal oceanographic conditions. Pilchard oil is used to a great extent in the manufacture of

paints, soap, shortenings, and oleomargarine. The meal is used largely as feed for livestock and poultry.

Range southern California to southeastern Alaska.

Herring

Clupea pallasii Valenciennes 1847

Body elongate, depth about 4 in standard length, moderately compressed. Head compressed; mouth terminal, moderate; lower jaw projecting; maxillary reaching to point below eye; teeth, absent from jaws, on vomer in form of ovate patch, on tongue small, weak; no striae on operculum. Fins: dorsal (1), 15 to 21; anal, 14 to 40; pelvic, abdominal, each with fleshy appendage at base, origin

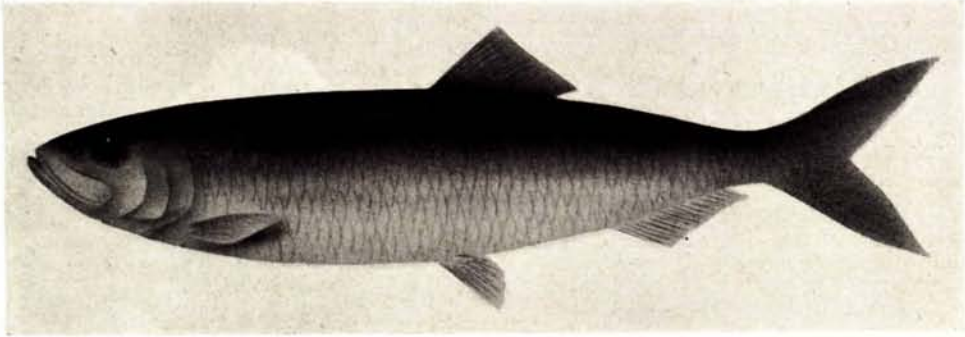


FIGURE 33. Herring. *Clupea pallasii* Valenciennes 1847

slightly behind that of dorsal; caudal, furcate. Lateral line: absent. Scales: cycloid; in oblique rows above midline of body, 51 to 54; on ventral surface modified as very weakly keeled scutes anterior to pelvic fins, more strongly keeled between pelvic fins and anus; on side of tail, not modified. Colour: bluish green on dorsal surface; silvery on ventral surface; black spots absent from sides of body; dusky on peritoneum.

Length to 18 inches.

Distinguished from other members of the herring family by the absence of striae from the operculum, the absence of specialized scales from the sides of the tail and the absence of black spots from the sides of the body.

The herring was first recorded from British Columbia waters in 1866 without date or locality by J. K. Lord as *Malletta caerulea* Girard. Two skins collected by Mr. Lord were presented to the British Museum and in 1868 they were recorded by A. Günther as *Clupea mirabilis*. It is of interest to note that Archibald Menzies records in his journal the purchase of herring July 2, 1792, for the mess of the *Discovery*, from the Indians at Stuart island. The herring is very abundant throughout the coastal waters of British Columbia. It spawns in the winter and early spring months in the southern portion of the province, some-

what later in the northern portion, coming into the shore waters in large schools and depositing pale amber translucent adhesive eggs in enormous quantities on eel-grass, seaweed, wharf piles, etc. The eggs hatch in about two weeks, depending upon the water temperature. Maturity is reached in the second, third or fourth year and an age of eight or more years may be attained. Recent studies indicate that herring occur along the coast in a number of localized populations, and that a limited amount of intermingling takes place among these. Each population appears to have an annual migration between an inshore spawning area and an open-sea feeding ground. The food is composed predominantly of plankton crustaceans. Herring constitute one of the fundamental sources of food for almost the whole gamut of marine animals. The eggs are eaten by fishes and waterfowl, the larvae by countless invertebrates, including jelly-fish, comb-jellies and crustaceans, and the larger fish by sharks and fishes, waterfowl, seals and undoubtedly sea-lions. The wonder is that any individuals survive to maturity. Large quantities of herring are taken annually in purse-seines, gill-nets and traps for reduction to oil and meal, for canning, for smoking, for the fresh-fish market and for bait. In earlier years much of the catch was pickled by the "Scotch" cure and in subsequent years was drysalted for export to the Orient. In the 1942-43 season the total catch amounted to slightly over 79,000 tons, having a value of \$8,223,754.00.

Range southern California to northwestern Alaska.

Anchovy

Engraulis mordax Girard 1854

Body elongate, slender, more or less spindle-shaped, somewhat compressed. Head moderately compressed; mouth subterminal, very large; maxillary extending behind eye almost to gill opening; teeth, absent; eye large, near tip of

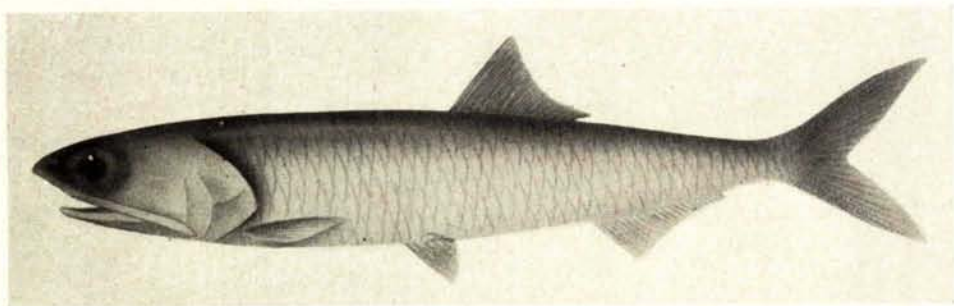


FIGURE 34. Anchovy. *Engraulis mordax* Girard 1854

snout; no striae on operculum. Fins: dorsal (1), 14 to 16; anal, 20 to 23; pelvic, abdominal, each with fleshy appendage at base, origin well in advance of that of dorsal; caudal, furcate. Lateral line: absent. Scales: cycloid; in oblique rows above midline of body, 41 to 50; on ventral surface, forming distinct serration.

Colour: metallic blue on dorsal surface; silvery on ventral surface; dusky on peritoneum.

Length to 7 inches.

Distinguished by the very large subterminal mouth and the eyes near the end of the snout.

The anchovy was first recorded from British Columbia waters in 1866 by J. K. Lord. In 1889 two specimens were obtained near Victoria and were recorded in 1891 by Ashdown Green as *Stolephorus ringens* in the *Proceedings of the Natural History Society of British Columbia*. The anchovy appears at times in rather large schools around both the west and east coasts of Vancouver island. In November, 1933, in Barkley sound, a single set of a purse-seine took about 200 tons. Large numbers appeared in the same area in 1939. During the early part of 1940 vast schools were observed in the strait of Georgia and as far north as Port Hardy. Spawning apparently occurs during July and August. The eggs are colourless or transparent, ellipsoidal and pelagic. Maturity is reached in the third year and an age of at least five years may be attained. The food consists largely of plankton crustaceans. Considerable quantities of anchovies are utilized for the production of oil and meal and small numbers are canned, pickled in brine and made into paste.

Range southern California to northern end of Vancouver island.

Suborder SALMONOIDEA

The fishes in this suborder have an adipose fin and a lateral line but no photophores or luminous organs on the body or the head. They inhabit the marine coastal waters, including brackish areas, and fresh water.

Two families are represented in the marine waters of British Columbia: Salmonidae and Osmeridae.

Family SALMONIDAE

Salmons

In the salmons the body is moderately stout and covered with numerous small cycloid scales. The lateral line is well developed. The adipose fin is prominent and fleshy and there is a large fleshy appendage at the base of each pelvic fin. The colours are bright steely blue to green above and silvery below.

Included in this family are the Pacific salmons, the Atlantic salmon, the trouts and the chars, all of which are important commercial or sport fishes.

The Pacific salmons are placed in the genus *Oncorhynchus* and include five species, pink, coho, spring, chum and sockeye. They are characterized by having a comparatively large anal fin with 12 to 19 rays.

The salmons all have somewhat similar life histories. They spawn in fresh water from late summer to late autumn and die shortly afterwards. The eggs are deposited in gravel beds. The resulting young have large yolk-sacs and are known as *alevins*. They remain in the gravel beds until the yolk-sacs are absorbed and then emerge as *fry* in the late winter or early spring. The fry of some species proceed to sea almost immediately but in other species the fresh-

water period may vary from a few weeks to one or more years. In the case of the sockeye, some populations do not go to sea and the fish are known as *kokanees*. The ocean life is one of feeding and rapid growth. During this time the colour is metallic blue on the back, with numerous black spots or specklings, and silvery on the sides and under surface. As the fish enter fresh water there is a tendency, in some species, for a red colour to appear on the body, especially in the males which at this time also develop elongate, hooked snouts.

The Pacific salmon support the most important commercial fishery of British Columbia, having a value of approximately \$15,000,000 per annum.

The trouts and the Atlantic salmon are placed in the genus *Salmo*. They are readily distinguished from the Pacific salmon by the presence of 8 to 12 rays in the anal fin and in the fact that they may spawn more than once during their lives. They have teeth on the head and shaft of the vomer and are black spotted.

In connection with the life history of the Atlantic salmon a number of stages are recognized and given special names. Among these are: *parr*—a young fish with a series of vertical bars or *parr marks* on each side of the body; *smolt*—the young silvery fish on its migration seaward; *grilse*—a fish which has spent one winter in the sea and is returning to fresh water to spawn at 3 years of age; *kelt*—a fish which has spawned and is thin and in poor condition. All of these terms may be applied in the life history of the steelhead trout and some of them in the life histories of the Pacific salmon. With reference to the latter, the term *grilse* has been applied to those sockeye and spring individuals which are maturing at three years of age.

The chars comprise the genus *Salvelinus*. They have 8 to 12 rays in the anal fin as do the trouts but lack teeth on the shaft of the vomer. In coloration, they possess round red, pink, yellow or gray spots and bright colours on the margins of the lower fins. The chars are the most beautiful of the Salmonidae and rank high as game fishes.

The term char is used in Europe and it would be well to adopt the name in North America in order to distinguish these fishes from the members of the genus *Salmo*.

Pink salmon

Oncorhynchus gorbuscha (Walbaum) 1792

Body elongate, somewhat compressed. Head conical; mouth terminal; teeth small, weak; branchiostegals, 9 to 15; rakers on first gill arch, 26 to 34. Fins: dorsal (1), 10 to 15; adipose, small, slender, fleshy; anal, 13 to 17; pelvic, abdominal, each with fleshy appendage at base; caudal, emarginate. Lateral line: slightly decurved, then straight. Scales: cycloid, small; in first row above lateral line, 170 to 229; on lateral line, 150 to 198. Pyloric caeca: 165 to 195. Colour: metallic blue on dorsal surface; silvery on sides; black blotches numerous, large, more or less oval on back and caudal fin; male at maturity, red to yellow on sides of body, black blotches obscure; female at maturity, olive-green on sides of body with dusky stripes. Flesh pink, paler in males with advancing maturity. Young without parr marks.

Length to 2 feet 6 inches.

Distinguished by the small scales, the 26 to 34 rakers on the first gill arch and the heavy oval black blotches on the caudal fin. The young are readily recognized by the absence of parr marks.

The pink salmon was first recorded from British Columbia waters in 1836 by Sir John Richardson on the basis of a male specimen taken in Observatory inlet which he described as the type of a new species, *Salmo Scouleri*. The skin was deposited in the British Museum. The pink salmon is common along the

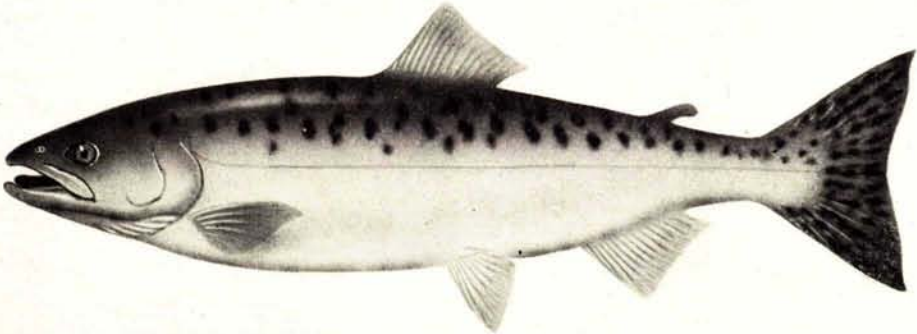


FIGURE 35. Pink salmon. *Oncorhynchus gorbuscha* (Walbaum) 1792

whole coast. Spawning takes place from late September to early November in practically all the streams. The males at this time develop in addition to their hooked snouts very large humps on their backs which led to their being called "hump-backs" in the early days of the fishery. Usually the fish remain near tidal waters but occasionally they travel for considerable distances, as for example, to Babine lake on the upper reaches of the Skeena river. The young go to sea as fry and reach maturity at two years of age. In most cases there is a large spawning run in one year and a small one in the next but occasionally the runs of successive years are approximately equal in size. In a few instances there are no runs in the second year, as for example, in Massett inlet and Naden harbour, which means the occurrence of a single population. Annual runs indicate two populations. In the southern portion of the province the large runs are in the odd years while in the northern portion the large runs are in the even years. The extent of the ocean movements is not yet known, but tagging experiments in relation to the Fraser river have shown that schools pass through both Juan de Fuca and Johnstone straits on their way to that river. The food consists chiefly of crustaceans. The weight at maturity is usually between 3 and 5 pounds but weights up to 10 pounds have been recorded. The pink salmon is taken commercially in purse-seines, gill-nets and traps. Quite frequently

specimens are caught on trolling gear at the northern end of the Queen Charlotte islands. Practically the entire catch is canned.

Range northern California to northwestern Alaska.

Coho salmon

Oncorhynchus kisutch (Walbaum) 1792

Body elongate, somewhat compressed; caudal peduncle stout. Head conical; mouth terminal; teeth firmly set, needle-like; branchiostegals, 11 to 15; rakers on first gill arch, 19 to 25, rough, widely spaced. Fins: dorsal (1), 9 to 13; adipose small, slender, fleshy; anal, 12 to 17; in young, up to 3 or 4 inches in length, first 2 or 3 rays usually longer and stouter than remainder; pelvic, abdominal, each

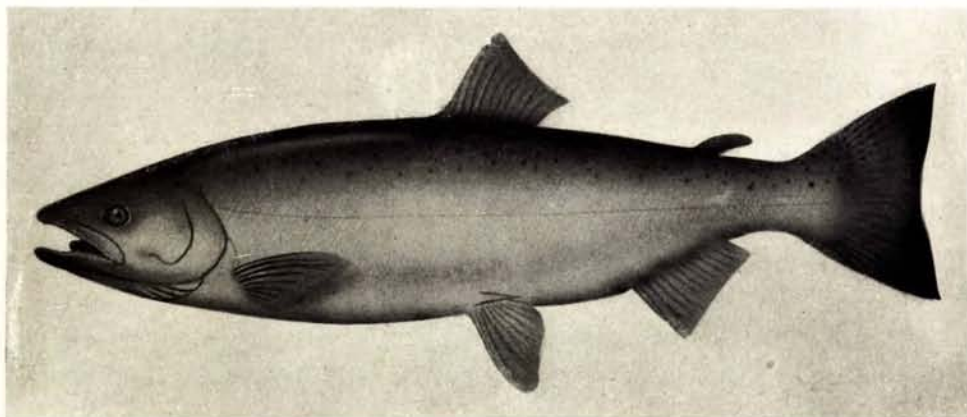


FIGURE 36. Coho salmon. *Oncorhynchus kisutch* (Walbaum) 1792

with fleshy appendage at base; caudal, emarginate, outer rays somewhat limp. Lateral line: slightly decurved, then straight. Scales: cycloid; in first row above lateral line, 120 to 145; on lateral line, 121 to 136. Pyloric caeca: 45 to 80. Colour: metallic blue on dorsal surface; silvery on ventral surface and on caudal peduncle; black spots numerous, irregular, on back and usually on upper lobe of caudal fin. Flesh pink. Young with parr marks very strongly developed, long, heavy, extending almost completely across body; orange tinge on pectoral, pelvic and anal fins; white on anterior margin of anal fin.

Length to 3 feet.

Distinguished by the black spotting confined to the back and the upper lobe of the caudal fin, the needle-like firmly set teeth, the 19 to 25 rough widely spaced rakers on the first gill arch and the small number of pyloric caeca. The young are readily recognized by the elongate rays in the anal fin, the orange tinge on the lower fins and the elongate parr marks.

The coho salmon was first recorded from British Columbia waters in 1881 from the Fraser river by D. S. Jordan and P. L. Jouy and the specimen is in the

United States National Museum. The species is common throughout the coastal waters. It enters innumerable streams and may spawn at a short distance from the sea or may proceed to the upper tributaries of the larger rivers. The great majority of the young remain one year in fresh water but a few migrate to sea in the first and third years. Growth is rapid and maturity is usually attained at the end of the third summer, occasionally at the end of the second or rarely the fourth. In certain areas young cohos at the beginning of the third year have deep blue backs and bright red flesh and are commonly referred to as blue-back salmon. The food of the coho salmon consists largely of herring, pilchards and sand-lance as well as other small fishes, squid and an assortment of crustaceans. The average weight at maturity is from 6 to 12 pounds but weights up to 26½ pounds have been recorded. The coho salmon is captured by troll, purse-seine, gill-net and trap. The bulk of the catch is canned and marketed either as coho or blue-back salmon. However some of the fish are sold as fresh salmon. This species also provides a considerable amount of sport fishing, in trolling and fly-casting. The term silver salmon is applied to the coho salmon in American waters.

Range northern California to northwestern Alaska.

Spring salmon

Oncorhynchus tshawytscha (Walbaum) 1792

Body elongate, somewhat compressed; caudal peduncle stout. Head conical; mouth terminal; teeth not rigid, conical, moderately sharp; branchiostegals, 13 to 19; rakers on first gill arch, 20 to 28. Fins: dorsal (1), 10 to 14; adipose,

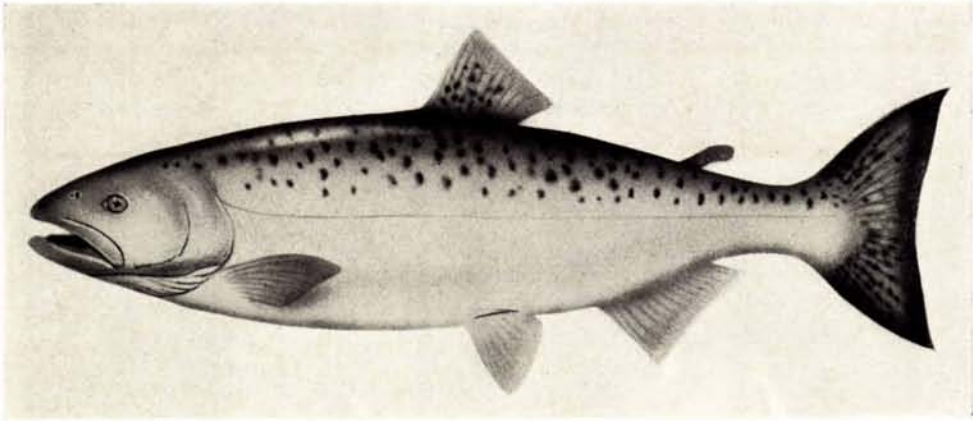


FIGURE 37. Spring salmon. *Oncorhynchus tshawytscha* (Walbaum) 1792

relatively small, stout, fleshy; anal, 15 to 19; pelvic, abdominal, each with fleshy appendage at base; caudal, emarginate, outer rays rigid. Lateral line: slightly decurved, then straight. Scales: cycloid; in first row above lateral line, 140 to 153; on lateral line, 131 to 151. Pyloric caeca, 140 to 185. Colour: greenish

blue to black on dorsal surface, frequently with faint reddish to rusty hue; black spots numerous, irregular, on back, dorsal fin and both lobes of caudal fin. Flesh red or white, occasionally pink. Young with parr marks very strongly developed, long, heavy, extending almost completely across sides of body.

Length to 4 feet 10 inches.

Distinguished by the black spotting on the back, dorsal fin and both lobes of the caudal fin, the large number of pyloric caeca and the loose conical teeth. The young are readily recognized by the strongly developed parr marks.

The spring salmon was first recorded from British Columbia waters in 1866, presumably from the Chilliwack (Chilukweyuk) river, by J. K. Lord as *Salmo quinnat*. It is common along the coast of the province. The spawning run in the late spring and early summer is chiefly to the larger rivers. The young may go to sea during the first year or remain at least a year in the streams. Growth is rapid in the sea and maturity is attained in the third to eighth year but usually in the fourth or fifth. Early maturing males are frequently called "Jacks". Tagging operations have shown that long distances may be travelled, as for example, from Alaska to the Columbia river, from Hippa island to Marshfield, Oregon, and from Barkley sound to the Sacramento river, California. The food consists chiefly of herring and sand-lance, with small quantities of other small fishes, crustaceans and squids. During 1940 young pilchards were very abundant in the vicinity of Barkley sound and in the southern portion of the strait of Georgia and comprised about 27% of the food of the spring salmon in the former area and about 77% in the latter. The weights at maturity usually range from 10 to 50 pounds but weights up to 108 pounds have been recorded. Commercial fishing is by troll, purse-seine, gill-net and trap and the catch is canned, frozen, smoked and drysalted. Large quantities are sold as fresh spring salmon. In many areas the spring salmon provides excellent sport fishing, as for example, off Campbell and Oyster rivers and off Comox where large individuals are caught by rod and line and called tye salmon. In American waters various names are applied to this species, such as king, chinook, quinnat, etc.

Range southern California to northwestern Alaska.

Chum salmon

Oncorhynchus keta (Walbaum) 1792

Body elongate, somewhat compressed; caudal peduncle slender. Head conical; mouth terminal; teeth conical, strongly developed, becoming fang-like in mature males; branchiostegals, 10 to 16; rakers on first gill arch, 19 to 26, short, stout, smooth, widely spaced. Fins: dorsal (1), 10 to 13; adipose, small, slender, fleshy; anal, 13 to 17; pelvic, abdominal, each with fleshy appendage at base; caudal, emarginate. Lateral line: slightly decurved, then straight. Scales: cycloid; in first row above lateral line, 130 to 153; on lateral line, 126 to 151. Pyloric caeca: 140 to 185. Colour: metallic blue on dorsal surface with occasional black specklings; no black spots; black tinge on tips of pectoral, anal and caudal fins, especially in male; in maturing adults in fresh water irregular reddish

to dusky streaks or bars across sides of body, white on tips of pelvic and anal fins. Flesh pale pink. Young with parr marks as slender bars, scarcely extending below lateral line and green iridescence on back.

Length to 3 feet 2 inches.

Distinguished by the absence of large black spots from the body and the fins, the slender caudal peduncle, the tips of all fins except dorsal tinged with black, the series of dusky streaks or bars across the sides of the body in mature adults in fresh water, the 20 to 26 smooth widely spaced rakers on the first gill

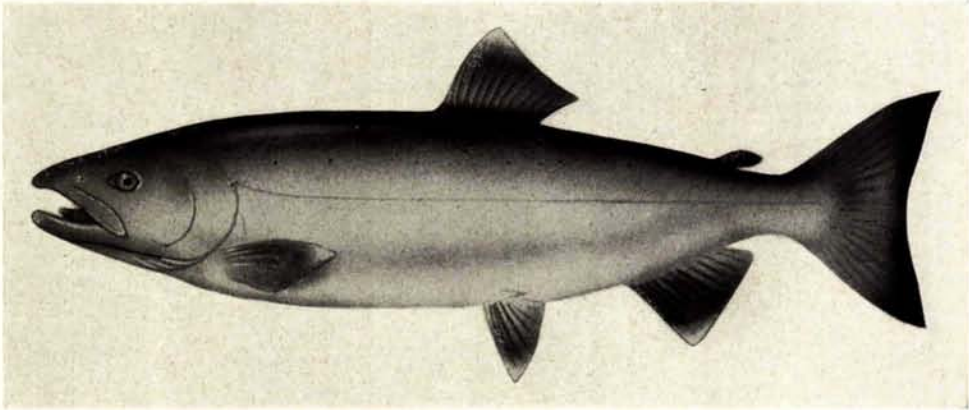


FIGURE 38. Chum salmon. *Oncorhynchus keta* (Walbaum) 1792

arch and the large number of pyloric caeca. The young are readily recognized by the slender parr marks, scarcely extending below the lateral line, and the green iridescence on the back.

The chum salmon was first recorded from British Columbia waters in 1881 from the Fraser river by D. S. Jordan and P. L. Jouy and the specimen is now in the United States National Museum. The species is abundant along the whole coast and of the Pacific salmons it is the latest to appear during the fall in spawning schools. It ascends practically all streams, spawning usually at no great distance from the salt water but in some cases travelling long distances upstream. The young go to sea during the following spring and usually reach maturity in the fourth year. Little is known of the ocean migration routes but tagging has shown that many chum salmon enter the strait of Georgia through Johnstone strait as well as through Juan de Fuca strait. The food consists chiefly of crustaceans. The weight at maturity is usually from 8 to 18 pounds but weights up to 30 pounds have been recorded. Fishing is by purse-seine, gill-nets and traps and the catch is chiefly canned, drysalted and frozen. The chum salmon was formerly known as the dog salmon.

Range northern California to northwestern Alaska.

Sockeye salmon

Oncorhynchus nerka (Walbaum) 1792

Body elongate, somewhat compressed. Head conical; mouth terminal; teeth small, weak; branchiostegals, 11 to 15; rakers on first gill arch, 30 to 39, long, slender, rough, closely set. Fins: dorsal (1), 11 to 16; adipose, small, slender, fleshy; anal, 13 to 17; pelvic, abdominal, each with fleshy appendage at base; caudal, emarginate. Lateral line: slightly decurved, then straight. Scales: cycloid; in first row above lateral line, 125 to 143; on lateral line, 125 to 139. Pyloric caeca: 66 to 92. Colour: greenish blue on dorsal surface with fine black

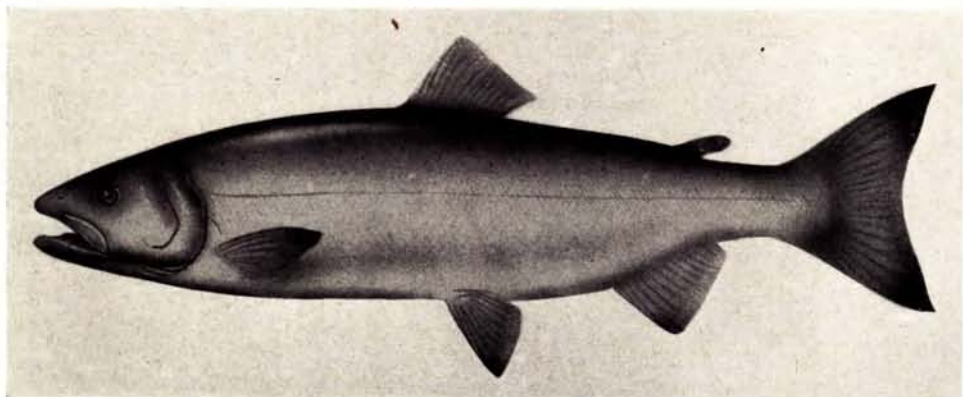


FIGURE 39. Sockeye salmon. *Oncorhynchus nerka* (Walbaum) 1792

specklings; no black spots; metallic green on head; brilliant red on body of mature male; dark red with green and yellow blotches on body of mature female. Flesh, rich red. Young with parr marks oval, scarcely extending below each lateral line.

Length to 2 feet 9 inches.

Distinguished by the 30 to 39 long slender closely-set rakers on the first gill arch, the small number of pyloric caeca and the fine black specklings on the back. The young are readily recognized by the oval parr marks scarcely extending below each lateral line.

The sockeye salmon was first recorded from British Columbia waters in 1866 without date or locality of capture by J. K. Lord as *Salmo paucidens* of Richardson. He also referred to the same species in spawning colours as *Salmo lycaodon*. The species is abundant along the whole coast. For the most part the spawning migration takes place during the summer months, the adults entering those rivers fed by lakes, which they pass through, and spawn in the streams tributary thereto. Upon hatching in the following spring the young descend to the lakes where they spend usually one, frequently two, occasionally three years and then migrate to the ocean, usually during March and April. Some individuals pass

directly to the sea as fry. In many localities the sockeye salmon has become "lake-locked", completing its life cycle in fresh water. It is then known as the kokanee, kickaninny, Kennerly's salmon or little red-fish and sometimes locally as "silver trout." The sockeye salmon usually matures at four and five years of age but a few mature at three and six years and fewer still at seven and eight years. Information concerning the movements in the ocean is meagre. Tagging operations in 1925 at Haystack island, off Portland canal, showed a main migration to the Nass river but also movements of a few individuals as far north as Ernest sound, Alaska, and as far south as Union passage (Grenville channel). Tagging, also in 1925, at Seymour narrows, showed a migration to the Fraser river, indicating a definite movement of sockeye salmon through Johnstone strait in addition to the main migration through Juan de Fuca strait. The food consists chiefly of crustaceans, of which euphausiids form a high percentage. The weight at maturity is usually between 5 and 7 pounds but weights up to 15½ pounds have been recorded. The sockeye salmon is taken chiefly in gill-nets at the mouths of rivers, to some extent in purse-seines and in traps at the south end of Vancouver island. Occasionally individuals are caught with trolling gear. It is the most prized of the Pacific salmon for canning purposes because of the deep red colour and the flavour of its flesh. This fish is known as the red in Alaska and the blue-back on the Columbia river.

Range southern Oregon to northwestern Alaska.

Coastal cut-throat trout

Salmo clarkii clarkii Richardson 1836

Body elongate, rounded, slightly compressed; caudal peduncle stout. Head relatively long; mouth terminal; maxillary extending to point well behind posterior margin of eye; teeth, on head and shaft of vomer and on back of tongue, well developed. Fins: dorsal (1), 8 to 11; adipose, small, slender, fleshy; anal, 10 usually, 9 or 11 occasionally; pelvic, abdominal, each with fleshy appendage

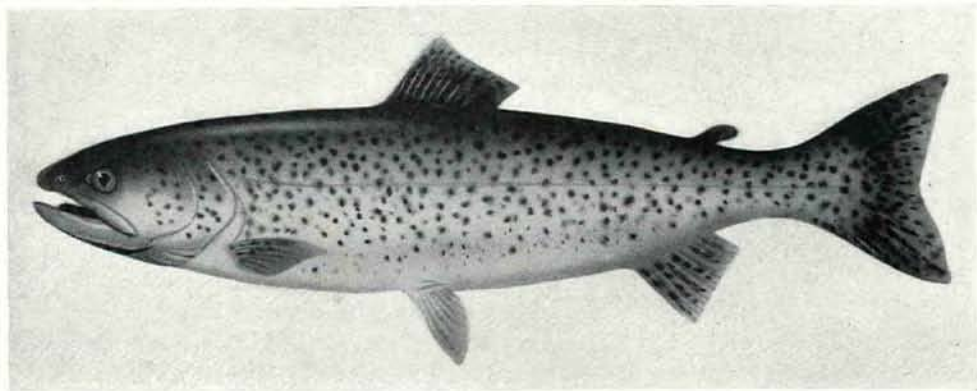


FIGURE 40. Coastal cut-throat trout. *Salmo clarkii clarkii* Richardson 1836

at base; caudal, truncate. Lateral line: slightly decurved, then straight. Scales: cycloid; in oblique rows above lateral line, 120 to 200. Colour: greenish blue on dorsal surface; silvery on sides; black spots on body, head and vertical fins, numerous, heavy, each without halo; bright red dash below lower jaw on each side.

Length to 2 feet 6 inches.

Distinguished by the teeth on the back of the tongue, the bright red dash on the under side of the lower jaw on each side (hence the name cut-throat), the long head and the more or less rounded body.

The coastal cut-throat trout was first recorded from British Columbia waters in 1866, without date or locality of capture, by J. K. Lord as *Fario stellatus*. This trout is common along the whole coast in the sea as well as in adjacent streams and lakes. A subspecies, the Yellowstone cut-throat, *Salmo clarkii lewisii*, occurs in the southeastern portion of the province and has been distributed widely in fish cultural operations; even to the river systems with immediate access to the sea. The coastal cut-throat trout spawns usually from February to May in small streams, although in the Cowichan river system it has been found to spawn as early as December. The young may descend to the sea in their second or third year, taking up an estuarine or marine life for one or more years. These estuarine fish frequently enter the lower reaches of streams in the spring and feed upon young salmon migrating seaward. Apparently they return to the sea and re-enter the streams in the autumn and winter on a spawning migration. Some individuals remain in fresh water throughout their lives. The food in the marine habitat consists of small fishes such as sand-lance, salmonoids, rock-fishes, sea-perches, sculpins and flat-fishes as well as crustaceans; while in fresh water it consists of insects, both aquatic and terrestrial, fresh-water shrimps and small fishes. Weights up to 17 pounds have been recorded from inland lakes. The cut-throat is much prized as a game fish, both in fresh and salt water. Small specimens caught in salt water are frequently called "sea-trout."

Range northern California to southeastern Alaska.

Brown trout

Salmo trutta Linnaeus 1758

Body elongate, little compressed; caudal peduncle stout. Head relatively short; mouth terminal; maxillary reaching to point behind posterior margin of eye; teeth on head and shaft of vomer well developed, on back of tongue, none. Fins: dorsal (1), about 11; adipose, small, slender, fleshy; anal, about 9; pelvic, abdominal, each with fleshy appendage at base; caudal, truncate. Lateral line: slightly decurved, then straight. Scales: cycloid; in oblique rows above lateral line, 116 to 136. Colour: brown to golden brown on dorsal surface; silvery on sides; small black spots and crosses on back and top of head; black spots below lateral line and forward, profuse, large, each surrounded by halo of pink or red; no red dash below lower jaw.

Length to 3 feet 3 inches.

Distinguished by the black spots below the lateral line surrounded by halos of pink or red, together with the absence of teeth from the back of the tongue.

