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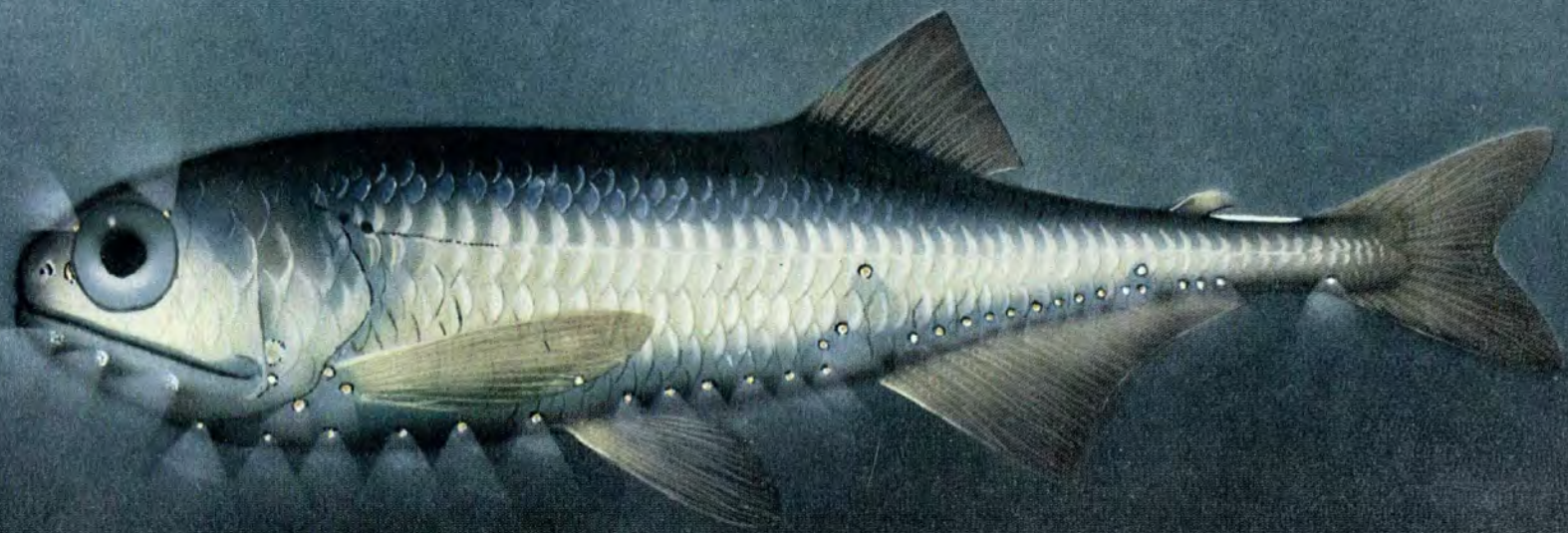
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**FISHERIES RESEARCH BOARD OF CANADA  
BULLETIN No. 68 (second edition)**

**FISHES OF THE PACIFIC COAST  
OF CANADA**

**BY W. A. CLEMENS AND G. V. WILBY**

**OTTAWA, 1961**



**BULLETIN No. 68**

(Second edition)

OF THE FISHERIES RESEARCH BOARD OF CANADA

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# Fishes of the Pacific coast of Canada

By **W. A. CLEMENS** and **G. V. WILBY**

*University of British Columbia and  
Fisheries Research Board of Canada*

*Illustrations by F. L. Beebe and D. B. Denbigh*

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Frontispiece opposite: The blue lanternfish, *Tarletonbeania crenularis*

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## 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 fish live in the water, 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 persons over a long period of years.

Since the first edition of this Bulletin was issued in 1946, there has been much activity on the part of ichthyologists. Many collections of fish have been made, new species have been discovered, new records have been obtained, geographic ranges have been extended and considerable new life history material has been secured. Through the much appreciated co-operation of many workers, some of whom are specialists in individual groups, it has been possible to incorporate this new knowledge in the present edition. It is hoped that the study of the fishes of British Columbia will be intensified in the years to come.

The authors have not attempted to anticipate records, in the hope that the pleasure of discovery will be an incentive to persons and organizations to make collections throughout the extensive waters along the coast.

## ACKNOWLEDGEMENTS

The work was started under the Fisheries Research Board of Canada at the Biological Station, Nanaimo, and continued at the University of British Columbia, Vancouver. To the Fisheries Research Board and to the University, including the Institute of Fisheries, the authors wish to express their appreciation and thanks for facilities provided and for the allotment of funds.

To the following they extend their sincere thanks for much and varied assistance: Dr W. Aron, Mr W. E. Barraclough, Dr R. L. Bolin, Dr J. C. Briggs, Dr G. C. Carl, Dr N. M. Carter, Dr W. M. Chapman, Dr D. M. Cohen, Mr H. A. Dunlop, Dr J. R. Dymond, Mr A. W. Ebeling, Dr R. E. Foerster, Dr J. L. Hart, Dr C. L. Hubbs, Dr K. S. Ketchen, Dr P. A. Larkin, Mr R. LeBrasseur, Dr C. C. Lindsey, Mr D. M. McAllister, Dr J. L. McHugh, Dr G. C. Myers, Dr F. Neave, Dr A. L. Pritchard, Dr W. E. Ricker, Dr L. P. Schultz, Mr T. Ueno, Dr L. A. Walford, Dr A. D. Welander, Dr N. J. Wilimovsky; and the following firms in Vancouver, B.C.: British Columbia Packers Limited, Canadian Fishing Co. Limited, Edmunds and Walker Limited, Shannon Brothers, and Vancouver Shellfish Co.

The half-tone illustrations of each species have been made by Mr F. L. Beebe of the British Columbia Provincial Museum Victoria, B.C. They were prepared under the direction of the authors, from actual specimens in the great majority of cases, otherwise from photographs and in few instances as reconstructions from illustrations in publications by D. S. Jordan and B. W. Evermann, E. C. Starks, R. L. Bolin, W. M. Chapman, R. R. Harry, W. Aron and P. McCrery, and J. L. B. Smith. Mr Beebe also prepared the colour drawing of the blue lanternfish which appears as a frontispiece. For this second edition six new colour illustrations have been added, prepared by Mr D. B. Denbigh of the staff of the Fisheries Research Board of Canada Biological Station, Nanaimo, B.C.

## INTRODUCTION

The composition of the marine fish fauna of the Pacific coast of Canada is extremely varied and interesting in many respects. A few northern, or arctic, fishes have their southern limits of distribution on the British Columbia coast as for example: the capelin, *Mallotus villosus*, which spawns annually in Departure Bay and which has been reported from as far south as Victoria; the toothed smelt, *Osmerus dentex*, which has been taken in Barkley Sound; the yellowfin sole, *Limanda aspera*, also from Barkley Sound; the crested sculpin, *Blepsias bilobus* and the bigmouth sculpin, *Hemitripterus bolini*, to Queen Charlotte Sound; and the longsnout prickleback, *Lumpenella longirostris*, to Burrard Inlet.

On the other hand certain southern pelagic forms tend to reach a northern limit on the British Columbia coast. The pilchard, *Sardinops sagax*, appeared in some years in vast numbers along the west coast of Vancouver Island and even into southeastern Alaska, but Cape Scott may be considered to be the usual limit. Others are the silvery hatchetfish, *Argyropelecus sladeni*; the whale-sucker, *Remilegia australis*; the white croaker, *Genyonemus lineatus*; the albacore, *Thunnus alalunga*; the bluefin tuna, *T. saliens*; the skipjack, *Katsuwonus pelamis*; the pompano, *Palometa simillima*; and the barracuda, *Sphyræna argentea*. On the west coast of Vancouver Island the following bottom forms, hitherto considered as distinctly southern in distribution, have been found, namely, the deepsea sole, *Embassichthys bathybius*; the warty poacher, *Occa verrucosa*; the striped kelpfish, *Gibbonsia metzi*; the crevice kelpfish, *G. montereyensis*; and the kelp clingfish, *Rimicola muscarum*.

During the past few years some unusual fishes known mostly from other oceans have been found off our coast. Among these are the daggertooth, *Anotopterus pharao*; the manefish, *Caristius macropus*; the coster dory, *Allocyttus verrucosus*; the boarfish, *Pseudopentaceros richardsoni*; and the squaretail, *Tetragonurus cuvieri* from near surface collections; and the bottom-living roughscale sole, *Clidoderma asperimum*, best known in Japanese waters.

Several unique fishes living at great depths along the coast have become known as the result of the voyages of the *Albatross* and the International Pacific Halibut

Commission's vessels. Among these may be mentioned the deepsea skate, *Raja abyssicola*, from 1588 fathoms off the Queen Charlotte Islands; the barreleye, *Macropinna microstoma*, 487 fathoms; the abyssal liparid, *Careproctus ovigerum* and the cuskpout, *Derepodichthys alepidotus*, both taken with *R. abyssicola*; and the dreamer, *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 brook trout, *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.

Twenty-three fishes were first captured in British Columbia waters, which are the type localities for the species, as follows: *Raja abyssicola*, *Macropinna microstoma*, *Chauliodus macouni*, *Coryphaenoides cyclolepis*, *C. filifera* and *C. acrolepis*, *Zaprora silenus*, *Triglops macellus*, *Radulinus taylori*, *Psychrolutes paradoxus*, *Rhamphocottus richardsoni*, *Synchirus gilli*, *Anoplagonus inermis*, *Eumicrotremus orbis*, *Liparis cyclopus*, *Polypera greeni*, *Careproctus ovigerum*, *Coryphopterus nicholsii*, *Clevelandia ios*, *Allolumpenus hypochromus*, *Bothrocara molle*, *Derepodichthys alepidotus*, and *Oneirodes bulbosus*. The following have been found only in these waters: the deepsea skate, *Raja abyssicola*; the smooth-scale rattail, *Coryphaenoides filifera*; the spinynose sculpin, *Radulinus taylori*; the abyssal liparid, *Careproctus ovigerum*; the cuskpout, *Derepodichthys alepidotus*; and the dreamer, *Oneirodes bulbosus*.

Since the first edition of this book was published the following 29 new British Columbia records have been reported: river lamprey, *Lampetra ayresii*; toothed smelt, *Osmerus dentex*; smoothtongue, *Leuroglossus stilbius*; highfin dragonfish, *Bathophilus flemingi*; loosejaw, *Aristostomias scintillans*; broadfin lanternfish, *Lampanyctus ritteri*; fangtooth lanternfish, *Ceratospopelus townsendi*; patchwork lanternfish, *Notospopelus resplendens*; slender barracudina, *Lestidium ringens*; ribbon barracudina, *Notolepis coruscans*; daggertooth, *Anotopterus pharao*; manefish, *Caristius macropus*; coster dory, *Alloctytus verrucosus*; roughscale sole, *Clidoderma asperrimum*; forkline sole, *Inopsetta ischyra*; deepsea sole, *Embassichthys bathybius*; boarfish, *Pseudopentaceros richardsoni*; bluefin tuna, *Thunnus saliens*; squaretail, *Tetragonurus cuvieri*; rougheyeye rockfish, *Sebastes aleutianus*; blackblotched rockfish, *S. crameri*; rosy rockfish, *S. rosaceus*; flag rockfish, *S. rubrivinctus*; brown rockfish, *S. auriculatus*; bigmouth sculpin, *Hemitripterus bolini*; tubesnout poacher, *Pallasina barbata aix*; bigeye poacher, *Asterotheca pentacantha*; smooth lumpsucker, *Aptocyclus ventricosus*; and black-and-white prickleback, *Plectobranchnus evides*.

The fact that the 272 species recorded here belong in 83 families indicates something of the varied character of the fish fauna in this area. Undoubtedly records of additional fishes will be added in the future, in view of the known

occurrence of at least 50 other species from southeastern Alaska and the Gulf of Alaska, as well as many others in Oregon and Washington. Present knowledge of the species has come mainly from collections in the southern portion of the Canadian coast and from a few deepsea specimens taken incidentally in programs of research relating to particular species such as the salmon, halibut and flatfishes, so there is every reason to believe that many new records will be made in the future. Since knowledge of the life history of most of the species is very incomplete, much can be added to existing information, and there is always the possibility that more discoveries will be made of species still unknown.

## 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 Richardson as the type of a new species, *Salmo scouleri*. This scientific name later was found to be a synonym of *Salmo gorbuscha* Walbaum, described 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 Lieutenant-Colonel Hawkins to continue the geodetic survey of the northeastern 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; he discovered 3 new species and obtained 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 United States 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, 12 of which were in Canadian territorial waters and fishes were obtained at 10 of these stations. In 1903 fishes were taken from 10 out of 14 stations established in the Strait of Georgia and in Queen Charlotte Sound. 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 off the coast, 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 Natural History Society of British Columbia*, 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 British Columbia 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 8 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 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 Professor 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, following some casual collections there by the Reverend G. W. Taylor. Dr Fraser laid the foundations

of the fish collection at the Biological Board of Canada's Pacific Biological Station at Departure Bay near Nanaimo, now the Fisheries Research Board of Canada Biological Station, Nanaimo, B.C. 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, Toronto. The records have generously been made available to the authors.

Between 1929 and 1932 the International Fisheries Commission, now the International Pacific 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 1939. The type specimens are now in the United States National Museum and the remainder are in the collections of the International Pacific Halibut 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 G. V. Wilby 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 Institute of Fisheries 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, in dredge and trawl hauls, and by shore collecting in tidepools. Altogether 623 fishes were taken, extending the known distribution of many and adding 8 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.

In recent years, the members of the staff of the Fisheries Research Board of Canada Biological Station, Nanaimo, have collected many fishes in connection with their fisheries investigations and have obtained much life history information. With the formation of the International North Pacific Fisheries Commission, many species have been obtained by the Fisheries Research Board and by various United States agencies associated with the investigational program recommended by the Commission. The Canadian vessels involved have been the *Fort Ross*, the *Challenger* and the *Key West II*, and among the United States vessels have been particularly the *Brown Bear* and the *John N. Cobb*.