The brown trout was introduced into British Columbia in 1932, 1933 and 1934 from Wisconsin and Montana as eggs purchased by the Dominion Department of Fisheries. The eggs were placed in hatcheries at Cowichan lake and Qualicum beach and later the young were liberated as fry, fingerlings and yearlings into the Cowichan and Little Qualicum rivers on Vancouver island, in an attempt to provide a fish for summer angling. A considerable number of individuals

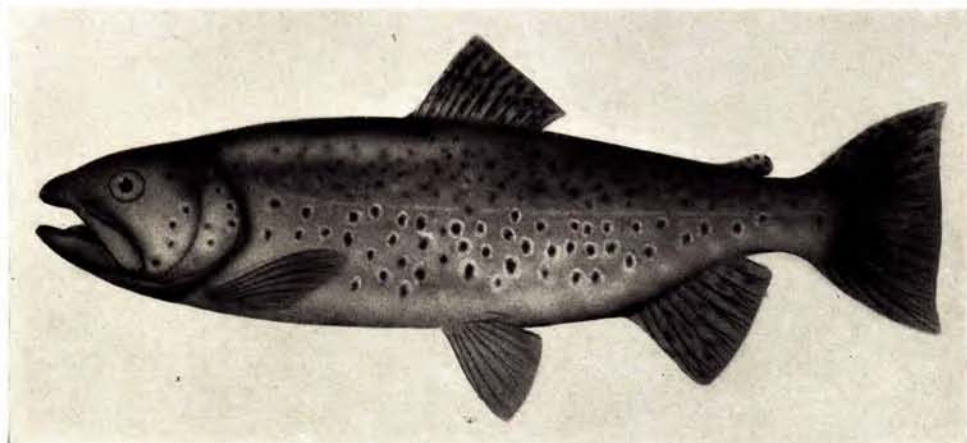


FIGURE 41. Brown trout. *Salmo trutta* Linnaeus 1758

have been caught in salt water at the mouth of the Little Qualicum river as well as in the stream itself. The brown trout is also established in the upper portion of the Cowichan river, where it reaches a weight of 5 pounds or more. Elsewhere in the river system the species is scarce and no sea-going tendencies have been observed. Fish in the upper part of the river do not appear to migrate extensively. Spawning takes place mainly in November and December in small streams tributary to the Little Qualicum and Cowichan rivers, the fish maturing at three or four years of age. The fry emerge in the following spring. Many of the young fish remain for one or two years in the spawning streams. Generally speaking, the species is not numerous in comparison with the native trouts although differences in habits may lead to its predominance in one or two restricted localities in summer. The incidence of the brown trout in anglers' catches is much lower than that of the native species in relation to numbers present, probably due to greater wariness or tendency to feed freely only at certain times of the day. The food is similar to that of the coastal cut-throat trout. The maximum weight recorded for the species is about 30 pounds. The trout of Loch Leven, Scotland, have been termed Loch Leven trout and the scientific name, *Salmo levenensis*, has been applied. However, a detailed study

of it and other European geographically isolated forms has shown them to be indistinguishable from the brown trout in any significant characters.

Range California to Vancouver island.

Steelhead trout

Salmo gairdnerii gairdnerii Richardson 1836

Body elongate, rather deep, compressed; caudal peduncle stout. Head relatively short; mouth terminal; maxillary extending to point below, or slightly behind, posterior margin of eye; teeth on head and shaft of vomer poorly developed, on back of tongue, none. Fins: dorsal (1), 11 or 12; adipose small,

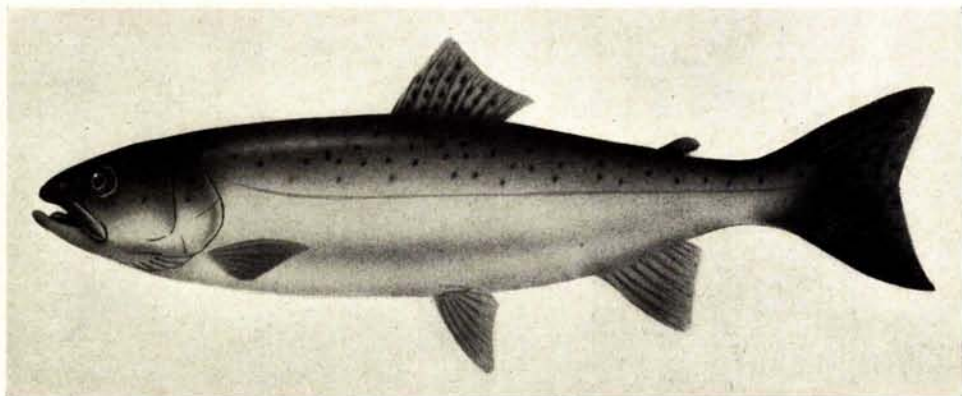


FIGURE 42. Steelhead trout. *Salmo gairdnerii gairdnerii* Richardson 1836

slender, fleshy; anal, 10 or 11 usually, 9 or 12 occasionally; pelvic, abdominal, each with fleshy appendage at base; caudal, truncate. Lateral line: slightly decurved, then straight. Scales: cycloid; in oblique rows above lateral line, 115 to 159. Colour: metallic blue on dorsal surface; silvery on sides; black spots on back, on dorsal, adipose and caudal fins, each without halo; continuous deep pink to red band along each side of body, especially in males, at spawning time; no red dash below lower jaw.

Length to 3 feet 9 inches.

Distinguished by the absence of a bright red dash from the under side of the lower jaw, the short head, the absence of teeth from the back of the tongue and the compressed body.

The steelhead trout was first recorded from British Columbia waters in 1866, without date of capture or locality, by J. K. Lord as *Salmo Gairdneri*. This trout is common along the whole coast of the province and is, in a sense, the Pacific representative of the Atlantic salmon. It spends a considerable part of its life in the sea entering the rivers in the third, fourth or fifth years, after two or more summers in salt water, for the first spawning. It may enter fresh water in almost any month of the year although it does not spawn until the

winter or spring. Like the Atlantic salmon it may spawn more than once and return to the sea after each spawning. The young go to sea after spending one or two years in fresh water and return as mature steelheads to spawn in fresh water. Some individuals remain in fresh water all their lives and are then known as "rainbows." The term rainbow trout is derived from the presence of a purplish coloured band along each side of the body. In the interior of the province, especially in the southern portion, there is a subspecies of the steelhead trout known as the Kamloops trout, *Salmo gairdnerii kamloops*, which inhabits the lakes, never goes to sea, and spawns during the spring months in the tributary streams. The Kamloops trout has been introduced widely into coastal streams and lakes. The steelhead trout enters to a considerable extent into the commercial fishery being taken chiefly in gill-nets in the mouths of the larger rivers. It is also a splendid game fish and is most frequently secured in and off the mouths of numerous streams along the coast. The food in the sea consists of herring and other fishes. Individuals have been taken weighing as much as 36 pounds.

Range southern California to southeastern Alaska.

Atlantic salmon

Salmo salar Linnaeus 1758

Body elongate, moderately compressed; caudal peduncle slender. Head relatively short; mouth terminal; maxillary reaching to point slightly behind posterior margin of eye; teeth on head and shaft of vomer, short, little developed, on back of tongue, none. Fins: dorsal (1), 11 or 12; adipose, small, slender,

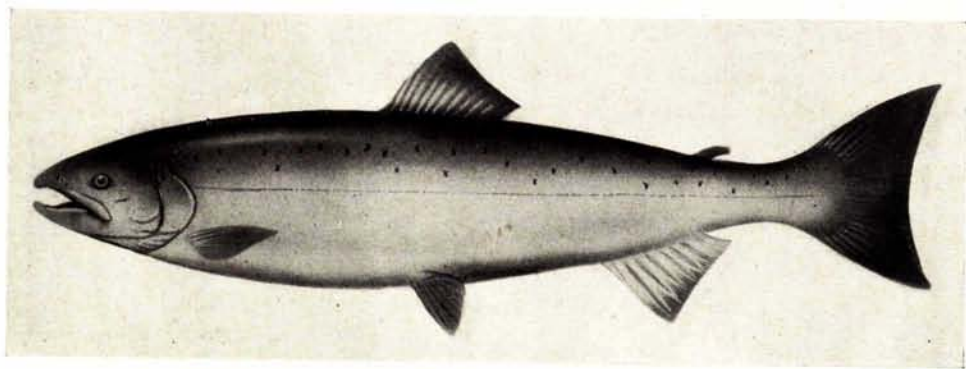


FIGURE 43. Atlantic salmon. *Salmo salar* Linnaeus 1758

fleshy; anal, 9 usually, 8 or 10 occasionally; pelvic, abdominal, each with fleshy appendage at base; caudal, more or less furcate in young, becoming more truncate with age. Lateral line: slightly decurved, then straight. Scales: cycloid; in oblique rows above lateral line, about 120. Colour: light brown on dorsal surface; silvery on sides; black spots on body numerous, often X-shaped, sometimes on dorsal, adipose and anal fins; no pink or red band along side of body; no red dash below lower jaw.

Length to 4 feet.

Distinguished by the brownish coloration on the back, the X-shaped black spots on the body and the slender caudal peduncle.

The Atlantic salmon was introduced into British Columbia in 1905, through the transfer of eggs from the Canadian Atlantic coast to the Cowichan lake hatchery by the Dominion Department of Fisheries. Further introductions were made over a considerable period of years. The resulting fingerlings and yearlings were liberated in the Cowichan and many other river systems. It was hoped that this much-prized fish might become established and provide an attractive angling fishery. However, the liberations of young fish did not produce the expected results, although a few individuals were caught in the Cowichan river by anglers. In 1933 and 1934, shipments of Atlantic salmon eggs were secured from Scotland but these introductions were even less successful in that no reports of captures were obtained. On the Atlantic coast the Atlantic salmon spawns in the upper reaches of streams in autumn, the eggs hatching in the following spring. The young remain in the streams for one or two years, then migrate to sea and mature at three, four, or five years of age. Like the steelhead and cut-throat trouts they do not die after the first spawning but return to the sea and may spawn a second or third time. Weights up to 100 pounds and slightly over have been reported in European countries. Since the name Atlantic salmon is rather confusing when this fish is grouped with the other trouts it might be well to point out that trouts were once supposed to be confined to fresh water while the salmon spent part of its life in salt water. (The "salmon" being *Salmo salar*.) Later it was found that the brown trout also went to sea. When European settlers came to the Pacific coast they applied the term *salmon* to the Pacific species—which are now placed in the genus *Oncorhynchus*.

Range northern California to Vancouver island.

Dolly Varden

Salvelinus malma (Walbaum) 1792

Body elongate, somewhat rounded, moderately compressed. Head large, elongate; mouth terminal, large; maxillary reaching to point behind posterior margin of eye; teeth on head of vomer only; eye large. Fins: dorsal (1), 10 or 11; adipose small, slender, fleshy; anal, about 9; pelvic, abdominal, each with fleshy appendage at base; caudal, truncate. Lateral line: slightly decurved, then straight. Scales: cycloid, small; in oblique rows above lateral line, 190 to 250. Colour: olive green to brown on dorsal surface with pale yellow spots; red spots on sides numerous, small; vermiculations, absent; sea-run individuals silvery.

Length to 3 feet.

Distinguished by the pale yellow spots on the back and the red spots on the sides of the body, the absence of vermiculations from the back and the presence of teeth on the head of the vomer only.

The Dolly Varden was first recorded from British Columbia waters in 1866

by J. K. Lord as *Salmo spectabilis* and as *Fario Lordii* n.s. The first definite locality record is that of a specimen taken in August, 1881, near Port Simpson by Capt. H. E. Nichols and recorded in the same year by T. H. Bean as *Salvelinus malma*. The Dolly Varden is widely distributed in British Columbia, occurring in both fresh and salt water, with its marine abundance to the northward. Spawning occurs in the autumn months in streams. In many areas regular seaward

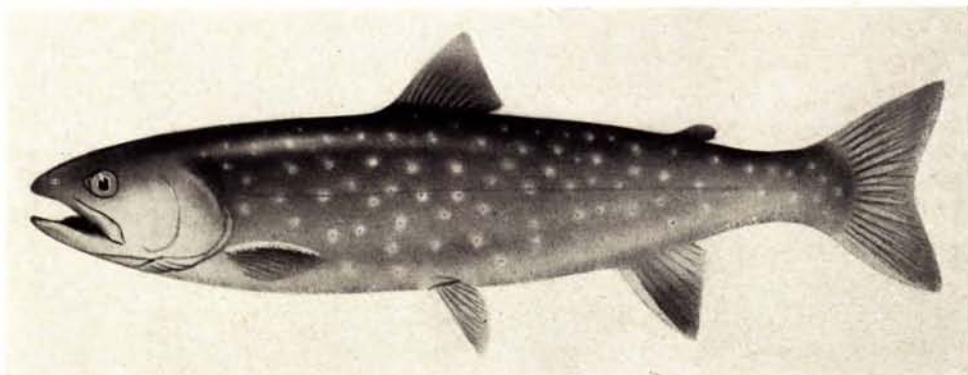


FIGURE 44. Dolly Varden. *Salvelinus malma* (Walbaum) 1792

migrations take place in the spring and upstream migrations in the fall. The food consists of insects, crustaceans and fishes, including sticklebacks, herring, young salmon and salmon eggs. It is the native red-spotted char of the province, varying in size and coloration according to the water inhabited. While not generally regarded as highly as the steelhead and cut-throat trouts, it nevertheless ranks as a splendid sport fish. Weights up to 20 pounds have been recorded.

Range northern California to northwestern Alaska.

Speckled char

Salvelinus fontinalis (Mitchill) 1815

Body elongate, somewhat moderately compressed. Head large, elongate; mouth terminal, large; maxillary reaching to point behind posterior margin of eye; teeth on head of vomer only; eye large. Fins: dorsal (1), about 10; adipose small, slender, fleshy; anal, about 9; pelvic, abdominal, each with fleshy appendage at base; caudal, truncate. Lateral line: slightly decurved, then straight. Scales: cycloid; in oblique rows above lateral line, about 230. Colour: dark olive green on dorsal surface, without spots; red spots surrounded by blue borders on sides; darker green vermiculations on back and dorsal fin. Sea-run individuals silvery.

Length to 2 feet 10 inches.

Distinguished by the red spots on the sides of the body, the dark olive green vermiculations on the back and the dorsal fin and the teeth on the head of the vomer only.

The speckled char was first introduced into British Columbia in 1908 as eggs from the province of Quebec. The young from this and subsequent introductions were distributed into various lakes and streams of British Columbia including some on Vancouver island. There is no record as yet of a specimen having been taken in the sea on the British Columbia coast but since the species is sea-running on the Atlantic coast there is reason to expect that it may have a similar habit on the Pacific. The speckled char is the eastern cousin of the Dolly Varden,

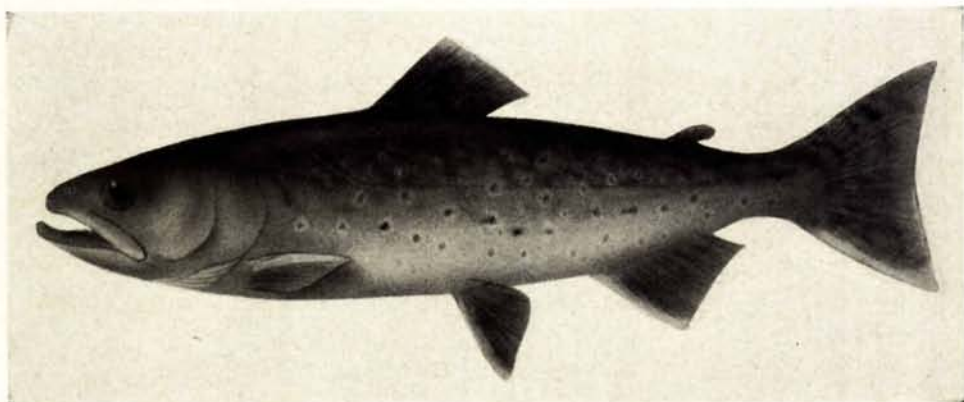


FIGURE 45. Speckled char. *Salvelinus fontinalis* (Mitchill) 1815

which it closely resembles in life history. Spawning occurs in the autumn months. It feeds largely upon insects, crustaceans and to a considerable extent upon small fishes, if available. This char is one of the most beautiful of sport fishes and in eastern waters it is known as the eastern brook trout and is very highly regarded. Whether it will become a popular game fish in British Columbia remains to be seen. In eastern waters the record weight is 14½ pounds, while in British Columbia a weight of 9 pounds has been reported.

Range northern California to Vancouver island.

Family OSMERIDAE

Smelts

In the smelts the body is slender and covered with numerous small cycloid scales. A lateral line is well developed. An adipose fin is present. There is no fleshy appendage at the base of either pelvic fin. The colours are olivaceous blue to brown above and silvery below.

The members of this family are essentially marine, although some species spend all or a considerable portion of their lives in fresh water. The males do not attain as great a size as the females and frequently have longer paired fins. They may develop enlarged scales along the lateral line or tubercles on the head, scales and fins at sexual maturity. Spawning takes place on sandy sea beaches

or in fresh water. Smelts are all relatively small in size and generally occur in large schools. Most of the species are very rich in oil and are excellent food fishes.

Capelin

Mallotus catervarius (Pennant) 1784

Body elongate, slender, appearing angular in breeding males because of enlarged scales on the lateral line. Head elongate; snout pointed; mouth terminal, large; maxillary extending to point below middle of eye; teeth small, on jaws, vomer, palatines and tongue; opercle roughened. Fins: dorsal (1), 12 or 13;

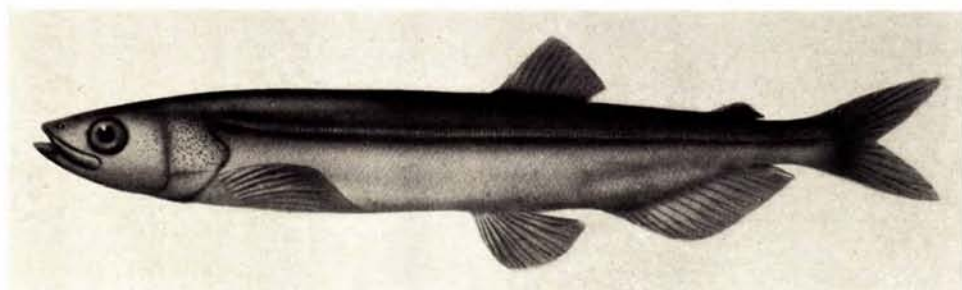


FIGURE 46. Capelin. *Mallotus catervarius* (Pennant) 1784

adipose large, base about half that of dorsal; anal, 17 to 20, large, bases and distal ends of first 10 to 12 rays much thickened in breeding males; pelvic, abdominal; pectoral, 16 to 19, shorter than head; caudal, furcate. Lateral line: almost straight. Scales: cycloid, small; on lateral line, 175 to 209; in two villous bands along each side of body in breeding male. Colour: olive green on dorsal surface, merging into silvery on sides and ventral surface; silvery with numerous black dots on opercles.

Length to 6 inches.

Distinguished by the very small scales, the large adipose fin, the rough opercles and the villous bands of scales on each side of the body in the breeding male.

The capelin was first recorded from British Columbia waters in 1891 by Ashdown Green as *Mallotus villosus* on the basis of a bucketful of these fish which he had seen for sale two years previously at Victoria. The capelin is common along the coast of British Columbia. It is an Arctic species apparently reaching its southern distribution in Juan de Fuca strait. In the strait of Georgia spawning occurs at night in late September and October on sandy beaches near the water's edge at maximum high tide. The eggs are adhesive and are attached to coarse sand grains. Through the wave action of the ebbing tide the eggs are buried to a depth as great as 6 inches. A single female deposits between 3,000 and 6,000 eggs which hatch in approximately two weeks. After hatching the capelin is rarely seen until the next spawning season. Scale studies indicate that

the life cycle may possibly be completed in one year. The food consists of small crustaceans, including euphausiids. The capelin forms part of the food of spring and coho salmon and probably other piscivorous fishes, such as dog-fish. This delectable fish does not enter the commercial fishery but it is much prized by those who are able to be on the beaches at the time of the spawning run.

Range Juan de Fuca strait to northwestern Alaska.

Silver smelt

Hypomesus pretiosus (Girard) 1854

Body elongate, relatively deep, depth approximately equal to length of head. Head elongate; snout pointed; mouth terminal, moderate; maxillary extending to point but little behind anterior margin of eye; teeth small, on jaws, vomer, palatines and tongue; opercle smooth, without striae. Fins: dorsal (1), 9 or 10,

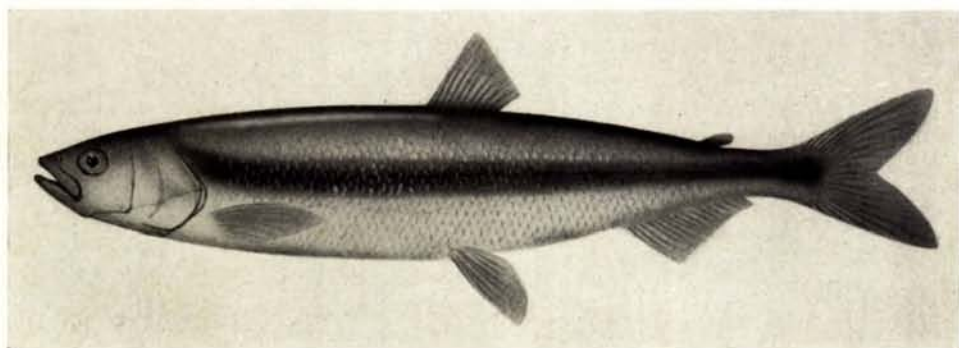


FIGURE 47. Silver smelt. *Hypomesus pretiosus* (Girard) 1854

origin distinctly in front of origin of pelvic fins; adipose small, slender; anal, 14 to 16; pelvic, abdominal; pectoral, 14 or 15, shorter than head; caudal, furcate. Lateral line: slightly decurved, then straight. Scales: cycloid, moderate; on lateral line, 66 to 76; not in villous bands on sides of body in male. Colour: light olive green on dorsal surface; silvery to white on ventral surface; dark on opercle; bright metallic silvery band sharply defined along side, becoming grayish black after fish has been removed from water. At spawning time in the male, light brown on dorsal surface, golden on ventral surface; in female, light green on dorsal surface, silvery white on ventral surface.

Length to 10 inches.

Distinguished by the silvery to dusky band on each side of the body and the origin of the dorsal fin in front of the origin of the pelvic fins.

The silver smelt was first recorded from British Columbia waters in 1866 by A. Günther as *Hypomesus olidus* on the basis of three specimens taken in Esquimalt harbour by J. K. Lord and presented to the British Museum by Earl Russell. The species is common along the coast of British Columbia,

especially in Boundary bay and the strait of Georgia. Spawning takes place from June to September on sandy beaches under conditions somewhat similar to those described for the capelin. A single female usually produces between 15,000 and 20,000 eggs. These hatch in about two weeks. The young disappear after hatching and may return in the first, second or third year. The food consists of small crustaceans and worms. The silver smelt forms part of the food of the spring salmon and other piscivorous fishes. Considerable numbers of this smelt are taken commercially with drag-seines and gill-nets at spawning time and find a ready sale in the fresh-fish market. Additional quantities are taken by amateur fishermen with rakes and dip-nets. This fish is also known as the surf smelt.

Range northern California to northwestern Alaska.

Eulachon

Thaleichthys pacificus (Richardson) 1836

Body elongate, more or less slender. Head elongate; snout pointed; mouth terminal, large; maxillary extending to point below posterior margin of eye or slightly behind; teeth hooked, on jaws well developed, usually deciduous at spawning time, on vomer few, large, on palatines short, on tongue large, strong;

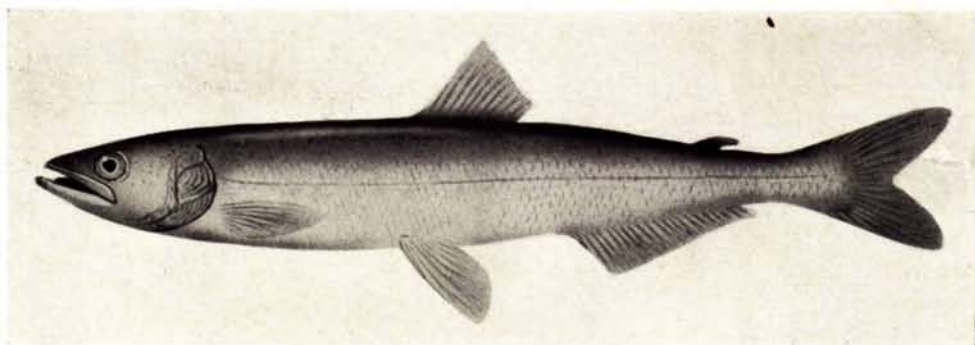


FIGURE 48. Eulachon. *Thaleichthys pacificus* (Richardson) 1836

opercle smooth, with well defined concentric striae following contour; rakers on first gill arch, 17 to 22. Fins: dorsal (1), 11 to 13, origin behind origin of pelvic fins; adipose small, slender, hooked; anal, 20 to 23; pelvic, abdominal; pectoral, 11 or 12, shorter than head; caudal, furcate. Lateral line: slightly decurved, then straight. Scales: cycloid, moderate; on lateral line, 75 to 78; not in villous bands in male but somewhat thickened at spawning time. Colour: uniform light bluish brown on dorsal surface; silvery white on sides and ventral surface; black stippling on back sparse, fine.

Length to 12 inches.

Distinguished by the origin of the dorsal fin behind the origin of the pelvic fins and the striae on the opercles following the contours of the bones.

The eulachon was first recorded from British Columbia waters in 1866 by A. Günther on the basis of four specimens, 8 to 9 inches in length, collected near Vancouver island by C. B. Wood, surgeon on H.M.S. *Plumper* and presented to the British Museum. The eulachon is common along the whole coast of British Columbia, particularly in the larger inlets, and enters the rivers during March, April and May to spawn. The fish matures at two and three years of age and apparently dies after spawning. A female of average size produces about 25,000 eggs. In the Fraser river the eggs are deposited on the bottom above Mission, particularly near Nikomen island. Each egg is surrounded by two membranes, the outer of which is fragile and very adhesive, and when broken and reflected backward becomes firmly fixed to a sand grain. The inner membrane, attached to the outer by a slender peduncle, contains the embryo which develops into a larva. The eggs hatch in two or three weeks. The young fish apparently are carried by the river current to the sea where they develop to maturity. The food consists of small crustaceans. The eulachon in turn comprises a portion of the food of the spring salmon and the fur-seal. The eulachon is taken in considerable numbers in gill-nets for the fresh-fish market and is a very choice fish because of its flavour and richness. In recent years a considerable portion of the catch has been utilized as food for animals on fur farms. It is used extensively by the Indians for food and the production of oil for cooking. Previous to the advent of manufactured candles and other lighting devices these fish were dried, fitted with a wick and used as candles, hence the frequently used name candle-fish. In 1877 a factory was built on the Nass river for the manufacture of eulachon oil, which for the most part was sold to the local Indians although a small amount was actually shipped to England. The eulachon fishery reached a maximum production in 1903 of about 600 tons and has declined since then to one of minor importance. The Chinook jargon name eulachon is most frequently used as the common name for this fish and the above spelling should be adopted in preference to such variants as: oolachan, oolichan, oulachon, ulchen, etc.

Range northern California to northwestern Alaska.

Long-finned smelt

Spirinchus dilatatus Schultz and Chapman 1934

Body moderately elongate, compressed. Head elongate, snout pointed; mouth terminal, large, strongly oblique; maxillary extending to point below posterior margin of eye; teeth hooked, on jaws small, on vomer few, small, not canine-like, on tongue large, strong; opercle smooth, without striae; rakers on first gill arch, 36 to 44. Fins: dorsal (1), 6 to 10, origin above or behind origin of pelvic fins; adipose small, somewhat broad; anal, 16 to 22; pelvic, abdominal; pectoral, 10 to 12, as long as head or longer; caudal, furcate. Lateral line: slightly decurved, then straight. Scales: cycloid, moderate; on lateral line,

59 to 65; not in villous bands in breeding male. Colour: pale olive brown on dorsal surface; silvery white on sides and ventral surface; black stippling on head and dorsal surface of body dense, prominent, very conspicuous in males during breeding season; in young, black spots in 2 conspicuous rows, 1 on each side of mid-line, extending from head to caudal peduncle.

Length to 6 inches.

Distinguished by the origin of the dorsal fin slightly behind the origin of the pelvic fins, the long pectoral fins, the opercles without striae and the fine black stippling on the head and the body.

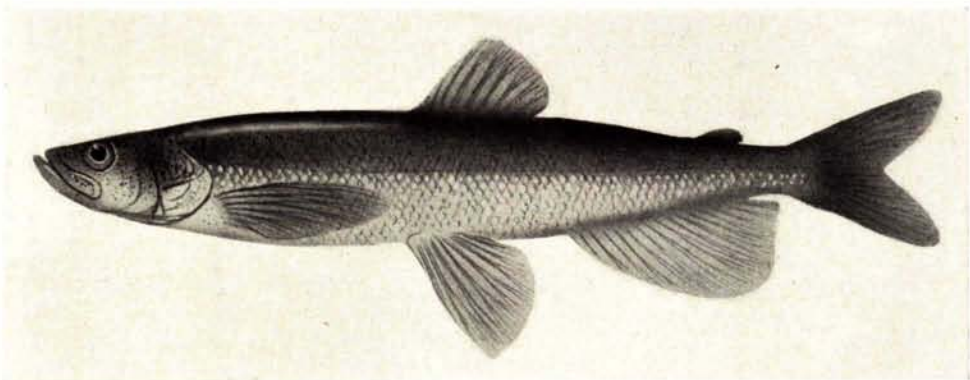


FIGURE 49. Long-finned smelt. *Spirinchus dilatatus* Schultz and Chapman 1934

The long-finned smelt was first taken in British Columbia waters in 1921 when a single specimen was obtained from Harrison lake by Dr. R. E. Foerster. The first specimen caught in salt water was obtained January 4, 1929, from Burrard inlet in a shrimp trawl by Dr. A. A. Berkeley Needler and was recorded in 1935 by L. P. Schultz and A. C. DeLacy. This individual is now in the Vancouver Museum. These specimens were secured before the species was recognized and described in 1934. In November, 1938, a small individual was taken near Prince Rupert. The long-finned smelt inhabits depths of from 10 to 70 fathoms and is captured frequently during the winter months, particularly by shrimp trawls which encounter the schools accidentally. Spawning takes place from October to December in streams near the sea at the end of the second year and whether the fish die after spawning is not known. Small specimens between 2 and 3 inches in length have been secured in May in the Fraser river below New Westminster. The food consists of small crustaceans. This smelt has a fine flavour and has a ready sale though the quantity is limited due to the difficulty of locating the fish.

Range Oregon to northern British Columbia.

Suborder OPISTHOPROCTOIDEA

The fishes in this suborder have an adipose fin. No photophores or luminous organs are present on the body or head. They are closely related to the Salmonoidea but are deep-water marine fishes with very large eyes, sometimes telescopic, and with reduced mouths and teeth.

Two families are represented in British Columbia waters: Bathylagidae and Macropinnidae.

Family BATHYLAGIDAE

Black smelts

In the black smelts the mouth is small and weak and the eyes are very large. The scales are large, thin, deciduous and cycloid. A small adipose fin is present. The lateral line is absent. There are no fleshy appendages at the bases of the pelvic fins. The colours are dark brown to black.

The black smelts are bathypelagic, inhabiting both the Atlantic and Pacific oceans.

Slender black smelt

Bathylagus pacificus Gilbert 1890

Body elongate, slender; caudal peduncle slender. Head large, deep, compressed; snout blunt; mouth terminal, small; maxillary scarcely reaching to point below middle of pupil; teeth small; eye moderately large, diameter 2.3 to 3.2 in length of head; interorbital space moderately concave; median occipital ridge

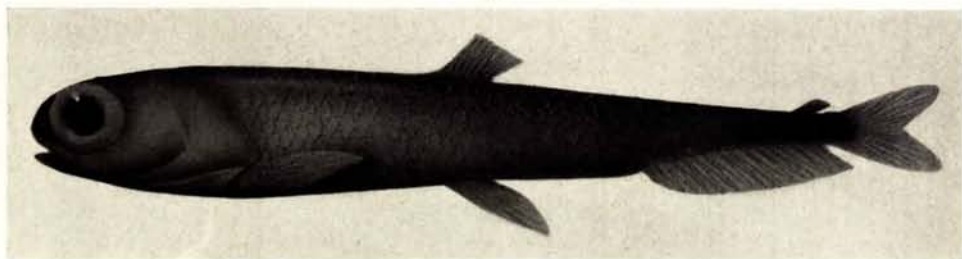


FIGURE 50. Slender black smelt. *Bathylagus pacificus* Gilbert 1890

absent. Fins: dorsal (1), 8 to 10; adipose, small; anal, 18 to 20; pelvic, abdominal; caudal, furcate. Lateral line: absent. Scales: cycloid, moderate, deciduous; in oblique rows above midline of body, 37 to 42. Colour: black to blackish brown; bluish black on head and ventral surface; bluish black on peritoneum.

Length to $7\frac{1}{2}$ inches.

Distinguished by the very large eyes, the black coloration, the scales in oblique rows above midline of body more than 30 and the absence of a ridge from the top of the head.

The slender black smelt was first taken in British Columbia waters May 21, 1931, northwest of the Queen Charlotte islands by the International Fisheries

Commission, station 386C, lat. 54° 18' N., long. 134° 27' W., depth between 379 and 488 fathoms and recorded in 1940 by W. M. Chapman. Only a single specimen was secured and it is the only occurrence known for the province.

Range southern California to northwestern Alaska.

Big-scaled black smelt

Bathylagus milleri Jordan and Gilbert 1898

Body elongate, deep anteriorly; caudal peduncle, slender. Head large, deep, compressed; snout blunt; mouth terminal, small; maxillary extending slightly behind anterior margin of pupil of eye; teeth small; eye very large, diameter 2 to 2.8 in length of head; interorbital space flat to concave; median occipital

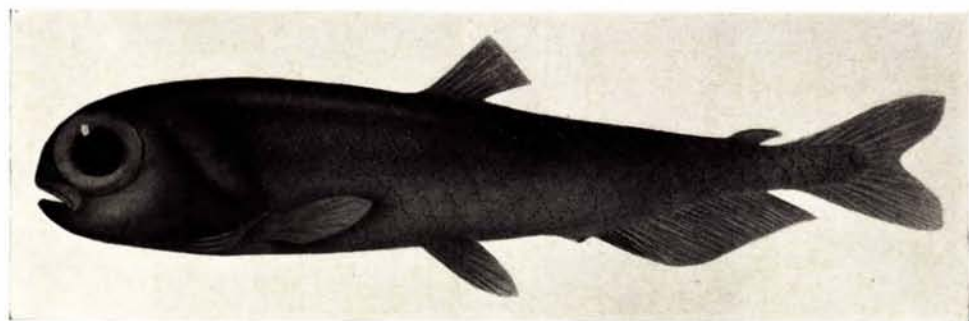


FIGURE 51. Big-scaled black smelt. *Bathylagus milleri* Jordan and Gilbert 1898

ridge strongly developed. Fins: dorsal (1), 7 to 9; adipose, small; anal, 23 to 27; pelvic, abdominal; caudal, furcate. Lateral line: absent. Scales: cycloid, large, thin, deciduous; in oblique rows above midline of body, 23 to 27. Colour: black to blackish brown; bluish black on peritoneum.

Length to 6¼ inches.

Distinguished by the very large eyes, the black coloration, the scales in oblique rows above midline of body fewer than thirty and the presence of a median ridge on the top of the head.

The big-scaled black smelt was first taken in British Columbia waters May 19, 1906, southwest of Moresby island by the *Albatross*, station 4758, lat. 52° 02' N., long. 132° 21' W., depth 1,600 fathoms, represented by two small specimens 1½ and 2 inches in length respectively and recorded in 1912 by C. H. Gilbert and C. V. Burke. Since March 16, 1929, the big-scaled black smelt has been taken on several occasions in the vicinity of the Queen Charlotte islands by the International Fisheries Commission at nine stations at various depths between 220 and 488 fathoms, and recorded in 1939 by W. M. Chapman as a new species, *Bathylagus alascanus*. The latter name is now considered to be synonymous with *B. milleri*.

Range southern California to northwestern Alaska.

In the barrel-eyes the head is grotesque with a small mouth, a pair of very large vertically directed cylindrical eyes and an enormous development of the opercular apparatus. The fins are very large and greatly elongate; the pelvic fins are high on the body without fleshy appendages at their bases; an adipose fin is present. A lateral line is present.

This family was established to embrace a new species taken by the International Fisheries Commission in northeastern Pacific waters.

Barrel-eye*Macropinna microstoma* Chapman 1939

Body short, deep. Head large; mouth terminal, very small; teeth small or absent; snout elongate, flat, broad, shovel-like; eye very large, on cylindrical base, directed upward, high on head, cornea projecting beyond dorsal outline; preopercle greatly expanded ventrally; gill membranes broadly united, joined to

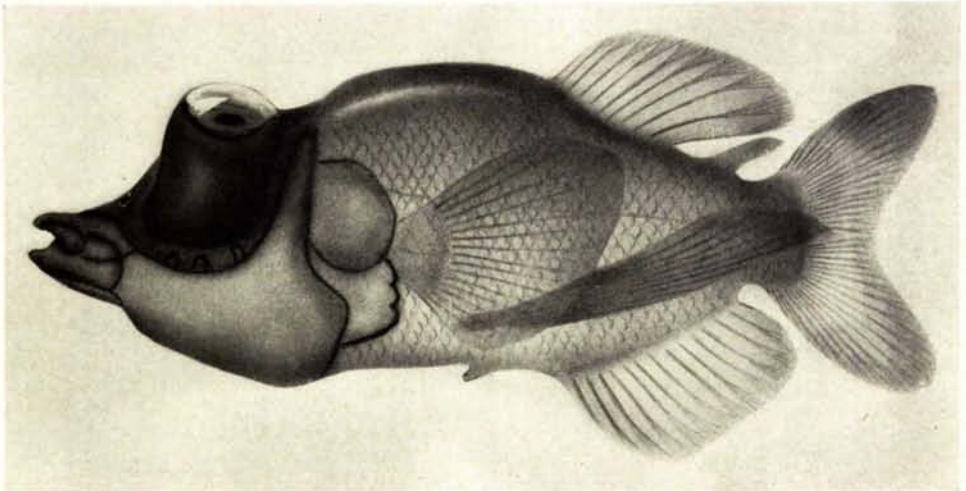


FIGURE 52. Barrel-eye. *Macropinna microstoma* Chapman 1939

isthmus with broad free fold posteriorly. Fins: dorsal (1), 11, far back on body; adipose elongate, slender; anal, 14; pelvic, 10, abdominal, very elongate, inserted high on side of body, slightly posterior to base of pectoral, tip, in adult, reaching base of caudal; pectoral, broad; caudal, short, broadly furcate. Lateral line: almost straight. Scales: cycloid, large, deciduous; on lateral line, 24 to 26. Luminous organs: absent from body and head. Colour: dark brown in adult; light coloured with distinctive pigment bars in larval stages.

Length to $1\frac{3}{4}$ inches.

Distinguished by the large upwardly directed eyes, the shovel-like snout and the very long pelvic fins inserted high on each side of the body.

The barrel-eye was first taken in British Columbia waters March 17, 1929, north of Graham island by the International Fisheries Commission, station 192, lat. $54^{\circ} 22' N.$, long. $132^{\circ} 18' W.$, depth 54 to 143 fathoms. A large specimen, $1\frac{3}{4}$ inches in length, selected for description as the type, was secured March 28, 1932, west of Graham island, station 621C, lat. $53^{\circ} 50' N.$, long. $134^{\circ} 20' W.$, depth 379 to 487 fathoms, recorded in 1939 by W. M. Chapman and deposited in the United States National Museum. Six other specimens at six other stations near the Queen Charlotte islands have also been obtained by the Commission at depths between 54 and 487 fathoms. A series of young stages from a length of $\frac{1}{4}$ of an inch upward have shown that considerable changes in body form take place during development. However, the large head and the long flat snout can be recognized even in the smallest specimens.

Range Queen Charlotte islands to northwestern Alaska.

Suborder STOMIATOIDEA

The fishes in this suborder have photophores which are in parallel rows on the body. Luminous organs, scales and an adipose fin may or may not be present.

Four families are represented in British Columbia waters: Gonostomatidae, Sternoptychiidae, Chauliodontidae and Stomiatidae.

Family GONOSTOMATIDAE

Angle-mouths

In the angle-mouths the body is elongate and slender, covered with cycloid scales. The mouth is very large with small teeth and the eyes are small. The dorsal fin is far back on the body over the anal fin, the pelvic fins are slightly anterior to the midlength of the body and the adipose fin is absent.

These are deep-sea fishes of wide distribution.

Veiled angle-mouth

Cyclothone microdon (Günther) 1878

Body elongate, rather slender, little compressed. Head conical, compressed; mouth terminal, large; maxillary extending to point far behind eye; teeth on jaws

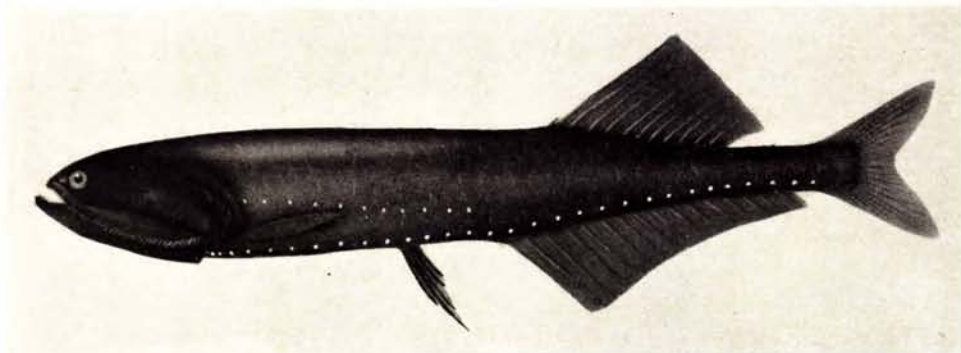


FIGURE 53. Veiled angle-mouth. *Cyclothone microdon* (Günther) 1878

and vomer small, needle-like; eye small, diameter 7 to 10 in length of head. Fins: dorsal (1), 12 to 14, far back on body, origin posterior to vertical from origin of pelvic fins; adipose, absent; anal, 17 to 21, large; pelvic, 5 or 6, abdominal, short; pectoral, 9 or 10, very narrow; caudal, furcate. Lateral line: absent. Scales: cycloid, large, deciduous; in oblique rows above midline of body, 28 to 33. Photophores: on body in two rows more or less parallel on abdomen; ventrolateral row, 7 to 11; ventral row, 31 to 35, extending onto caudal peduncle; on head in one row below lower jaw, 8 to 10. Colour: brownish black to black.

Length to 3 inches.

Distinguished by the elongate body, the posterior position of the dorsal fin, the large anal fin, the two rows of photophores parallel along the lower portion of each side of the abdomen and the small needle-like teeth.

The veiled angle-mouth was first taken in British Columbia waters March 17, 1929, off cape Knox, Queen Charlotte islands, by the International Fisheries Commission, station 189C, lat. 54° 08' N., long. 134° 06' W., depth 379 to 488 fathoms, when a single specimen was secured and recorded in 1940 by W. M. Chapman. Five other individuals were obtained in May, 1930, in the vicinity of Queen Charlotte sound, and in May, 1931, another individual was secured off cape Knox. These all were captured somewhere between 54 and 650 fathoms in tow-nets by the International Fisheries Commission but specimens have been taken in the mid-Pacific by the *Challenger* expedition in a haul from 2,900 fathoms.

Range southern California to northwestern Alaska.

Family STERNOPTYCHIIDAE

Hatchet-fishes

In the hatchet-fishes the body is very greatly compressed, very deep anteriorly and slender posteriorly, thus somewhat hatchet-shaped. The mouth is large with small teeth and the eyes are large, directed upward. Scales are absent. The dorsal fin is preceded by large projecting neural processes forming a bony plate. A long low adipose fin is sometimes present.

These are small oceanic fishes usually living at considerable depths but coming near the surface at night.

Silvery hatchet-fish

Argyropelecus olfersii (Cuvier) 1829

Body short, very deep anteriorly, extremely compressed. Head large, much compressed; mouth terminal, large; jaws almost vertical; teeth small; eye large, diameter about 3 in length of head, directed upward. Fins: dorsal (1), 9, short; adipose long, low; anal (2), 7 - 5, separated by small interspace; pelvic, 6, abdominal, small; pectoral, 10 or 11, very low on body; caudal, furcate. Lateral line: absent. Scales: absent. Photophores: numerous, large, in two more or less parallel rows along ventrolateral region of abdomen; from abdomen to caudal peduncle in single row. Spines: above shoulder, 1, small; at lower posterior extremity of abdomen, 1, divided into two spinules, one projecting forward, other backward. Neural processes: 7 or 8, projecting above back immediately in front

of dorsal fin, low anteriorly, progressively higher posteriorly. Colour: silvery, overlying brown to black substratum; silvery to white on fins; black on margins of photophores.

Length to $2\frac{1}{4}$ inches.

Distinguished by the deep highly compressed body, the almost vertical jaws, the upwardly directed eyes, the projecting neural processes, the rows of photophores along the lower portion of the body and the silvery coloration.

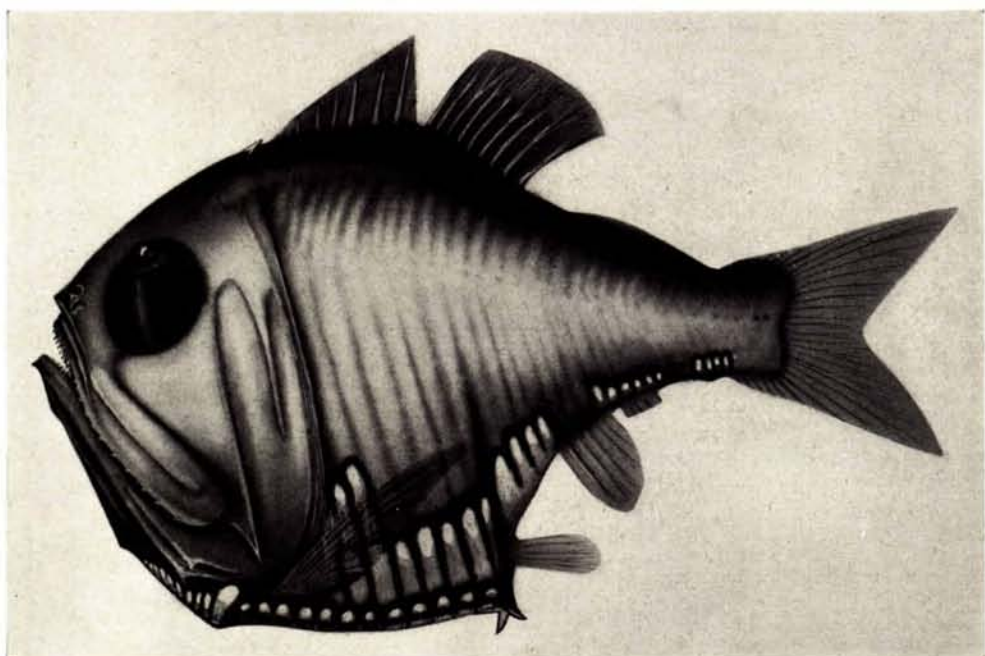


FIGURE 54. Silvery hatchet-fish. *Argyropelecus olfersii* (Cuvier) 1829

The silvery hatchet-fish has been taken but once in British Columbia waters. The specimen was obtained June 13, 1935, in English bay off Jericho beach by Mr. Y. Kondo at a depth of about 30 fathoms in a shrimp trawl. The specimen is now in the fish collection of the University of British Columbia. Apparently this fish is found ordinarily at great depths in the tropical Pacific ocean, depths ranging from 286 to 2,232 fathoms having been recorded.

Range southern California to strait of Georgia.

Family CHAULIODONTIDAE

Viper-fishes

In the viper-fishes the body is elongate and slender, covered with cycloid scales. The mouth is very large with fang-like teeth and the eyes are moderately small. The dorsal fin is far forward on the body with the first ray separate and

greatly elongate; the pelvic fins are slightly anterior to the midlength of the body and an adipose fin is present.

These are small fishes living for the most part in the depths of the ocean.

Fanged viper-fish

Chauliodus macouni Bean 1890

Body elongate, rather slender, tapering to short slender caudal peduncle; deepest at head. Head relatively large; snout concave; mouth terminal, extensive, gaping; teeth on premaxillary, 4, very long, fang-like, on maxillary and palatines, small, on mandible very long, fang-like, wide-set; eye large, diameter

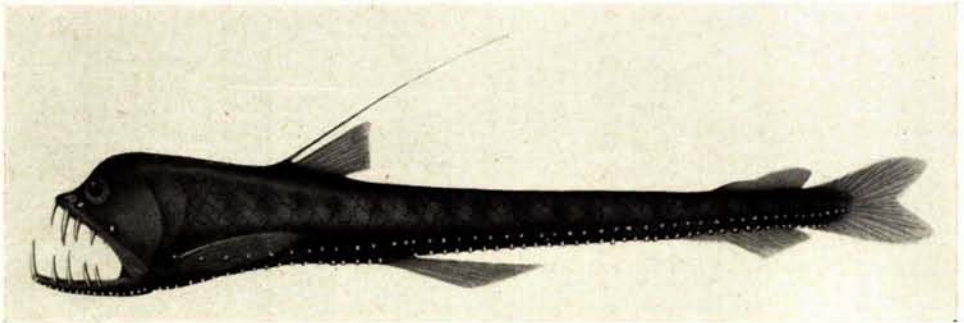


FIGURE 55. Fanged viper-fish. *Chauliodus macouni* Bean 1890

3.3 to 4.4 in length of head. Fins: dorsal (1), 6 or 7, near head, first ray separated from remainder of fin, produced into long filament about one-quarter length of body; adipose, large; anal, 10 to 12, rather small, slightly larger than adipose; pelvic, 7 or 8, abdominal, long, narrow; pectoral, 12 or 13, relatively broad; caudal, furcate. Lateral line: absent. Scales: cycloid, moderate, thin; in oblique rows above midline of body, about 56. Photophores: on body in two parallel rows; ventrolateral row, 40 to 46; ventral row, 54 to 58; on head below eye, 2, one anterior, one posterior; below lower jaw in one row, 18 to 21. Colour: dark brown to black.

Length to $4\frac{1}{4}$ inches.

Distinguished by the elongate body, the very long fang-like teeth in the gaping mouth, the presence of an adipose fin, the forward position of the dorsal fin with the long filamentous ray and the two rows of photophores along the lower portion of the body.

The fanged viper-fish was first taken in British Columbia waters August 29, 1888, off the Queen Charlotte islands near cape St. James by the *Albatross*, station 2860, lat. $51^{\circ} 23' N.$, long. $130^{\circ} 34' W.$, depth 876 fathoms, recorded in 1890 by T. H. Bean as the type of a new species and deposited in the United States National Museum. From 1929 to 1934 large numbers were taken in tow-nets by the International Fisheries Commission at 58 stations off the west coasts of

Vancouver and the Queen Charlotte islands at depths from 54 to 487 fathoms. Specimens taken off the coast of California were found to have fed upon the arrow-worm, *Sagitta*.

Range southern California to northwestern Alaska.

Family STOMIATIDAE

Stomiatis

In the stomiatids the body is elongate, very slender, without scales. The mouth is large with well developed teeth, the eyes are very small and a barbel is present under the lower jaw. The dorsal fin is far back on the body over the anal fin; the pelvic fins are well behind the mid-length of the body and the adipose fin is absent.

These fishes frequently live at very great depths and are usually said to be abyssal.

Arrow-fish

Tactostoma macropus Bolin 1939

Body very elongate, slender, almost cylindrical. Head very short, length 7 to 9 in standard length; mouth terminal, very large, upcurved; maxillary more than half length of head; teeth depressible, on jaws arranged in several rows, varying in size from minute denticles to moderate sized fangs, on tongue in 2 rows



FIGURE 56. Arrow-fish. *Tactostoma macropus* Bolin 1939

of 6 or 7 each, large, fang-like; eye very small; barbel on lower jaw, small; gill membranes united, attached anteriorly to isthmus. Fins: dorsal (1), 14 to 16, very far back on body; anal, 19 or 20, very far back, origin below that of dorsal; pelvic, 8 to 10, abdominal, large, behind middle of body; pectoral and adipose, absent; caudal, small, furcate. Lateral line: absent. Scales: absent. Photophores: on body; in two parallel rows to anal fin; ventrolateral row, 73 to 79; ventral row, isthmus to pelvic fin, 54 to 57, pelvic fin to anal fin, 19 to 21, above anal fin, 12 or 13; on head: suborbital, 1, large, with deeply embedded globular lens; opercular, 1, small; branchiostegal, 14. Luminous organs on head: in front of eye, 3; behind eye, 1. Glandular bodies: on body and head numerous, minute. Colour: jet black; black on barbel; pale green on suborbital photophore in life; light gray on posterior of lower jaw; rich brown in young.

Length to 11 inches.

Distinguished by the elongate cylindrical body, the absence of pectoral fins, the posterior positions of the dorsal, anal and pelvic fins, the two rows of numerous photophores along the lower portion of each side of the body and the large teeth on the jaws and on the tongue.

The arrow-fish was first taken in British Columbia waters April 14, 1932, south of cape St. James by the International Fisheries Commission, station 665C, lat. 51° 16' N., long. 130° 35' W., depth between 379 and 487 fathoms. A second specimen was secured January 3, 1935, station 1256C, lat. 51° 15' N., long. 131° 37' W., between the same depths. This fish was described as a new species, *Photonectops multipunctata*, in 1939 by W. M. Chapman who was unaware of the description by Rolf L. Bolin of the same species based on another specimen taken off Monterey bay, California, and whose publication predated his by a short time.

Range northern California to Queen Charlotte sound.

Order INIOMI

In this order the premaxillary bone forms the margin of the upper jaw. The fins have rays only; the pelvic fins are abdominal or thoracic (abdominal in British Columbia species); and an adipose fin is usually present (present in British Columbia species). The scales, when present, are cycloid.

Two suborders are represented along the British Columbia coast: Myctophoidea and Alepidosauroidea.

Suborder MYCTOPHOIDEA

The fishes in this suborder are of small size and with the body deep in relation to the length. The mouth is large and the teeth are small. Photophores are numerous and luminous organs are present in all the species herein recorded.

One family, the Myctophidae, is represented in British Columbia waters.

Family MYCTOPHIDAE

Lantern-fishes

The lantern-fishes are so named because of the presence of numerous light-producing organs on the head and body. The photophores have definite positions and are named accordingly as shown in the accompanying drawing. Variations in the positions and numbers of these photophores occur among the various species and thus form a useful means for identification.

Big-eyed lantern-fish

Electrona thompsoni Chapman 1944

Body elongate, stout, greatest depth 3 to 3.9 in standard length, in front of dorsal fin. Head large, deep, anterior profile rounded; mouth terminal, large; maxillary extending to point slightly behind eye, greatly expanded posteriorly; teeth small, villiform; eye large, diameter 2 to 2.8 in length of head. Fins: dorsal (1), 11 to 13; adipose, large; anal, 22 to 25, very large, origin below middle of dorsal; pelvic, 8, abdominal; pectoral, long, tip reaching to point slightly in front of anus; caudal, furcate. Lateral line: slightly decurved, then straight.

Scales: cycloid, moderate; on lateral line, 35 to 39. Photophores: Vn, small; Op₁, absent; Op₂, above and behind maxillary; PLO, well below base of pectoral fin, above, slightly behind PO₂; PVO₁, behind PLO, above interspace between PO₂ and PO₃; PVO₂, at base of pectoral fin; VLO, about midway between, forming straight line with, PVO₂ and SAO₁; SAO₁, behind VLO above VO₃; SAO₂, on same level, above origin of anal fin; SAO₃, about half distance between lateral line and AO₁; Pol, absent; PO, 5, on same level, PO₃ and PO₅ closer together than PO₁ and PO₂; VO, 4, on same level; AO, 15 to 18, in single continuous series; Prc, 2,

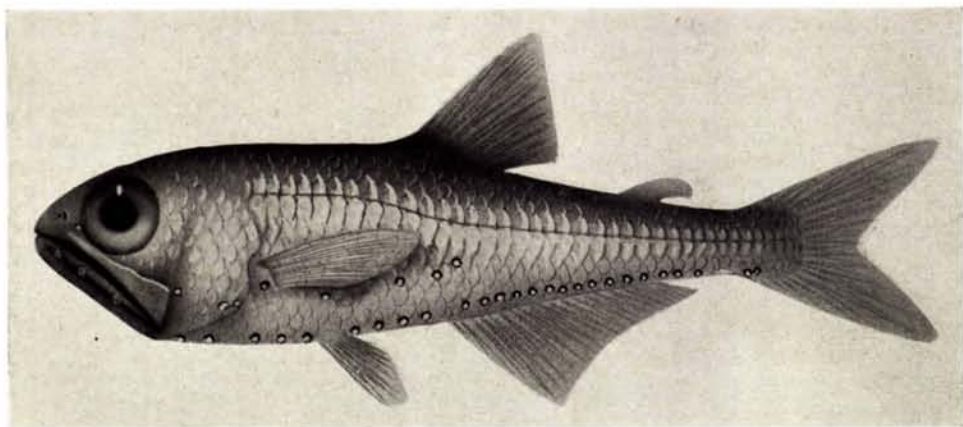


FIGURE 57. Big-eyed lantern-fish. *Electrona thompsoni* Chapman 1944

well separated from most posterior AO. Luminous organs: supracaudal or infracaudal, not both on same individual. Colour: metallic blue on dorsal surface; bright silvery on ventral surface.

Length to 2 inches.

Distinguished by the presence of 2 precaudal photophores well separated from the anal photophores, the 15 to 18 anal photophores in a continuous row, the absence of a posterolateral photophore and the large eyes.

The big-eyed lantern-fish was first taken in British Columbia waters March 10, 1929, west of cape Scott by the International Fisheries Commission, station 171C, lat. 50° 34' N., long. 129° 27' W., in a vertical haul between 487 and 379 fathoms. Specimens were also taken by the Commission at twelve other stations in the vicinity of the Queen Charlotte islands. The species was originally described in 1939 by W. M. Chapman as *Myctophum oculum*, which name was preoccupied by Garman and so was renamed in 1944 as *Electrona thompsoni*.

Range Washington to northwestern Alaska.

Blue lantern-fish (Fig. 1) *Tarletonbeania crenularis* (Jordan and Gilbert) 1880

Body elongate, stout anteriorly, greatest depth 4.2 to 4.8 in standard length, through base of pectoral fin; caudal peduncle elongate, slender. Head moderate,

deep; mouth terminal, large, maxillary extending to point far behind eye; teeth small, villiform; eye moderate, diameter 3.2 to 3.7 in length of head. Fins: dorsal (1), 11 to 14; adipose, small; anal, 17 to 19, large, origin below middle of dorsal; pelvic, 7 or 8, abdominal, small; pectoral small, tip barely reaching to point above origin of pelvic; caudal, furcate. Lateral line: very short, length less than that of head, represented by pores on anterior 2 or 3 scales only. Scales: cycloid, small, margins crenulate; in oblique rows above midline of body, 48 to 52. Photophores: Dn, small, deeply embedded; Suo, small; Vn, large; Op₁, small;

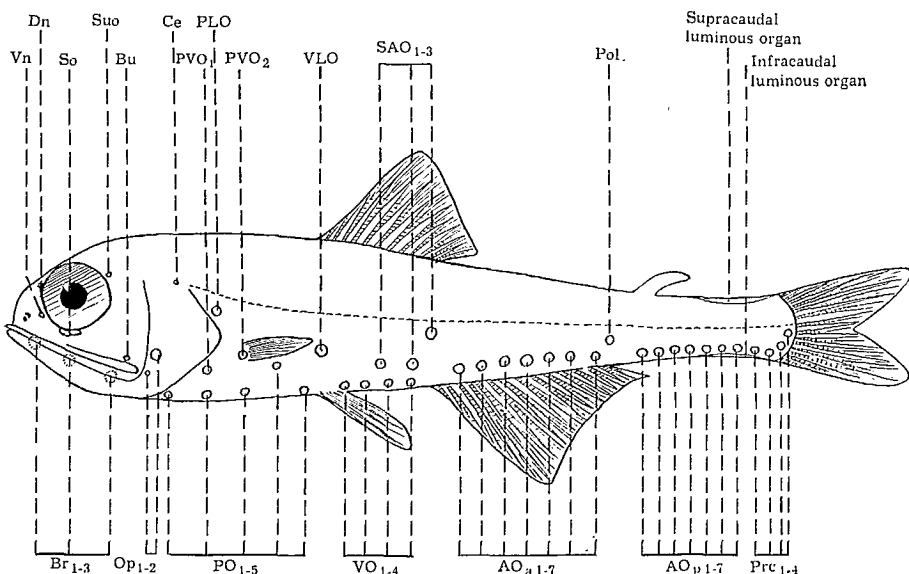


FIGURE 58. A hypothetical myctophid showing the general distribution and terminology of the photophores. Dn—dorsonasal; Suo—supraorbital; Ce—cervical; Vn—ventronasal; So—suborbital; Br—branchiostegal; Bu—buccal; Op—opercular; PLO—suprapectoral; PVO—subpectoral; VLO—supraventral; SAO—supraanal; Pol—posterolateral; PO—thoracic; VO—ventral, AO_a—anterior anal, AO_p—posterior anal; Prc—precaudal.

Op₂, large; PLO, small below level of upper ray of pectoral fin, covered by subopercle; PVO₁, immediately below subopercle; PVO₂, at base of pectoral fin, about above PO₃; VLO, on level with PVO₂, about above base of pelvic fin; SAO₁, above and slightly behind posterior VO; SAO₂, behind SAO₁ and slightly above, directly above origin of anal fin; SAO₃, near lateral line, above origin of anal fin; Pol, 1, above posterior AO_a; PO, 5 to 8, in straight line and on same level; VO, 5 to 7, on same level; AO, in two series, AO_a, 9 to 12, AO_p, 3 to 5 (not always same number on both sides of body); Prc, 1, widely separated from posterior AO_p but on same level. Luminous organs: in male, supra-caudal only; in female, none. Colour: bright metallic blue on dorsal surface; bright silvery on ventral surface; vivid electric blue light emitted from photophores in life.

Length to 3 inches.

Distinguished by the low position of the suprapectoral photophore, the single precaudal photophore, the short lateral line and the slender caudal peduncle.

The blue lantern-fish was first taken in British Columbia waters March 7, 1929, in Juan de Fuca strait by the International Fisheries Commission, station 165B, lat. 48° 00' N., long. 125° 41' W., in a vertical haul between 260 and 173 fathoms and recorded in 1940 by W. M. Chapman. In the same year a specimen was obtained west of cape Scott and eleven others in Queen Charlotte sound at depths between 54 and 487 fathoms. Specimens have been obtained from the stomachs of albacore from California to British Columbia.

Range southern California to northwestern Alaska.

Big-finned lantern-fish

Myctophum californiense Eigenmann and Eigenmann 1889

Body elongate, slender, greatest depth about 5 in standard length, in front of pectoral fin. Head moderate, pointed; mouth terminal, large; maxillary extending to point well behind eye; teeth small, villiform; eye moderate, diameter about 3 in length of head. Fins: dorsal (1), 14 or 15; adipose, small; anal, 20 to

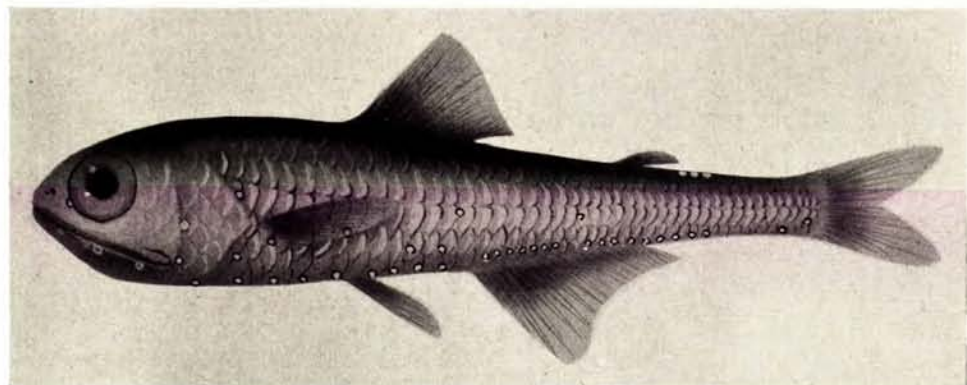


FIGURE 59. Big-finned lantern-fish. *Myctophum californiense* Eigenmann and Eigenmann 1889

22, moderate, origin below insertion of dorsal; pelvic, 8, abdominal; pectoral, moderate, tip reaching to point well behind insertion of pelvic; caudal, furcate. Lateral line: 38 to 42. Photophores: V_n , small, deeply embedded; Op_1 , small; Op_2 , large; PLO, in advance of pectoral fin, about midway between lateral line and base of pectoral fin; PVO_1 , about midway between PVO_2 and PO_1 ; PVO_2 , near base of lower pectoral fin rays; VLO, above origin of pelvic fin, about midway between lateral line and base of pelvic fin; SAO_1 , above interspace between VO_2 and VO_3 ; SAO_2 , above VO_4 ; SAO_3 , close to lateral line above origin of anal fin; Pol, 1, close to lateral line above interspace between AO_a and AO_p ; PO, 5, in

straight line, about evenly spaced, on same level; VO, 4, on same level; AO, in two series, AO_a, 6 or 7, AO_p, 8 to 10; Prc, 2, well separated from posterior AO_p, Prc₂, posterior to and slightly higher than Prc₁. Luminous organs: supracaudal in male, 3 to 6; infracaudal in female, 4 to 8. Colour: black on dorsal surface; silvery on sides; dusky at bases of fins. Pale greenish light emitted by photophores.

Length to 4½ inches.

Distinguished by the presence of two precaudal photophores well separated from the anal photophores, the position of the suprapectoral photophore above the pectoral fin and the anal photophores in two groups, the anterior series of 7 or 8 and the posterior series of 8 to 11.

The big-finned lantern-fish was first recorded from British Columbia waters in the neighbourhood of Vancouver island in 1864 by A. Günther as *Scopelus boops*. This is the only known record from these waters.

Range southern California to Vancouver island.