Further, some collections are being made from the vessels occupying the weather station "Papa" located at Latitude 50° N and Longitude 145° W.

The British Columbia Provincial Museum, Victoria, has extended its collections by several expeditions and through donations by many individuals. Likewise, the Museum of the Institute of Fisheries, University of British Columbia, is steadily building up a splendid collection.

For the most part the collections mentioned have been quite extensive numerically and, in addition, a considerable number of isolated records have been published by various individuals.



## EXTERNAL CHARACTERS

In referring to the various parts of the body and describing their differences, among sharks, rays and fishes, it is necessary to use definite terms. The glossary on page 404 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 (Fig. 1-7) 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, and tip of snout to origin of dorsal fin, 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, to the end of the vertebral column.

*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, the fish being laid in a natural position.

*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.

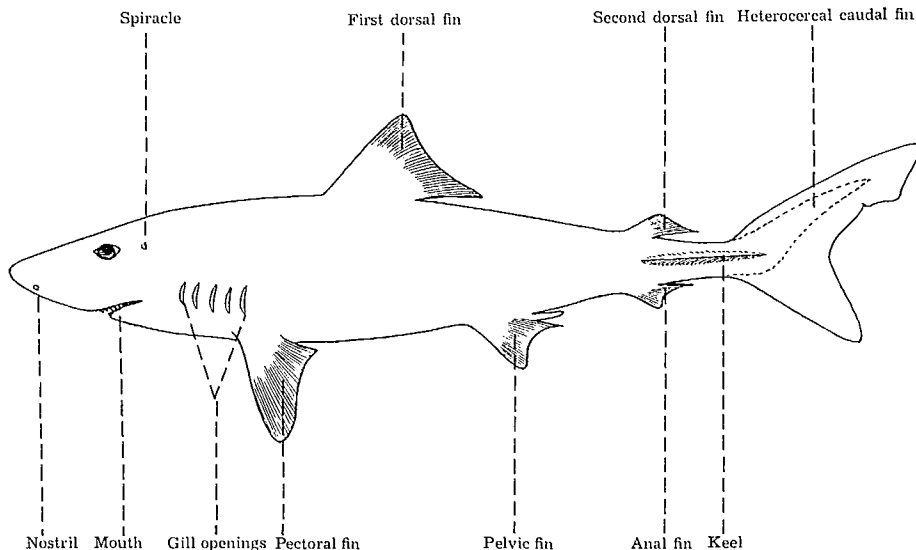


FIGURE 1. A hypothetical shark showing the external characters.

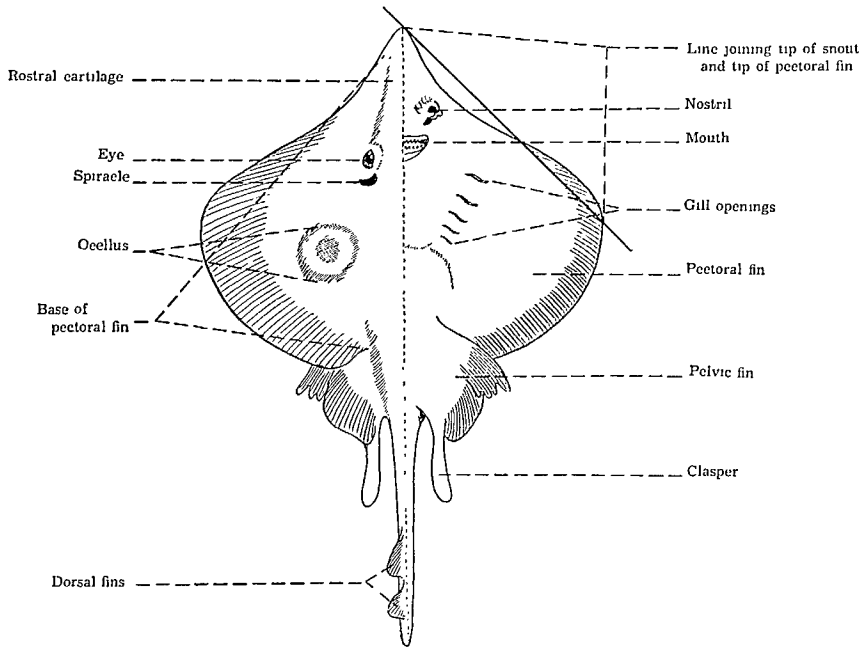


FIGURE 2. A hypothetical skate. Dorsal view on left. Ventral view on right.

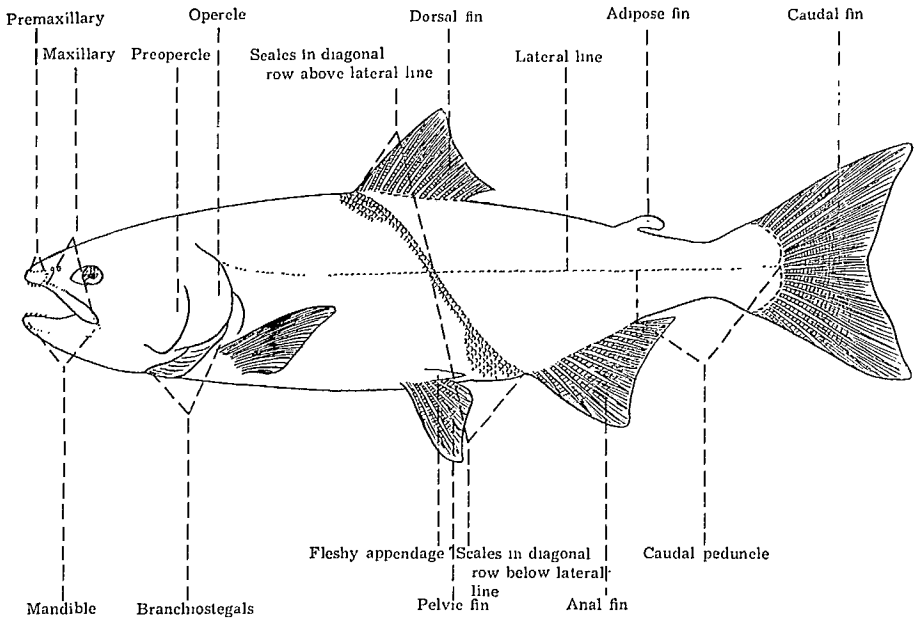


FIGURE 3. A hypothetical salmon showing the external characters.

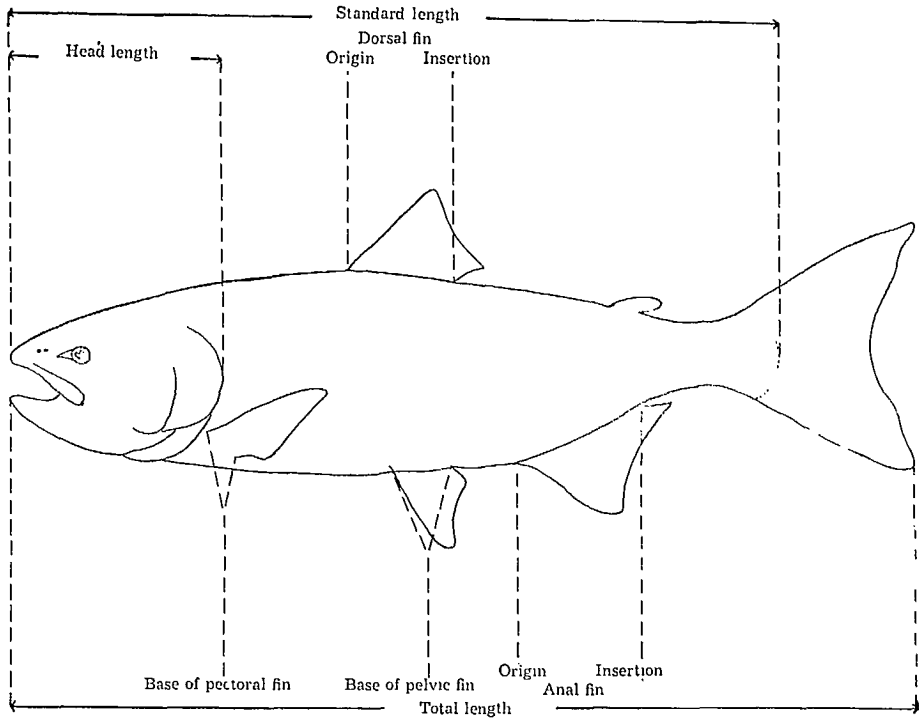


FIGURE 4. A hypothetical salmon showing methods of making measurements.

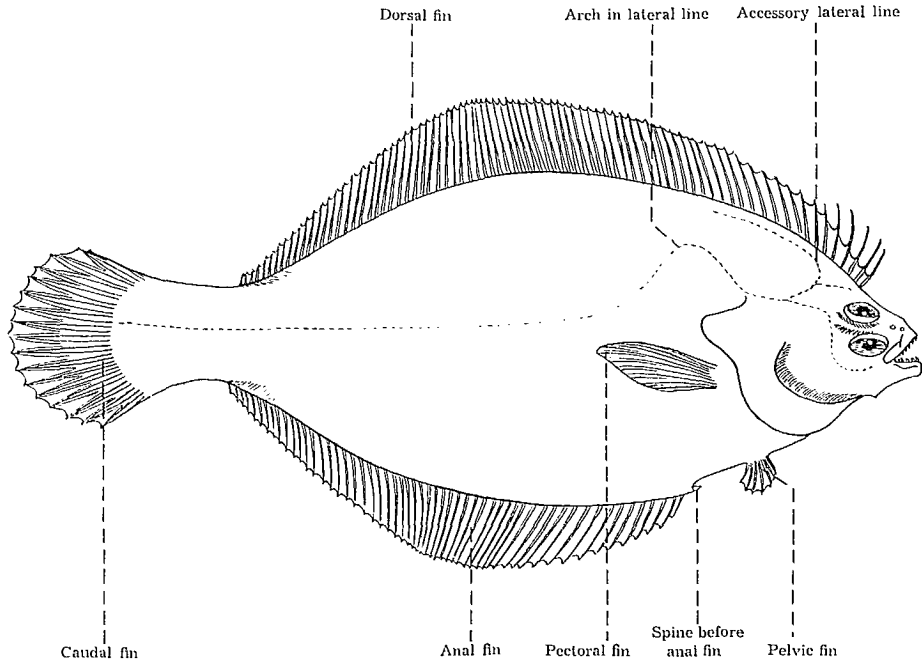


FIGURE 5. A hypothetical flounder showing external characters.

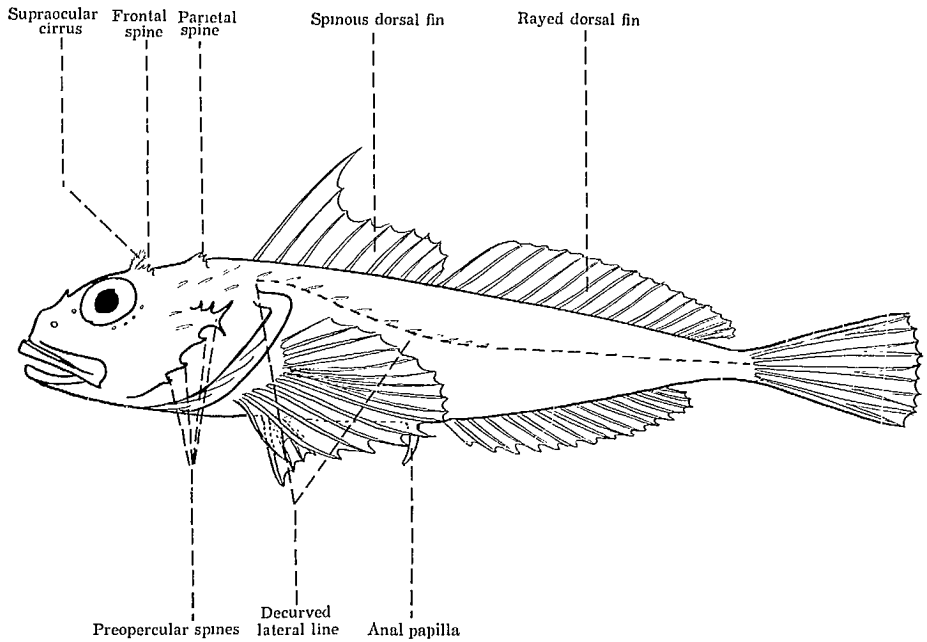


FIGURE 6. A hypothetical sculpin showing external characters.

*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.

*Depth of body.* The greatest depth.

*Diameter of eye.* The greatest length of the eyeball measured antero-posteriorly.

## 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 ancient and 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.

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, rockfishes, sculpins, flounders. 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. lumpsuckers 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. clingfishes.

## 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. It has no rays and is called the adipose fin. 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 11 to 13 rays, the second with 16 to 18, and the third with 12 to 14;

dorsal (2), V—I, 9, indicates that there are two fins, the first composed of 5 spines, the second of a spine and 9 rays;

dorsal (1), XXI or XXII, 27 to 33, indicates that there is a single fin, the anterior portion of which is composed of 21 or 22 spines, and the posterior portion of 27 to 33 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 5 rays. In 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 the 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 3 dorsal spines, 19 rays and 3 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 frequencies. Apparently the movements of the fish produce vibrations which are reflected from its surroundings. The fish is thus able to avoid collisions and to learn of the approach of food or enemies.

In some species the lateral line may be high, following the dorsal contour of the body. In others, it may be decurved strongly, continuing below the median

position to or toward the caudal fin. Occasionally it may be extremely irregular and wavy, as in the Scombridae. A prominent arch may be present over the pectoral fin in some of the flatfishes.