White-spotted lantern-fish

Diaphus rafinesquii (Cocco) 1820

Body elongate, moderately stout, greatest depth 4 to 4.4 in standard length in front of dorsal fin; caudal peduncle stout. Head moderately large, deep; anterior profile rounded; mouth terminal, large; maxillary extending to point well behind eye; teeth small, villiform; eye large, diameter 2.6 to 3.2 in length of

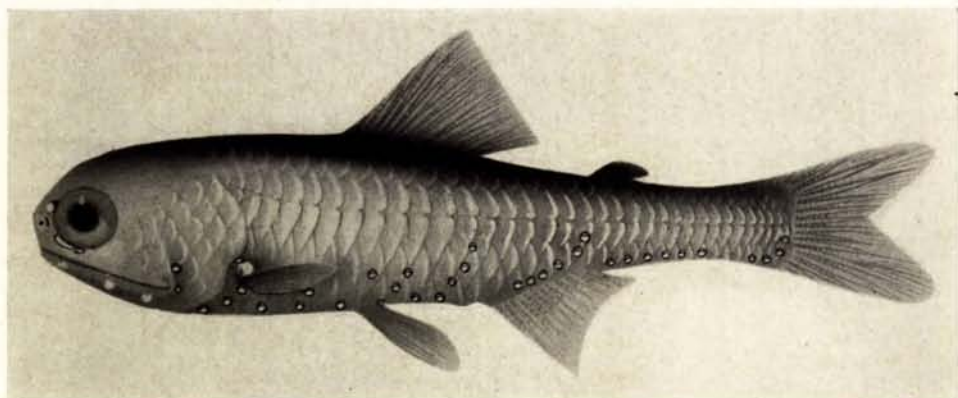


FIGURE 60. White-spotted lantern-fish. *Diaphus rafinesquii* (Cocco) 1820

head. Fins: dorsal (1), 13 to 15; adipose, small; anal, 12 to 14, small, origin behind insertion of dorsal; pelvic, 8, abdominal; pectoral, moderate, tip not reaching to point above origin of pelvic; caudal, furcate. Lateral line: slightly decurved, then straight. Scales: cycloid, moderate; on lateral line, 34 to 37. Photophores: Dn, conspicuously large, circular; So, imperfectly divided into long slender anterior portion, separated from minute posterior portion by strand of black pigment; Op₁, small; Op₂, large; PLO, above base of pectoral fin; PVO₁,

about midway between PO_1 and PVO_2 ; PVO_2 , in front of lower rays of pectoral fin; VLO , behind base of pectoral fin directly above base of pelvic; SAO_1 , behind and slightly above VO_5 ; SAO_2 , behind and above SAO_1 ; SAO_3 , behind and above SAO_2 , about midway between it and lateral line; Pol , 1, above interspace between posterior AO_a and anterior AO_p ; PO , 5, PO_1 , under opercle, interspace between PO_1 and PO_2 , long, PO_4 , slightly elevated; VO , 5, VO_2 and VO_3 much elevated; AO , in two series, AO_a , 4 to 6, AO_p , 4 to 7; Prc , 4, in curve following base of caudal fin, Prc_1 , separated from posterior AO_p by interspace slightly greater than that between AO_a and AO_p . Luminous organs: suprapectoral, 1, large, below and contiguous with PLO ; absent from caudal peduncle. Colour: brown to black on dorsal surface; lighter on ventral surface; pale on fins; black on slightly curved septum separating upper and lower parts of body photophores.

Length to $2\frac{3}{4}$ inches.

Distinguished by the four precaudal photophores, the large dorsonasal photophores, the black septa dividing the photophores on the body, the large luminous organ above the base of each pectoral fin and the absence of luminous organs from the caudal peduncle.

The white-spotted lantern-fish was first taken in British Columbia waters September 2, 1891, off Port San Juan by the *Albatross*, station 3459, lat. $48^{\circ} 24' N.$, long. $124^{\circ} 24' W.$, depth 123 fathoms and recorded in 1895 by C. H. Gilbert as *Diaphus theta* Eigenmann and Eigenmann. It occurs along the whole coast at depths ranging from 25 to 325 fathoms and is captured frequently in English bay in shrimp trawls at depths of 25 and 35 fathoms. Thirteen specimens have been obtained off the Queen Charlotte islands by the International Fisheries Commission at eleven stations at depths ranging from 54 to 325 fathoms. Off the coast of Washington the species has been found at a depth of 584 fathoms and in Alaskan waters near Mount Edgecumbe at 922 fathoms.

Range southern California to northwestern Alaska.

Small-finned lantern-fish

Lampanyctus leucopsarus (Eigenmann and Eigenmann) 1890

Body elongate, slender, greatest depth about 5 in standard length, in front of dorsal fin. Head elongate, bluntly pointed; mouth terminal, large; maxillary extending to point far behind eye; teeth small, villiform; eye moderate, diameter 3.5 to 4.5 in length of head. Fins: dorsal (1), 12 to 15; adipose, small; anal, 14 to 16, small, origin below posterior third of dorsal; pelvic, 8 or 9, abdominal; pectoral, minute, length about equal to diameter of eye, tip far in advance of origin of pelvic; caudal, furcate. Lateral line: slightly deurved, then straight. Scales: cycloid, moderate; on lateral line, 35 to 38. Photophores: V_n , small; Op_1 , small; Op_2 , large; PLO , in advance of pectoral fin, about midway between lateral line and base of pectoral fin; PVO_1 , well in front of PO_2 , about below PVO_2 ; PVO_2 , in front of base of pectoral fin; VLO , about midway between lateral line and VO_1 ; SAO_1 , behind and slightly above posterior VO ; SAO_2 , behind and

above SAO₁; SAO₃, behind and above SAO₂; Pol, 1, about one-third distance from lateral line to insertion of anal fin; PO, 5 or 6, PO₄ much elevated, above interspace between PO₃ and PO₅; VO, 3 to 5, following contour of abdomen; AO, in two series, AO_a, 5 to 7, AO_p, 6 to 8; Prc, 4, separated from AO_p, evenly spaced, Prc₄ well below lateral line. Luminous organs: supracaudal, 5 to 8; infracaudal, 7 to 9. Colour: gray to dark greenish blue on dorsal surface; lighter on ventral surface; black on opercle and fins; golden or claret on photophores in life.

Length to 5 inches.

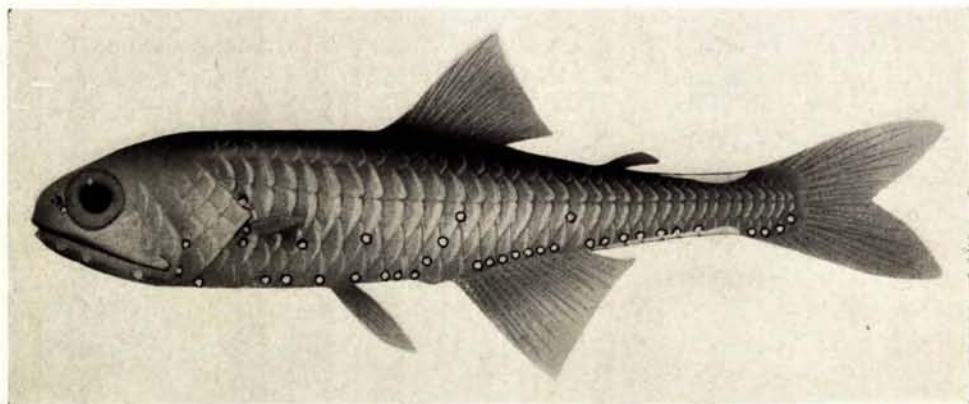


FIGURE 61. Small-finned lantern-fish. *Lampanyctus leucopsarus* (Eigenmann and Eigenmann) 1890

Distinguished by the very small pectoral fins, the luminous organs above and below the caudal peduncle, the single posterolateral photophore on each side of the body and the black coloration on the fins.

The small-finned lantern-fish was first taken in British Columbia waters September 3, 1890, west of Moresby island by the *Albatross*, station 3342, lat. 52° 39' N., long. 132° 38' W., depth 1,588 fathoms and recorded in 1895 by C. H. Gilbert as *Lampanyctus nannochir* (Gilbert). The species is common along the whole coast. Between February 18, 1929, and March 25, 1934, specimens were obtained at 142 stations from Juan de Fuca strait to Alaska by the International Fisheries Commission at depths ranging from 22 to 650 fathoms.

Range southern California to northwestern Alaska.

Small-eyed lantern-fish

Lampanyctus regalis (Gilbert) 1891

Body elongate, slender, greatest depth 5 to 5.9 in standard length, in front of dorsal fin. Head elongate, pointed; mouth terminal, very large, maxillary extending to point far behind eye; teeth small, villiform; eye small, diameter 5.4 to 6.5 in length of head. Fins: dorsal (1), 14 to 16, large; adipose, large; anal, 17 to 19, large, origin below posterior third of dorsal; pelvic, 8, abdominal; pectoral,

long, tip reaching to point slightly behind origin of pelvic; caudal, furcate. Lateral line: slightly decurved, then straight. Scales: cycloid, moderate; on lateral line, 36 to 39. Photophores: very small; on body, flattened, reflecting downward; Ce, small; Vn, small; Bu, very small; Op₁, small; Op₂, moderate; PLO, high, about one-quarter distance from lateral line to base of pectoral fin; PVO₁, above interspace between PO₁ and PO₂; PVO₂, at base of uppermost ray of pectoral fin; VLO, above insertion of pelvic fin, close to lateral line; SAO₁, about midway between lateral line and interspace between VO₂ and VO₃; SAO₂,

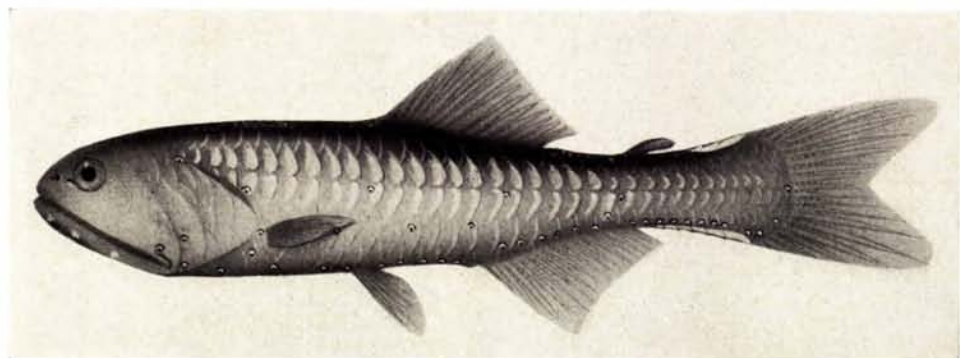


FIGURE 62. Small-eyed lantern fish. *Lampanyctus regalis* (Gilbert) 1891

behind SAO₁ about midway between lateral line and origin of anal fin; SAO₃, close to lateral line, behind SAO₂; Pol, 2, Pol₁ close to posterior end of AO_a series, Pol₂ close to lateral line; PO, 5, PO₄ much elevated; VO, 4 or 5, on same level; AO, in two series, AO_a, 6 to 8, AO_p, 7 or 8; Prc, 4, first two on level with AO_p series, Prc₃ above and behind Prc₂, Prc₄ in contact with lateral line. Luminous organs: supracaudal, 3 to 5; infracaudal, 5 to 8. Colour: rich brown to black; dark on dorsal surface; light on ventral surface; dusky on fins.

Length to 6½ inches.

Distinguished by the elongate body, the small eyes, the minute flattened photophores on the body, the two posterolateral photophores on each side of the body and the fourth precaudal photophore on each side of the body in contact with the lateral line.

The small-eyed lantern-fish was first taken in British Columbia waters March 15, 1929, off Queen Charlotte sound by the International Fisheries Commission, station 183C, lat. 51° 47' N., long. 131° 02' W., depth between 379 and 487 fathoms, recorded in 1939 by W. M. Chapman as a new species, *Lampanyctus micropunctatus*, which is now known to be synonymous with *L. regalis* (Gilbert). There were ten other specimens taken by the Commission at ten other stations at depths ranging from 54 to 487 fathoms.

Range southern California to northwestern Alaska.

Suborder ALEPIDOSAUROIDEA

The fishes in this suborder range in size from about 7 inches to 5 feet and have long slender bodies. The mouth is large with numerous teeth, many strongly developed. Photophores are absent but luminous organs may be present.

Two families are represented along the British Columbia coast: Scopelarchidae and Alepidosauridae.

Family SCOPELARCHIDAE

Scopelarchids

In the scopelarchids the body is small, moderately elongate, little compressed and covered with cycloid scales. The mouth is large with depressible fang-like teeth on lower jaw and palatines. The eyes are large, sometimes telescopic. The dorsal fin is small, well forward on the body. Luminous organs are sometimes present on the head.

The members of this family are all deep-sea fishes.

Pearl-eye

Neoscopelarchoides dentatus Chapman 1939

Body elongate, slender. Head relatively short; mouth terminal, very large; maxillary reaching to point well behind eye; lower jaw projecting; teeth on upper jaw small, on lower jaw and palatines large, fang-like; eye moderately large, telescopic. Fins: dorsal (1), 6 or 7, small; adipose, slender, insertion above that

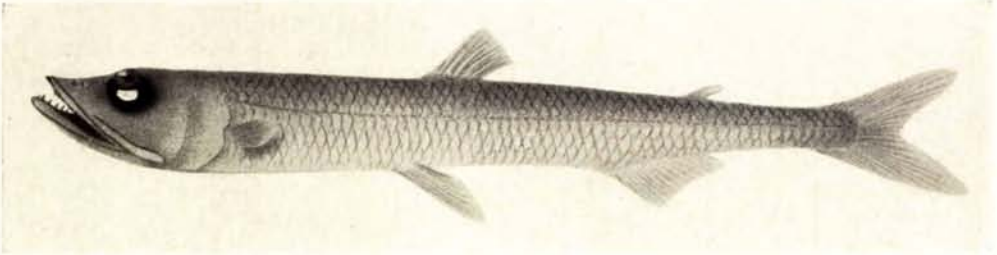


FIGURE 63. Pearl-eye. *Neoscopelarchoides dentatus* Chapman 1939

of anal; anal, 17 to 21; pelvic, 9, abdominal, large; pectoral, 22 to 25, small, slightly longer than diameter of eye; caudal, emarginate. Lateral line: almost straight. Scales: cycloid; on lateral line, 56 to 58, enlarged. Photophores: absent. Luminous organs: on eyeball, 1, oval. Colour: brown on dorsal surface; lighter on ventral surface; in adults. Larval stages: translucent, almost transparent in abdominal region.

Length to 7 inches.

Distinguished by the elongate body, the telescopic eyes with the large oval luminous organs, the large mouth with the fang-like teeth on the lower jaw and the small pectoral and the large pelvic fins.

The pearl-eye was first taken in British Columbia waters March 10, 1929, off the west coast of Vancouver island near cape Scott by the International Fisheries Commission, station 172C, lat. 50° 43' N., long. 129° 23' W., in a vertical haul between 487 and 379 fathoms. This and six other specimens, obtained at six other stations during the next five years by the Commission, were recorded in 1939 by W. M. Chapman. The depths recorded were all between 54 and 488 fathoms.

Range west coast of Vancouver island to northwestern Alaska.

Family ALEPIDOSAURIDAE

Lancet-fishes

In the lancet-fishes the body is large, elongate, greatly compressed and without scales. The mouth is large with many immovable fang-like teeth. The eyes are large, non-telescopic. The dorsal fin is very long and high. Luminous organs are absent.

The members of this family are all large, slender and very fragile. They inhabit the ocean depths and are known for the most part from specimens cast upon the shore.

Handsaw-fish

Alepidosaurus aesculapius Bean 1882

Body elongate, slender, greatly compressed. Head greatly compressed; snout long; mouth terminal, widely cleft; maxillary reaching to margin of preopercle; teeth: on upper jaw numerous, minute, sharp; on lower jaw, 1, large, anterior, about 12 small, 4 large, followed by about 12 small to moderate, in-

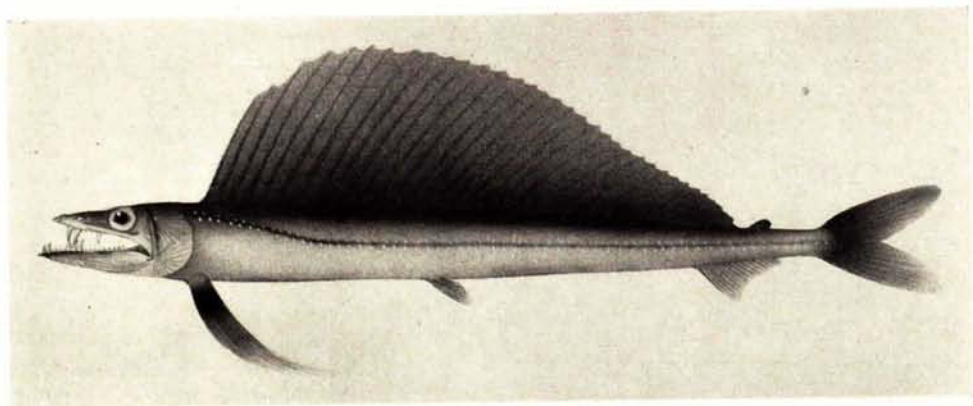


FIGURE 64. Handsaw-fish. *Alepidosaurus aesculapius* Bean 1882

creasing in size posteriorly; on palatines very large, fang-like, 2 anterior, 1 posterior, eye very large; ridges on opercle, radiating, prominent. Fins: dorsal (1), 30 to 40, very long, high, rays depressible so that whole fin may be folded down into a deep groove and thus become invisible; adipose, small; anal, 15 to 17,

small; pelvic, 8 or 9, abdominal; pectoral, long, length about equal to that of head; caudal, deeply furcate. Lateral line: high anteriorly, then almost straight. Scales: absent. Colour: dark gray to greenish brown on dorsal surface; silvery on sides, somewhat iridescent, with row of small translucent spots; dark streak along lateral line; black on dorsal fin with steel blue reflections; black on pectoral, adipose and caudal fins; silvery gray to dusky on pelvic and anal fins.

Length to 5 feet.

Distinguished by the long high dorsal fin, the presence of an adipose fin and the long fang-like teeth on the lower jaw and the palatine bones.

The handsaw-fish was first taken in British Columbia waters in September, 1896, in Quatsino sound by Mr. T. B. Norgate and the specimen was recorded in 1898 by J. Fannin as *Alepisaurus borealis* Gill and is in the collection of the Provincial Museum at Victoria. The species is captured occasionally along the Pacific coast from Washington to Alaska on halibut fishing gear, using herring for bait, and is sometimes cast up on shore after storms. Specimens have been secured near Victoria, in Quatsino sound off Triangle and Kains islands, near Butedale, off cape St. James, in Hecate strait and near Prince Rupert. The depths for the cape St. James and Hecate strait specimens were 170 and 140 fathoms respectively, while that of the Kains island individual was only 30 fathoms. The body is flaccid and the fins are fragile suggesting that this fish is an inhabitant of deep water. The food is somewhat varied. Individuals from halibut banks usually contain squid whose capture is evidently facilitated by the fang-like teeth. Other specimens have been found to contain spiny lump-suckers (*Eumicrotremus orbis*), the soft sculpin (*Gilbertidia sigalutes*) and herring.

Range southern California to northwestern Alaska.

Order APODES

In this order the body is extremely elongate. The maxillary bone forms the major portion of the upper jaw, the premaxillary not being evident because of fusion with other bones. The fins are supported by rays only. The dorsal and anal fins are very long, each usually continuous with a very small caudal fin which is sometimes reduced to a filament; the pelvic fins are absent in modern species. The scales, when present, are cycloid.

In those species in which the life history has been studied, as for example the true eel, *Anguilla*, and the conger, *Conger*, the larva is flattened, more or less leaf-shaped, and is known as a leptocephalus. The above mentioned genera do not occur on the coast of British Columbia.

Family NEMICHTHYIDAE

Thread-fishes

This is a family of curious, exceedingly slender fishes with long, almost needle-like recurved jaws, the upper being somewhat the longer. The thread-fishes apparently inhabit fairly deep water but occasionally appear at the surface.

Snipe eel

Avocettina gilli (Bean) 1890

Body very elongate, extremely slender, tapering posteriorly to sharp point; greatest depth about 40 in total length, near midlength. Head elongate, length about 8.2 in total length, flattened on top; mouth terminal, deeply cleft; jaws prolonged, very slender, flexible, recurved, upper jaw longer, each ending in pad covered with teeth; teeth on jaws and vomer, numerous, small, sharp, backward-slanting; eye small, diameter about 17 in length of head, not projecting into dorsal outline of head. Anus remote from head, distance behind more than 9

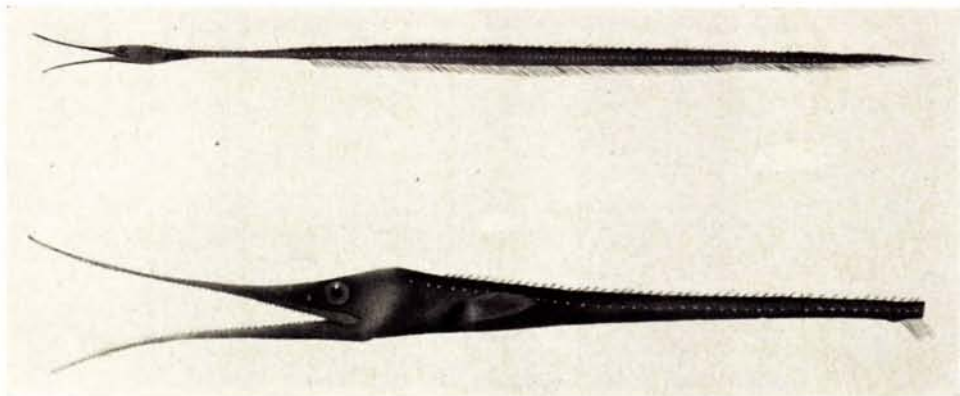


FIGURE 65. Snipe eel. *Avocettina gilli* (Bean) 1890

times length of pectoral fin. Fins: dorsal (1), about 260, extending practically full length of body; anal, about 205, shorter, origin immediately behind anus; pelvic, absent; pectoral, small; caudal, extremely small, short. Lateral line: pores in single row, about 156, large, open. Scales: absent. Colour: uniform black.

Length to 18 inches.

Distinguished by the extremely slender body without pelvic fins, the elongate recurved jaws, the anus remote from the head, the single row of pores on the lateral line and the small short caudal fin.

The snipe eel was first taken in British Columbia waters January 1, 1935, in Queen Charlotte sound by the International Fisheries Commission, station 1248A, lat. $51^{\circ} 00' N.$, long. $130^{\circ} 48' W.$, depth between 50 and 150 fathoms, approximately. Only a single specimen was obtained. It is the only one known from British Columbia waters and was recorded in 1940 by W. M. Chapman. The type specimen was secured east of Prince of Wales island, Alaska, at a depth of 1,569 fathoms.

Range northern British Columbia to southeastern Alaska.

Thread-fish

Nemichthys avocetta Jordan and Gilbert 1880

Body very elongate, extremely slender, tapering very gradually from mid-length, ending in filamentous projection; greatest depth about 60 in total length, near midlength. Head elongate, about 11 in total length, flattened on top; mouth terminal, deeply cleft; jaws prolonged, very slender, flexible, recurved, needle-like at tips, upper jaw longer; teeth on jaws and vomer numerous, small, sharp, backward-slanting; eye large, diameter about 13 in length of head. Anus near head, below pectoral fins. Fins: dorsal (1), about 330, extending practically

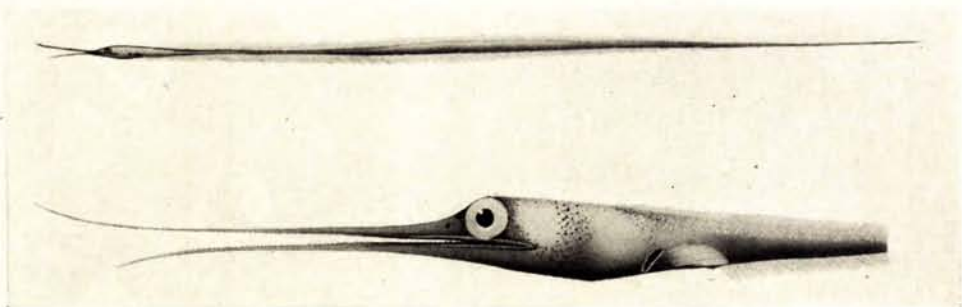


FIGURE 66. Thread-fish. *Nemichthys avocetta* Jordan and Gilbert 1880

full length of body, rays slender, basal portion of each strong, stiff, distal portion slender, delicate; anal, about 320, origin immediately behind anus; pelvic, absent; pectoral, small; caudal, absent. Lateral line: along midline. Pores: above, on and below lateral line, in 3 rows. Scales: absent. Colour: white on dorsal surface, unspotted; black on sides and ventral surface; white on dorsal fin, faintly black on margin; bluish black on margin of anal fin and tips of pectoral fins.

Length to 2 feet 7½ inches.

Distinguished by the extremely slender body without pelvic fins, the elongate recurved jaws, the anus near the head, the three rows of pores along the lateral line, the body ending in an elongate filament and the reversed coloration of the body.

The thread-fish was first taken in British Columbia waters in 1894 when a specimen was found on the beach at Beacon hill, Victoria, by Mr. T. B. Norgate and recorded in 1898 by J. Fannin as being in the collection of the Provincial Museum at Victoria. A second individual was obtained from a herring-seine August 10, 1941, in Klemtu pass, near Butedale, by Mr. Emil Bostrom, at a depth of 16 fathoms, and the specimen is in the fish collection of the University of British Columbia. Other individuals are stated to have been observed by fishermen off the west coast of Vancouver island at various times. It appears occasionally at the surface and sometimes it is attracted at night to the surface by artificial light. Whether the reversed coloration of the thread-fish is the result of

swimming upside down is not known but an African cat-fish (*Synodontus*), is known to do so and is brown to black on the ventral surface and pale silvery gray on the dorsal surface. The names brittle water-snake, glass-snake, avocet and thread-eel have been applied to this fish.

Range Oregon to northern British Columbia.

Order SYNENTOGNATHI

In this order the body is somewhat elongate and the head is pointed. The jaws are more or less produced in the non-flying forms. The fins are supported by rays only; the dorsal fin is placed far back on the body and is similar to and above the anal fin; the pelvic fins are abdominal. The lateral line is placed very low on the body. The scales are cycloid.

Family SCOMBERESOCIDAE

Sauries

In the sauries the body is slender and "stream-lined." The jaws are prolonged to form a slender beak. There is a series of finlets behind both the dorsal and anal fins as in the mackerels.

These are fishes of the open seas, often occurring in large schools. They frequently leap out of the water, a habit which is highly developed in their close relatives, the flying-fishes.

Saury

Cololabis saira (Brevoort) 1850

Body elongate, slender, slightly compressed; dorsal contour, in lateral view, straight from tip of snout to origin of dorsal fin. Head conical, flattened above; mouth terminal, slightly cleft; lower jaw somewhat projecting; teeth small, feeble; snout very pointed. Fins: dorsal (1), 9 to 11, far back on body, slightly

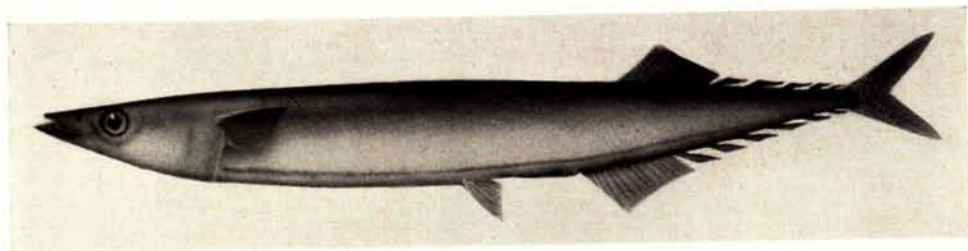


FIGURE 67. Saury. *Cololabis saira* (Brevoort) 1850

behind vertical from origin of anal fin, followed by 5 or 6 finlets; anal, 12 to 14, followed by 5 to 7 finlets; pelvic, abdominal; pectoral, slightly emarginate; caudal, deeply furcate. Lateral line: very low, along side of ventral surface, extending to about fourth anal finlet. Scales: cycloid, small, thin, deciduous; in oblique rows above midline of body, 120 to 129. Colour: dark green on dorsal surface; silvery on ventral surface; pale on pelvic and anal fins; more or less dusky on other fins.

Length to 14 inches.

Distinguished by the single dorsal fin far back on the body, the finlets following both dorsal and anal fins, the pointed conical head with the projecting lower jaw and the low lateral line on each side of the body.

The saury was first taken in British Columbia waters off Vancouver island by C. H. Gilbert who obtained a specimen 10 inches in length and recorded it in 1915 as *Cololabis brevirostris* (Peters). Other specimens have been taken off the west coast of Vancouver island, in Queen Charlotte strait, in Queen Charlotte sound, in Hecate strait and in Massett inlet. The eggs possess short filaments and are pelagic. The young are undoubtedly pelagic also but little is known of the life history. The food is apparently plankton. Because of the habit of jumping out of the water this fish is sometimes referred to as the skipper.

Range southern California to southeastern Alaska.

Order GASTEROSTEI

In this order the head is pointed, sometimes much produced, the mouth is small with the premaxillary bone forming most of the margin of the upper jaw. The pelvic fins are thoracic with the pelvic girdle free from the pectoral girdle; there are two or more free spines representing the first dorsal fin. Bony pitted plates are usually present on the body.

Two families, the Gasterosteidae, sticklebacks, and the Aulorhynchidae, tube-snouts, are represented in British Columbia waters.

Family GASTEROSTEIDAE

Sticklebacks

In the sticklebacks the body is somewhat elongate, stout, compressed, with a slender caudal peduncle. There are two dorsal fins, the first represented by free spines, fewer than 20 in number. The sides of the body are sometimes partially or completely covered with vertical oblong bony plates.

These are small fishes represented by five genera and about twelve species which inhabit the fresh and salt waters of North America, Europe and Asia.

Three-spined stickleback

Gasterosteus aculeatus Linnaeus 1758

Body elongate, moderately compressed; caudal peduncle slender, sometimes with well developed lateral keels in marine forms. Head pointed; mouth terminal, moderate; teeth minute, sharp. Fins: dorsal (2), II or III—I, 11 or 12, spinous fin with 2 or 3 widely separated stout serrate spines, rarely spine in second fin absent; anal, I—8 or 9, spine short; pelvic, I, 1, thoracic, spine large, serrate, ray small, fins below interspace between first and second spines of spinous dorsal fin; all spines may be locked rigidly in their sockets to stand out from body at right angles, thus forming a very effective armour; pectoral, truncate, origin some distance behind gill opening; caudal, slightly furcate. Lateral line: high, following dorsal contour, pores microscopic. Plates: large, bony, oblong, vertical, in series along side of body in marine individuals, greatly reduced in brackish-

water individuals, almost completely absent in fresh-water individuals. Bony plate formed by fusion of pelvic girdle parts, elongate, triangular, on ventral surface of body between and behind pelvic fins. Colour: variable; silvery green to intensely bluish black in marine, mottled brown in fresh-water specimens; bright silvery in young.

Length to 4 inches.

Distinguished by the large spines in the dorsal and pelvic fins, the slender caudal peduncle and the vertical bony plates on the sides of the body.

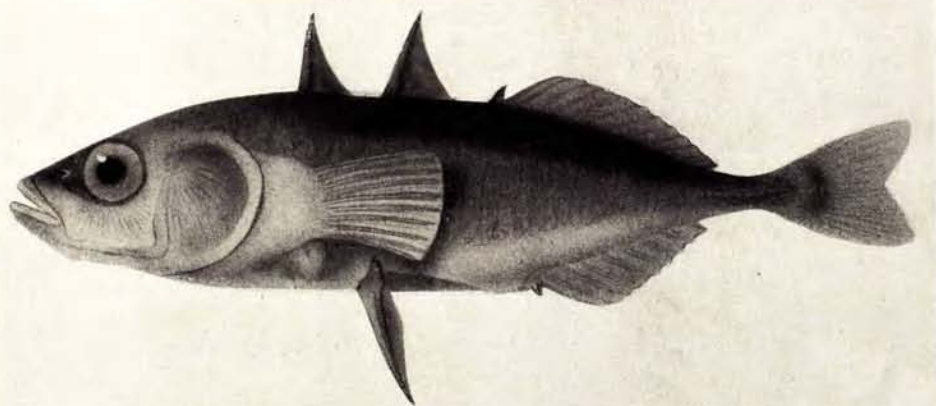


FIGURE 68. Three-spined stickleback. *Gasterosteus aculeatus* Linnaeus 1758

The three-spined stickleback was first recorded from British Columbia waters in 1866 by J. K. Lord as *Gasterosteus serratus* and *G. concinnus*, without definite locality stated. The first locality record was that of a specimen taken in June, 1882, near Duncan bay, collected by Capt. H. E. Nichols and recorded in 1883 by T. H. Bean as *Gasterosteus cataphractus* Pallas. The species is common along the whole coast and in the various streams and lakes. It occurs frequently in small schools, particularly in eel-grass and around wharves. The habit of remaining stationary with the tail bent is a characteristic posture. Specimens have been found in the stomachs of fur-seals obtained 20 miles off the west coast of Vancouver island and one specimen, entirely bluish black in colour, was taken in July, 1941, in northern British Columbia at Laredo inlet in a herring-seine at a depth of 15 fathoms. The spawning activities of this fish in fresh water are of interest in that the male constructs a rather elaborate nest, induces one or more females to spawn therein and then guards the nest and its eggs until the fry have left to forage for themselves. The classic description of these activities is to be found in *The naturalist in Vancouver island and British Columbia*, by J. K. Lord, published in 1866. The food of this stickleback in the sea consists largely of small

crustaceans but in fresh water aquatic insects are taken in addition. In spite of the spines, the stickleback is readily eaten by other fishes and waterfowl.

Range southern California to northwestern Alaska.

Family AULORHYNCHIDAE

Tube-snouts

In the tube-snouts the body is elongate, slender and almost cylindrical with a slender caudal peduncle. The head is prolonged into a peculiar snout with a very small mouth at the end, with a hinged upper jaw. There are two dorsal fins, the first represented by free spines, about 25 in number. The body is partially covered with rows of small bony plates.

There is only one species in the family, confined to the northwestern Pacific ocean.

Tube-snout

Aulorhynchus flavidus Gill 1861

Body very elongate, slender, terete; caudal peduncle elongate, tapering, depressed. Head elongate; snout elongate, tubular, depressed; mouth terminal, small; lower jaw flattened, projecting slightly beyond upper; premaxillaries enlarged, hinged, freely movable; teeth small, recurved; eye, large. Fins: dorsal

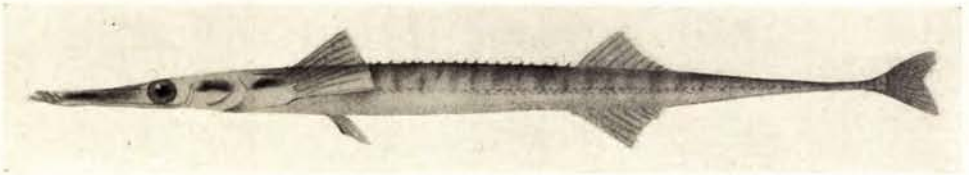


FIGURE 69. Tube-snout. *Aulorhynchus flavidus* Gill 1861

(2), about XXV—9 or 10, spinous fin represented by minute, free, sharp spines; rayed fin far back on body; anal, I, 9, spine minute, broad; pelvic, I, 4, thoracic; pectoral broad, truncate; caudal, furcate. Lateral line: straight. Plates: small, bony, embedded; in series along mid-dorsal line; in series along lateral line; in paired series along mid-ventral line on caudal peduncle. Colour: usually pale mottled brown, varying from light olive green to yellow brown on dorsal surface; pale creamy white on ventral surface.