In some fishes the lateral line is partially developed and in others there may be 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 Stichaeidae.

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

In some instances the lateral line is represented by a few pores only and in older fishes the pores may be more or less obsolete. Sometimes the pores may be located by slight pressure in the area resulting in bubbles appearing from the openings. For the purposes of this text, the lateral line is considered as absent where it is obscure.

### SCALES

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

In the sharks and rays (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 and liparids, 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 salmons and several other species of fishes and are used in age determinations.

#### 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, and used particularly when the lateral line is absent.

*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 7 scales in a diagonal row above the lateral line, 70 in the lateral line series, and 11 in a diagonal row below the lateral line.

#### CIRRI

Cirri (*singular*, cirrus) are fleshy extensions of the skin and may be simple, bifid or multfid. 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.

*Preocular.* 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 rockfishes, 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 (Fig. 7). 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 2 bones which form part of the pectoral girdle. The upper is the supracleithrum which may bear 1 or 2 spines, and the lower is the cleithrum, usually bearing 1 spine, occasionally 2. On the posterior margin of the gill cover is a bone, the operculum, with 2 slightly diverging spines, the opercular spines. The curved bone immediately in front of the operculum is the preoperculum, on which are 5 spines, the preopercular spines. Below the eye and extending partly behind it is a series of 3 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. 7)

*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).

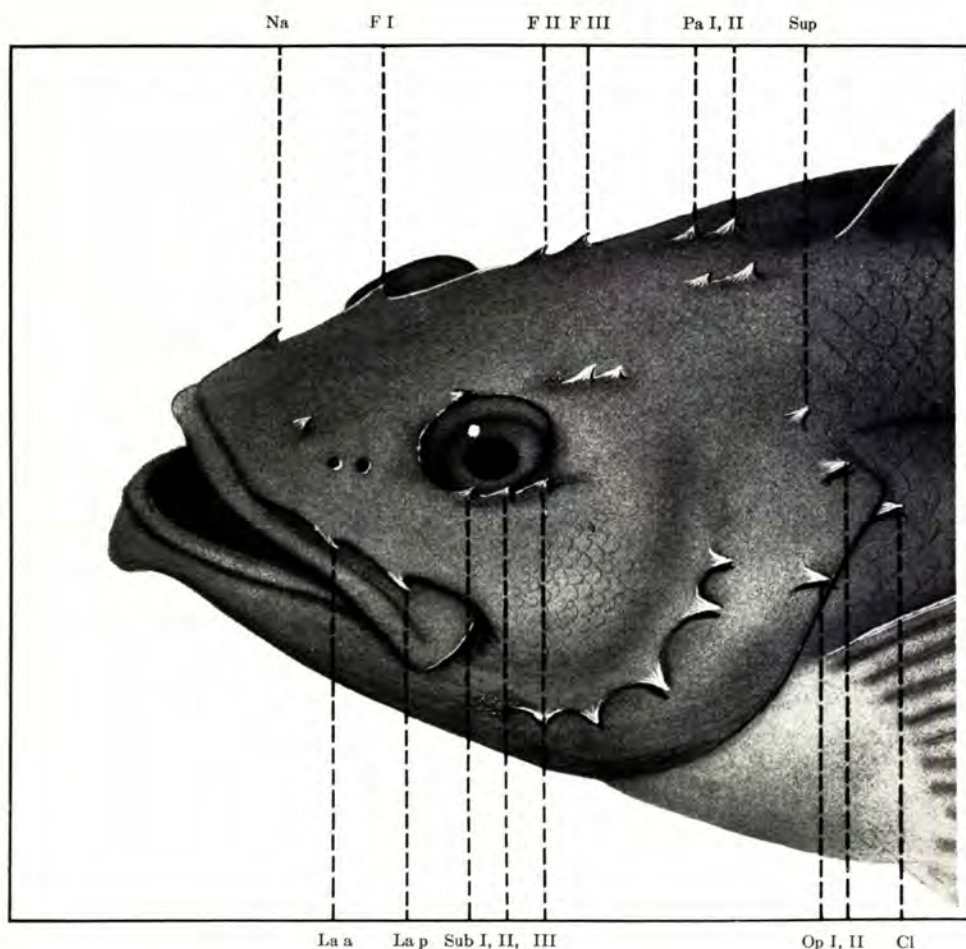


FIGURE 7. A hypothetical rockfish head showing the cranial spines. Na—nasal; F I, II, III—frontals; Pa I, II—parietals; Sup—supracleithral; La a—anterior lacrymal; La p—posterior lacrymal; Sub I, II, III—suborbitals; Op I, II—operculars; Cl—cleithral.

*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.

*Posttemporal.* Immediately behind the pterotic.

*Supracleithral.* Immediately above the anterior end of the lateral line. In some species 2 spines may be present. They may be covered by the operculum.

*Cleithral.* Immediately below the anterior end of the lateral line. Sometimes 2 spines may be present.

*Opercular.* Near the posterior tip or margin of the operculum, usually 2 spines are present.

*Preopercular.* On the posterior margin of the preoperculum. Five spines usually are present, sometimes the 5th 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 1 or 2 lobes on which spines occur. Usually not more than 1 on the anterior lobe but 1 to several on the posterior (preorbital).

*Suborbital.* Immediately below eye.

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

## IDENTIFICATION

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. Reference should then be made to the figure and description at the page indicated, in order to verify the determination.

When the correct key choices are made, all the fishes described in this book *should* fit either one alternative or the other at each stage,—*not both*. If a fish seems to fit both alternatives, or neither alternative, the user should first check and recheck each statement along his path through the key. If the fish still does not "key out", it may be an aberrant specimen of an included species, or a new record for British Columbia, or possibly even an undescribed species. Such a fish should be preserved and sent to a specialist for further study.

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 and Liparidae appear in two sections. The key therefore does not present a complete systematic arrangement of the families.

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

- 1 (6) Mouth in a circular sucking disk; jaws absent; nostril, 1, median.
- 2 (3) 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**—Hagfishes

PACIFIC HAGFISH                      *Polistotrema stoutii* (page 67)

- 3 (2) Gill pores on each side of body, 7, first close behind eye; eyes not covered with skin; barbels around mouth or nostril, none.

#### Family **Petromyzontidae**—Lampreys

- 4 (5) Supraoral bar with 3 cusps; lateral horny plates in mouth, in 4 pairs (Fig. 8).

PACIFIC LAMPREY                      *Entosphenus tridentatus* (page 68)

- 5 (4) Supraoral bar with 2 cusps; lateral horny plates in mouth, in 3 pairs.

RIVER LAMPREY                      *Lampetra ayresii* (page 69)

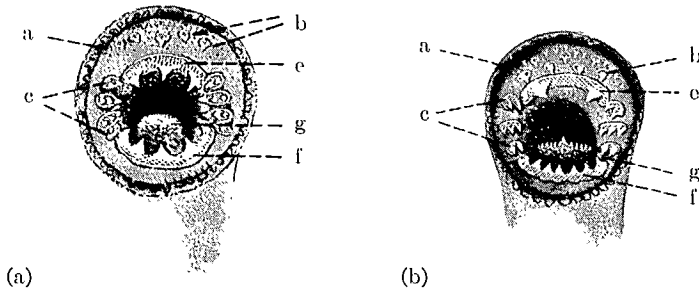


FIGURE 8. (a) *Entosphenus tridentatus*; (b) *Lampetra ayresii*.

Horny plates are as follows: (a) marginal; (b) supraoral; (c) lateral; (d) infraoral (present in *Entosphenus*, but not marked above); (e) supraoral bar; (f) infraoral bar; (g) lingual.

- 6 (1) Mouth not in circular sucking disk; jaws present; nostrils, 2.
- 7 (40) External gill openings on each side of body, 5 to 7, or on ventral surface in 5 pairs.
- 8 (27) External gill openings on each side of body, 5 to 7; pectoral fins not expanded at bases.
- 9 (12) Dorsal fin (1); external gill openings, 6 or 7.

Family **Hexanchidae**—Cow sharks

- 10 (11) External gill openings, 7.  
SEVENGILL SHARK                      *Notorynchus maculatum*    (page 71)
- 11 (10) External gill openings, 6.  
SIXGILL SHARK                              *Hexanchus corinum*    (page 72)

- 12 (9) Dorsal fins 2; external gill openings, 5.
- 13 (24) Anal fin present.
- 14 (15) Caudal fin long, length about half total length of shark.

Family **Alopiidae**—Thresher sharks

- THRESHER SHARK                      *Alopias vulpinus*    (page 73)

- 15 (14) Caudal fin short, length much less than half total length of shark.
- 16 (19) Large keel on each side of caudal peduncle.
- 17 (18) Gill slits moderate, first about equal in length to distance from tip of snout to posterior margin of eye.

Family **Lamnidae**—Mackerel sharks

- SALMON SHARK                              *Lamna ditropis*    (page 75)

- 18 (17) Gill slits very long, first more than twice as long as distance from tip of snout to posterior margin of eye.  
 Family **Cetorhinidae**—Basking sharks  
 BASKING SHARK                      *Ceteorhinus maximus* (page 76)
- 19 (16) No keels on caudal peduncle.
- 20 (21) Anal fin large, length of base about twice that of first dorsal fin.  
 Family **Scyliorhinidae**—Cat sharks  
 BROWN CAT SHARK                      *Apristurus brunneus* (page 78)
- 21 (20) Anal fin small, length of base much less than that of first dorsal fin.  
 Family **Carcharhinidae**—Blue sharks
- 22 (23) Length of pectoral fin twice height of first dorsal fin, fin sabre-shaped; no black spot on either dorsal fin.  
 BLUE SHARK                              *Prionace glauca* (page 79)
- 23 (22) Length of pectoral fin only slightly greater than height of first dorsal fin, fin not sabre-shaped; black spot on each dorsal fin.  
 SOUPFIN SHARK                      *Galeorhinus zyopterus* (page 80)
- 24 (13) Anal fin absent.
- 25 (26) Large spine in anterior margin of each dorsal fin.  
 Family **Squalidae**—Dogfishes  
 PACIFIC DOGFISH                      *Squalus suckleyi* (page 81)
- 26 (25) No spine in anterior margin of either dorsal fin.  
 Family **Dalatiidae**—Sleeper sharks  
 PACIFIC SLEEPER SHARK                      *Somniosus pacificus* (page 83)
- 27 (8) External gill openings on ventral surface of body in 5 pairs; pectoral fins expanded at bases, each extending from snout to pelvic fin.
- 28 (39) Snout acutely pointed anteriorly.
- 29 (38) Body elongate posteriorly, not forming whip-like extension and without large spine above; dorsal fins (2), near tip.  
 Family **Rajidae**—Skates
- 30 (33) Outline between tip of snout and tip of pectoral fin concave so that a line drawn between these two points lies almost wholly without body margin; snout supported by firm cartilage.
- 31 (32) 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* (page 84)

- 32 (31) Pelvic fins deeply notched when extended; colour on upper surface of body nearly plain brown, on lower surface, muddy blue.  
LONGNOSE SKATE *Raja rhina* (page 86)
- 33 (30) 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 body margin; snout supported by weak cartilage.
- 34 (37) One or more spines present on shoulder girdle.
- 35 (36) Spines on shoulder girdle, about 6; on orbital rim, in row.  
STARRY SKATE *Raja stellulata* (page 87)
- 36 (35) Spines on shoulder girdle, 1 or 2; on orbital rim, none.  
BLACK SKATE *Raja kincaidii* (page 88)
- 37 (34) No spines on shoulder girdle.  
DEEPSEA SKATE *Raja abyssicola* (page 90)
- 38 (29) Body greatly elongate posteriorly, forming whip-like extension with large sharp spine above; dorsal fins, none.  
Family **Dasyatidae**—Sting rays  
DIAMOND STINGRAY *Dasyatis dipterurus* (page 91)
- 39 (28) Snout bluntly rounded anteriorly.  
Family **Torpedinidae**—Electric rays  
PACIFIC ELECTRIC RAY *Torpedo californica* (page 93)
- 40 (7) External gill opening on each side of body, 1.
- 41 (490) PELVIC FINS PRESENT. (In *Benthodesmus simonyi* the pelvic fins are reduced to mere scale-like processes and are considered as absent in this key.)
- 42 (137) PELVIC FINS ABDOMINAL IN POSITION.
- 43 (44) Dorsal fins (2), spine at anterior margin of first dorsal fin stout, grooved, serrate; teeth in chisel-like bony plates formed by union of several teeth. (The adipose fin of salmon, trout and other species is not regarded as a dorsal fin in this key.)  
Family **Chimaeridae**—Chimaeras  
RATFISH *Hydrolagus colliei* (page 94)
- 44 (43) Dorsal fin (1), or absent, no spine at anterior margin (dorsal fin preceded by a series of bony plates in the silvery hatchetfish); teeth, if present, not chisel-like.
- 45 (48) Bony shields on body in 5 widely separated rows; mouth ventral, protusable; barbels under snout, 4, in transverse row.  
Family **Acipenseridae**—Sturgeons





- 58 (53) Mouth large, subterminal.  
 Family **Engraulidae**—Anchovies  
 ANCHOVY *Engraulis mordax* (page 104)
- 59 (52) Either adipose fin or lateral line, or both present.  
 60 (81) Large fleshy appendage at base of each pelvic fin.  
 Family **Salmonidae**—Salmons
- 61 (72) Rays in anal fin, 8 to 12.  
 62 (69) 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
- 63 (66) No red band along side of body; no red dash below lower jaw.  
 64 (65) No spots below lateral line.  
 ATLANTIC SALMON *Salmo salar* (page 107)
- 65 (64) Large black spots below lateral line, each surrounded by pink or red halo.  
 BROWN TROUT *Salmo trutta* (page 108)
- 66 (63) Either red band along side of body *or* red dash below lower jaw.  
 67 (68) Red band along side of body; no red dash below lower jaw; no teeth on back of tongue.  
 STEELHEAD TROUT *Salmo gairdnerii* (page 109)
- 68 (67) No red band along side of body; red dash below lower jaw; teeth present on back of tongue.  
 COASTAL CUTTHROAT TROUT *Salmo clarkii clarkii* (page 111)
- 69 (62) 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
- 70 (71) Spots on back, pale yellow; vermiculations on back and dorsal fin absent or weak.  
 DOLLY VARDEN *Salvelinus malma* (page 112)
- 71 (70) No spots on back; vermiculations on back and dorsal fin dark green, prominent.  
 BROOK TROUT *Salvelinus fontinalis* (page 113)
- 72 (61) Rays in anal fin, 13 to 19.  
 Genus **Oncorhynchus**—Pacific salmon

- 73 (78) Black spots on back and caudal fin.
- 74 (75) Spots on back and caudal fin large; scales in first row above lateral line, 170 or more.  
 PINK SALMON *Oncorhynchus gorbuscha* (page 114)
- 75 (74) Spots on back and caudal fin small, irregular; scales in first row above lateral line, fewer than 155, moderate.
- 76 (77) Black spots on caudal fin, usually on upper lobe only; light silvery pigment along bases of teeth; pyloric caeca, fewer than 100.  
 COHO SALMON *Oncorhynchus kisutch* (page 116)
- 77 (76) Black spots on both lobes of caudal fin; black along bases of teeth; pyloric caeca, 120 or more.  
 CHINOOK SALMON *Oncorhynchus tshawytscha* (page 117)
- 78 (73) No large black spots on caudal fin, small black speckling usually present.
- 79 (80) Rakers on first gill arch, 19 to 26, short, stout, smooth, widely spaced.  
 CHUM SALMON *Oncorhynchus keta* (page 119)
- 80 (79) Rakers on first gill arch, 30 to 39, long, slender, rough, closely set.  
 SOCKEYE SALMON *Oncorhynchus nerka* (page 120)
- 81 (60) No large fleshy appendage at base of either pelvic fin.
- 82 (91) Eye small, diameter less than length of gape.  
 Family **Osmeridae**—Smelts
- 83 (90) Scales on lateral line moderate, fewer than 80; rays in pectoral fin 15 or fewer.
- 84 (85) Origin of dorsal fin behind origins of pelvic fins; striae on opercular bones following contours, well developed.  
 EULACHON *Thaleichthys pacificus* (page 122)
- 85 (84) Origin of dorsal fin above origins of pelvic fins or in front; no striae on opercular bones.
- 86 (87) Pectoral fin as long as head or longer; black stippling on head and back dense, prominent.  
 LONGFIN SMELT *Spirinchus dilatatus* (page 124)
- 87 (86) Pectoral fin shorter than head; no black stippling on head or body.
- 88 (89) Maxillary reaching below front of eye; no large teeth on vomer.  
 SURF SMELT *Hypomesus pretiosus* (page 125)

- 89 (88) Maxillary reaching point behind eye; two large canine-like teeth on vomer.  
     TOOTHED SMELT                      *Osmerus dentex* (page 126)
- 90 (83) Scales on lateral line small, more than 160; rays in pectoral fin, 16 or more.  
     CAPELIN                              *Mallotus villosus* (page 127)
- 91 (82) Eye large, diameter greater than length of gape.  
     Family **Argentinidae**—Deepsea smelts
- 92 (97) Eyes lateral, not directed upward; snout not broad or shovel-like.  
 93 (94) Rays in anal fin, fewer than 15.  
     SMOOTH TONGUE                      *Leuroglossus stilbius* (page 128)
- 94 (93) Rays in anal fin, 18 or more.  
 95 (96) Rays in anal fin, 18 to 20; scales in oblique rows above midline of body, more than 30.  
     SLENDER BLACKSMELT              *Bathylagus pacificus* (page 129)
- 96 (95) Rays in anal fin, 23 to 27; scales in oblique rows above midline of body, fewer than 30.  
     STOUT BLACKSMELT                  *Bathylagus milleri* (page 130)
- 97 (92) Eyes on cylindrical bases, directed upwards; snout broad, shovel-like.  
     BARRELEYE                          *Macropinna microstoma* (page 131)
- 98 (51) Photophores present, low on body, in two rows anteriorly.  
 99 (102) Teeth on jaws, small.  
 100 (101) Body elongate, slender, little compressed.  
     Family **Gonostomatidae**—Anglemouths  
     VEILED ANGLEMOUTH                  *Cyclothone microdon* (page 132)
- 101 (100) Body short, deep, very greatly compressed.  
     Family **Sternoptychidae**—Hatchetfishes  
     SILVERY HATCHETFISH                *Argyropelecus sladeni* (page 133)
- 102 (99) Teeth on jaws large, fang-like.  
 103 (108) Dorsal fin far back on body, first ray not elongate; scales, absent.  
 104 (107) Rays in dorsal fin, fewer than 18; barbel not ending in bulbous structure.  
     Family **Melanostomiidae**—Dragonfishes

- 105 (106) Pectoral fins present; pelvic fins high on sides of body.  
HIGHFIN DRAGONFISH *Bathophilus flemingi* (page 135)
- 106 (105) Pectoral fins absent; pelvic fins low on body.  
ARROW DRAGONFISH *Tactostoma macropus* (page 136)
- 107 (104) Rays in dorsal fin, more than 20; barbel ending in bulbous structure.  
Family **Malacosteidae**—Loosejaws  
LOOSEJAW *Aristostomias scintillans* (page 137)
- 108 (103) Dorsal fin far forward on body, first ray greatly elongate; scales, present.  
Family **Chauliodontidae**—Viperfishes  
FANGED VIPERFISH *Chauliodus macouni* (page 138)
- 109 (50) Upper jaw with premaxillaries only in gape.
- 110 (127) Photophores present in definite patterns below lateral line. (See Fig. 10 for identification of photophores.)

Family **Myctophidae**—Lanternfishes

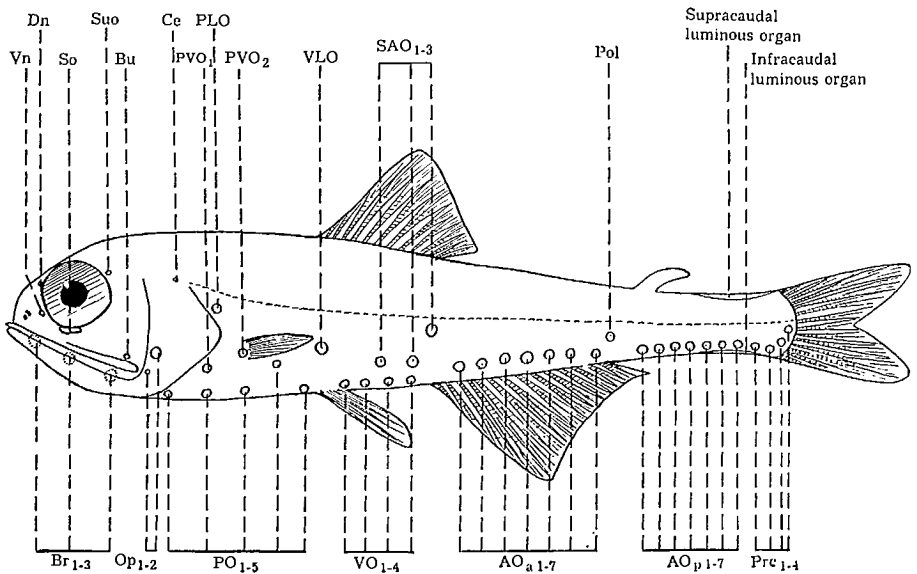


FIGURE 10. A hypothetical myctophid showing the general distribution and terminology of the photophores. Dn—dorsonasal; Suo—supraorbital; Ce—cervical; Vn—ventronasal; So—suborbital; Br—branchiostegal; Bu—buccal; Op—opercular; PLO—suprapectoral; PVO—subpectoral; VLO—supraventral; SAO—supraanal; Pol—posterolateral; PO—thoracic; VO—ventral, AO<sub>a</sub>—anterior anal, AO<sub>p</sub>—posterior anal; Prc—precaudal.

- 111 (112) AO in continuous series; no Pol.  
 BIGEYE LANTERNFISH *Electrona arctica* (page 140)
- 112 (111) AO in two series, separated by an interspace; 1 or 2 Pol.
- 113 (114) PLO below upper end of base of pectoral fin; lateral line very short.  
 BLUE LANTERNFISH *Tarletonbeania crenularis* (page 141)
- 114 (113) PLO above upper end of base of pectoral fin; lateral line complete.
- 115 (126) Rays in dorsal fin 16 or fewer; Pol. 1 or 2, if two, second not immediately behind first; no small glands below PLO, PVO, VLO, SAO, last AO<sub>a</sub>, Pol. and last Prc photophores.
- 116 (117) 2 Prc, close to ventral surface of caudal peduncle.  
 BIGFIN LANTERNFISH *Myctophum californiense* (page 143)
- 117 (116) 4 Prc, in continuous series, or 3 + 1.
- 118 (125) Pectoral fin short, tip not reaching to vertical from origin of dorsal fin.
- 119 (120) Large luminous patch above pectoral fin, closer to pectoral fin than to lateral line; PLO directly over or slightly behind base of pectoral fin.  
 THETA LANTERNFISH *Diaphus theta* (page 144)
- 120 (119) No luminous patch above pectoral fin; PLO in advance of base of pectoral fin, close to lateral line.
- 121 (122) Pol, 1; Prc, 4, continuous.  
 SMALLFIN LANTERNFISH *Lampanyctus leucopsarus* (page 145)
- 122 (121) Pol. 2; Prc, 3 + 1.
- 123 (124) VLO much closer to lateral line than base of pelvic fin.  
 PINPOINT LANTERNFISH *Lampanyctus regalis* (page 147)
- 124 (123) VLO about midway between lateral line and base of pelvic fin, or lower.  
 BROADFIN LANTERNFISH *Lampanyctus ritteri* (page 148)
- 125 (118) Pectoral fin long, tip reaching well past vertical from origin of dorsal fin.  
 FANGTOOTH LANTERNFISH *Ceratoscopelus townsendi* (page 149)
- 126 (115) Rays in dorsal fin more than 18; Pol, 2, second immediately behind first; small glands below PLO, PVO, VLO, SAO, last AO<sub>a</sub>, Pol and last Prc photophores.  
 PATCHWORK LANTERNFISH *Notoscopelus resplendens* (page 150)

- 127 (110) No photophores on body.
- 128 (135) Dorsal fin, if present, short, length of base less than length of head.
- 129 (134) Dorsal fin present.
- 130 (131) Light pearly area on eye below pupil; eyes directed upward.  
 Family **Scopelarchidae**—Pearleyes  
 PEARLEYE *Neoscopelarchoides dentatus* (page 152)
- 131 (130) No pearly area on eye; eyes directed laterally.  
 Family **Paralepidae**—Barracudinas
- 132 (133) Origin of dorsal fin behind origin of pelvic fins; gill rakers with row of 4 stout teeth on each basal plate.  
 SLENDER BARRACUDINA *Lestidium ringens* (page 153)
- 133 (132) Origin of dorsal fin in front of origin of pelvic fins; gill rakers with many scattered needle-like teeth on each basal plate.  
 RIBBON BARRACUDINA *Notolepis coruscans* (page 154)
- 134 (129) Dorsal fin absent.  
 Family **Anotopteridae**—Daggertooshs  
 DAGGERTOOTH *Anotopterus pharao* (page 155)
- 135 (128) Dorsal fin extending almost full length of body.  
 Family **Alepisauridae**—Lancetfishes  
 PACIFIC LANCETFISH *Alepisaurus borealis* (page 156)
- 136 (49) Dorsal fin followed by 5 to 7 free finlets.  
 Family **Scomberesocidae**—Sauries  
 PACIFIC SAURY *Cololabis saira* (page 158)
- 137 (42) PELVIC FINS THORACIC IN POSITION.
- 138 (153) Dorsal fins (2), or (3), supported by rays only, barbel usually present on tip of lower jaw.
- 139 (148) Caudal fin truncate to concave.
- 140 (141) Dorsal fins (2), second deeply notched.  
 Family **Merlucciidae**—Hakes  
 PACIFIC HAKE *Merluccius productus* (page 162)
- 141 (140) Dorsal fins (3), or (2), if two, second not deeply incised.  
 Family **Gadidae**—Cods

- 142 (147) Mouth terminal.
- 143 (144) Lower jaw projecting; anus below interspace between first and second dorsal fins.  
 WHITING *Theragra chalcogrammus* (page 163)
- 144 (143) Lower jaw included; anus not below interspace between first and second dorsal fins.
- 145 (146) Anus below first dorsal fin; barbel small, length equal to half diameter of eye.  
 PACIFIC TOMCOD *Microgadus proximus* (page 164)
- 146 (145) Anus below second dorsal fin; barbel well developed, length at least equal to diameter of eye.  
 PACIFIC COD *Gadus macrocephalus* (page 165)
- 147 (142) Mouth subterminal.  
 LONGFIN COD *Antimora rostrata* (page 167)
- 148 (139) Caudal fin very pointed, indistinguishable from dorsal and anal fins.  
 Family **Coryphaenoididae**—Rattails
- 149 (150) Interspace between dorsal fins longer than length of base of first dorsal fin; anus below interspace between dorsal fins.  
 SMOOTHSCALE RATTAIL *Coryphaenoides cyclolepis* (page 168)
- 150 (149) Interspace between dorsal fins shorter than length of base of first dorsal fin; anus below second dorsal fin.
- 151 (152) Interspace between dorsal fins more than half length of base of first dorsal fin; teeth on lower jaw in one row, large.  
 FILAMENTED RATTAIL *Coryphaenoides filifera* (page 169)
- 152 (151) Interspace between dorsal fins less than half length of base of first dorsal fin; teeth on lower jaw in villiform band, none enlarged.  
 ROUGHSCALE RATTAIL *Coryphaenoides acrolepis* (page 170)
- 153 (138) Dorsal fins (1), or (2), if two, first composed of spines; barbel absent from lower jaw.
- 154 (155) 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**—Moonfishes  
 OPAH *Lampris regius* (page 171)

- 155 (154) Pelvic fins with total number of rays, or spines and rays, not more than 8; if body ovate, colours never dark bluish gray with white or silvery spots.
- 156 (157) Upper lobe of caudal fin very greatly developed, fan-shaped; anal fin absent.