Length to 6½ inches.

Distinguished by the very elongate terete body, the prolonged tubular snout with the small mouth at the tip and the numerous minute free spines preceding the rayed dorsal fin.

The tube-snout was first recorded from British Columbia waters in 1866 without date or locality by J. K. Lord as *Gasterosteus spinachia*. The first definite locality record is that of a specimen 5½ inches in length taken May 12, 1893, in the Queen Charlotte islands at Massett by Mr. J. H. Keen and recorded in 1920 by B. A. Bean and A. C. Weed. The species is common in the strait of

Georgia and has been reported from the west coast of Vancouver island. The tube-snout is a common shore fish, often appearing in small schools at the surface of the water around wharves, swimming slowly with fins moving rapidly and jaws snapping constantly. It is obtained frequently with the pipe-fish in shore-seines, especially around eel-grass beds. The food consists of small plankton crustaceans.

Range southern California to southeastern Alaska.

Order SOLENICHTHYES

In this order the body is usually elongate. The snout is prolonged into a more or less elongate and tube-like "beak" at the extreme end of which is placed a small mouth. Teeth usually are absent and when present are exceedingly small.

Six families comprise the order, all of which are found in tropical or temperate seas, generally living near the shore and sometimes entering fresh water. Only one of these, the Syngnathidae, is represented in British Columbia waters and comprises the pipe-fishes and sea-horses.

Family SYNGNATHIDAE

Pipe-fishes

In the pipe-fishes the body is elongate, slender and is enclosed in an armour of bony plates which form a series of encircling rings. There is a single rayed dorsal fin; the pelvic fins are absent.

The pipe-fishes and sea-horses swim in a more or less upright position, propelling themselves partly by the dorsal fin and partly by wriggling movements of the body. The care of the eggs and also of the fry is undertaken by the male. It is unfortunate that the picturesque sea-horse does not occur in British Columbia waters.

Pipe-fish

Syngnathus griseo-lineatus Ayres 1854

Body elongate, very slender, subcylindrical, 6-angled anteriorly, 4-angled posteriorly. Head elongate; snout elongate, tubular, almost cylindrical, slightly longer in female; mouth terminal, small; upper and lower jaws united by membrane; teeth absent. Sexes very different in appearance; in female, body anterior to anus moderately stout of slightly greater length than that of male, posterior to anus slender and tapering to origin of caudal fin; in male, body posterior to anus expanded into pair of lateral folds forming longitudinal brood pouch, about one-third of total body length, edges of folds meeting on midline below. Fins: dorsal (1), 36 to 41, short, approximately at middle of body in female, slightly forward in male; anal, minute in female, immediately behind anus, absent in male; pelvic, absent; pectoral, small; caudal, small, fan-shaped. Lateral line: absent. Bony plates on body: in rows, 6 anteriorly (dorsal, 1, ventral, 1, lateral, 4), 4 posteriorly, lateral. Colour: variable, from pale olive green to dark green or brown, according to environment; frequently pale olive green with narrow horizontal gray lines.

Length to 13 inches in females, slightly less in males.

Distinguished by the elongate subcylindrical angular body enclosed in bony plates, the tubular mouth and snout and the absence of pelvic fins.

The pipe-fish was first recorded from British Columbia waters in 1866 by J. K. Lord as *Syngnathus arundinaceus*. The first definite locality record is that of a specimen taken in 1885 in the strait of Georgia by Dr. G. M. Dawson and recorded in 1887 by J. F. Whiteaves as *Siphostoma Californiense* Storer (evidently a misprint for *californiense*). The pipe-fish is very common in the strait of Georgia and has been recorded from the west coast of Vancouver island, Lough-

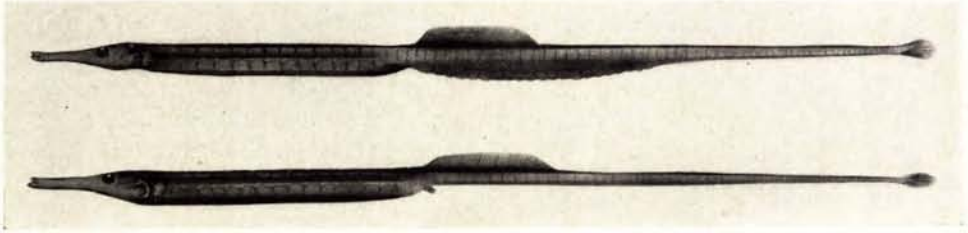


FIGURE 70. Pipe-fish. *Syngnathus griseo-lineatus* Ayres 1854

borough inlet and the Queen Charlotte islands. Occurring along the shores, amongst eel-grass and about wharves, it swims slowly in a jerky manner often maintaining an almost vertical position in the water. The reproductive period is in the spring. Males have been found carrying eggs as early as May 26, and young as late as August. The female transfers the fertilized eggs to the brood pouch of the male where they are incubated and the young remain therein until they reach a length of about $\frac{3}{4}$ of an inch. The food consists largely of small crustaceans and is taken into the tubular mouth by a sucking movement accompanied by an inflation of the cheeks.

Range southern California to southeastern Alaska.

Order ANACANTHINI

In this order the body is elongate and deep anteriorly, covered with cycloid scales. The fins are soft rayed; the dorsal fins are long and may be divided into two or more separate fins; the pelvic fins are thoracic with the pelvic girdles attached to the cleithra by means of ligaments; the apparent caudal fin, when present, is composed mainly of dorsal and anal fin rays but herein is referred to as a caudal fin. There is frequently a barbel near the tip of the lower jaw.

Three families are represented in British Columbia waters: Merlucciidae, hakes; Gadidae, cods; and Macruridae, grenadiers.

Family MERLUCCIIDAE

Hakes

In the hakes the mouth is large with the lower jaw projecting. There is no barbel. The frontal bones are separated and possess ridges which diverge from

the occipital crest and border a large triangular depression. The second dorsal fin and the anal fin are deeply notched.

Hake

Merluccius productus (Ayres) 1855

Body elongate, moderately compressed. Head large; mouth terminal, large; lower jaw projecting; maxillary extending to point below pupil of eye; teeth on jaws slender, canine-like, strong, in two bands, on vomer in bands; snout long, flattened above; eye large, diameter 4 or more in length of head, high, upper

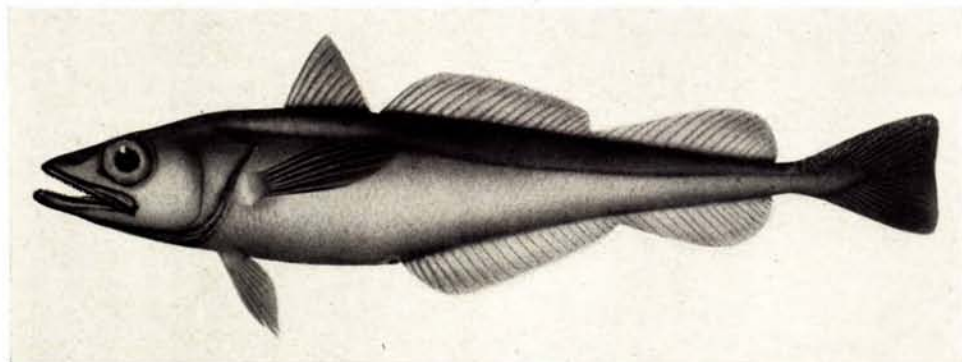


FIGURE 71. Hake. *Merluccius productus* (Ayres) 1855

margin level with top of head; ridges on top of head: 3, frontal, 2, diverging; occipital, 1, median. Fins: dorsal (2), 10 or 11—41, first short, second long, deeply notched; anal (1), 40 to 43, deeply notched; pelvic, 6 to 8, thoracic; pectoral, long, tip reaching to anal; caudal, truncate. Lateral line: moderately decurved, then nearly straight. Scales: cycloid, very small, deciduous. Colour: dull silvery gray; black speckling on dorsal surface; brown on pectoral fins; jet black on inside of mouth and opercles.

Length to 3 feet.

Distinguished by the two dorsal fins, the first short, the second long and deeply notched, the large mouth with the protruding lower jaw, the large eyes and the ridges on the top of the head.

The hake was first taken in British Columbia waters in 1885 near Gabriola island by Dr. G. M. Dawson and recorded in 1887 by J. F. Whiteaves as *Merluccius productus* Ayres (evidently a misprint for *Merluccius*). It is common along the whole coast. This fish is a frequent source of annoyance to the salmon fishermen at the mouth of the Fraser river as it gills in their nets, particularly at night. The young are captured occasionally in shrimp trawls at depths of 50 fathoms and more. Off the California coast the hake has been reported from 491 fathoms. The food consists of small fishes and squids. Because of the soft flesh and lack of flavour the hake seldom reaches the markets.

Range southern California to northwestern Alaska.

In the cods the mouth is terminal with the lower jaw projecting or included or is subterminal. A barbel is usually present at the tip of the lower jaw but it may be minute or absent in some forms. The frontal bones are united without ridges. The dorsal and anal fins are variously divided.

The members of this family are mostly fishes of the colder waters and constitute one of the most important commercial groups. In the north Pacific area occur the cod, whiting, tomcod and long-finned cod. These are represented in the north Atlantic by closely related species and in addition there occur the haddock, pollack, and several other species of lesser economic value. There is one fresh-water member of the family, namely the ling (burbot, lawyer, or loche), which occurs in the larger lakes and streams across North America as well as across northern Asia and Europe.

It might be well to point out that several fishes in the Pacific have erroneously been called "cods" such as: the rock-fishes (rock cods), Scorpaenidae; the greenlings (tommy-cod), Hexagrammidae; the sable-fish (black cod), *Anoplopoma fimbria*; the lingcod (cultus cod), *Ophiodon elongatus*. None of the above fishes is in any way related to the true cod, *Gadus*, and it would be advisable to suppress the common names given in brackets.

Whiting

Theragra chalcogramma (Pallas) 1811

Body elongate, moderately compressed. Head pointed; mouth terminal, moderate; lower jaw slightly projecting; teeth on jaws villiform, outer row on upper jaw slightly enlarged; eye moderately large, diameter 3.3 to 4.7 in length

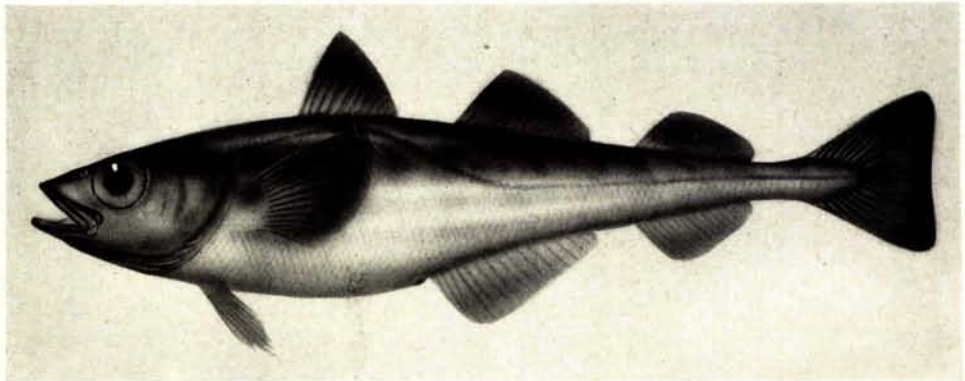


FIGURE 72. Whiting. *Theragra chalcogramma* (Pallas) 1811

of head; barbel on lower jaw, absent or minute. Anus below interspace between first and second dorsal fins. Fins: dorsal (3), 10 to 13—12 to 18—14 to 20, well separated; anal (2), 15 to 22—15 to 21; pelvic, 6 or 7, thoracic; caudal, concave.

Lateral line: high anteriorly, then straight. Scales: cycloid, small. Colour: olive green to brown on dorsal surface, frequently blotched or mottled; silvery on sides; lighter on ventral surface; dusky to black on fins; in young, two narrow light yellow bands along sides, occasionally short third band.

Length to 3 feet.

Distinguished by the three dorsal fins, the projecting lower jaw, the position of the anus below the interspace between the first and second dorsal fins and the minute barbel on the lower jaw, when present.

The whiting was first taken in British Columbia waters August 2, 1881, at the head of Kingcome inlet by Capt. H. E. Nichols, and recorded in the same year by T. H. Bean as *Pollachius chalcogrammus* (Pallas). It occurs abundantly along the coast and is taken in waters of moderate depth where it feeds upon crustaceans of the plankton. Considerable quantities are caught in seines and trawls and find a ready market. While the name Alaska pollack has been used for this species, the term whiting is just as appropriate and since the fishermen know the fish under the latter name its adoption seems advisable. It should be pointed out that the whiting of Great Britain is not the same species, although belonging to the cod family. The northern and southern individuals of the Pacific coast differ somewhat in the numbers of fin rays and have been given subspecific names. Those of northern British Columbia and Alaska have the higher fin ray counts and are referred to as *T. chalcogramma chalcogramma*, while those of southern British Columbia and Washington have the lower fin ray counts and are referred to as *T. chalcogramma fucensis*. Undoubtedly intergrading forms occur along the coast of British Columbia.

Range northern California to northwestern Alaska.

Tomcod

Microgadus proximus (Girard) 1854

Body elongate, slender, moderately compressed. Head elongate, convex above; mouth terminal, moderate; lower jaw included; teeth on jaws, villiform, outer row on each jaw slightly enlarged; eye moderately small, diameter about 5 in length of head; barbel on lower jaw small, length about 2 in diameter of eye. Anus below first dorsal fin. Fins: dorsal (3), 11 to 14—17 to 20—18 to 20, slightly separated; anal (2), 20 to 25—18 to 21; pelvic, 6 or 7, thoracic; caudal, truncate or slightly concave. Lateral line: high anteriorly, then straight. Scales: cycloid, small. Colour: olive green on dorsal surface; creamy white on ventral surface; dusky on tips of dorsal, pectoral, second anal and caudal fins.

Length to 12 inches.

Distinguished by the three dorsal fins, the position of the anus below the first dorsal fin and the small barbel on the lower jaw.

The tomcod was first taken in British Columbia waters in 1885 at Alert bay at a depth of 10 fathoms by Dr. G. M. Dawson and recorded in 1887 by J. F. Whiteaves as *Gadus proximus* Ayres. It occurs along the whole coast and appears in small quantities on the local markets, being taken by otter and shrimp trawls

at depths ranging from 15 to 50 fathoms. The tomcod apparently is much less abundant than the whiting.

Range northern California to northwestern Alaska.

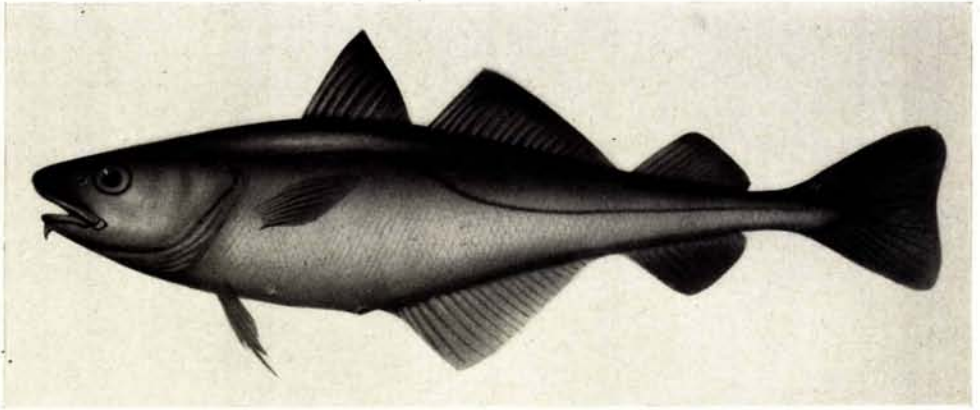


FIGURE 73. Tomcod. *Microgadus proximus* (Girard) 1854

Cod

Gadus macrocephalus Tilesius 1810

Body elongate, stout, moderately compressed. Head large; snout blunt; mouth terminal, moderate; lower jaw included; teeth on jaws cardiform, outer row on each jaw much enlarged; eye small, diameter about 6 in length of head; barbel on lower jaw long, at least as long as diameter of eye, longer in adults. Anus below second dorsal fin. Fins: dorsal (3), 11 to 14—14 to 21—14 to 20, well separated; anal (2), 16 to 24—14 to 19; pelvic, 6 or 7, thoracic; caudal, truncate or slightly concave. Lateral line: high anteriorly, then straight. Scales: cycloid, small. Colour: brown to gray on dorsal surface; lighter on ventral

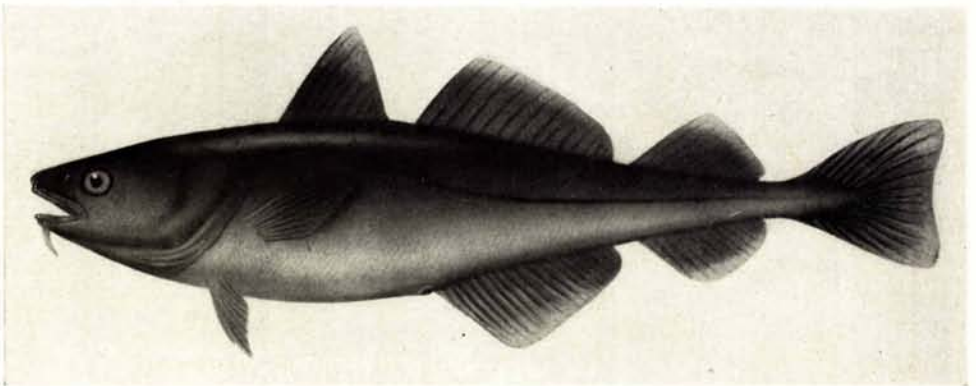


FIGURE 74. Cod. *Gadus macrocephalus* Tilesius 1810

surface; brownish spots numerous on back and sides; more or less dusky on fins; white on outer margins of all vertical fins, wider on anal and caudal fins.

Length to 3 feet 3 inches.

Distinguished by the three dorsal fins, the position of the anus below the second dorsal fin and the long barbel on the lower jaw.

The cod was first taken in British Columbia waters July 27, 1881, at Quadra island in Drew harbour, by Capt. H. E. Nichols, and recorded in the same year by T. H. Bean as *Gadus morrhua* Linn. A specimen taken in 1903 off Fort Rupert, at *Albatross* station 4202, was recorded as *Eleginus navaga* (Kölreuter) by B. W. Evermann and E. L. Goldsborough but was subsequently shown by L. P. Schultz and A. D. Welander in 1935 to be a *Gadus macrocephalus*. The species is common along the whole coast, particularly in the north. It is the true cod of the Pacific, resembling the Atlantic species, *G. morrhua*, very closely in appearance and habits. There appears to be something of a migration from deep to shallow water at certain seasons of the year. Specimens have been taken at depths of 130 fathoms as well as in shallow water around wharves. Spawning takes place in winter and early spring and undoubtedly the eggs are pelagic as are those of the Atlantic cod. Apparently feeding takes place near or at the bottom, the food consisting largely of fishes, of which herring and sand-lances form a considerable proportion, as well as various crustaceans. It is captured frequently on halibut gear and in trawls and marketed as fresh fish in the round or as filets but a small quantity is smoked or drysalted. The cod is an excellent food product if after capture it is dressed immediately and iced with a minimum of handling.

Range Oregon to northwestern Alaska.

Long-finned cod

Antimora rostrata Günther 1878

Body elongate, tapering considerably posteriorly, moderately compressed. Head pointed, compressed; snout acute, small sharp protuberance on tip in some specimens; mouth subterminal, large; teeth small, villiform; eye large, diameter 3.6 to 4.5 in length of head (about 3 in small specimens); barbel on lower jaw, long. Fins: dorsal (2), 4 or 5—50 to 55, first very short, first ray greatly elongate, second fin long, low; anal (1), 39 to 42, deeply notched; pelvic, 6 or 7, thoracic, first ray greatly elongate; caudal, truncate to emarginate. Lateral line: slightly decurved, then straight. Scales: cycloid, small. Colour: pale bluish gray to olive green.

Length to 21 inches.

Distinguished by the presence of two dorsal fins, the first short, the second very long, the single deeply notched anal fin and the short acutely rounded snout resembling that of a grenadier.

The long-finned cod was first taken in British Columbia waters August 29, 1888, when two specimens were obtained near cape St. James by the *Albatross*, station 2860, lat. 51° 23' N., long. 130° 34' W., depth 876 fathoms. The only subsequent capture is that of a specimen secured September 3, 1890, west of

Moresby island, *Albatross* station 3342, depth 1,588 fathoms. These fish were considered by T. H. Bean to constitute a new species, *Antimora microlepis*, and he recorded them as such in 1890. This species was subsequently shown by

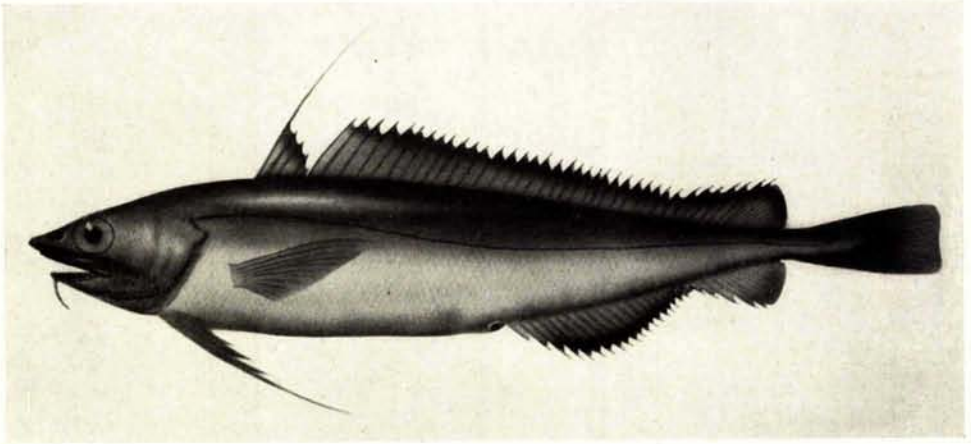


FIGURE 75. Long-finned cod. *Antimora rostrata* Günther 1878

W. C. Schroeder to be synonymous with *A. rostrata* Günther of the Atlantic. The long-finned cod is a deep-water species and probably will only be taken by scientific expeditions such as that of the *Albatross*.

Range southern California to northwestern Alaska.

Family MACRURIDAE

Grenadiers

In the grenadiers the body is deep anteriorly and tapers very gradually to a point. The head is large, with a prominent suborbital ridge. The mouth is subterminal and a barbel usually is present. There are two dorsal fins, the first short and high, the second very long and low; the anal fin is similar to the second dorsal but usually has longer rays; the caudal fin is absent; the pelvic fins have the outer ray greatly elongate.

This is a large family of deep-water fishes of wide distribution. The term rat-tails is sometimes applied to the members of this group.

Smooth-scaled grenadier

Dolloa cyclolepis (Gilbert) 1895

Body elongate, stout anteriorly, tapering to point posteriorly. Head large, compressed, smooth; snout pointed, projecting beyond premaxillaries; mouth subterminal, small; teeth on upper jaw in two rows, outer small, inner smaller, pointing backward, on lower jaw in one row; eye small, diameter about 5 in length of head; barbel on lower jaw short, about 1.5 in length of snout. Anus below interspace between dorsal fins. Fins: dorsal (2), 10 or 11 (ray count of second

dorsal, unknown), first fin short, high, first two rays stiff, first elongate, minutely spinous, second fin very long, low, inconspicuous, interspace longer than length of base of first dorsal fin; anal (ray count, unknown), long, low; pelvic, 12, thoracic; caudal, absent. Lateral line: decurved, then straight. Scales: cycloid, small, keeled, spinules few or absent. Colour: dark brown on dorsal surface; black on

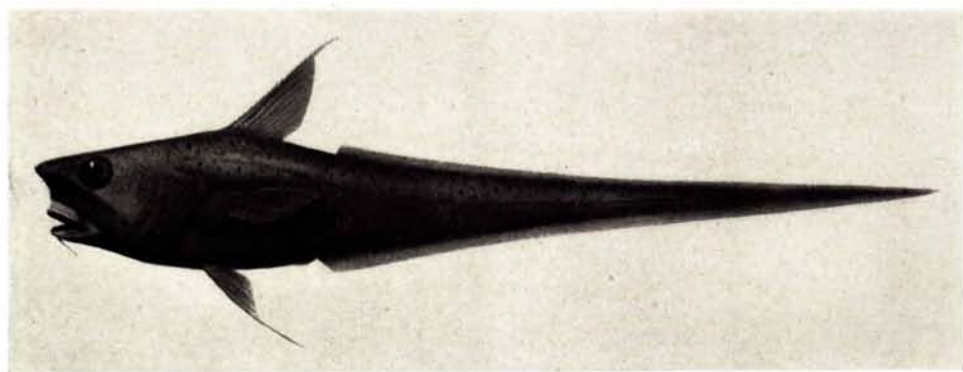


FIGURE 76. Smooth-scaled grenadier. *Dolloa cyclolepis* (Gilbert) 1895

ventral surface; black dots scattered over anterior of back and sides; black on lower side of head, opercles, gill membranes, lining of mouth and peritoneum.

Length to 6 inches.

Distinguished by the absence of a caudal fin, the presence of a barbel on the lower jaw, the interspace between the dorsal fins longer than the base of the first dorsal fin and the anus below the interspace between the dorsal fins.

The smooth-scaled grenadier is known from two specimens taken September 3, 1890, west of Moresby island by the *Albatross*, station 3342, lat. 52° 39' N., long. 132° 38' W., depth 1,588 fathoms. One of these is the type which was described in 1895 by C. H. Gilbert as *Nematonurus cyclolepis* and deposited in the United States National Museum.

Range off the Queen Charlotte islands.

Filamented grenadier

Chalinura filifera Gilbert 1895

Body elongate, stout anteriorly, tapering to point posteriorly. Head large, compressed, rough; snout pointed, projecting beyond premaxillaries; mouth sub-terminal, large; teeth on upper jaw in villiform band, in outermost row enlarged; on lower jaw in one row, large; eye moderate, diameter about 4 in length of head; barbel on lower jaw short, 2 to 2.5 in length of snout. Anus below second dorsal fin. Fins: dorsal (2), 14 to 16 (ray count of second dorsal, unknown), first fin short, high, second ray elongate, slender, smooth at base, strongly spinous on upper half, second fin very long, low, inconspicuous, interspace more than half length of base of first dorsal fin; anal (ray count, unknown), long, low; pelvic,

9 or 10, thoracic; caudal, absent. Lateral line: decurved, then straight. Scales: cycloid, small, spinules numerous, short, rigid. Colour: dark brown; black on fins, nostrils, ventral surface of snout, lips and gill membranes.

Length to $22\frac{1}{2}$ inches.

Distinguished by the absence of a caudal fin, the presence of a short barbel on the lower jaw, the interspace between the dorsal fins more than half the length

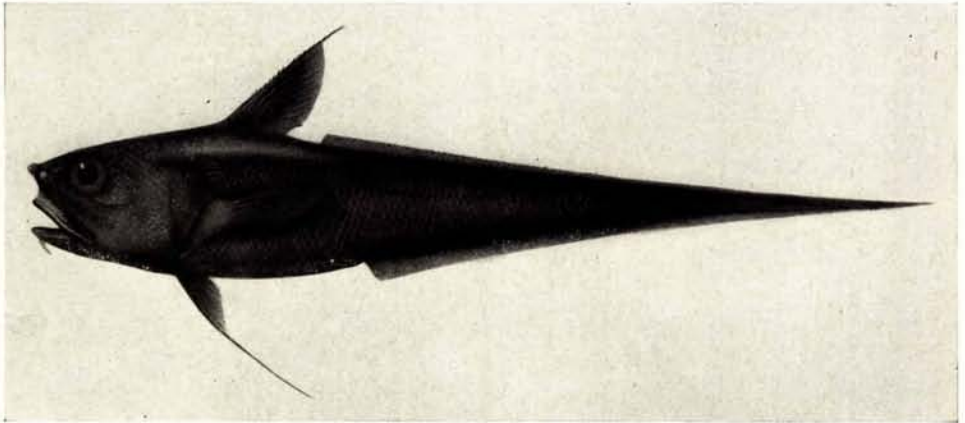


FIGURE 77. Filamented grenadier. *Chalinura filifera* Gilbert 1895

of the base of the first dorsal fin, the anus below the second dorsal fin, the 14 to 16 rays in the first dorsal fin and the 9 or 10 rays in the pelvic fin.

The filamented grenadier is known from three specimens taken September 3, 1890, west of Moresby island by the *Albatross*, station 3342, lat. $52^{\circ} 39' N.$, long. $132^{\circ} 38' W.$, depth 1,588 fathoms. One of these is the type which was described in 1895 by C. H. Gilbert and deposited in the United States National Museum.

Range off the Queen Charlotte islands.

Rough-scaled grenadier

Macrurus acrolepis Bean 1883

Body elongate, stout anteriorly, tapering to point posteriorly. Head large, compressed, rough; suborbital ridge prominent; snout pointed, projecting beyond premaxillaries; mouth subterminal, moderate; teeth on both jaws in villiform bands, those on outer series not enlarged; eye large, diameter about 3.5 in length of head; barbel on lower jaw long, about equal to length of snout. Anus below second dorsal fin. Fins: dorsal (2), 11 to 13—111 +, first fin short, high, first ray very short, second elongate, spinous; second fin very long, low, inconspicuous, interspace less than half length of base of first dorsal fin; anal, 94 +, long, low; pelvic, about 10, thoracic; caudal, absent. Lateral line: decurved, then straight.

Scales: cycloid, small, keeled, spinules numerous, short, rigid. Colour: dark brown to black on dorsal surface; lighter on ventral surface.

Length to $2\frac{1}{2}$ feet.

Distinguished by the absence of a caudal fin, the presence of a long barbel on the lower jaw, the interspace between the dorsal fins less than half the length of the base of the first dorsal fin and the anus below the second dorsal fin.

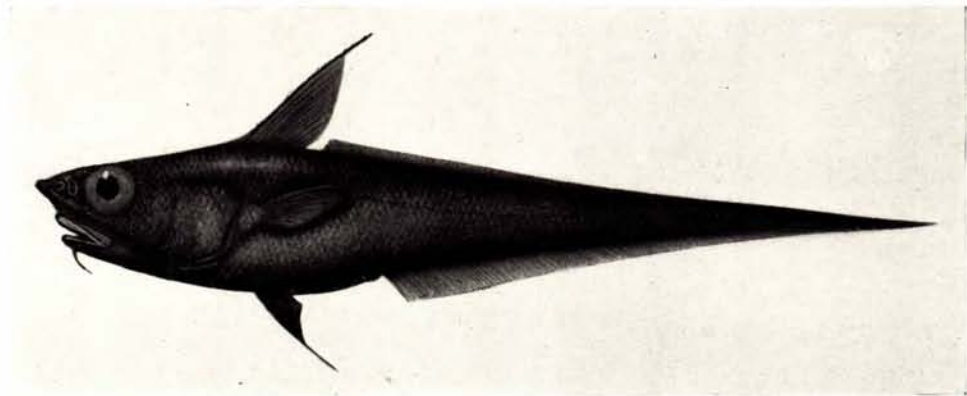


FIGURE 78. Rough-scaled grenadier. *Macrurus acrolepis* Bean 1883

The rough-scaled grenadier was first taken in 1882 by Mr. J. G. Swan who discovered a specimen in the stomach of a fur-seal captured in Juan de Fuca strait off Neah bay and landed at Port Townsend. This is the type which was recorded in 1883 by T. H. Bean and deposited in the United States National Museum. The record is included here as the fish may well have been caught in the waters north and west of the International boundary line. In 1895 this species was recorded by C. H. Gilbert who said that it was common off Vancouver island. Records from areas outside of Canadian waters indicate a range of depths from 345 to 1,217 fathoms.

Range southern California to northwestern Alaska.

Order ALLOTRIognathi

In this order the body varies from deep ovate to elongate slender. The fins are soft-rayed; the pelvic fins, when present, are thoracic; the dorsal fin is long and usually high anteriorly; the pectoral fins have their bases horizontal. The mouth is protrusible through the action of the protractile premaxillary and maxillary bones.

The diversity of shape, structure and size of the various fishes in this group is amazing as shown by the large oval compressed body of the opah, the long, slender, ribbon-like form of the king-of-the-salmon and the bizarre 11-inch very slender *Stylophorus* of the Atlantic depths with extremely protractile jaws,

telescopic eyes and whip-like caudal appendage almost twice the length of the body.

Two families are represented in British Columbia waters, Lampridae and Trachypteridae.

Family LAMPRIDAE

Moon-fishes

There is but a single species in this family, the opah or moon-fish, which occurs in all seas. It is remarkable because of the size attained, the deeply ovate body and the brilliant coloration.