Family **Trachypteridae**—Ribbonfishes

KING-OF-THE-SALMON      *Trachypterus rexsal-* (page 173)  
*monorum*

- 157 (156) Upper lobe of caudal fin not greatly developed, not fan-shaped; anal fin present.
- 158 (159) Third ray of dorsal fin almost reaching base of caudal fin.

Family **Caristiidae**—Manefishes

MANEFISH      *Caristius macropus* (page 175)

- 159 (158) Third ray of dorsal fin not reaching near base of caudal fin.
- 160 (163) Dorsal fin, III, 12 to 16, short; pelvic fins separate, each I, 7.

Family **Melamphaidae**—Melamphids

- 161 (162) Prominent crest on top of head; rostral spine present.
- CRESTED MELAMPHID      *Melamphaes rugosus* (page 176)
- 162 (161) No crest on top of head; rostral spine, absent.
- HIGHSNOUT MELAMPHID      *Melamphaes lugubris* (page 177)
- 163 (160) Dorsal fin not as above; pelvic fins, if separate, each with a spine and 6 rays or fewer, or if spine absent, 6 rays or fewer.
- 164 (165) Diameter of eye at least equal to half length of head; body sharply angular at origin of dorsal fin.

Family **Zcidae**—John dories

COSTER DORY      *Allocyttus verrucosus* (page 178)

- 165 (164) Diameter of eye much less than half length of head; body not sharply angular at origin of dorsal fin.
- 166 (205) Body asymmetrical; both eyes on same side of head.
- 167 (170) 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**—Sanddabs

- 168 (169) 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 SANDDAB      *Citharichthys sordidus* (page 180)



169 (168) 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 SANDDAB *Citharichthys stigmaeus* (page 181)

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

Family **Pleuronectidae**—Flounders

171 (182) Mouth nearly symmetrical, gape on eyed side usually wide; posterior margin of upper jaw extending below pupil of eye or behind.

172 (175) Caudal fin lunate; no spine preceding anal fin.

173 (174) Upper jaw extending well behind eye; teeth arrow-shaped; scales large, rough; no distinct arch in lateral line over pectoral fin.

ARROWTOOTH FLOUNDER *Atheresthes stomias* (page 183)

174 (173) Upper jaw extending to point below eye; teeth not arrow-shaped; scales small, smooth; distinct arch in lateral line over pectoral fin.

PACIFIC HALIBUT *Hippoglossus stenolepis* (page 184)

175 (172) Caudal fin truncate or rounded; exposed spine preceding anal fin.

176 (181) First rays in dorsal fin not elongate, not free from membranes; no dorsal branch to lateral line.

177 (178) Teeth on upper jaw in 1 row; scales in diagonal row between dorsal fin and lateral line at widest part of body, 40 or more.

FLATHEAD SOLE *Hippoglossoides elassodon* (page 185)

178 (177) Teeth on upper jaw in 2 rows; scales in diagonal row between dorsal fin and lateral line at widest part of body, 30 or fewer.

179 (180) Scales on both sides of body large, readily deciduous; on lateral line, fewer than 75.

SLENDER SOLE *Lyopsetta exilis* (page 187)

180 (179) Scales on both sides of body small, not deciduous; on lateral line, more than 85.

BRILL *Eopsetta jordani* (page 188)

181 (176) First rays in dorsal fin elongate, mostly free from membranes; dorsal branch to lateral line close to dorsal fin, short.

SAND SOLE *Psettichthys melanostictus* (page 189)

- 182 (171) Mouth asymmetrical, gape on eyed side usually narrow; posterior margin of upper jaw not extending to point below pupil of eye.
- 183 (184) Upper jaw on blind side of head nearly half length of head; scales on eyed side of body modified into bony plates in six definitely marked rows.  
ROUGHSCALE SOLE            *Clidoderma asperrimum* (page 190)
- 184 (183) Upper jaw on blind side of head not as long as one-third length of head; scales, if modified into bony plates, not in six longitudinal rows.
- 185 (188) Scales embedded.
- 186 (187) Origin of dorsal fin on blind side of body at angle of mouth, first 9 to 12 rays on blind side.  
CURLFIN SOLE            *Pleuronichthys decurrens* (page 191)
- 187 (186) 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* (page 192)
- 188 (185) Scales not embedded, more or less imbricated, free.
- 189 (196) Lateral line with accessory dorsal branch.
- 190 (195) Lateral line above pectoral fin decurved or very flatly arched.
- 191 (194) Accessory branch to lateral line extending backward to point over pectoral fin, not forked posteriorly.
- 192 (193) Scales on eyed side of body smooth anteriorly; on blind side smooth; none on fins.  
LEMON SOLE            *Parophrys vetulus* (page 194)
- 193 (192) Scales on both sides of body and on dorsal and anal fins, rough.  
BUTTER SOLE            *Isopsetta isolepis* (page 195)
- 194 (191) Accessory branch to lateral line not extending backward behind head, forked posteriorly.  
FORKLINE SOLE            *Inopsetta ischyra* (page 196)
- 195 (190) Lateral line above pectoral fin highly arched.  
ROCK SOLE            *Lepidopsetta bilineata* (page 197)
- 196 (189) Lateral line without accessory branch.
- 197 (204) Body covered with cycloid or ctenoid scales, never with spinous stellate plates; dorsal and anal fins not banded with intense black.
- 198 (203) Length of pectoral fin much less than that of head.
- 199 (200) Lateral line above pectoral fin highly arched.  
YELLOWFIN SOLE            *Limanda aspera* (page 198)

- 200 (199) Lateral line above pectoral fin not highly arched.  
 201 (202) Upper and lower thirds of body not sharply more compressed than middle third; never more than 3 teeth in either jaw on eyed side of body.

DOVER SOLE *Microstomus pacificus* (page 200)

- 202 (201) Upper and lower thirds of body highly compressed, distinctly more so than middle third; at least 7 teeth in either jaw on eyed side of body.

DEEPSEA SOLE *Embassichthys bathybius* (page 201)

- 203 (198) Pectoral fin on eyed side of body much longer than length of head.

REX SOLE *Glyptocephalus zachirus* (page 202)

- 204 (197) Body covered with spinous stellate plates; dorsal and anal fins banded with intense black.

STARRY FLOUNDER *Platichthys stellatus* (page 203)

- 205 (166) Body symmetrical.

- 206 (207) Dorsal fins (2), first modified to form large adhesive disk on top of head.

Family **Echeneidae**—Remoras

WHALE SUCKER *Remilegia australis* (page 205)

- 207 (206) Dorsal fins (1), or (2), if two, first not modified to form adhesive disk on top of head.

- 208 (221) Sheath of scales at base of dorsal fin demarked from scales of body by pronounced furrow.

Family **Embiotocidae**—Seaperches

- 209 (218) Scales on lateral line, more than 54.

- 210 (213) No frenum between lower lip and symphysis of lower jaw; middle spines in spinous portion of dorsal fin longer than longest ray.

- 211 (212) Rakers below angle of first gill arch, about 21; if bands of colour across body, those above lateral line not alternating with those below.

WALLEYE SEAPERCH *Hyperprosopon argenteum* (page 207)

- 212 (211) Rakers below angle of first gill arch, 11 to 13; bands of colour across body above lateral line alternating with those below.

REDTAIL SEAPERCH *Holconotus rhodoterus* (page 208)

- 213 (210) A frenum between lower lip and symphysis of lower jaw; none of spines in spinous portion of dorsal fin longer than longest ray.

- 214 (215) Last spine in spinous portion of dorsal fin about equal in length to ray following.  
 WHITE SEAPERCH *Phanerodon furcatus* (page 209)
- 215 (214) Last spine in spinous portion of dorsal fin shorter than first ray.
- 216 (217) Last spine in spinous portion of dorsal fin about half length of ray following; dark spot on preopercle behind posterior tip of upper jaw, prominent; no blue longitudinal stripes on sides of body.  
 PILE SEAPERCH *Damalichthys vacca* (page 210)
- 217 (216) Last spine in spinous portion of dorsal fin about three-quarters length of ray following; no dark spot on preopercle behind posterior tip of upper jaw; blue longitudinal stripes on sides of body.  
 STRIPED SEAPERCH *Embiotoca lateralis* (page 211)
- 218 (209) Scales on lateral line, fewer than 48.
- 219 (220) Rays in dorsal fin, 18 to 23; rays in anal fin, 23 to 25; no frenum between lower lip and symphysis of lower jaw.  
 SHINER SEAPERCH *Cymatogaster aggregata* (page 213)
- 220 (219) Rays in dorsal fin, 13 to 15; rays in anal fin, 21 or 22; frenum between lower lip and symphysis of lower jaw.  
 KELP SEAPERCH *Brachyistius frenatus* (page 214)
- 221 (208) No sheath of scales along base of dorsal fin.
- 222 (223) Fringes on lips.  
 Family **Trichodontidae**—Sandfishes  
 SANDFISH *Trichodon trichodon* (page 215)
- 223 (222) No fringes on lips.
- 224 (227) Body elongate, slender; fleshy appendage at base of each pelvic fin.  
 Family **Sciaenidae**—Croakers
- 225 (226) Lower jaw projecting; anal fin, II, 8 or 9.  
 WHITE SEABASS *Cynoscion nobilis* (page 217)
- 226 (225) Lower jaw included; anal fin, II, 10 to 12.  
 WHITE CROAKER *Genyonemus lineatus* (page 218)
- 227 (224) If body elongate, slender, no fleshy appendage at base of each pelvic fin.
- 228 (229) Body ovate; bones on head and above pectoral fins exposed, strongly striate.  
 Family **Histiopteridae**—Boarfishes  
 BOARFISH *Pseudopentaceros richardsoni* (page 219)

- 229 (228) If body ovate, bones on head and above pectoral fins not striate.  
 230 (231) 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* (page 220)

- 231 (230) Dorsal and anal fins, if single, never both with anterior portions prominently elevated; caudal fin not broadly lunate on slender caudal peduncle.  
 232 (243) Both dorsal and anal fins followed by one or more free finlets.  
 233 (234) Both dorsal and anal fins followed by single finlet.

Family **Carangidae**—Jacks

MACKERELJACK *Trachurus symmetricus* (page 222)

- 234 (233) Both dorsal and anal fins followed by 5 or more free finlets.

Family **Scombridae**—Mackerels

- 235 (242) Dorsal fins close together, more than 13 spines in spinous dorsal fin; keel on each side of caudal peduncle.  
 236 (241) Scales completely covering body.  
 237 (240) Spines in spinous dorsal fin, fewer than 15.  
 238 (239) Pectoral fin longer than head.

ALBACORE *Thunnus alalunga* (page 224)

- 239 (238) Pectoral fin shorter than head.

BLUEFIN TUNA *Thunnus saliens* (page 225)

- 240 (237) Spines in spinous dorsal fin, more than 16.

PACIFIC BONITO *Sarda lineolata* (page 226)

- 241 (236) Scales absent from posterior of body.

SKIPJACK TUNA *Katsuwonus pelamis* (page 227)

- 242 (235) Dorsal fins far apart, distance equal to length of snout, fewer than 12 spines in spinous dorsal fin; no keels on sides of caudal peduncle.

PACIFIC MACKEREL *Pneumatophorus japonicus* (page 229)

- 243 (232) Dorsal and anal fins not followed by finlets.

- 244 (245) Top of head spongy with free flap posteriorly; fifth ray of pelvic fin long, filamentous.

Family **Centrolophidae**—Rudderfishes

BROWN RUDDERFISH *Icichthys lockingtoni* (page 232)

- 245 (244) Top of head may be soft, not spongy with free flap posteriorly; fifth ray of pelvic fin, if present, not long, or filamentous.
- 246 (247) Body oblong to elliptical, much compressed, very limp; colour yellow to brown.

Family **Icosteidae**—Ragfishes

RAGFISH *Icosteus aenigmaticus* (page 234)

- 247 (246) Body, if oblong, or elliptical, not much compressed, not limp; colour not yellow to brown.
- 248 (249) Pair of keels on each side of caudal peduncle.

Family **Tetragonuridae**—Squaretails

SQUARETAIL *Tetragonurus cuvieri* (page 236)

- 249 (248) No keels on caudal peduncle.
- 250 (251) Body subterete with two dorsal fins; head very elongate, sharply pointed with large teeth; pelvic fins far behind pectoral fins.

Family **Sphyraenidae**—Barracudas

PACIFIC BARRACUDA *Sphyraena argentea* (page 238)

- 251 (250) Body, if subterete, with one dorsal fin; if head very elongate, teeth not large; pelvic fins not far behind pectoral fins.
- 252 (255) Dorsal fins (2), with one or two spines in second fin.

Family **Anoplopomatidae**—Skilfishes

- 253 (254) Body slender; spinous dorsal fin XVII to XXII, interspace between dorsal fins more than twice diameter of eye; anal fin, III, 15 to 19, origin below that of second dorsal fin.