Opah

Lampris regius (Bonnaterre) 1788

Body ovate, deep, much compressed; caudal peduncle short, slender. Head deep, compressed; mouth terminal, moderate; maxillary protractile; teeth, absent; eye, large. Fins: dorsal (1), 48 or 49, high, falcate anteriorly, low posteriorly; anal, 33 or 34, long, low; both dorsal and anal fins depressible into deep grooves;

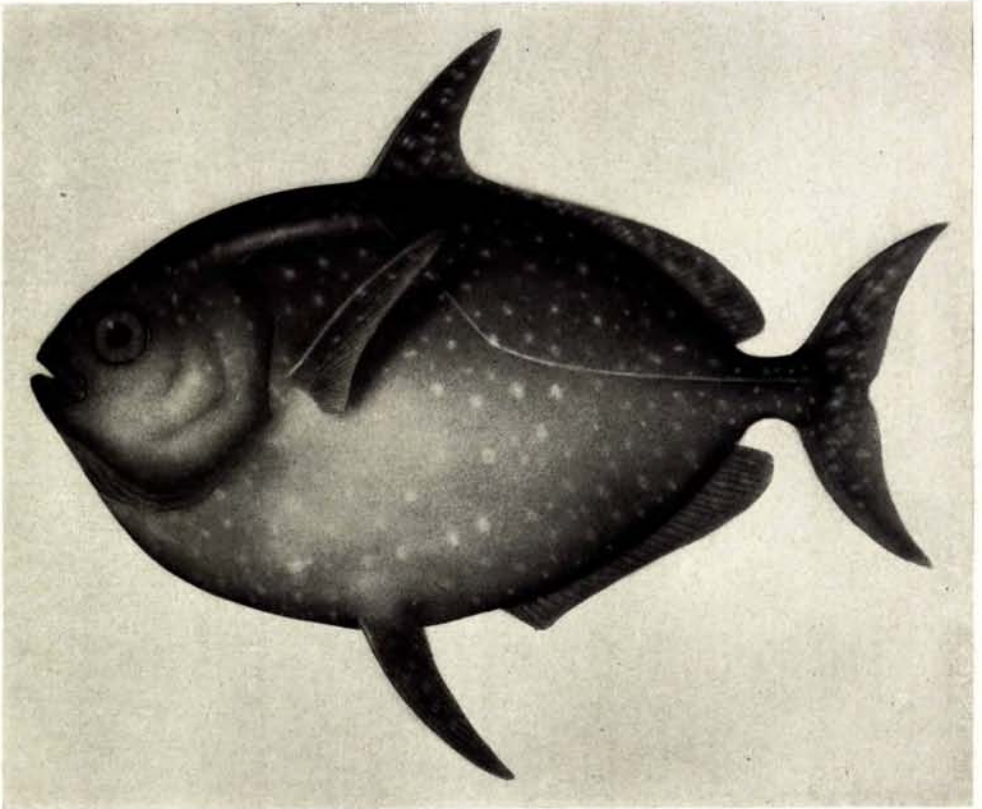


FIGURE 79. Opah. *Lampris regius* (Bonnaterre) 1788

pelvic, 14 to 17, thoracic, long; pectoral, 20 to 22, long, falcate; caudal, broadly lunate. Lateral line: very highly arched above pectoral fin, straight posteriorly. Scales: cycloid, minute. Colour: steely blue to dark bluish gray on dorsal surface, shading to silver flushed with rose red on ventral surface; white or silvery spots numerous, round; white on lateral line; golden around eyes; vermilion on jaws and fins, white mottling on dorsal and caudal fins.

Length to 6 feet.

Distinguished by the deep, ovate, much compressed body, the dorsal fin high and falcate in front, the silvery spotting and the brilliant coloration.

The opah was first taken in British Columbia waters August 25, 1935, off the west coast of Vancouver island 20 miles south of Lennard light on a brass salmon- spoon at about 10 fathoms below the surface. It was recorded anonymously the same year as *Lampris luna*, which name should be replaced by *Lampris regius*. Two other specimens taken in July, 1936, off Kyuquot and in September, 1937, near cape Beale were recorded in 1938 by I. McT. Cowan as *Lampris luna* (Gmelin). A number of other individuals have been reported since from time to time from the same general area. This fish is an inhabitant of the open waters, usually of the warmer seas, and is of world-wide distribution. The species attains a very large size and weights of 500 and 600 pounds have been recorded. It is one of the most beautifully coloured of marine fishes. The food consists of crustaceans, squid and small fishes. The flesh is salmon red of various shades, oily, and is said to be of excellent flavour and is used for food in Europe and Japan. Various names other than opah have been applied to this fish such as: moon-fish, mariposa, Jerusalem haddock, etc.

Range southern California to northwestern Alaska.

Family TRACHYPTERIDAE

Ribbon-fishes

In the ribbon-fishes the body is long ribbon or band-shaped and extremely flexible because of the weakly ossified skeleton. The caudal fin is divided into two portions, the upper large, fan-shaped, the lower present in the young, usually disappearing in the adult; the anal fin is absent.

While these are evidently deep-sea fishes, occasionally individuals are observed swimming at the surface of the water and specimens are sometimes found washed up on shore.

Fishermen in various parts of the world have considered them as more or less sacred, believing that if harmed such schooling fishes as herring and salmon leave the fishing ground, hence such names as, king-of-the-herring and king-of-the-salmon have been given to these fishes.

King-of-the-salmon *Trachypterus rex-salmonorum* Jordan and Gilbert 1894

Body elongate, greatly compressed, ribbon-like. Head pointed, profile steep, nearly straight; mouth terminal, small; maxillary very broad, protractile; teeth on jaws few, canine-like. Fins: dorsal (1), 166 to 188, first 5 rays greatly elongate;

anal, absent; pelvic, 6, thoracic, elongate, sometimes absent in large individuals; pectoral, very small; caudal, 13, asymmetrical, upper lobe developed into large fan-shaped structure directed obliquely upward from end of caudal peduncle, supported by 8 rays, lower lobe supported by 5 rays, fourth extremely elongate in young. Lateral line: straight. Scales: in form of pad-like tubercles; on lower portion of body, numerous, small, conical; on lateral line, conical, spinous, more numerous posteriorly. Colour: iridescent silvery; jet black patch on front of head, another, oblong in form, at base of dorsal fin slightly behind head; dusky

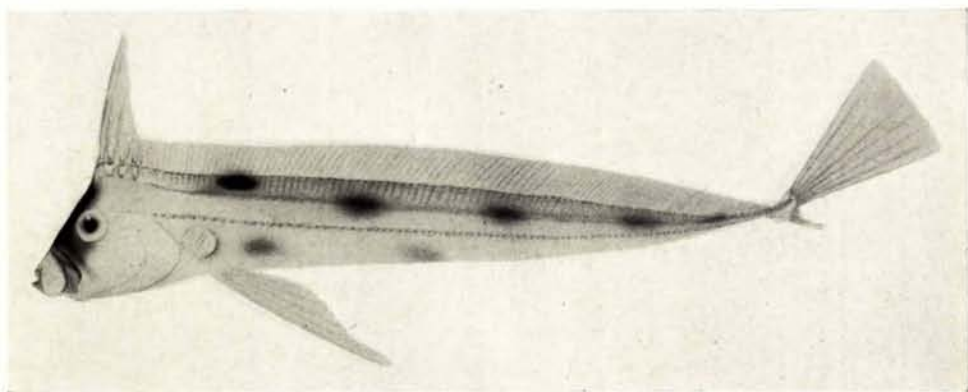


FIGURE 80. King-of-the-salmon. *Trachipterus rex-salmonorum* Jordan and Gilbert 1894

areas on each side of body above lateral line, 4, below lateral line, 2; carmine red on dorsal, pelvic and caudal fins in life.

Length to 8 feet.

Distinguished by the ribbon-shaped body, the high anterior portion of the long dorsal fin, the absence of an anal fin and the greatly developed upper lobe of the caudal fin.

The king-of-the-salmon was first taken in British Columbia waters in 1907 off Sherringham point in a salmon-trap and it, together with a second individual obtained in August, 1908, are now in the collection of the Provincial Museum at Victoria. These specimens were recorded in 1923 by H. W. Fowler as *Trachipterus rex-salmonorum* Jordan and Gilbert. On January 20, 1935, an individual was found on the beach at Pender island. On February 6, 1943, a female 5 feet 11 inches in total length was taken on a salmon-spoon off Sooke harbour and early in the same year another individual 5½ feet in length was captured off Barkley sound. A small specimen 5½ inches in total length, in excellent condition, was captured in June, 1941, near the wharf at Nootka, with both pelvic and caudal fins well developed. The young of this species have been secured rather frequently in southern California waters. They differ markedly from the adults in form of body and fin characters and undergo an extensive metamorphosis

during development. In the larval stage the dorsal and pelvic fin rays are greatly elongate and very delicate, evidently serving as flotation organs. As development continues these elongate rays gradually shorten or break off until in some adults the pelvic fins may disappear. The lower lobe of the caudal fin is best developed in the young but it gradually becomes reduced in size to a mere projection while the upper grows rapidly, bends forward and upward until it forms a large fan-shaped structure.

Range southern California to Vancouver island.

Order BERYCOMORPHI

In this order the body is stout and covered with cycloid scales. The mouth is bordered above by protrusible premaxillaries. The anterior portions of the vertical fins are spinous; the pelvic fins are thoracic, each with 1 spine and 3 to 13 rays; the caudal fin has 19 principal rays, the outer two unbranched, and usually 3 to 5 short spines above and below.

The order appears to be intermediate between the orders Isospondyli and Percomorphi on the basis of the above and other characters, especially those of the skull.

There are about eleven families in the order, but only one, the Melamphidae, is represented in British Columbia waters.

Family MELAMPHAIDAE

Melamphids

In the melamphids the bones of the head are thin and paper-like, the whole skull being soft and spongy and frequently raised into soft ridges and spines. The superficial bones are penetrated by numerous wide muciferous tubes.

These are oceanic fishes found at considerable depths, usually brown to black in colour.

Crested melamphid

Melamphaes rugosus Chapman 1939

Body elongate, stout; caudal peduncle elongate. Head large, deep, blunt, sculptured; mouth terminal, large, oblique; lower jaw projecting; teeth small, villiform, on premaxillaries and dentaries; snout high, sloping; eye moderate, diameter about 5.8 in length of head; rostral spine, prominent; frontal crest conspicuous, crenulate. Fins: dorsal (1), III, 12, short; anal, I, 9; pelvic, I, 7, thoracic; pectoral, 13, long, slender, longer than head; caudal, III, 19, III, furcate. Lateral line: absent. Scales: cycloid, large; in oblique rows above midline of body, about 25. Colour: black.

Length to 3.7 inches.

Distinguished by the sculptured head, the prominent crest on the top of the head and the prominent rostral spine.

The crested melamphid has been taken once in British Columbia waters, February 9, 1939, off the west coast of Moresby island by the International Fisheries Commission, station 1763C, lat. 52° 23' N., long. 132° 04' W., in a

vertical net haul, depth between 487 and 379 fathoms. The single specimen obtained was loaned from the Commission's collection by the Director, Mr. H. A. Dunlop, who also supplied the accompanying data, heretofore unpublished.

Range northern British Columbia to northwestern Alaska.

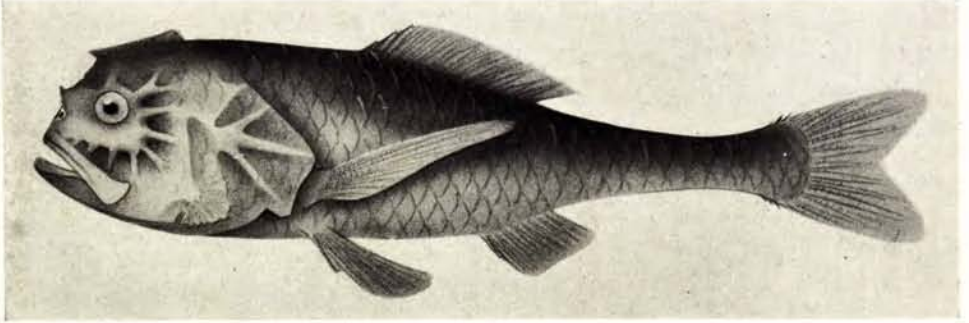


FIGURE 81. Crested melamphid. *Melamphaes rugosus* Chapman 1939

High-snouted melamphid

Melamphaes cavernosus Chapman 1939

Body elongate, stout; caudal peduncle elongate. Head large, deep, blunt, sculptured; mouth terminal, large, oblique; lower jaw projecting; teeth small, villiform on each jaw; snout high, vertical; eye small, diameter 6.2 to 7.1 in length of head; rostral spine, absent; frontal crest, absent. Fins: dorsal (1), III, 15 or 16, short; anal, I, 8 or 9; pelvic, I, 7, thoracic; pectoral, 15 or 16, elongate, shorter than head; caudal, III to V, 19, III, furcate. Lateral line: absent. Scales: cycloid, large; in oblique rows above midline of body, 29 to 31. Colour: black.

Length to 3 inches.

Distinguished by the sculptured head, the high vertical snout, the absence of a crest from the top of the head and the absence of a rostral spine.

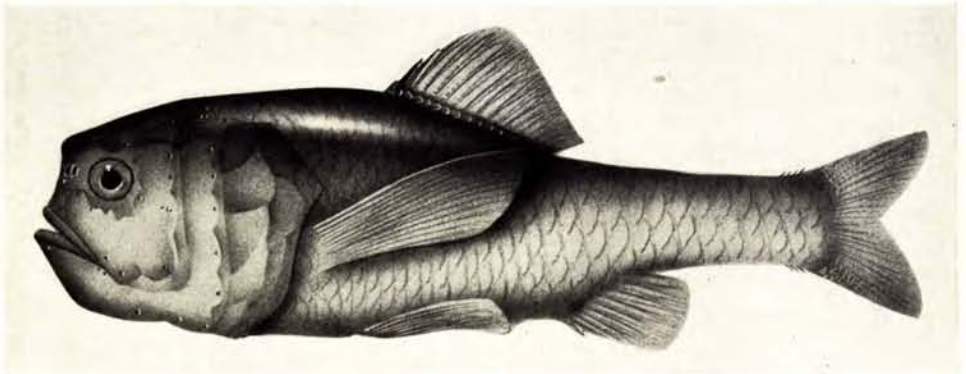


FIGURE 82. High-snouted melamphid. *Melamphaes cavernosus* Chapman 1939

The high-snouted melamphid is known from British Columbia waters by a single specimen taken March 13, 1934, in Queen Charlotte sound by the International Fisheries Commission, station 1119C, lat. 51° 45' N., long. 131° 54' W., in a vertical net haul between 487 and 379 fathoms and recorded in 1939 by W. M. Chapman. The type was obtained June 8, 1932, in the gulf of Alaska.

Range northern British Columbia to northwestern Alaska.

Order PERCOMORPHI

In this order are included fishes of very diverse form and size. The pelvic fins are thoracic, each with 1 spine and not more than 5 rays; however, they may be absent; the caudal fin never has more than 17 principal rays, the outer two unbranched. There is no backward projection of any of the suborbital bones to reach the preopercular bone and thus form a bony stay across the cheek.

This order embraces fifteen or more suborders of which nine are represented in British Columbia waters.

Suborder PERCOIDEA

The fishes in this suborder are very diversified in shape, the most generalized of which have a perch form of body. The pelvic fins are thoracic, each with 1 spine and 5 rays.

In this suborder are recognized some eighty families which vary much in external features but are similar in detailed structure. The following families are represented in British Columbia marine waters: Bramidae, pomfrets; Sciaenidae, croakers; Embiotocidae, sea-perches; Trichodontidae, sand-fishes; Bathymasteridae, ronquils. In addition, but not included in the present description, there are represented in the fresh waters of the province the yellow perch and the black basses.

Family BRAMIDAE

Pomfrets

In the pomfrets the body is strongly compressed, deep anteriorly and terminating posteriorly in a slender caudal peduncle. The profile of the head is rounded. The dorsal and anal fins are long, spinous anteriorly; the pectoral fins are long and pointed; the caudal fin is deeply lunate or furcate.

These are fishes of the open seas and are said to descend to considerable depths. The common pomfret, or Ray's bream, reaches a large size and is widely distributed in both the Atlantic and Pacific oceans. The name *Brama* was applied because of a fancied resemblance to the fresh-water bream.

Pomfret

Brama raii (Bloch) 1791

Body moderately elongate, deep, strongly compressed; caudal peduncle slender. Head deep, compressed, profile rounded; mouth terminal, moderate; snout nearly vertical. Fins: dorsal (1), III, 30 to 33, long, anterior portion elevated, membranes expanded laterally from each spine and ray; anal, II or III,

25 to 27, long, anterior portion elevated, membranes expanded laterally from each spine and ray; pelvic, 1, 5, thoracic, small, with small fleshy appendage at base, lateral fringes on spine; pectoral, longer than head, falcate; caudal very broad, lunate, membranes expanded laterally from each ray. Lateral line: up-curved anteriorly, nearly straight posteriorly. Scales: cycloid; on side of body wider than long, each with vertical ridge, exposed portion thin; on lateral line, 80 to 84. Colour: dusky to black with bright silvery iridescence; black on snout and opercle; black on margins of dorsal and caudal fins.

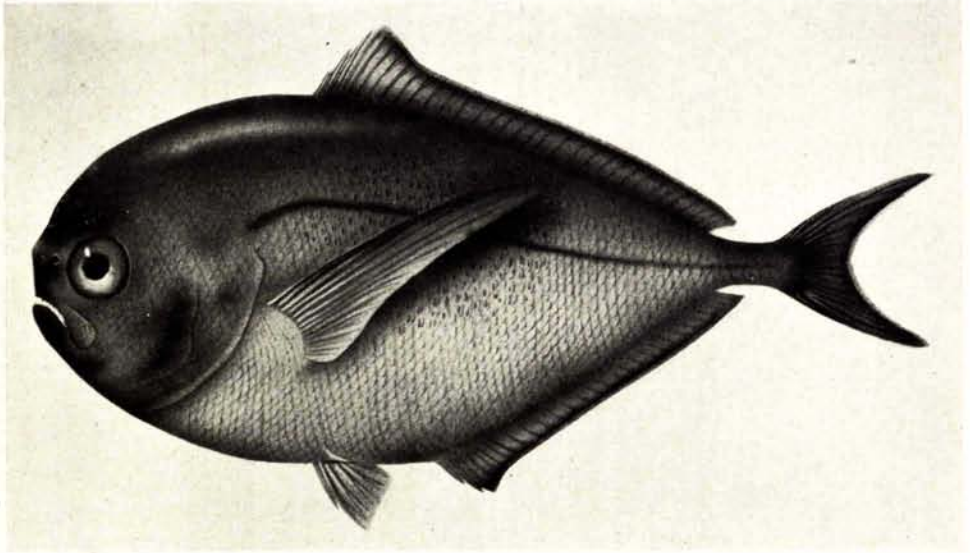


FIGURE 83. Pomfret. *Brama raii* (Bloch) 1791

Length to 4 feet.

Distinguished by the strongly compressed scaly body, the nearly vertical snout, the fleshy appendage at the base of each pelvic fin and the slender caudal peduncle with the very broadly lunate caudal fin.

The pomfret was first recorded from British Columbia waters in 1883 by T. H. Bean, who reported, on the authority of Mr. J. G. Swan, that it was not uncommon off Vancouver island. The second specimen known to be taken in these waters was one obtained July 27, 1926, at Ucluelet by Dr. H. C. Williamson and now in the collection of the Royal Ontario Museum of Zoology at Toronto. In some years the species occurs in considerable numbers off the west coast of Vancouver island and the Queen Charlotte islands. Specimens have been secured off Kyuquot, Port Hardy and near Prince Rupert off the Skeena river. Off the Queen Charlotte islands these fish were reported as being so abundant for one day in the summer of 1929 that they interfered with salmon-trolling oper-

ations. The pomfret is also referred to as Ray's bream. It is said to be an excellent food fish.

Range southern California to northwestern Alaska.

Family SCIAENIDAE

Croakers

In the croakers the body is elongate, somewhat compressed. The maxillary is received under a broad preorbital. The scales are weakly ctenoid, covering body and head, sometimes extending onto the fins. The dorsal fin is deeply notched or divided into two distinct fins, the spinous portion usually being triangular in shape; the pelvic fins are thoracic.

This family consists of approximately 150 species, the majority of which are found in warm seas. Most of the species have the peculiarity of making noises like humming, grunting or croaking which are produced by the vibrations of the air-bladder, hence they are referred to as the croakers. The otoliths, or ear-bones, are large and are sometimes used as ornaments or carried as "lucky-stones."

White sea-bass

Cynoscion nobilis (Ayres) 1860

Body elongate, somewhat compressed. Head pointed; mouth terminal, large; lower jaw slightly projecting; maxillary extending to point behind eye; preopercle minutely crenulate posteriorly. Fins: dorsal (2), IX or X—I, 20 to 23, sometimes scarcely connected by membrane; anal, II, 8 or 9, far back on body,

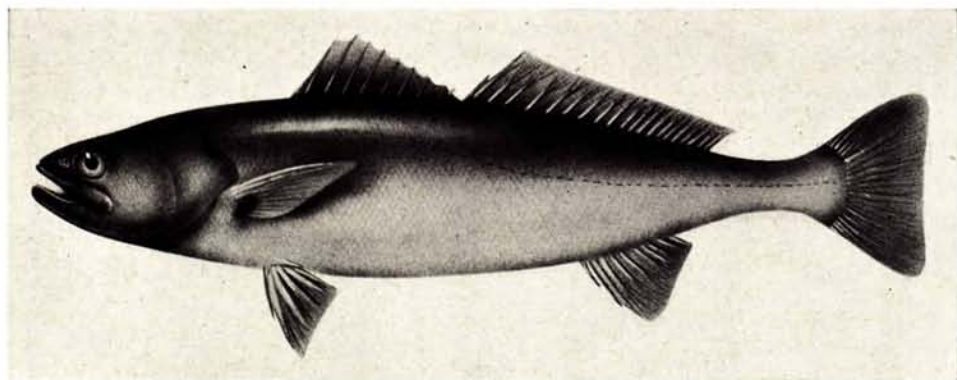


FIGURE 84. White sea-bass. *Cynoscion nobilis* (Ayres) 1860

base about one-third that of rayed dorsal; pelvic, I, 5, thoracic, with fleshy appendage at base; pectoral shorter than head, pointed; caudal, truncate. Lateral line: high, decurved, then straight. Scales: weakly ctenoid; on body and head even to tip of snout; on lateral line, about 88; in diagonal row above lateral line, 12 or 13; in diagonal row below lateral line, 24 to 27. Colour: metallic blue to coppery on dorsal surface; frosted silvery on ventral surface; dark points, very

fine, everywhere dusted over body; black spot prominent on inner base of each pectoral fin, extending onto body.

Length to 6 feet.

Distinguished by the short anal fin with 2 spines and 8 or 9 rays, the fleshy appendage at the base of each pelvic fin, the slightly projecting lower jaw, the dusky metallic blue to coppery coloration and the prominent black spot at the base of each pectoral fin.

The white sea-bass was first taken in British Columbia waters in January, 1893, at Sooke where a specimen weighing 45 pounds was discovered floating by Sir Clive Phillips Wolley. The occurrence was recorded in the same year by D. S. Jordan as *Cynoscion nobilis* and by Ashdown Green as *Atractoscion nobilis* (Ayres). A second individual was obtained July 15, 1906, in a fish-trap at Sherringham point and is now in the Provincial Museum at Victoria. The species is observed occasionally in Juan de Fuca strait and on the west coast of Vancouver island. In California waters it is abundant, ranking about seventh among the marketable fishes and is not only an excellent food fish but is highly prized by sport fishermen. Spawning occurs from March to August near kelp beds. The food consists of pilchards, herring, anchovies, smelts, crustaceans, squids, etc.

Range southern California to southeastern Alaska.

King-fish

Genyonemus lineatus (Ayres) 1855

Body elongate, somewhat compressed. Head bluntly rounded; mouth subterminal, lower jaw included; maxillary extending to point below anterior margin of eye; barbels on membrane below lower jaw, minute, in 2 to 5 pairs; preopercle minutely crenulate posteriorly. Fins: dorsal (2), XII to XV—I, 21 to 24; anal, II, 10 to 12, far back on body, base about one-third that of rayed dorsal, spines weak; pelvic, I, 5, thoracic; pectoral shorter than head, pointed;

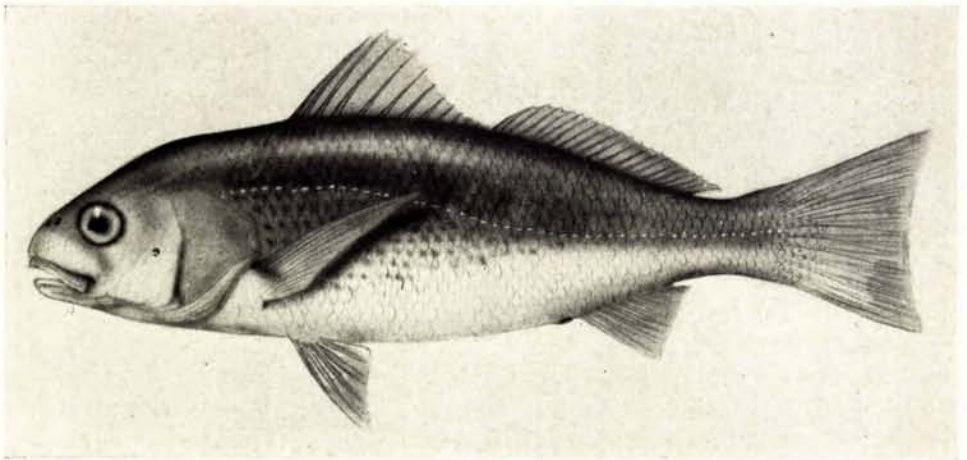


FIGURE 85. King-fish. *Genyonemus lineatus* (Ayres) 1855

caudal, slightly furcate. Lateral line: high, decurved, then straight. Scales: weakly ctenoid; on lateral line, 52 to 54; in diagonal row above lateral line, 7 to 9; in diagonal row below lateral line, 14 to 16. Colour: silvery on dorsal surface; silvery to white on ventral surface; dark points outlining scales; black spot prominent on inner base of each pectoral fin, extending onto body.

Length to 13 inches.

Distinguished by the short anal fin with 2 weak spines and 10 to 12 rays, the minute barbels on the membranes below the subterminal lower jaw and the prominent black spot at the base of each pectoral fin.

The king-fish was first taken in British Columbia waters September 8, 1945, in Barkley sound in Mayne bay at a depth of 10 fathoms in a trawl by Mr. G. H. Smith and the specimen is now in the Provincial Museum at Victoria. This record extends the known range of the species northward from California. The king-fish is common along the coast of California and southward at depths of about 30 fathoms, occurring in small schools. It enters to some extent into the commercial fishery. Spawning occurs from November to May. The food consists of worms, small crustaceans and molluscs.

Range southern California to Vancouver island.

Family EMBIOTOCIDAE

Sea-perches

In the sea-perches the body is compressed, elliptical in outline, with a furrow on each side of the base of the dorsal fin. The lips are thick and fleshy, the lower either forming a free border to the jaw or else attached thereto at the symphysis by a frenum. The dorsal fin is spinous anteriorly, rayed posteriorly; the anal fin has 3 spines with 15 to 35 rays, the anterior portion frequently modified into a thickened glandular structure in the males; the pelvic fins are thoracic, each with 1 spine and 5 rays; the caudal fin is deeply furcate. The scales are cycloid on the body and the sides of the head and form a sheath along the base of the dorsal fin; in the majority of the species the rows of scales above the lateral line tend to follow the dorsal contour of the body while those below tend to be in straight longitudinal lines. The lateral line is continuous and high on the body.

The sea-perches occur in schools and live as a rule in the shallow waters along rocky or sandy beaches or around wharves and kelp beds. They give birth to young of considerable size. The young, while in the oviducts, have very large median fins with fimbriated margins which undoubtedly serve as respiratory structures.

The family comprises about twenty genera distributed along the shores of the north Pacific. The species are all marine except for one which lives in streams in northern California.

Yellow shiner

Cymatogaster aggregatus Gibbons 1854

Body somewhat elongate, elliptical, compressed; caudal peduncle short, slender, least depth 8.5 to 9 in standard length. Head small; mouth terminal, small; no frenum between lower lip and symphysis of lower jaw. Fins: dorsal (1), IX or X, 18 to 23, low, rayed portion long; anal, III, 23 to 25; pelvic, I, 5, thoracic;

caudal, furcate. Lateral line: high on body anteriorly. Scales: cycloid, large; on lateral line, 38 to 46; in sheath along base of dorsal fin demarked from scales of body by pronounced furrow. Colour: silvery; dusky on dorsal surface; dark points in clusters on lower portion of sides, particularly on anterior half, forming series of longitudinal stripes tapering off posteriorly; light yellow bars across sides below lateral line, 3, vertical; males in winter and spring almost entirely black.

Length to 8 inches.

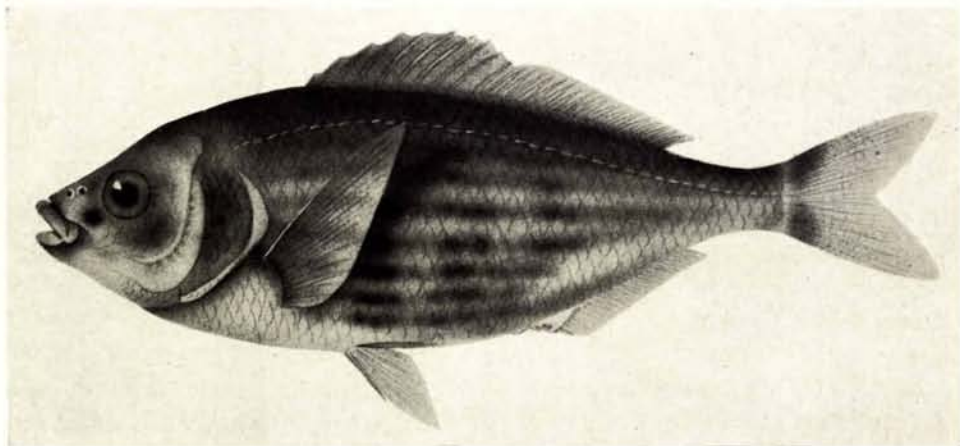


FIGURE 86. Yellow shiner. *Cymatogaster aggregatus* Gibbons 1854

Distinguished by the large scales, the short slender caudal peduncle, the 18 to 23 rays in the dorsal fin, the absence of a frenum between the lower lip and the symphysis of the lower jaw and the vertical light yellow bars on the sides of the body.

The yellow shiner was first taken in British Columbia waters in Esquimalt harbour by J. K. Lord and recorded in 1862 by A. Günther as *Ditrema aggregatum* (Gibbons), the identification being made on skins presented to the British Museum by Earl Russell. The species is abundant along the whole coast, appearing during the summer in schools in shallow water. During the winter months it seems to inhabit deeper water since it is taken commonly in shrimp trawls at depths between 10 and 40 fathoms. Considerable quantities are brought to the markets during the winter as a ready sale is found amongst the Chinese who consider this fish a delicacy. The breeding period appears to extend from April to July and between 8 and 36 young are liberated 10 to 12 months later. The food consists of small crustaceans and other invertebrates. Frequently these fish may be observed around wharves nipping off the appendages of barnacles.

Range southern California to northwestern Alaska.

Brown sea-perch

Brachyistius brevipinnis (Günther) 1862

Body somewhat elongate, deeply elliptical, compressed; caudal peduncle long, deep, least depth 6 to 7 in standard length. Head small; mouth terminal, small;

frenum between lower lip and symphysis of lower jaw. Fins: dorsal (1), VII to IX, 13 to 15, high, rayed portion short; anal, III, 21 or 22; pelvic, I, 5, thoracic; caudal, furcate. Lateral line: high on body anteriorly. Scales: cycloid, large; on lateral line, 38 to 41; in sheath along base of dorsal fin demarked from scales of body by pronounced furrow. Colour: olive brown on dorsal surface with small dark spot under each scale; light bright coppery red to golden on ventral surface; bluish punctulations in series of longitudinal rows on sides; pale red on fins.

Length to 8 inches.

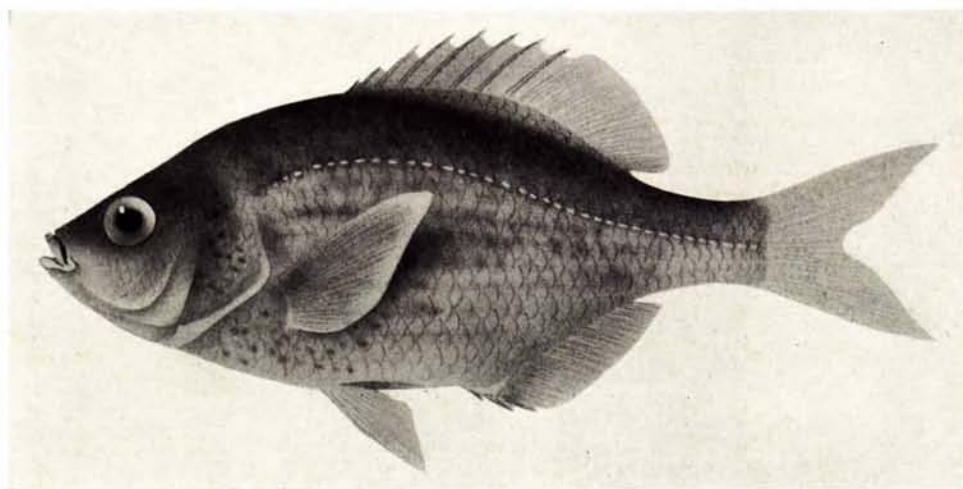


FIGURE 87. Brown sea-perch. *Brachyistius brevipinnis* (Günther) 1862

Distinguished by the large scales, the long stout caudal peduncle, the 13 to 15 rays in the dorsal fin and the frenum between the lower lip and the symphysis of the lower jaw.

The brown sea-perch was first recorded from British Columbia waters in 1862 from Esquimalt harbour by A. Günther who described it as a new species, *Ditrema brevipinne*, on the basis of a skin $7\frac{1}{2}$ inches in length presented to the British Museum by Earl Russell. In 1936, on data supplied by the second author, L. P. Schultz and A. C. DeLacy recorded the species from Departure bay and Round island as *Brachyistius frenatus* Gill. The brown sea-perch is obtained occasionally in the Departure bay area. Nothing is known of its life history.

Range southern California to strait of Georgia.

Blue sea-perch

Taeniotoca lateralis (Agassiz) 1854

Body elliptical, compressed; caudal peduncle short, deep, least depth 6.5 to 7 in standard length. Head small; mouth terminal, small; frenum between lower lip and symphysis of lower jaw. Fins: dorsal (1), X to XII, 23 or 24, spinous

portion low, last spine about three-quarters length of first ray, rayed portion high anteriorly; anal, III, 29 to 31, high; pelvic, I, 5, thoracic; caudal, furcate. Lateral line: high on body anteriorly. Scales: cycloid, small; on lateral line, 63 to 65; in sheath along base of dorsal fin demarked from scales of body by pronounced furrow. Colour: dull red to brown with some green on dorsal surface; black punctulations numerous, fine; dull orange and bright blue in longitudinal stripes along rows of scales on sides of body; bluish black on dorsal and anal fins except for posterior margins, pronounced in males in spring months; clear on pectoral

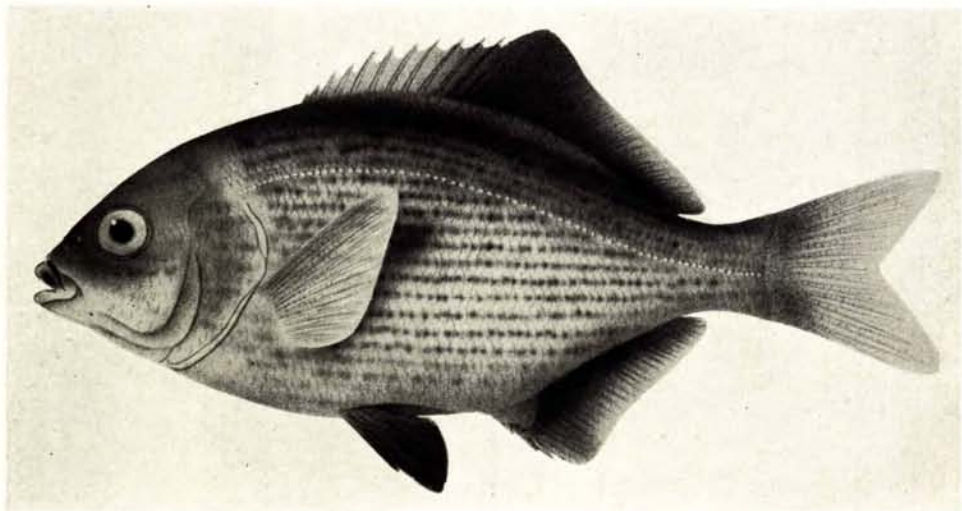


FIGURE 88. Blue sea-perch. *Taeniotoca lateralis* (Agassiz) 1854

fins; bluish black on pelvic fins; dusky on caudal fin, bluish black along dorsal and ventral margins in males in spring months.

Length to 15 inches.

Distinguished by the low spinous portion of the dorsal fin with the last spine about three-quarters of the length of the first ray and the orange and blue longitudinal stripes on the sides of the body.

The blue sea-perch was first recorded from British Columbia waters in 1862 from Victoria harbour by A. Günther as *Ditrema laterale* (Agassiz), based on the skin of an adult fish presented to the British Museum by Earl Russell. In the same year he also recorded two specimens from Esquimalt harbour, collected by Mr. J. K. Lord, as *Ditrema jacksoni*. These are considered by Dr. L. P. Schultz as *T. lateralis*. The blue sea-perch is common in the strait of Georgia and occurs around the southern end of Vancouver island to Ucluelet. This is one of the most beautiful of the marine fishes of the British Columbia coast. The young are born in June and July and 36 have been observed to be liberated from a single female in less than an hour. As many as 44 have been recorded by Dr. C. McLean

Fraser as occurring in one female. The food consists of small crustaceans, worms, mussels and at times herring eggs.

Range southern California to northwestern Alaska.

Dusky sea-perch

Damalichthys vacca Girard 1855

Body elliptical, compressed; caudal peduncle short, slender, least depth about 8 in standard length. Head small; mouth terminal, small; frenum between lower lip and symphysis of lower jaw. Fins: dorsal (1), X, 21 to 24, spinous

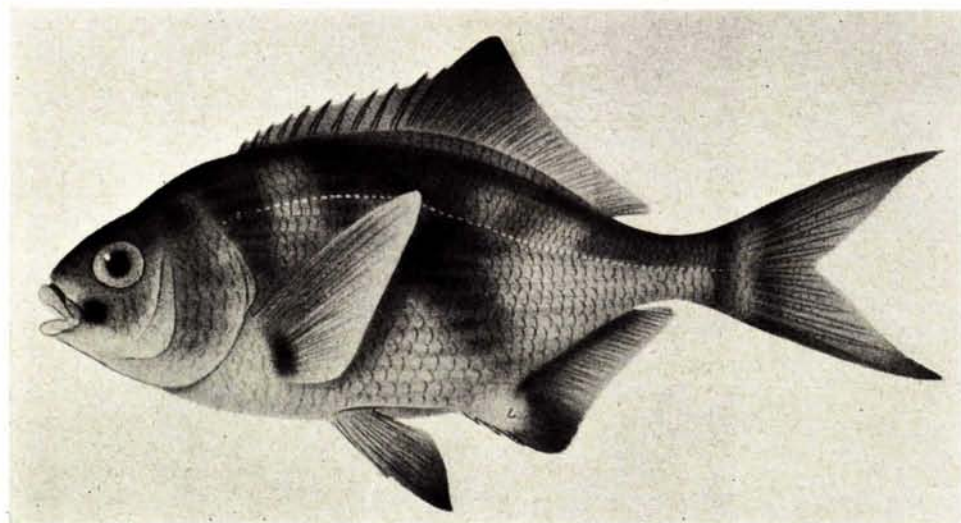


FIGURE 89. Dusky sea-perch. *Damalichthys vacca* Girard 1855

portion low, last spine slightly more than half length of first ray, rayed portion high anteriorly, margin distinctly concave; anal, III, 25 to 29; pelvic, I, 5, thoracic; caudal, furcate. Lateral line: high on body anteriorly. Scales: cycloid, small; on lateral line, 56 to 67; in sheath along base of dorsal fin demarked from scales of body by pronounced furrow. Colour: slightly brown on dorsal surface; silvery on ventral surface; sometimes blotches of darker on upper part of body, 3 or 4, vague; small black spot on preopercle behind posterior tip of maxillary; dusky on dorsal, anal and caudal fins; clear on pectoral fins; pale yellow or orange tipped with black on pelvic fins.

Length to 15 inches.

Distinguished by the low spinous portion of the dorsal fin with the last spine slightly more than half of the length of the first ray and the dusky coloration with the black spot on each preopercle.

The dusky sea-perch was first recorded from British Columbia waters in 1862 by A. Günther as *Ditrema vacca* on the basis of a specimen from Esquimalt

harbour collected by J. K. Lord. An individual was taken in the summer of 1881 in Nootka sound at Friendly cove by Capt. H. E. Nichols and recorded in the same year by T. H. Bean as *Damalichthys argyrosomus* (Girard). The species is common around the coast of Vancouver island and in Burrard inlet, inhabiting the shallower water in summer and somewhat deeper in winter. It is caught frequently on hand-lines baited with marine worms and affords considerable sport for the youthful angler.

Range southern California to northwestern Alaska.

White sea-perch

Phanerodon furcatus Girard 1854

Body elliptical, compressed; caudal peduncle long, slender, least depth 8 to 9.5 in standard length. Head small; mouth terminal, small; frenum between lower lip and symphysis of lower jaw. Fins: dorsal (1), X or XI, 22 to 26,

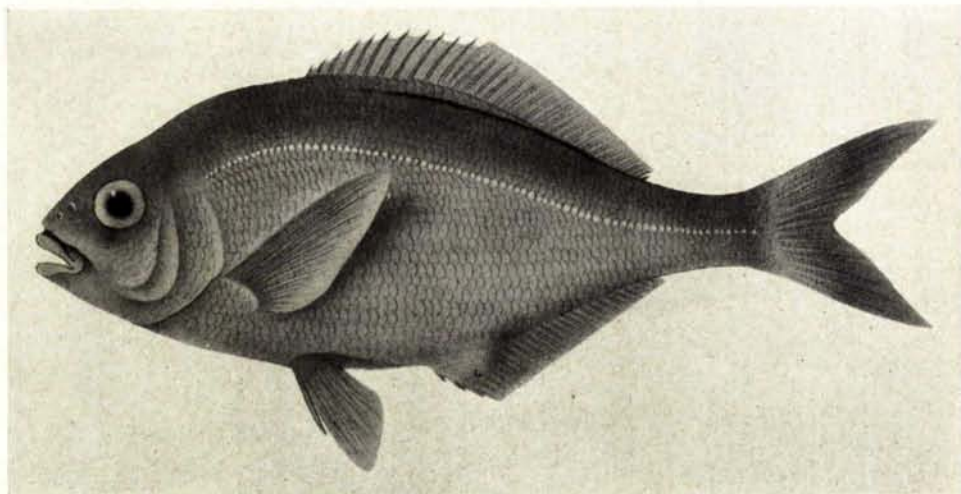


FIGURE 90. White sea-perch. *Phanerodon furcatus* Girard 1854

moderate, spines as high as rays, upper margin practically continuous; anal, III, 29 to 34; pelvic, I, 5, thoracic; caudal, deeply furcate. Lateral line: high on body anteriorly. Scales: cycloid, small; on lateral line, 66 to 69; in sheath along base of dorsal fin demarked from scales of body by pronounced furrow. Colour: entirely silvery, slightly darker on dorsal surface, usually dark in furrow at base of dorsal fin; yellowish tinge usually on fins; darkish blotch frequently on anterior portion of anal fin; plain, without markings, on pelvic fins; dusky on margin of caudal fin.

Length to 12 inches.

Distinguished by the continuous margin of the dorsal fin and the silvery coloration.

The white sea-perch was first recorded from British Columbia waters in 1898 by D. S. Jordan and B. W. Evermann as from Vancouver island. In 1921 C. McLean Fraser referred to the species as occurring in the strait of Georgia. The record in 1916 by the same author is undoubtedly in error since the description states "the spines were all low, the last one being less than half of the length of the soft ray." The species was evidently *Damalichthys vacca*. The white sea-perch is a southern species and may be an uncommon inhabitant of these waters.

Range southern California to Vancouver island.

Wall-eyed sea-perch

Hyperprosopon argenteum Gibbons 1854

Body elliptical, compressed; caudal peduncle short, slender, least depth about 9.4 in standard length. Head small; mouth terminal, small; no frenum between lower lip and symphysis of lower jaw; rakers below angle of first gill arch, about 21. Fins: dorsal (1), IX to XI, 27 or 28, spinous portion high, angular, maximum

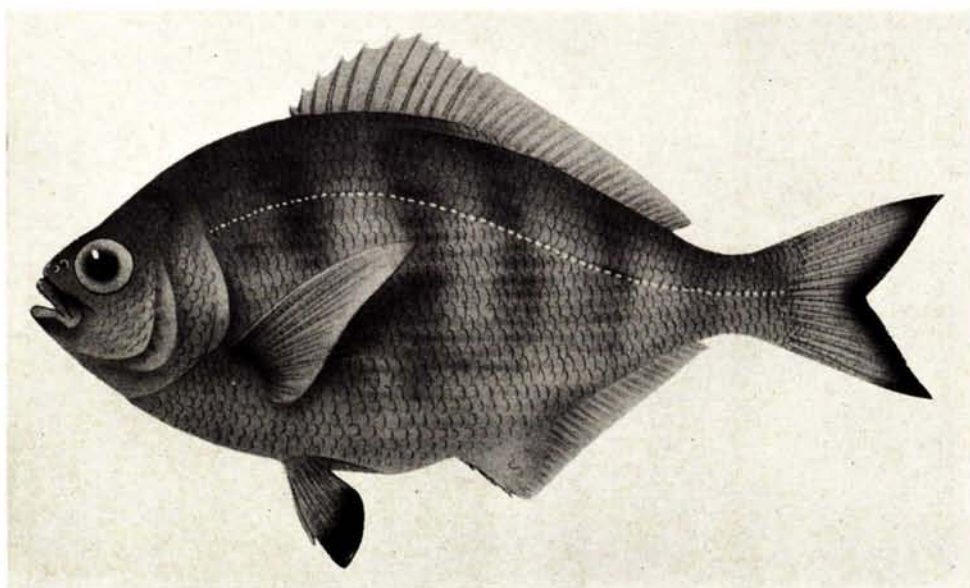


FIGURE 91. Wall-eyed sea-perch. *Hyperprosopon argenteum* Gibbons 1854

height about middle, higher than rayed portion; anal, III, 32 or 33; pelvic, I, 5, thoracic; caudal, furcate. Lateral line: high on body anteriorly. Scales: cycloid, small; on lateral line, 72 to 74; in sheath along base of dorsal fin demarked from scales of body by pronounced furrow. Colour: steely blue on dorsal surface; silvery on sides and ventral surface; dusky bars on each side, about 5, faint, vertical; black on tips of pelvic and caudal fins.

Length to 12 inches.

Distinguished by the high angular spinous portion of the dorsal fin, the 21 or more rakers on the first gill arch below the angle, the blue to silvery coloration with the 5 faint dusky bars on each side of the body and the black margins on the pelvic and caudal fins.

The wall-eyed sea-perch was first recorded from British Columbia waters in 1862 from Esquimalt harbour by A. Günther as *Ditrema arcuatum*. The four specimens so identified were collected by J. K. Lord and constitute the only known record from these waters. It occurs southward to California where it is the second most important sea-perch commercially.

Range southern California to Juan de Fuca strait.

Porgy

Holconotus rhodoterus Agassiz 1854

Body elliptical, compressed; caudal peduncle short, slender, deep, least depth about 9 in standard length. Head small; mouth terminal, small; no frenum between lower lip and symphysis of lower jaw; rakers below angle of first gill arch, 11 to 13. Fins: dorsal (I), IX or X, 26, spinous portion high, angular,

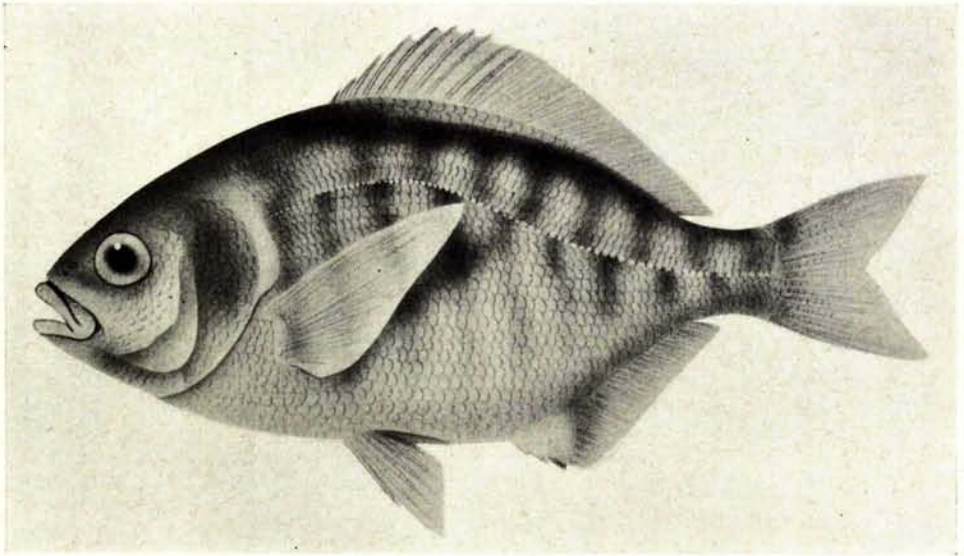


FIGURE 92. Porgy. *Holconotus rhodoterus* Agassiz 1854

maximum height about middle, higher than rayed portion; anal, III, 28 to 31; pelvic, I, 5, thoracic; caudal, furcate. Lateral line: high on body anteriorly. Scales: cycloid, small; on lateral line, 67 to 70; in sheath along base of dorsal fin demarked from scales of body by pronounced furrow. Colour: light green on dorsal surface; silvery on sides and ventral surface; reddish bars on each side,

about 10, narrow, vertical, those above lateral line alternating with those below; bright light red on pelvic, anal and caudal fins.

Length to 12 inches.

Distinguished by the high angular spinous portion of the dorsal fin, the 11 to 13 rakers on the first gill arch below the angle and the reddish vertical bars above the lateral line alternating with those below.

The pogy was first recorded from British Columbia waters in 1862 by A. Günther as *Ditrema rhodoterum*, on the basis of five specimens from Esquimalt harbour collected by J. K. Lord. This constitutes the only record from these waters. In California this species is sometimes spoken of as the pogie.

Range southern California to Juan de Fuca strait.

Family TRICHODONTIDAE

Sand-fishes

In the sand-fishes the body is elongate, somewhat compressed and without scales. The mouth is nearly vertical with fringed lips and the eyes are high on the head. The pectoral fins are large, very broad and procurrent.

The sand-fishes have the habit of burying themselves in the sand with only the mouth and eyes exposed. While only the genus *Trichodon* has been taken in the British Columbia area another genus, *Arctoscopus*, has been recorded from southeastern Alaska, and may eventually be discovered in the northern waters of the province.

Sand-fish

Trichodon trichodon (Tilesius) 1811

Body moderately elongate, deep anteriorly, much compressed. Head moderate, length about 3.5 in standard length; mouth terminal, large, opening

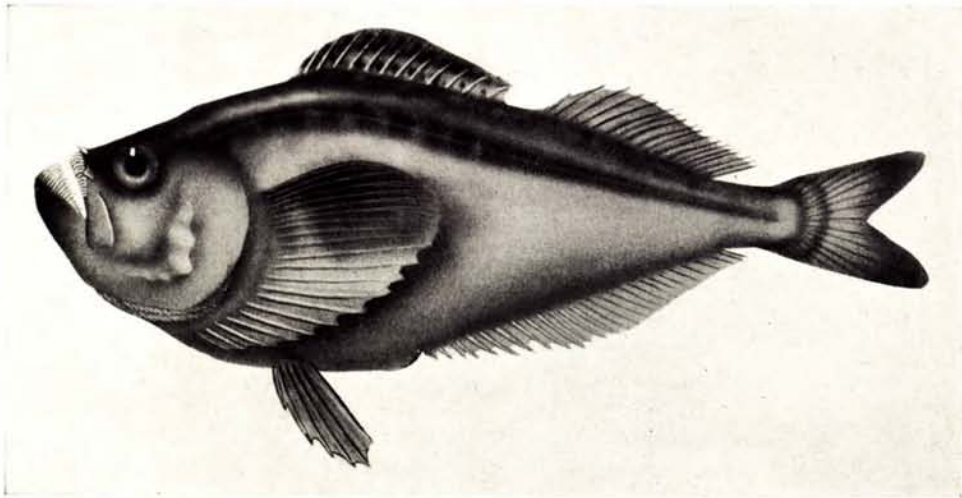


FIGURE 93. Sand-fish. *Trichodon trichodon* (Tilesius) 1811

upward; jaws nearly vertical; lips prominently fringed; teeth on jaws small, sharp, recurved; eye high on head; preopercular spines, 5. Fins: dorsal (2), XIII to XV—I, 18 to 20, slightly separated; anal, about 28, long; pelvic, I, 5, thoracic; pectoral, about 22, large, broadly rounded, procurent. Lateral line: faint, high, following dorsal contour of body. Scales: absent. Colour: light brown on dorsal surface; silvery on ventral surface; dark streak above lateral line, in irregular patches anteriorly; light brown along margin of spinous dorsal fin with dark spots in two series.

Length to 12 inches.

Distinguished by the almost vertical jaws, the fringed lips, the absence of scales and the broad procurent pectoral fins.

The sand-fish was first taken in British Columbia waters in 1892 near Victoria. The specimen was deposited in the Provincial Museum and recorded in 1898 by J. Fannin as *Trichodon stelleri* Tilesius. Other individuals have been secured on the west coast of Vancouver island and off the mouth of the Nass river. Though not obtained frequently it appears to be distributed widely, particularly in Alaskan waters. A specimen from Wickaninnish bay (Long beach), was discovered February 23, 1936, by Mr. Hillier in sand at a depth of about a foot. It was a female about 12 inches in length and extruded mature eggs when disturbed. Another individual was found June 15, 1939, off Stevens island in the stomach of a spring salmon.

Range northern California to northwestern Alaska.

Family BATHYMASTERIDAE

Ronquils

In the ronquils the body is elongate with small cycloid or ctenoid scales. The lateral line is high and straight. The head is subconic, well supplied with mucous pores. The dorsal fin is long, composed of rays, the anterior of which are entire, the remainder branched; the anal fin is long, supported by rays only; the pectoral fins are broad and rounded; the pelvic fins are thoracic, each with 1 spine and 5 rays.

The members of this family are bottom-living fishes of moderate depths. The two species recorded herein are of northern distribution.

Searcher

Bathymaster signatus Cope 1873

Body elongate, moderately compressed. Head subconic; mouth terminal, large; maxillary extending to point below posterior margin of pupil; eye high; gill membranes separate, slightly joined anteriorly to isthmus. Fins: dorsal (1), about 47, long, high, first 3 or 4 rays entire, remainder branched; anal, 32 to 34; pelvic, I, 5, thoracic; pectoral, about 21, rounded; caudal, truncate, rounded. Lateral line: high, almost straight. Scales: ctenoid; extending onto dorsal and pectoral fins about half length of rays; absent from cheek. Pores: on lateral line, about 100, each covered with fleshy flap; on head, numerous, large, mostly elevated, some with dermal flap. Colour: brown on dorsal surface with dark

markings; lighter on ventral surface with yellow to orange streaks; yellow on head in some areas; yellow mottlings on fins; black blotch on anterior of dorsal fin conspicuous, extending backward to fourth or fifth ray; dusky on pelvic and anal fins; somewhat dusky on other fins.

Length to 12 inches.

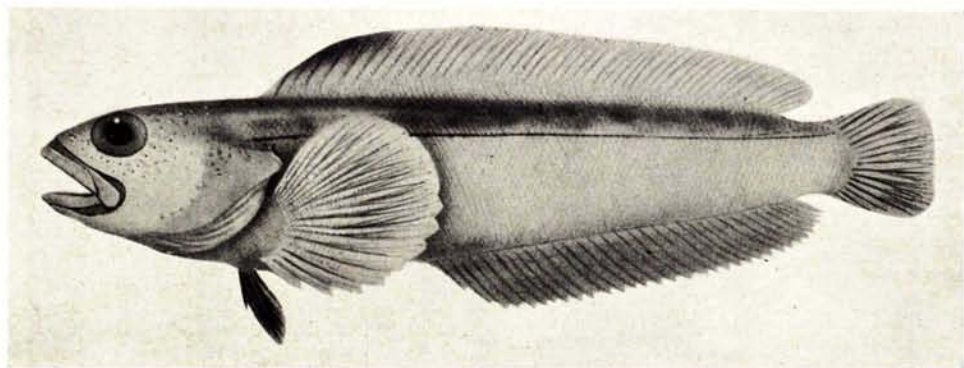


FIGURE 94. Searcher. *Bathymaster signatus* Cope 1873

Distinguished by the first 3 or 4 rays in the dorsal fin entire and the remainder branched, the prominent elevated pores on the head, the ctenoid scales and the absence of scales from the cheeks.

The searcher was first taken in British Columbia waters in June, 1882, north of Milbanke sound at Carter bay, by Capt. H. E. Nichols and recorded in 1883 by T. H. Bean. A second specimen, a male, $9\frac{1}{4}$ inches in total length was obtained August 15, 1924, off the west coast of the Queen Charlotte islands by Capt. A. M. Henderson of the Fisheries Patrol Service and is now in the collection of the Pacific Biological Station at Nanaimo.

Range Puget sound to northwestern Alaska.

Ronquil

Ronquilus jordani (Gilbert) 1888

Body elongate, rounded anteriorly. Head subconic; mouth terminal, moderate; maxillary extending to point approximately below anterior margin of pupil; eye large, high; gill membranes separate, slightly joined anteriorly to isthmus; in male, puffy crest from snout to dorsal fin, conspicuous in breeding season. Fins: dorsal (1), 41 to 48, long, high, first 20 to 30 rays entire, remainder branched; anal, 31 to 34; pelvic, I, 5, thoracic; pectoral, about 18, rounded; caudal, rounded. Lateral line: high, almost straight. Scales: cycloid; absent from fins; on cheek below and behind eye, numerous, minute. Pores: on lateral line, about 93, exposed; on head numerous, not conspicuous, none elevated. Colour of male: reddish olive on dorsal surface; dull olive green on ventral surface; yellow longitudinal lines below lateral line, 2, or more, fine; golden bar below eye, another across middle of cheek; jet black behind eye; black saddle across occiput extending

onto opercle; dusky blotch on anterior of dorsal fin, small; black, margined with yellow, on dorsal and caudal fins; iridescent light blue, margined with black, on anal fin (these colours particularly brilliant in breeding season); black entirely on pelvic fins; yellow on upper half, black on lower half of pectoral fins. Colour of female: olive green on dorsal surface; lighter on ventral surface; yellow longitudinal lines on sides as in male; somewhat red on occiput; dusky blotch on anterior of dorsal fin as in male; dull orange on tips of dorsal and caudal fins; pale light blue, margined with brown, on anal fin; white on pelvic fins.

Length to $6\frac{3}{4}$ inches.

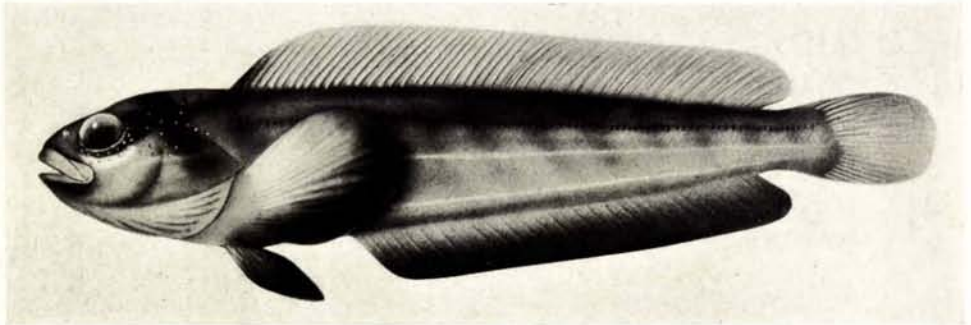


FIGURE 95. Ronquil. *Ronquilus jordani* (Gilbert) 1888

Distinguished by the first 20 to 30 rays in the dorsal fin entire and the remainder branched, the cycloid scales, the minute scales on the cheeks and the inconspicuous pores on the head.

The ronquil was first taken in British Columbia waters September 4, 1891, east of Victoria by the *Albatross*, station 3465, lat. $48^{\circ} 21' N.$, long. $123^{\circ} 14' W.$, depth 48 fathoms and recorded in 1895 by C. H. Gilbert as *Bathymaster jordani* Gilbert. Apparently it is fairly common along the whole coast and has been captured in the strait of Georgia, off the west coast of Vancouver island west of Vargas island at a depth of 24 fathoms, at Fort Rupert and northward to Prince Rupert at various depths down to 90 fathoms. Shrimp trawlers frequently secure individuals in Burrard inlet at depths of 10 to 20 fathoms. Females with fully developed salmon-coloured eggs have been taken early in March and at this time the males were in full breeding colours. It appears to be a fish of northern distribution.

Range Puget sound to northwestern Alaska.

Suborder AMMODYATIOIDEA

The fishes in this suborder have elongate slender bodies. The vertical fins are without spines; the pelvic fins, if present, are thoracic, each with 1 spine and 3 rays.

There is only one family, Ammodytidae, in the suborder.

In the sand-lances the body is elongate, slender and covered with small cycloid scales. The lateral line is high and straight. The head is long and pointed with the lower jaw projecting; teeth are absent and the gill rakers are long and slender. The dorsal fin is long, supported by rays only, and the pelvic fins usually are absent.

The fishes of this family often occur in large schools near the shore and frequently are abundant on banks off shore. They are active in the surf of sandy shores and in quiet waters sometimes can be seen partially buried in the sand.

Sand-lance*Ammodytes tobianus personatus* Girard 1856

Body elongate, very slender. Head elongate, sharply pointed; mouth terminal, moderate; lower jaw projecting; maxillary reaching to point below front of eye; teeth, absent from jaws; snout elongate, pointed; gill membranes separate, free from isthmus; gill rakers, long, slender. Skin: on side of body in 130 to 150

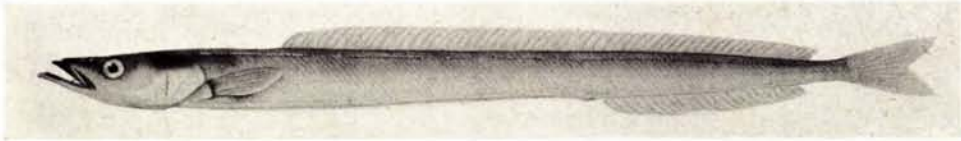


FIGURE 96. Sand-lance. *Ammodytes tobianus personatus* Girard 1856

diagonal folds; above ventrolateral angle of body in slender delicate longitudinal fold. Fins: dorsal (1), 54 to 59, very long; anal, 24 to 30, less than half length of dorsal; pelvic, absent; pectoral, narrow, low; caudal, deeply furcate. Lateral line: high, almost straight, close to dorsal fin. Scales: cycloid, minute. Colour: pale light green on dorsal surface; silvery on ventral surface.

Length to 8 inches.

Distinguished by the sharply pointed head with the projecting lower jaw, the oblique folds of skin along the sides of the very slender body, the delicate longitudinal folds above the ventrolateral angles of the body and the absence of pelvic fins.

The sand-lance was first taken in British Columbia waters in June, 1882, near Port Simpson by Capt. H. E. Nichols, and recorded in 1883 by T. H. Bean as *Ammodytes personatus* Girard. It is everywhere abundant along the coast, occurring in large schools. At times it may bury itself in the sand of the beaches and has been observed with the anterior third of the body projecting obliquely from the sea bottom. It feeds upon plankton, especially small crustaceans, including barnacle larvae, and in turn is eaten extensively by spring and coho salmon, lingcod, halibut and many other fishes and to some extent by the fur-seal. The sand-lance is said to be an excellent food fish of delicious flavour.

Range southern California to northwestern Alaska.

Suborder TRICHIUROIDEA

The fishes in this suborder have the body mackerel-like or ribbon-like. The premaxillaries are non-protractile, beak-like, firmly attached to the maxillaries. The lower jaws are usually projecting. The teeth are mostly strong and canine-like. The dorsal fins are long and the pectoral fins are placed low on the body.

One family, the Trichiuridae, is represented in British Columbia waters.

Family TRICHIURIDAE

Hair-tails

In the hair-tails the body is elongate, strongly compressed, without scales. The dorsal fin is long and low, composed of rays; the pectoral fins are small, placed low on the body; the pelvic fins are absent, or each is represented by a minute spine or scale-like structure thoracic in position; the caudal fin is small pointed or deeply forked.

Frost-fish

Benthodesmus atlanticus Goode and Bean 1895

Body very elongate, slender, much compressed, tapering to very slender caudal peduncle narrower than diameter of pupil. Head elongate, flattened above; mouth terminal, large; upper jaw beak-like; lower jaw projecting, barbel at tip conspicuous; teeth numerous, canine-like; four very long; eye large, about



FIGURE 97. Frost-fish. *Benthodesmus atlanticus* Goode and Bean 1895

midlength of head. Fins: dorsal (1), 142 to 154, long, low, continuous from opercular region to caudal peduncle; anal, 88 to 100, long, extending from anus to caudal peduncle; pelvic absent, or represented by minute spine or scale-like structure; pectoral, 12, small, placed low on body; caudal, small, deeply furcate. Lateral line: almost straight, in deep furrow. Scales: absent. Colour: silvery anteriorly; gray to black posteriorly; black on lips, inside of mouth and gill cavity; black on peritoneum.

Length to 3 feet 5½ inches.

Distinguished by the very elongate compressed body, the elongate head with the beak-like upper jaw, the barbel on the tip of the lower jaw, the large teeth, the slender caudal peduncle and the small deeply forked caudal fin.

The frost-fish is represented by a single specimen taken May 30, 1916, at Bentinck island near Victoria. It was recorded in 1917 by C. H. Gilbert and is now in the Provincial Museum at Victoria. This apparently constitutes the only record for the Pacific. The species occurs in the north Atlantic as an inhabitant of deep waters.

Range Juan de Fuca strait.

Suborder SCOMBROIDEA

The fishes in this suborder have a fusiform body with a slender caudal peduncle. The head is conical, the premaxillary is immovable, produced and pointed to a greater or lesser extent. The dorsal fins are two in number, the anterior high and weakly spinous, depressible in a groove or fleshy sheath; the posterior low and rayed; the pectoral fins are placed high on the body; the pelvic fins, when present, are thoracic; the caudal fin is widely forked.

Four families are included in this suborder: Carangidae, carangids; Scombridae, mackerels; Histiophoridae, sail-fishes; and Xiphiidae, sword-fishes. The first two families are represented in British Columbia waters.

Family CARANGIDAE

Carangids

In the carangids the body is elongate to deep with a very slender peduncle. The scales are cycloid. The lateral line is complete, arched anteriorly, straight posteriorly, sometimes armed with large spinous scales. There are two dorsal fins, the first spinous and usually depressible in a groove and the caudal fin is widely forked.

The carangids are pelagic, mostly swift swimmers and are abundant in warm seas.