SABLEFISH *Anoplopoma fimbria* (page 239)

- 254 (253) Body stout; spinous dorsal fin XII to XIV, interspace between dorsal 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 second dorsal fin.

SKILFISH *Erilepis zonifer* (page 241)

- 255 (252) If dorsal fins (2), second fin without spines.
- 256 (267) Body completely covered with cycloid or ctenoid scales; dorsal fin (1), spinous anteriorly, rayed posteriorly; pelvic fin, I, 5; cirrus above eye large. (*If specimen does not fit all the four characters above see 267 (256).*)

Family **Hexagrammidae**—Greenlings

- 257 (262) Lateral lines on each side of body, more than 1.  
258 (259) 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 *Hexagrammos decagrammus* (page 242)

- 259 (258) Multifid cirrus above each eye present, none on occiput; no spine before anal fin.  
260 (261) 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.

WHITESPOTTED GREENLING *Hexagrammos stelleri* (page 244)

- 261 (260) 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.

ROCK GREENLING *Hexagrammos superciliosus* (page 245)

- 262 (257) Lateral line on each side of body, 1.  
263 (264) Maxillary not reaching anterior margin of eye; dark bars on each side of body and caudal fin, 7, vertical.

PAINTED GREENLING *Oxylebius pictus* (page 246)

- 264 (263) Maxillary reaching to point well behind anterior margin of eye; no distinct bars on sides of body.  
265 (266) Anterior spines of spinous portion of dorsal fin elongate, second spine very elongate; teeth on jaws small.

LONGSPINED COMBFISH *Zaniolepis latipinnis* (page 247)

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

LINGCOD *Ophiodon elongatus* (page 248)

- 267 (256) If *all* four characters in 256 (267) are not present continue below.  
268 (315) Spines in anal fin, III, conspicuously large, stout, second and third usually longer and stronger than first; rays, 5 to 9.

Family **Scorpaenidae**—Rockfishes

- 269 (314) 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.
- 270 (285) Interorbital space at midorbits highly convex.
- 271 (278) Spines on head, absent.
- 272 (273) Dorsal fin deeply notched, spinous portion almost separate from rayed portion; rays in pectoral fin, 16 or fewer, 7 or fewer unbranched; lower jaw projecting beyond upper profile of head.  
                   BOCACCIO                               *Sebastodes paucispinis* (page 251)
- 273 (272) Dorsal fin not deeply notched, spinous portion definitely attached to last spine by membrane; rays in pectoral fin 17 or more, 8 or more unbranched; lower jaw not projecting beyond upper profile of head.
- 274 (275) Interorbital space 3.5 or less in length of head; black on peritoneum.  
                   BLUE ROCKFISH                               *Sebastodes mystinus* (page 252)
- 275 (274) Interorbital space 3.7 or more in length of head; white on peritoneum.
- 276 (277) Posterior margin of anal fin nearly vertical when stretched; colour grayish brown above, brown on sides, dusky yellow on fins.  
                   YELLOWTAIL ROCKFISH                               *Sebastodes flavidus* (page 253)
- 277 (276) Posterior margin of anal fin with anterior slant above when stretched; colour black above, gray or black on sides, not yellow on fins.  
                   BLACK ROCKFISH                               *Sebastodes melanops* (page 254)
- 278 (271) Spines evident on head; nasal, prefrontal, frontals, II and III.
- 279 (282) White or silvery on peritoneum.
- 280 (281) Scales on mandible smooth; colour gray, mottled with orange, orange on fins.  
                   ORANGE ROCKFISH                               *Sebastodes pinniger* (page 256)
- 281 (280) Scales on mandible rough; colour dark red, mottled with gray, gray on margins of fins.  
                   VERMILION ROCKFISH                               *Sebastodes miniatus* (page 257)
- 282 (279) Brown to black on peritoneum.
- 283 (284) Head length in standard length, 2.7 or less; rakers on first gill arch, 33 or fewer; no clear light red zone along lateral line.  
                   BLACKBLOTCHED ROCKFISH                               *Sebastodes crameri* (page 258)
- 284 (283) Head length in standard length, 2.9 or more; rakers on first gill arch, 38 or more; clear red zone along lateral line.  
                   REDSTRIPE ROCKFISH                               *Sebastodes proriger* (page 260)



- 285 (270) Interorbital space at midorbits not highly convex, either slightly convex, flat, or concave.
- 286 (305) Peritoneum black, brownish black or with black dots giving grayish appearance. (*S. ruberrimus* and *S. rubrivinctus* sometimes with white or silvery on peritoneum, however, these two species are to be considered as in this group.)
- 287 (290) Lower jaw greatly projecting; symphyseal knob large, pointing forward.
- 288 (289) Sharp spines pointing backward on lower margin of orbital rim; pores on lateral line, 29 to 34.  
     ROUGHEYE ROCKFISH      *Sebastodes aleutianus* (page 261)
- 289 (288) No spines pointing backward on lower margin of orbital rim; pores on lateral line, 44 to 51.  
     LONGJAW ROCKFISH      *Sebastodes alutus* (page 262)
- 290 (287) Lower jaw not greatly projecting; symphyseal knob, if present, not pointing forward.
- 291 (296) Interorbital space at midorbits very slightly convex to flat, never concave; cranial spines slender, sharp.
- 292 (293) Rakers on first gill arch, 38 or more.  
     PYGMY ROCKFISH      *Sebastodes wilsoni* (page 263)
- 293 (292) Rakers on first gill arch, 37 or fewer.
- 294 (295) Dentigerous lobes on upper jaw little developed; spines on lacrymal lobes, minute or absent.  
     STRIPETAILED ROCKFISH      *Sebastodes saxicola* (page 264)
- 295 (294) Dentigerous lobes on upper jaw well developed; spines on lacrymal lobes, well developed.  
     SPLITNOSE ROCKFISH      *Sebastodes diploproa* (page 266)
- 296 (291) Interorbital space at midorbits concave; cranial spines well developed.
- 297 (300) Frontal I, spines present (sometimes very blunt in large *S. ruberrimus*).
- 298 (299) Preopercular spines thin, sharp; not black on tips of fins.  
     ROSY ROCKFISH      *Sebastodes rosaceus* (page 267)
- 299 (298) Preopercular spines broad, third multifid; usually black on tips of fins.  
     RED SNAPPER      *Sebastodes ruberrimus* (page 268)
- 300 (297) Frontal I spines, absent.

- 301 (304) Lacrymal spines present, posterior often multifold; no green stripes on body.
- 302 (303) Rakers on first gill arch, 32 or fewer; broad vertical bars across body.  
 FLAG ROCKFISH                    *Sebastes rubrivinctus* (page 270)
- 303 (302) Rakers on first gill arch, 33 or more; no vertical bars across body.  
 SHARPCHIN ROCKFISH            *Sebastes zacentrus* (page 271)
- 304 (301) Lacrymal spines absent; green stripes on body prominent.  
 GREENSTRIPE ROCKFISH        *Sebastes elongatus* (page 272)
- 305 (286) Peritoneum white or silvery.
- 306 (311) Interorbital space slightly convex, flat, or slightly concave, never deeply concave; parietal ridges not high, thick.
- 307 (310) Membranes of dorsal fin between first and fifth spines not incised to half length of spines; no round clear orange brown spots on anterior of body.
- 308 (309) Median frontal spine present; no pink or yellow coloration.  
 BROWN ROCKFISH                *Sebastes auriculatus* (page 273)
- 309 (308) Median frontal spine absent; pink or yellow in coloration.  
 COPPER ROCKFISH                *Sebastes caurinus* (page 275)
- 310 (307) Membranes of dorsal fin between first and fifth spines incised to more than half length of spines; round clear orange brown spots on anterior of body.  
 QUILLBACK ROCKFISH            *Sebastes maliger* (page 276)
- 311 (306) Interorbital space deeply concave; parietal ridges high, thick.
- 312 (313) Pores on lateral line, 41 or fewer; colour blue black; broad yellow stripe from anterior of dorsal fin to lateral line, thence backward to caudal peduncle; small white or yellow speckling everywhere on body.  
 YELLOWSTRIPE ROCKFISH       *Sebastes nebulosus* (page 277)
- 313 (312) Pores on lateral line, 43 or more; colour light red to pink with broad dark red or black bands on sides of body.  
 BLACKBANDED ROCKFISH        *Sebastes nigrocinctus* (page 279)
- 314 (269) 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.  
 SPINYCHEEK ROCKFISH        *Sebastolobus alascanus* (page 280)

- 315 (268) Spines in anal fin, 0 to IV, if three, not large or stout, sometimes buried in flesh; rays more than 10.
- 316 (489) No photophores on body.
- 317 (486) Pelvic fins separate or joined, if joined, not forming a laterally-cleft adhesive disk.
- 318 (485) Lateral line, or lines, present or absent; if present, not in two widely separated parts.
- 319 (474) If dorsal and anal fins are joined to the caudal fin, they are not confluent with it so that caudal rays cannot be counted; if each fin is composed of rays only, rays in dorsal fin fewer than 80, rays in anal fin fewer than 60.
- 320 (457) Dorsal fin, or fins, composed of spines and rays, or rays only, never with spines only.
- 321 (454) Rays in dorsal fin fewer than 30, pelvic fins separate or in form of adhesive disk; or, if dorsal rays more than 30, pelvic fins in the form of a circular or oval disk.
- 322 (451) If dorsal fin single, first portion not composed of 24 to 37 spines followed by 5 to 9 elevated rays.
- 323 (446) Pelvic fins not united to form a flaring cone free from the body.
- 324 (445) Head never prolonged into a tubular snout with small jaws at the tip; no small rayed dorsal fin preceded by about 25 short free spines.
- 325 (444) If dorsal fins (2), the first not composed of 2 or 3 long, stout, free spines; no large spine in anal fin longer than snout.
- 326 (419) Pelvic fins separate, not forming a circular or oval flattened adhesive disk.
- 327 (394) Body may have bony plates separated from one another, never completely enclosed by them.

Family **Cottidae**—Sculpins

- 328 (393) Pectoral fins separate.
- 329 (392) Head moderate to large, not covered with high blunt bony projections; spinous portion of dorsal fin not deeply incised between the spines, no fleshy pennant-like flaps on tips of spines.
- 330 (391) Length of head much less than half standard length of body.
- 331 (390) Caudal fin symmetrical; body not rising abruptly behind head.
- 332 (387) Body slender to robust, not deep and highly compressed; no large cirri on snout and lower jaw.
- 333 (380) Scales or pores on lateral line, more than 30.
- 334 (339) Dorsal fin (1), notched between spinous and rayed portions.
- 335 (336) Gill membranes free from isthmus; scales deeply embedded, not visible.

CABEZON

*Scorpaenichthys marmoratus* (page 282)

- 336 (335) Gill membranes joined to isthmus; scales above and below lateral line.
- 337 (338) Band of scales between dorsal fin and lateral line in 6 or 7 rows at widest part; gill membranes widely joined to isthmus.  
 BROWN IRISH LORD      *Hemilepidotus spinosus* (page 283)
- 338 (337) Band of scales between dorsal fin and lateral line in 4 rows at widest part; gill membranes narrowly joined to isthmus.  
 RED IRISH LORD      *Hemilepidotus hemilepidotus* (page 284)
- 339 (334) Dorsal fins (2), first spinous, second rayed.
- 340 (377) Gill membranes free from isthmus, or narrowly joined to isthmus with free fold posteriorly.
- 341 (342) Spines in spinous dorsal fin, more than 16; pelvic fin I, 5.  
 LONGFIN SCULPIN      *Jordania zonope* (page 285)
- 342 (341) Spines in dorsal fin, fewer than 12; pelvic fin with a spine and fewer than 5 rays.
- 343 (350) Upper preopercular spine stout, antler-like, with 3 to 6 upwardly directed free spinules.
- 344 (345) Scales between dorsal fins and lateral line completely covering body.  
 ROUGHBACK SCULPIN      *Chitonotus pugetensis* (page 286)
- 345 (344) Scales between dorsal fins and lateral line in two bands two scales in width.
- 346 (347) Rows of scales below bases of dorsal fins extending behind rayed dorsal fin; neither first nor second spine in spinous dorsal fin elongate.  
 COMB SCULPIN      *Icelinus borealis* (page 287)
- 347 (346) 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.
- 348 (349) 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* (page 289)
- 349 (348) 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 filamentosus* (page 290)

- 350 (343) Upper preopercular spine not antler-like (except in *Artedius fenestralis*), either simple, bifid or sometimes trifold and covered with skin.
- 351 (364) Scales in single row or bands above lateral line, or completely covering area; scales not reduced to prickles or irregularly scattered over body embedded in fleshy papillae.
- 352 (359) Scales in 1 or 4 rows above lateral line or completely covering area above lateral line.
- 353 (356) Scales in 1 or 4 rows above lateral line.
- 354 (355) Rays in anal fin 20 to 23; dorsal surface of body flattened forming prominent ridge on each side of body.  
 SLIM SCULPIN *Radulinus asprellus* (page 291)
- 355 (354) Rays in anal fin 15 or 16; dorsal surface of body slightly arched.  
 SPINYNOSE SCULPIN *Radulinus taylori* (page 292)
- 356 (353) Scales completely covering body above lateral line.
- 357 (358) Scales small, no enlarged scales at bases of fins.  
 ROUGHSPINE SCULPIN *Triglops macellus* (page 294)
- 358 (357) A row of enlarged scales at bases of fins.  
 RIBBED SCULPIN *Triglops beani* (page 295)
- 359 (352) Scales in band above lateral line, 7 to 10 rows in width.
- 360 (363) Band of scales on each side of body meeting behind rayed dorsal fin.
- 361 (362) Supraocular cirri present; uppermost preopercular spine broad or weakly bifid.  
 SCALYHEAD SCULPIN *Artedius harringtoni* (page 296)
- 362 (361) Supraocular cirri absent; uppermost preopercular spine antler-like with 2 or 3 spinules, partially covered with skin.  
 PADDED SCULPIN *Artedius fenestralis* (page 298)
- 363 (360) Band of scales on each side of body not reaching posterior end of dorsal fin.  
 SMOOTHHEAD SCULPIN *Artedius lateralis* (page 299)
- 364 (351) Scales absent, or reduced to mere prickles all over body, or scattered over body embedded in fleshy papillae.
- 365 (376) Scales absent or reduced to mere prickles; head not broad, or depressed.