Scad

Decapterus polyaspis Walford and Myers 1944

Body elongate, fusiform; caudal peduncle slender, depth less than diameter of eye. Head pointed; mouth terminal, moderate; maxillary not reaching to point below anterior margin of eye; teeth, small; eye large, partially covered

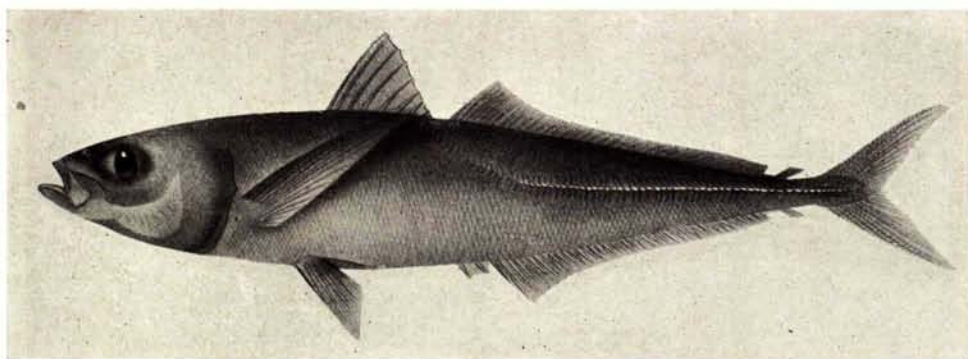


FIGURE 98. Scad. *Decapterus polyaspis* Walford and Myers 1944

anteriorly and posteriorly with strong transparent membranes. Fins: dorsal (2), VIII—1, 31 to 34—1, spinous fin triangular, depressible in groove, rayed fin high anteriorly, depressible in groove, low posteriorly, followed by free finlet; anal (2), II—1, 27 to 29—1, anterior fin depressible in groove, posterior fin high anteriorly,

low posteriorly, followed by free finlet; pelvic, 1, 5, thoracic; pectoral, pointed; caudal, deeply furcate. Lateral line: high anteriorly to point below interspace between dorsal fins, decurved to midline of body, thence straight to end of body. Scales: cycloid; on lateral line, 50 to 53 + 43 to 52, smooth anteriorly, scute-like spinous posteriorly. Colour: metallic blue on dorsal surface; somewhat silvery on ventral surface.

Length to 2 feet 1 inch.

Distinguished by the single free finlet following both the rayed dorsal fin and the second anal fin, the small anterior anal fin supported by 2 spines and the decurved lateral line with the numerous enlarged scute-like spinous scales on the posterior straight portion.

The scad was first taken in British Columbia waters August 27, 1934, near Nootka, about 20 miles off shore. Two specimens, each 21 inches in length, were obtained by Mr. Martin Brevik while fishing for pilchards. They were sent to the Pacific Biological Station at Nanaimo where they were identified tentatively as *Trachurus symmetricus* and recorded anonymously as such in the same year. During the following five years several other individuals were secured in the same general region and one was obtained from Massett inlet. Critical examination of Oregon and the above British Columbia specimens by Walford and Myers revealed a new species to which the specific name *polyaspis*, was given, referring to the large number of scutes on each lateral line. In December 1944, the attention of the authors was drawn to a shipment of 5 tons of fish in cold storage in Vancouver which had been secured four months previously east of Moresby island in Selwyn channel in a purse-seine. Upon identification as *Decapterus polyaspis* the fish were disposed of for canning purposes. There is a report that about 1939 over 8 tons of these fish had been landed on the west coast of Vancouver island at Kildonan and after being held in cold storage for several years were finally reduced to oil and meal.

Range northern California to Queen Charlotte islands.

Family SCOMBRIDAE

Mackerels

In the mackerels the body is streamlined with a slender keeled caudal peduncle. The scales are cycloid. The lateral line is undulating. A series of finlets occurs posterior to both rayed dorsal and anal fins; the pelvic fins are thoracic, each with 1 spine and 5 rays.

The mackerels are among the most rapid swimmers of the fishes. The statement has been made, "The contours are said by nautical engineers to be perfect for passage through the water with least resistance." Not only is the body of streamline form but it is very smooth and the pectoral, pelvic and spinous dorsal fins are set in grooves on the body so that when appressed and depressed they offer little resistance to the water.

Included in the family are the various mackerels, bonitos, albacores and tunnies, all of which are of great importance as commercial and sport fishes.

Pacific mackerel

Pneumatophorus diego (Ayres) 1856

Body elongate, fusiform; caudal peduncle slender, keel absent. Head conical; mouth terminal, moderate. Fins: dorsal (2), VIII to X—1, 12, interspace greater than length of pectoral fin, spinous fin short, high, triangular, finlets, 5 or 6; anal, II, 11, origin slightly behind that of rayed dorsal, finlets, 5 or 6; pelvic, I, 5, thoracic; pectoral, shorter than head, triangular; caudal, lunate. Lateral line: slightly wavy. Scales: cycloid, very small; covering body. Colour: metallic steel blue on dorsal surface; silvery on ventral surface; iridescent blackish

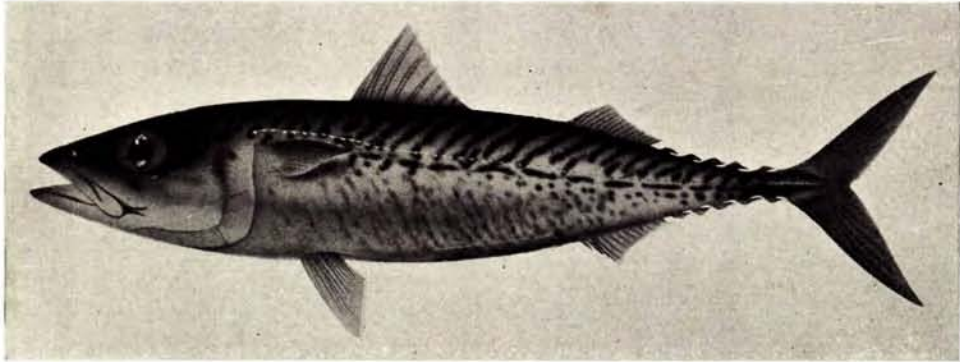


FIGURE 99. Pacific mackerel. *Pneumatophorus diego* (Ayres) 1856

stripes, 25 to 30, irregular, wavy, extending obliquely forward across back to short distance below lateral line.

Length to 20 inches.

Distinguished by the slender caudal peduncle with 5 or 6 finlets above and below, the long interspace between the dorsal fins and the 25 to 30 irregular wavy blackish stripes across the back and down the sides of the body.

The Pacific mackerel was first taken in British Columbia waters November 30, 1904, at Nanaimo. The two specimens secured were presented to the Provincial Museum at Victoria and were recorded in 1909 by F. Kermodé as *Scomba colias* Gmelin. The species is very abundant at times off the west coast of Vancouver island where many tons are sometimes obtained in purse-seines. Small numbers enter the strait of Georgia and small schools have been observed in the vicinity of Prince Rupert. Spawning has not been observed in British Columbia waters but is known to take place off the California coast from late April through July near the shore usually at depths down to 50 fathoms. A female may produce as many as half a million eggs. These are pelagic and hatch in about three days. Some individuals mature in their second year and the length of life may extend to nine or ten years. The food consists of a varied diet of crustaceans, squids and small fishes. This is an excellent food fish of fine flavour, especially when baked or broiled.

Range southern California to northwestern Alaska.

Bonito

Sarda lineolata (Girard) 1858

Body elongate, tusiform; caudal peduncle slender, keel on each side. Head pointed, conical; mouth terminal, moderate; gill rakers below angle of first gill arch, 16 or 17. Fins: dorsal (2), XVIII — I, 12, interspace much less than length of pectoral fin, spinous fin long, high anteriorly, finlets, 8 or 9; anal, II, 11, origin below posterior end of rayed dorsal, finlets, 6 or 7; pelvic, I, 5, thoracic; pectoral, shorter than head, extending barely beyond corselet, triangular; caudal, lunate. Lateral line: irregularly wavy. Scales: cycloid, small, covering body; in corselet,

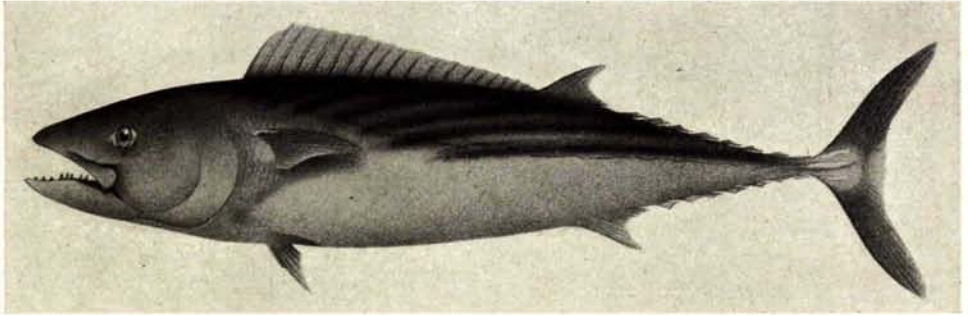


FIGURE 100. Bonito. *Sarda lineolata* (Girard) 1858

large; corselet large, prominent. Colour: dark metallic blue on dorsal surface, shading into silvery on ventral surface; blackish stripes, 10 or 11, narrow, extending backward and upward along upper portion of body.

Length to 3 feet.

Distinguished by the slender caudal peduncle with finlets above and below, the very short interspace between the dorsal fins and the 10 or 11 narrow stripes extending obliquely along the upper portion of the body.

The bonito was first taken in British Columbia waters in September, 1900, near Rivers inlet and was recorded in 1909 by F. Kermode as *Sarda chilensis* Cuvier and Valenciennes. This specimen is now represented by a cast in the Provincial Museum at Victoria. A second individual, 30½ inches in total length, recorded in the same year as from Victoria, was taken in a salmon-trap at Otter point near Sooke and is also in the Provincial Museum. Individuals are caught occasionally off the west coast of Vancouver island. The bonito is a fish of the open ocean appearing in large schools along the California coast where its food consists principally of squid and various fishes. It is an important food fish, has an excellent flavour when baked and is valued as a sport fish as well.

Range southern California to northern end of Vancouver island.

Skipjack

Katsuwonus pelamis (Linnaeus) 1758

Body elongate, fusiform; caudal peduncle slender, keel on each side. Head pointed, conical; mouth terminal, moderate; gill rakers below angle of first gill

arch, 35 to 43. Fins: dorsal (2), XV or XVI—14 to 16, interspace much less than length of pectoral fin, spinous fin long, high anteriorly, finlets, 7 or 8; anal, II, 12 to 14, origin below posterior end of rayed dorsal, finlets, 6 to 8; pelvic, I, 5, thoracic; pectoral shorter than head, not extending beyond corselet, triangular; caudal, lunate. Lateral line: nearly straight to point below rayed dorsal fin, sharply decurved, then straight. Scales: cycloid, small, covering upper anterior portion of body. Colour: dark metallic blue on dorsal surface; shading into silvery on ventral surface; black to dusky stripes on lower portion of body, 4 or 5, narrow, longitudinal.

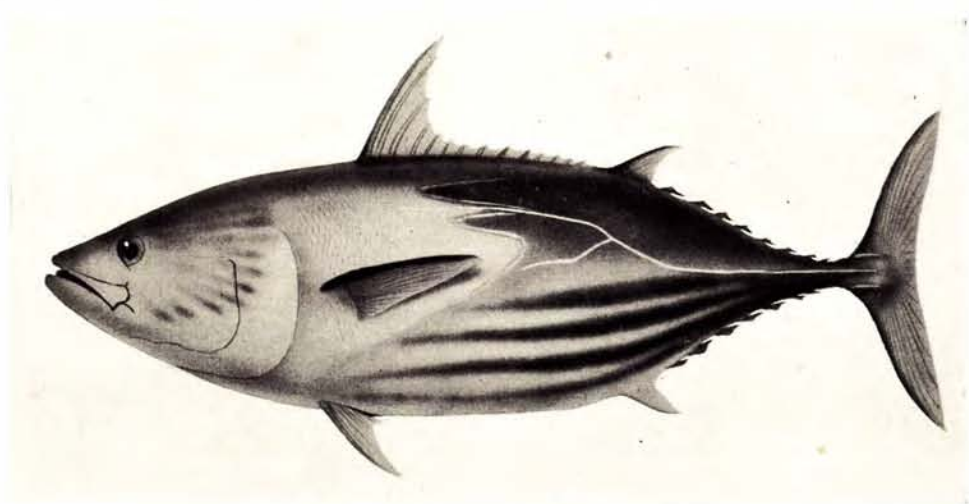


FIGURE 101. Skipjack. *Katsuwonus pelamis* (Linnaeus) 1758

Length to 3 feet.

Distinguished by the slender caudal peduncle with finlets above and below, the very short interspace between the dorsal fins and the 4 or 5 narrow longitudinal stripes along the lower portion of the body.

The skipjack was first taken in British Columbia waters July 6, 1943, in Barkley sound and recorded in the same year by J. L. Hart. The specimen, 25½ inches in total length, is now in the collection of the Pacific Biological Station and constitutes the only record for British Columbia waters. The skipjack is a fish of warm oceanic seas where it usually occurs in large schools. In southern California waters it forms a very important part of the commercial fishery and is also an excellent game fish on light tackle. The food consists of small fishes and plankton crustaceans.

Range southern California to Vancouver island.

Albacore

Thunnus alalunga (Gmelin) 1788

Body elongate, fusiform; caudal peduncle slender, keel on each side. Head conical; mouth terminal, moderate; gill rakers below angle of first gill arch, 19 to 21. Fins: dorsal (2), XIII or XIV—II, 13 or 14, interspace very short, spinous fin long, high anteriorly, finlets 7 or 8; anal, II, 12 or 13, origin below insertion of rayed dorsal, finlets, 7 or 8; pelvic, I, 5, thoracic; pectoral very long, longer than head, reaching behind insertion of anal fin, sabre-shaped; caudal, lunate. Lateral line: decurved anteriorly, nearly straight for greater part of length. Scales:

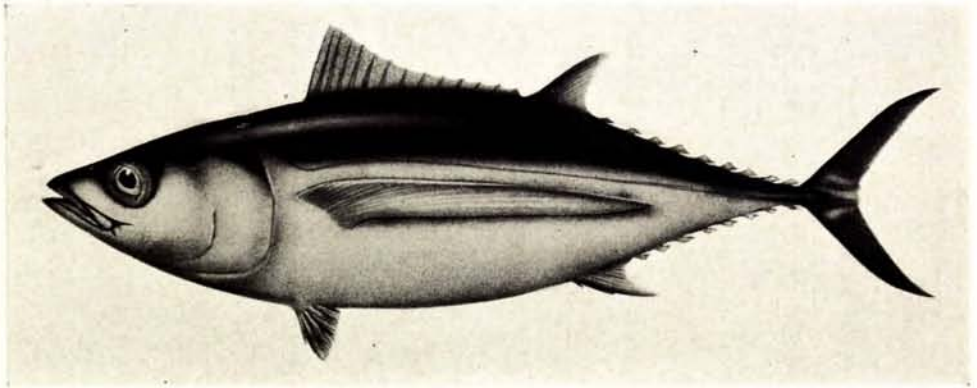


FIGURE 102. Albacore. *Thunnus alalunga* (Gmelin) 1788

cycloid, moderate, covering body; corselet small, indistinct. Colour: metallic steely blue on dorsal surface and sides; silvery on ventral surface.

Length to 4 feet 1 inch.

Distinguished by the slender caudal peduncle with finlets above and below, the extremely long sabre-shaped pectoral fins and the absence of stripes from the body.

The albacore was first recorded from British Columbia waters in 1938 by I. McT. Cowan as *Germo alalunga* (Gmelin) on the basis of a specimen taken August 17, 1937, near Kyuquot on a salmon troll. The specimen is now in the Provincial Museum at Victoria. An individual was reported in July, 1936, from near Nootka but was not examined. In August, 1939, west of cape St. James, lat. 52° 49' N., long. 134° 29' W., three specimens were obtained on a tuna lure and were recorded in 1940 by V. J. Samson. The albacore has been captured off the west coast of Vancouver island in increasing numbers since 1939. The first large commercial catch was made in 1940. The abundance of the fish may prove to be rather variable in Canadian waters since the fishery off the California coast has shown great fluctuations. This pelagic fish is distributed throughout all warm to temperate seas. Since no mature individuals have been taken anywhere along the Pacific coast of North America, it would seem that the albacore is a

tropical fish whose young make extensive feeding migrations to distant regions and return to the tropics at the onset of maturity. The food consists of schooling small fishes such as anchovies, pilchards, herring, sauries, young mackerel and albacore, blue lantern-fish (*Tarletonbeania crenularis*), as well as squid and zooplankton. It is a highly-prized sport and commercial fish and is taken with bone, rag and feather jigs towed behind boats. The commercial catch in Canadian waters is secured by trolling with bright red feather lures and is frozen for subsequent canning. Fishermen sometimes refer to the albacore as the tuna or long-finned tuna.

Range southern California to northwestern Alaska.

Suborder GOBIOIDEA

The fishes in this suborder have an elongate, somewhat stout body. The head is depressed. The mouth is large with protractile premaxillaries. The eyes are small, high on the head. The lateral line is absent. The spinous dorsal fin, when present, is small, composed of not more than 8 flexible spines; the anal fin is similar to the rayed dorsal fin; the pelvic fins are thoracic; the caudal fin usually is rounded or slightly pointed.

About 600 species have been described. Only one family is represented in British Columbia waters.

Family GOBIIDAE

Gobies

In the gobies the pelvic fins usually are united to form a flaring cone free from the body. The gill openings are small.

The gobies are, for the most part, small bottom-living fishes of shallow coastal waters including estuaries, lagoons and fresh waters in the tropics. However, some species extend into the marine temperate waters.

They inhabit muddy or sandy areas where they lie with the head upraised due to the weight of the body being supported by the pelvic and caudal fins. Frequently they are almost completely buried with only the highly placed eyes visible, but their presence may be detected by sudden spurts of water ejected forcefully backward through the small gill openings.

Five species have been recorded from British Columbia waters but there is considerable doubt as to the validity of the occurrences of *Quietula y-cauda* and *Gillichthys mirabilis*. These two species are omitted from this account for the following reasons: (1) there is much confusion in the records; (2) the species are southern in distribution and have not been taken north of southern California; (3) it is very likely that the latter has been confused with *Clevelandia ios* and the former with *Rhinogobiops nicholsii*.

Large-scaled goby

Rhinogobiops nicholsii (Bean) 1881

Body elongate, moderately stout, depth 5 to 5.25 in standard length, slightly compressed. Head moderate; mouth terminal, small; maxillary not reaching to

point below anterior margin of eye; eye large, diameter 3 to 4 in length of head; crest on head dorsal, median, from slightly behind eyes to origin of spinous dorsal fin. Fins: dorsal (2), VI or VII—12 to 14; anal, 11 or 12; pelvic, thoracic, united, forming hollow cone free from body; caudal, rounded. Lateral line: absent. Scales: cycloid, large; on head, none; in oblique rows above midline of body, 25 to 28. Colour: pale orange olive, irregularly streaked horizontally with purplish brown, promiscuously flecked with metallic green; iridescent stripe below eye, faint; pale yellow, barred with fine wavy vertical orange lines on

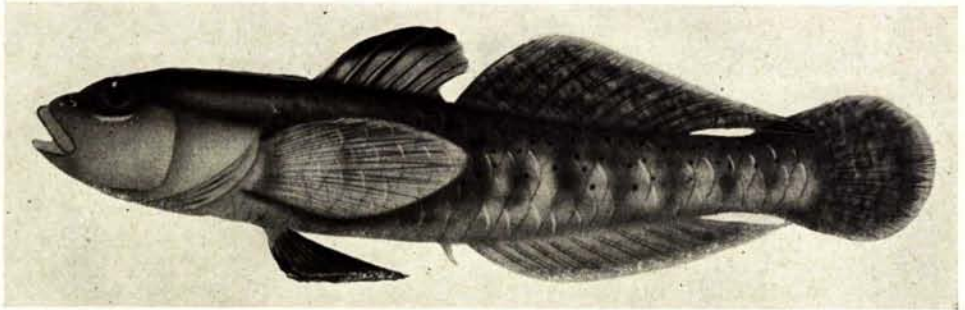


FIGURE 103. Large-scaled goby. *Rhinogobiops nicholsii* (Bean) 1881

vertical fins; jet black on tips of first five spines of spinous dorsal fin; white margin on tips of rayed dorsal, anal and caudal fins; black on pelvic fins except at bases.

Length to $4\frac{3}{4}$ inches.

Distinguished by the fleshy crest on the top of the head from behind the eyes to the origin of the spinous dorsal fin, the 25 to 28 large scales in oblique rows above the midline of the body, the black area on the spinous dorsal fin and the black pelvic fins with pale bases.

The large-scaled goby was first taken July 26, 1881, in Departure bay by Capt. H. E. Nichols, U.S.N., of the United States Coast and Geodetic Survey steamer *Hassler*. It was a specimen $4\frac{2}{5}$ inches in length, obtained at a depth of 20 fathoms and was described in the same year by T. H. Bean as the type of a new species, *Gobius Nicholsii*, in honour of its discoverer who took a great interest in natural history. The individual was deposited in the United States National Museum. Since then over a dozen specimens have been secured in the bay. A few individuals have also been taken in English and Nanoose bays, in Barkley sound at Ucluelet and in Esperanza inlet on the west coast of Vancouver island, and on June 12, 1935, a specimen was dredged from Skidegate channel, Queen Charlotte islands. Nothing is known concerning the life history but all specimens taken in British Columbia waters have been from depths of 20 fathoms or less.

Range southern California to Queen Charlotte islands.

Fine-scaled goby

Lepidogobius lepidus (Girard) 1854

Body elongate, slender, terete, depth about 7 in standard length. Head small, subconical; mouth terminal, moderate; maxillary reaching to point below pupil of eye; eye large, diameter about 4 in length of head; no crest on top of head. Fins: dorsal (2), VII—16 to 18; anal, 15 or 16; pelvic, thoracic, united, forming hollow cone free from body; caudal, rounded. Lateral line: absent. Scales: cycloid, very small; covering body and head; in oblique rows above midline of body, about 86. Colour: pale olive green, somewhat mottled with brown on

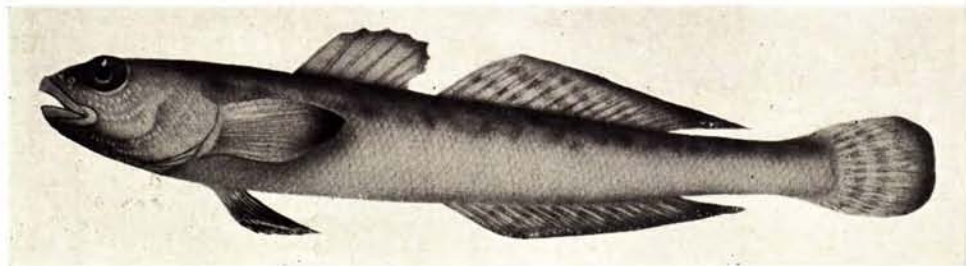


FIGURE 104. Fine-scaled goby. *Lepidogobius lepidus* (Girard) 1854

dorsal surface, rayed dorsal, anal and caudal fins; dusky to black on ventral surface of head and on tips of fins.

Length to 4 inches.

Distinguished by the elongate terete body, the conical head, the 86 or so small scales in oblique rows above the midline of the body and the dusky to black coloration on the tips of the fins.

The fine-scaled goby was first recorded from British Columbia waters in 1881, from Victoria, by D. S. Jordan and C. H. Gilbert from a single specimen 4 inches in length as *Lepidogobius gracilis* (Girard). It has been taken at Esquimalt, in Burrard inlet, Howe and Baynes sounds and near Comox. The fine-scaled goby inhabits muddy bottoms from shallow water down to 30 fathoms.

Range southern California to Vancouver island.

Arrow goby

Clevelandia ios (Jordan and Gilbert) 1882

Body elongate, slender, depth 6 to 7 in standard length, somewhat compressed. Head long; mouth terminal, large; maxillary reaching to point far behind eye; eye small, diameter about 6.5 in length of head; no crest on top of head. Fins: dorsal (2), IV or V—15 to 17; anal, 14 to 17; pelvic, thoracic, large, united, forming hollow cone free from body; caudal, rounded. Lateral line: absent. Scales: cycloid, very small; in oblique rows above midline of body, about 70. Colour: gray to pale, light olive green to tawny, black spotting promiscuous, fine; light orange spots minute, scattered over body without pattern, on dorsal, pectoral and caudal fins forming irregular bars; bright iridescent green

spots scattered over body; shining iridescent white opaque spots on sides of body and head; in male, black band on anal fin conspicuous.

Length to 2 inches.

Distinguished by the slender body, the maxillary extending about two-thirds of the length of the head and the bright iridescent spots on the body and the head.

The arrow goby was first taken in British Columbia waters in June, 1880, in Saanich arm, when a specimen two inches in length was obtained from the stomach of a white-spotted greenling, *Hexagrammos stelleri* (recorded as *Hexagrammus*

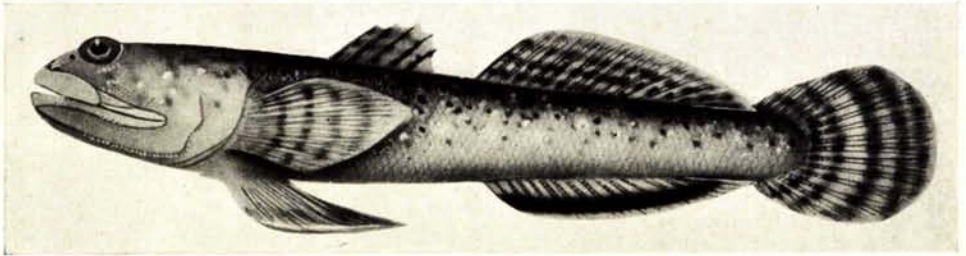


FIGURE 105. Arrow goby. *Clevelandia ios* (Jordan and Gilbert) 1882

asper), recorded in 1882 by D. S. Jordan and C. H. Gilbert as the type specimen of a new species, *Gobiosoma ios* and deposited in the United States National Museum. In recent years it has been secured in Departure and Taylor bays and from Pender harbour. These fish are found over mixtures of sand and mud in shallow water and are so well camouflaged that they are very difficult to see except when disturbed. By rapid vibrations of their bodies and gill covers they are able to bury themselves in the sand very quickly. Frequently their presence can be detected by the two spurts of water issuing from behind the gill covers.

Range southern California to strait of Georgia.

Suborder BLENNIOIDEA

The fishes in this suborder have an elongate slender body, usually very elongate, eel-like, compressed. The teeth are small and conical except in the Anarrhichadidae where they are greatly enlarged canines and molars. The dorsal fin is long, usually extending the full length of the body, composed of spines or rays, or both; the dorsal and anal spines or rays correspond to the vertebrae; the pelvic fins, when present, are thoracic, with or without 1 spine and fewer than 5 rays.

In British Columbia waters there are represented eleven families, embracing the wolf-fishes, blennies, eel-pouts, etc.

In the wolf-fishes the gill membranes are broadly attached to the isthmus. There is no lateral line. The dorsal fin is composed of spines only; the pelvic fins are absent.

The wolf-fishes are large fishes of northern seas, inhabiting waters of moderate depths. They have a remarkable development of grasping and grinding teeth which enable them to prey upon fishes and crush the hard outer coverings of various invertebrates.

Wolf-eel*Anarrhichthys ocellatus* Ayres 1855

Body greatly elongate, compressed. Head deep, rounded; mouth terminal, large; lips thick, fleshy; teeth on anterior of jaws very strong conical canines, on sides of lower jaw strong molars, on vomer coarse molars in 2 series, on palatines molars in 2 series meeting lateral series of lower jaw; snout short, blunt; eye,



FIGURE 106. Wolf-eel. *Anarrhichthys ocellatus* Ayres 1855

small; gill membranes broadly joined to isthmus. Fins: dorsal (1), CCXXX to CCL, long, continuous to posterior end of body, low; anal, 200 to 233, long, continuous to posterior end of body; pelvic, absent; caudal, slender, pointed, separated from dorsal and anal fins by slight notches. Lateral line: absent. Scales: cycloid, minute, embedded in skin. Colour: gray, frequently dark green; sometimes orange in young; black spots round, ocellate, of various sizes, everywhere covering body and dorsal fin; pale on anal fin.

Length to 8 feet.

Distinguished by the absence of pelvic fins, the extremely elongate body, the large canine and molar teeth, the dorsal and anal fins extending to the posterior end of the body, the slender caudal fin separated from the dorsal and the anal fins by slight notches and the gray or green coloration with the large ocellated black spots.

The wolf-eel was first taken in British Columbia waters in 1894 in Juan de Fuca strait near Race rocks when two specimens were obtained, placed in the Provincial Museum, and recorded in 1898 by J. Fannin. The species is caught rather frequently along the coast in salmon-traps, seines and occasionally on hook and line, probably accidentally. The records are from the strait of Georgia, Kyuquot and Hecate strait. The Kyuquot specimen is a young individual about 16½ inches in length and was removed from the stomach of a salmon. In the spring and summer months of 1940, four specimens from the west coast of Vancouver

island were on exhibition at the Vancouver Aquarium. The food appears to consist in part of crustaceans, mussels, sea-urchins, sand-dollars and other hard-shelled invertebrates as well as fishes. That the wolf-eel will attack other fishes is shown by the fact that an individual about 4 feet in length was observed to make a violent attack upon a lingcod slightly smaller than itself in an exhibition tank at the Vancouver Aquarium. It seized the lingcod by the middle of the back, tearing the skin and flesh so that the victim died as a result of its injuries.

Range southern California to southeastern Alaska.

Family CLINIDAE

Kelp-fishes

In the kelp-fishes the gill membranes are united and free from the isthmus. The lateral line is well developed, decurved anteriorly, straight posteriorly. The dorsal fin usually has elevated anterior and posterior portions and is spinous except for a few rays posteriorly; the vertical fins are not confluent; the pelvic fins are thoracic, with 1 spine and 3 or 4 rays.

The kelp-fishes are small colorful tide-pool fishes of tropical and temperate shores, represented by a single species in British Columbia waters.

Spotted kelp-fish

Gibbonsia elegans montereyensis Hubbs 1927

Body elongate, moderately stout, compressed. Head short, pointed; mouth terminal, small; teeth on jaws small; gill membranes united, free from isthmus. Fins: dorsal (1), XXXIV to XXXVI, 5 to 8, usually 6 or 7, long, first four or five

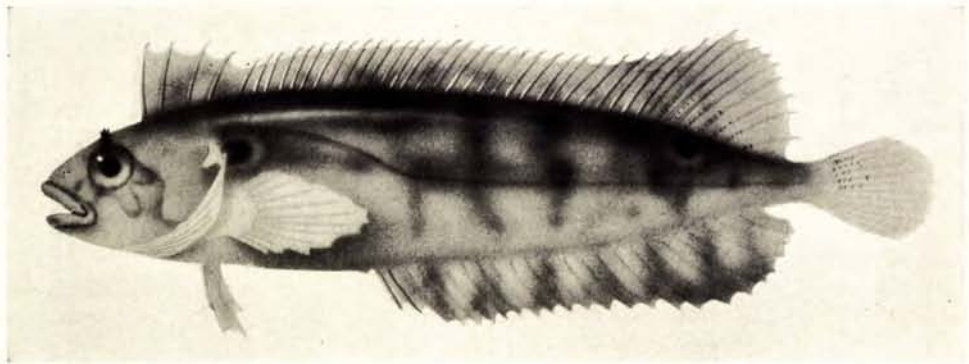


FIGURE 107. Spotted kelp-fish. *Gibbonsia elegans montereyensis* Hubbs 1927

anterior spines evenly spaced, high, decreasing in height posteriorly, forming shallow notch with remainder of fin, posterior spines gradually increasing in height posteriorly to height of first ray, rays crowded anteriorly, more widely spaced posteriorly; anal, II, 23 to 28; pelvic, I, 3, thoracic; caudal, rounded. Lateral line: decurved, then straight. Scales: cycloid, minute. Cirri: 2, small, one over each eye; on tips of dorsal spines, minute. Colour: variable, red, brown

or frequently intense lavender, variously spotted, usually with two well developed brownish black ocelli.

Length to 4 inches.

Distinguished by the elongate dorsal fin with the anterior part of the spinous portion and the rayed portion elevated, the first four or five anterior spines evenly spaced, the last spine approximately the same height as the first ray and the two brownish black ocelli on each side of the body.

The spotted kelp-fish was first taken in British Columbia waters in July, 1909, at Ucluelet, by Messrs. C. H. Young and W. Spreadborough and the 38 specimens obtained were recorded in 1920 by B. A. Bean and A. C. Weed as *Gibbonsia evides* (Jordan and Gilbert). In 1927, C. L. Hubbs re-examined the collection and designated one of the specimens as a paratype of his new subspecies *Gibbonsia elegans montereyensis*. This is a blenny inhabiting tide-pools.

Range southern California to Vancouver island.

Striped kelp-fish

Gibbonsia metzi Hubbs 1927

Body elongate, moderately stout, compressed. Head short, pointed, mouth terminal, small; teeth on jaws, small; gill membranes united, free from isthmus. Fins: dorsal (1), XXIV to XXVII, 7 to 9, usually 8 or 9, long, first three anterior

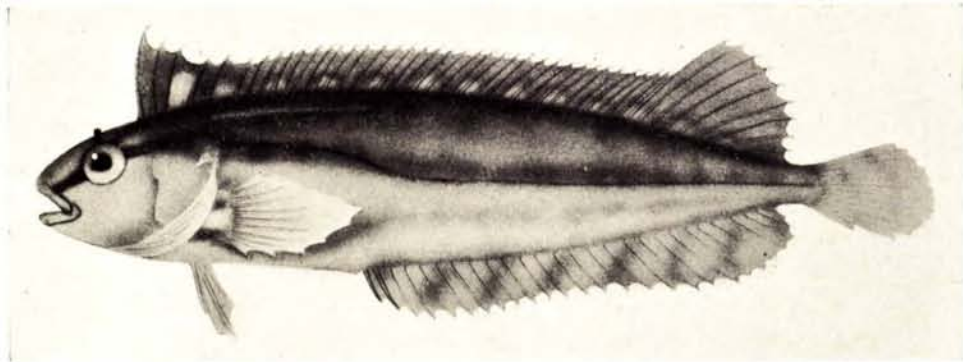


FIGURE 108. Striped kelp-fish. *Gibbonsia metzi* Hubbs 1927

spines closely approximated, high, decreasing in height posteriorly, forming shallow notch with remainder of fin, posterior spines little elevated, last spine about half height of first ray, rays evenly spaced; anal, II, 24 to 27; pelvic, I, 3, thoracic; caudal, rounded. Lateral line: decurved, then straight. Scales: cycloid, minute. Cirri: 2, small, one over each eye; on tips of dorsal spines, minute. Colour: red or brown, weakly striped with darker shades.

Length to 5½ inches.

Distinguished by the elongate dorsal fin with the anterior part of the spinous portion and the rayed portion elevated, the first three anterior spines closely