- 366 (371) Origin of anal fin below spinous dorsal fin.  
 367 (368) Body everywhere covered with slender spines.  
     SADDLEBACK SCULPIN      *Oligocottus rimensis* (page 300)
- 368 (367) Body naked; no tubercles or spines present.  
 369 (370) Cirri on body single or paired, those on lateral line confined to anterior portion.  
     TIDEPPOOL SCULPIN      *Oligocottus maculosus* (page 301)
- 370 (369) Cirri on body in groups of 3 or 4, on lateral line and in 2 rows above.  
     FLUFFY SCULPIN      *Oligocottus synderi* (page 302)
- 371 (366) Origin of anal fin below rayed dorsal fin.  
 372 (373) Head blunt, anterior profile broadly rounded.  
     MOSSHEAD SCULPIN      *Clinocottus globiceps* (page 304)
- 373 (372) Head acute, anterior profile pointed.  
 374 (375) Cirri on head multifid, large.  
     CALICO SCULPIN      *Clinocottus embryum* (page 305)
- 375 (374) Cirri on head simple, small.  
     SHARPNOSE SCULPIN      *Clinocottus acuticeps* (page 306)
- 376 (365) Scales on body widely scattered, embedded in fleshy papillae; head broad, depressed.  
     GREAT SCULPIN      *Myoxocephalus polyacanthocephalus* (page 307)
- 377 (340) Gill membranes broadly joined to isthmus.  
 378 (379) Scales in form of large rough tubercles on lateral line; uppermost preopercular spine very elongate, roughly serrate.  
     BUFFALO SCULPIN      *Enophrys bison* (page 308)
- 379 (378) Scales absent; uppermost preopercular spine antler-like, with 3 or 4 spinules.  
     STAGHORN SCULPIN      *Leptocottus armatus* (page 309)
- 380 (333) Scales or pores on lateral line, fewer than 18.  
 381 (384) Dorsal fins (2), spinous fin usually as high as rayed fin.  
 382 (383) Cranial spines large, upright; gill membranes joined to isthmus with free fold posteriorly.  
     SPINYHEAD SCULPIN      *Dasycottus setiger* (page 311)

- 383 (382) Cranial spines absent; gill membranes joined to isthmus without free fold posteriorly.  
 BLACKFIN SCULPIN *Malacocottus kincaidi* (page 312)
- 384 (381) Dorsal fin (1), spinous portion buried in flesh.
- 385 (386) Rays in pectoral fin, 16 or 17; lower jaw projecting; anus immediately in front of anal fin.  
 SOFT SCULPIN *Gilbertidia sigalutes* (page 313)
- 386 (385) 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* (page 314)
- 387 (332) Body deep, highly compressed; large cirri on snout and lower jaw.
- 388 (389) Spinous dorsal fin emarginate, first 3 or 4 spines elevated; large silvery white areas on body, naked.  
 SILVERSPOTTED SCULPIN *Blepsias cirrhosus* (page 315)
- 389 (388) Spinous dorsal fin entire, first spines not elevated; body completely covered with minute spines embedded in thick conical fleshy papillae.  
 CRESTED SCULPIN *Blepsias bilobus* (page 317)
- 390 (331) Caudal fin asymmetrical; body rising abruptly behind head.  
 SAILFIN SCULPIN *Nautichthys oculo-fasciatus* (page 318)
- 391 (330) Length of head about half standard length.  
 GRUNT SCULPIN *Rhamphocottus richardsoni* (page 319)
- 392 (329) Head very broad, depressed, covered with high blunt bony projections; spinous portion of dorsal fin deeply incised between spines; large fleshy pennant-like flaps on tips of spines.  
 BIGMOUTH SCULPIN *Hemitripteris bolini* (page 321)
- 393 (328) Pectoral fins united anteriorly and ventrally.  
 MANACLED SCULPIN *Synchirus gilli* (page 322)
- 394 (327) Body completely enclosed in close-fitting bony plates.  
 Family **Agonidae**—Poachers
- 395 (418) Mouth terminal or subterminal, not surrounded by large cirri.
- 396 (417) Dorsal fins (2).
- 397 (402) Gill membranes united, free from isthmus.
- 398 (401) Plates on body rough.
- 399 (400) Body deep, rising abruptly behind head; caudal fin asymmetrical.  
 FOURHORN POACHER *Hypsagonus quadricornis* (page 323)

- 400 (399) Body slender, not rising abruptly behind head.  
 WARTY POACHER *Occa verrucosa* (page 324)
- 401 (398) Plates on body smooth.  
 TUBESNOUT POACHER *Pallasina barbata aix* (page 325)
- 402 (397) Gill membranes joined to isthmus.
- 403 (416) Plates on body rough; body slender.
- 404 (405) Spines pointing forward on snout, 2; no rostral plate.  
 WINDOWTAIL POACHER *Agonopsis emmelane* (page 326)
- 405 (404) No spines pointing forward on snout; rostral plate with one or more spines.
- 406 (409) Occipital region without pit.
- 407 (408) Lower jaw projecting; no spinous projections on eyeball; intensely blue black on all fins.  
 BLACKFIN POACHER *Bathyagonus nigripinnis* (page 327)
- 408 (407) Jaws about equal; 3 to 8 spinous projections on eyeball; not blue black on fins.  
 BLACKTIP POACHER *Xeneretmus latifrons* (page 328)
- 409 (406) Occipital region with definite pit.
- 410 (415) Spines on rostral plate forming star with 5 or more points.
- 411 (414) One pair of plates on ventral surface immediately in front of pelvic fins; gill membranes joined to isthmus with free fold posteriorly; plates in dorsal series on body, 36 to 39.
- 412 (413) Origin of anal fin below interspace between dorsal fins; no spines on lacrymal bone.  
 GRAY STARSNOUT *Asterotheca alascana* (page 329)
- 413 (412) Origin of anal fin below insertion of spinous dorsal fin; spines on front of lacrymal bone, 3 or more, conspicuous.  
 SPINYCHEEK STARSNOUT *Asterotheca infraspinata* (page 330)
- 414 (411) Two pairs of plates on ventral surface immediately in front of pelvic fins; gill membranes joined to isthmus without free fold posteriorly; plates in dorsal series on body, 41 to 44.  
 BIGEYE STARSNOUT *Asterotheca pentacantha* (page 331)
- 415 (410) One spine only on rostral plate.  
 PYGMY POACHER *Odontopyxis trispinosa* (page 333)



- 416 (403) Plates on body smooth; body stout.  
 DEEP-PITTED POACHER      *Bothragonus swanii* (page 334)
- 417 (396) Dorsal fin (1).  
 SMOOTH POACHER      *Anoplagonus inermis* (page 335)
- 418 (395) Mouth ventral, surrounded by large cirri.  
 STURGEON POACHER      *Agonus acipenserinus* (page 336)
- 419 (326) Pelvic fins united, forming flattened adhesive disk with thickened margin.
- 420 (423) Body short; dorsal and anal fins well separated from caudal fin rays.  
 Family **Cyclopteridae**—Lumpsuckers
- 421 (422) Spinous conical tubercles scattered over body.  
 SPINY LUMPSUCKER      *Eumicrotremus orbis* (page 337)
- 422 (421) No tubercles on body.  
 SMOOTH LUMPSUCKER      *Aptocyclus ventricosus* (page 339)
- 423 (420) Body elongate; dorsal and anal fins close to, or encroaching on, caudal fin.  
 Family **Liparidae**—Snailfishes
- 424 (437) Posterior margin of adhesive disk below or behind vertical from gill openings.
- 425 (436) Dorsal fin connected to caudal fin for one-fifth or less length of caudal fin.
- 426 (427) Greatest depth of body behind origin of anal fin.  
 TIDEPOOL SNAILFISH      *Liparis florum* (page 340)
- 427 (426) Greatest depth of body slightly behind posterior margin of adhesive disk.
- 428 (431) Gill opening entirely above pectoral fin or not extending below first ray.
- 429 (430) Adhesive disk large, length less than 2 in length of head; white band across base of caudal fin.  
 RINGTAIL SNAILFISH      *Liparis rutteri* (page 341)
- 430 (429) Adhesive disk moderate, length more than 2 in length of head; no white band across base of caudal fin.  
 SPOTTED SNAILFISH      *Liparis callyodon* (page 342)

- 431 (428) Gill opening extending below upper 3 or more rays of pectoral fin.  
 432 (433) Rays in pectoral fin, fewer than 35.  
           RIBBON SNAILFISH                                 *Liparis cyclopus* (page 343)
- 433 (432) Rays in pectoral fin more than 35.  
 434 (435) 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.  
           SLIPSKIN SNAILFISH                                 *Liparis fucensis* (page 344)
- 435 (434) 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.  
           MARBLED SNAILFISH                                 *Liparis dennyi* (page 345)
- 436 (425) Dorsal fin connected to caudal fin for more than four-fifths length of caudal fin.  
           SHORTTAIL SNAILFISH                                 *Liparis pulchellus* (page 346)
- 437 (424) Posterior margin of adhesive disk in front of vertical from gill openings.  
 438 (439) Nostrils double; anal fin barely reaching caudal fin.  
           LOBEFIN SNAILFISH                                 *Polypera greeni* (page 347)
- 439 (438) Nostril single; anal fin extending onto caudal fin for at least two-fifths length of caudal fin.  
 440 (441) 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 SNAILFISH                                 *Careproctus ovigerum* (page 348)
- 441 (440) 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.  
 442 (443) 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.  
           SMALLDISK SNAILFISH                                 *Careproctus gilberti* (page 349)
- 443 (442) 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.  
           BLACKTAIL SNAILFISH                                 *Careproctus melanurus* (page 350)

444 (325) Dorsal fins (2), first composed of 2 or 3 long stout free spines; large serrate spine in pelvic fin, spine longer than snout.

Family **Gasterosteidae**—Sticklebacks

THREESPINE STICKLEBACK *Gasterosteus aculeatus* (page 353)

445 (324) Head prolonged into tubular snout with small jaws at tip; small rayed dorsal fin preceded by about 25 short free spines.

Family **Aulorhynchidae**—Tubesnouts

TUBESNOUT *Aulorhynchus flavidus* (page 355)

446 (323) Pelvic fins united to form flaring cone free from body.

Family **Gobiidae**—Gobies

447 (448) Scales large, in oblique rows above midline of body, fewer than 30, usually 25 to 28; black on pelvic fins except at bases.

CRESTED GOBY *Coryphopterus nicholsii* (page 358)

448 (447) Scales small to moderate, in oblique rows above midline of body, more than 60; not entirely black on pelvic fins.

449 (450) 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.

FINESCALE GOBY *Lepidogobius lepidus* (page 359)

450 (449) 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* (page 360)

451 (322) Dorsal fin single, spines 24 to 37, followed by 5 to 9 elevated rays.

Family **Clinidae**—Kelpfishes

452 (453) Dorsal fin with first 3 spines closely approximated, last spine approximately half length of first ray; no ocelli on sides of body.

STRIPED KELPFISH *Gibbonsia metzi* (page 361)

453 (452) 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.

CREVICE KELPFISH *Gibbonsia montereyensis* (page 362)

454 (321) Rays in dorsal fin, 40 to 50, first 3 to 30 entire, remainder branched; pelvic fins not in form of circular or oval disk.

Family **Bathymasteridae**—Ronquils

455 (456) First 20 to 30 rays in dorsal fin entire, remainder branched; scales cycloid.

RONQUIL *Ronquilus jordani* (page 364)

456 (455) First 3 or 4 rays in dorsal fin entire, remainder branched; scales ctenoid.

SEARCHER *Bathymaster signatus* (page 365)

457 (320) Dorsal fin long, composed of spines only, more than 45 in number.

458 (471) Pelvic fins, I, 3 or I, 4; anal fin free from caudal fin.

Family **Stichaeidae**—Pricklebacks

459 (468) Pelvic fins, I, 3; no cirri on head.

460 (463) Spines in anal fin, III to V.

461 (462) Snout short; cheek not appearing inflated; white vertical bars on sides of body, short; pale cream on lining of mouth.

WHITEBARRED PRICKLEBACK *Poroclinus rothrocki* (page 368)

462 (461) Snout long; cheek appearing inflated; no white bars on sides of body; dusky to black on lining of mouth.

LONGSNOUT PRICKLEBACK *Lumpenella longirostris* (page 369)

463 (460) Spines in anal fin, II, I, or O.

464 (467) Spines in anal fin, I, or none; gill membranes joined to isthmus, with or without free fold.

465 (466) Gill membranes joined far forward to isthmus, with free fold posteriorly; rays in anal fin, about 31; Y-shaped marks black, in series on each side of body.

Y-PRICKLEBACK *Allolumpenus hypochromus* (page 370)

466 (465) Gill membranes joined far forward to isthmus, without free fold posteriorly; rays in anal fin, 45 or more; no Y-shaped black marks on sides of body.

SNAKE PRICKLEBACK *Lumpenus sagitta* (page 371)

467 (464) Spines in anal fin, II; gill membranes free from isthmus.

BLACK-AND-WHITE PRICKLEBACK *Plectobranthus* (page 372)  
*evides*

- 468 (459) Pelvic fins, I, 4; numerous cirri on head.
- 469 (470) Cirri on head high, plumose, extending onto tips of first 4 to 8 spines of dorsal fin; rays in anal fin, 44 to 51; no ocelli on dorsal fin.  
 DECORATED PRICKLEBACK *Chirolophis* (page 373)  
*polyactocephalus*
- 470 (469) 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.  
 MOSSHED PRICKLEBACK *Chirolophis nugator* (page 374)
- 471 (458) Pelvic fins, I, 1; anal fin joined to caudal fin.  
 Family **Pholidae**—Gunnels
- 472 (473) Black markings along base of dorsal fin in series, V- to U-shaped.  
 SADDLEBACK GUNNEL *Pholis ornata* (page 380)
- 473 (472) Black markings along base of dorsal fin in series, bracket-shaped, as ( ).  
 CRESCENT GUNNEL *Pholis laeta* (page 381)
- 474 (319) Dorsal and anal fins confluent with caudal fin so that caudal rays cannot be counted; rays in dorsal fin more than 80; rays in anal fin more than 60.
- 475 (484) Gill openings extending below bases of pectoral fins; pelvic fins slightly in advance of pectoral fins, not below eyes; scales, present.  
 Family **Zoarcidae**—Eelpouts
- 476 (477) No teeth on palatines.  
 BLACKBELLY EELPOUT *Lycodopsis pacifica* (page 385)
- 477 (476) Teeth on palatines.
- 478 (479) No teeth on vomer.  
 BIGFIN EELPOUT *Aprodon cortezianus* (page 386)
- 479 (478) Teeth on vomer.
- 480 (481) Pectoral fins deeply notched; black on peritoneum.  
 BLACKFIN EELPOUT *Lycodes diapterus* (page 387)
- 481 (480) Pectoral fins entire; white to pink on peritoneum.
- 482 (483) 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 EELPOUT *Lycodes palearis* (page 388)

483 (482) Cartilaginous folds on ventral surface of head moderate, without lobes; pelvic fins minute, length about 3 in diameter of eye; if white bars present on sides of body, first one only in front of dorsal fin.

SHORTFIN EELPOUT *Lycodes brevipes* (page 389)

484 (475) Gill openings reduced to small vertical slits in front of pectoral fins; pelvic fins far forward below eyes; scales, absent.

Family **Derepodichthyidae**—Cuskpouts

CUSKPOUT *Derepodichthys alepidotus* (page 392)

485 (318) Lateral line in two parts, upper broadly arched above pectoral fin to point above midlateral position, directly above anus, lower almost straight, commencing directly below posterior end of first, extending onto caudal fin.

Family **Brotulidae**—Brotulas

RED BROTLA *Brosmophycis marginata* (page 393)

486 (317) Pelvic fins joined to form laterally cleft adhesive disk.

Family **Gobiesocidae**—Clingfishes

487 (488) Body stout, tadpole-shaped; head large, broad; rays in dorsal fin, 13 or 14.

FLATHEAD CLINGFISH *Gobiesox maeandricus* (page 396)

488 (487) Body elongate, slender; head small, narrow; rays in dorsal fin, 4 to 6.

KELP CLINGFISH *Rimicola muscarum* (page 397)

489 (316) Photophores on body and head in rows.

Family **Batrachoididae**—Toadfishes

MIDSHIPMAN *Porichthys notatus* (page 398)

490 (41) PELVIC FINS ABSENT.

491 (542) Gill opening in front of pectoral fin; no jointed appendage on snout.

492 (541) Total length of fish greater than distance from tip of dorsal fin to tip of anal fin; length of base of dorsal fin greater than height of fin.

493 (540) Body with scales or naked; skin not in oblique folds passing downward and backward.

494 (497) Jaws greatly prolonged, very slender, with recurved tips.

Family **Nemichthyidae**—Threadfishes

495 (496) Anus remote from head, distance behind more than 9 times length of pectoral fin; lateral line pores in single row.

SNIPE EEL *Avocettina gilli* (page 159)

496 (495) Anus near head, below pectoral fins; lateral line pores in three rows.  
THREADFISH *Nemichthys avocetta* (page 160)

497 (494) Jaws not prolonged, or slender, or with recurved tips.

498 (499) Caudal peduncle very slender, diameter less than pupil of eye; upper jaw beak-like.

Family **Trichiuridae**—Hairtails

FROSTFISH *Benthodesmus simonyi* (page 229)

499 (498) Caudal peduncle not slender as above; upper jaw not beak-like.

500 (501) Length of pectoral fin greater than length of head.

Family **Stromateidae**—Butterfishes

PACIFIC POMPANO *Palometa simillima* (page 231)

501 (500) Length of pectoral fin less than length of head.

502 (503) Large conspicuous pores on head; lemon yellow on head and behind pectoral fins.

Family **Zaproridae**—Prowfishes

PROWFISH *Zaprora silenus* (page 233)

503 (502) If pores on head, not conspicuous; not lemon yellow on head and behind pectoral fins.

504 (505) Body elliptical, very limp; skin firm.

Family **Icosteidae**—Ragfishes

RAGFISH *Icosteus aenigmaticus* (page 234)

505 (504) Body elongate, slender to moderately stout; if limp, skin very fragile.

506 (507) Dorsal fin, VII to X, 17 to 20, spinous portion lower than rayed portion; anal fin 13 to 16; spine on preopercle.

Family **Cottidae**—Sculpins

ROSYLIP SCULPIN *Ascelichthys rhodorus* (page 310)

507 (506) Dorsal fin not as above; anal fin with more than 30 rays, or minute, or absent; no spine on preopercle.

508 (511) Skin very thin and loose; gill opening on each side of body not extending below upper 15 or 16 rays of pectoral fin.

Family **Liparidae**—Snailfishes

509 (510) Anus below vertical from gill openings, opening downward; gill opening on each side of body extending down to about upper 10 to 14 rays.

PRICKLY SNAILFISH *Paraliparis deani* (page 350)

510 (509) Anus below vertical from eyes, opening forward; gill opening small, entirely restricted to front of pectoral fin.

TADPOLE SNAILFISH      *Nectoliparis pelagicus* (page 352)

511 (508) Skin not thin and loose; gill opening not restricted to above upper part of pectoral fin.

512 (513) Body completely enclosed in bony plates; head prolonged into tubular snout.

Family **Syngnathidae**—Pipefishes

PIPEFISH      *Syngnathus griseolineatus* (page 356)

513 (512) Body not enclosed in bony plates; head not prolonged into tubular snout.

514 (533) Dorsal fin composed entirely of spines, or spines anteriorly, rays posteriorly.

515 (516) Teeth large, developed as crushing molars in back of mouth; large black spots on body.

Family **Anarrhichadidae**—Wolfishes

WOLF-EEL      *Anarrhichthys ocellatus* (page 366)

516 (515) Teeth, if present, not developed as crushing molars; no large black spots on body.

517 (518) Dorsal fin composed of about 90 small hooked spines anteriorly, followed by about 130 higher, unsegmented, unbranched rays; lower jaw ending in fleshy tip.

Family **Ptilichthyidae**—Quillfishes

QUILLFISH      *Ptilichthys goodei* (page 367)

518 (517) Dorsal fin composed entirely of hard spines; no fleshy tip on lower jaw.

519 (530) Lateral lines, 4 or 1, composed of faint pores.

Family **Stichaeidae**—Pricklebacks

520 (521) Anal fin free from caudal fin; crest on top of head prominent.

COCKSCOMB PRICKLEBACK      *Anoplarchus purpurescens* (page 375)

521 (520) Anal fin confluent with caudal fin; no crest on top of head.

522 (527) Lateral lines, 4, with numerous vertical branches; gill membranes free from isthmus.

523 (524) Spines in anal fin, II or III.

RIBBON PRICKLEBACK      *Phytichthys chirus* (page 376)



- 524 (523) Spines absent from anal fin.  
 525 (526) Distance from tip of snout to origin of dorsal fin approximately equal to length of head.  
     ROCK PRICKLEBACK                      *Xiphister mucosus* (page 376)
- 526 (525) Distance from tip of snout to origin of dorsal fin about 1½ times length of head.  
     BLACK PRICKLEBACK      *Epigeichthys atropurpureus* (page 377)
- 527 (522) Lateral line, 1, represented by pores; gill membranes joined to isthmus.  
 528 (529) Maxillary extending to at least one diameter of eye behind eye; scales on posterior half of body.  
     GIANT WRYMOUTH                      *Delolepis gigantea* (page 378)
- 529 (528) Maxillary not extending behind eye; no scales on body.  
     RED DEVIL                              *Lyconectes aleutensis* (page 379)
- 530 (519) Lateral line, absent.  
   Family **Pholidae**—Gunnels
- 531 (532) Spine in anal fin, I, large, grooved anteriorly like pen-point.  
     PENPOINT GUNNEL                      *Apodichthys flavidus* (page 382)
- 532 (531) Spines in anal fin, I or II, small, anterior spine short, rounded, never grooved like pen-point.  
     ROCKWEED GUNNEL                      *Xererpes fucorum* (page 383)
- 533 (514) Dorsal fin composed entirely of rays.  
 534 (535) Body deeper behind anus than in front.  
   Family **Scytalinidae**—Graveldivers  
     GRAVELDIVER                              *Scytalina cerdale* (page 384)
- 535 (534) Body deeper in front of anus than behind.  
   Family **Zoarcidae**—Eelpouts
- 536 (537) Upper jaw projecting.  
     SOFT BELPOUT                              *Bothrocara molle* (page 390)
- 537 (536) Upper jaw not projecting.  
 538 (539) Lower jaw projecting; snout angular; upper outline of head concave in lateral view.  
     BLACKMOUTH EELPOUT                      *Lycodapus ferasfer* (page 391)

539 (538) Jaws equal; snout rounded; upper outline of head straight in lateral view.

PALLID EELPOUT                    *Lycodapus mandibularis* (page 391)

540 (493) Body with minute scales; skin in oblique folds passing downward and backward.

Family **Ammodytidae**—Sandlances

PACIFIC SANDLANCE                *Ammodytes hexapterus* (page 395)

541 (492) Total length of fish less than distance from tip of dorsal fin to tip of anal fin.

Family **Molidae**—Ocean sunfishes

OCEAN SUNFISH                        *Mola mola* (page 400)

542 (491) Gill opening behind pectoral fin; large jointed appendage on snout.

Family **Oneirodidae**—Dreamers

DREAMER                                *Oneirodes bulbosus* (page 402)

## DESCRIPTIONS OF THE SPECIES

### PLAN OF DESCRIPTIVE ARRANGEMENT

The fishes and fish-like vertebrates are divided into groups or *Classes*, three of which are represented in British Columbia waters. The first, Cyclostomata or cyclostomes, includes the hagfish and the lampreys. The second Class, Selachii (Elasmobranchii) or selachians, includes the sharks, rays and chimaeras. The third Class, the Pisces or fishes, includes all the true fishes.

Each of the above classes is further divided into various groups and subgroups, 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.

The sequence of the orders, suborders and families follows closely that adopted by the majority of ichthyologists at the present time. The nomenclature is that in common usage.

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. For the most part the common name is that recommended by the Committee on Names of Fishes set up by the American Fisheries Society and the American Society of Ichthyologists and Herpetologists (Anon., 1960). This adoption of names is a contribution toward establishing a uniform fish nomenclature in North America. In the few instances where it seemed inadvisable to adopt the Committee's name, the latter is mentioned at the end of the account of the species, with a reference to its origin with the "AFS/ASIH Committee". When different scientific or common names were used in the first edition of this work (Clemens and Wilby, 1946), these too are mentioned, and are indexed.

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 total length 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 of general information includes: the first record, distribution within the Provincial waters, the habitat, abundance, life history as far as known, economic importance, and other information.

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 the Alaskan coast of the Bering Sea, 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 fold around the posterior end of the body, 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 are supported by a lateral network of cartilage, known as the branchial basket.

The class Cyclostomata comprises two orders: Hyperotreta, hagfishes; Hyperoartia, lampreys.

### Order **HYPEROTRETA**

In this order the nostril is at the anterior dorsal tip of the head, surrounded by 4 barbels, and opens into a nasopituitary 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 remote from the eye.

#### Family **MYXINIDAE**

#### Hagfishes

In the hagfishes 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 California, from

off Cape Flattery and from southeastern Alaska and probably will 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.

**Pacific hagfish**

*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 tongue; nostril single, large, median, terminal, with opening into pharynx; barbels around mouth, 4, around nostril, 4; 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. Fin folds: dorsal (1), far back, median, very low, continuous with caudal; ventral, median, very 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.



FIGURE 11. Pacific hagfish. *Polistotrema stoutii* (Lockington) 1878

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 at a point remote from the eye and the large anus very remote from the head.

The Pacific hagfish 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. 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 approximately  $1\frac{1}{4}$  inches in length and  $\frac{3}{8}$  inch in width. Tufts of short hooked spines at the ends of the egg cases serve for attachment to seaweeds and to each other. The hagfish is a predaceous animal attacking large fishes, into which it burrows and completely consumes the softer parts. Rockfishes, lingcod, flounders and seaperches are recorded as being eaten and attacks on salmon have been reported. It was recorded as the hag-fish in 1946 by Clemens and Wilby.

Range: Southern California to southeastern Alaska.

## Order HYPEROARTIA

In this order the nostril is on the dorsal surface of the head and opens into a nasopituitary 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 PETROMYZONTIDAE

### Lampreys

In the lampreys the body is elongate and cylindrical and the mouth is surrounded by a circular suctorial disk bearing leathery fimbriae on the margin and armed with horny multicuspid plates within.

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 at this time, 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.

The young lamprey, or *ammocoete*, lacks a suctorial disk but has an oral hood overhanging the mouth dorsally.

### Pacific lamprey

*Entosphenus tridentatus* (Gairdner) 1836

Body elongate, somewhat cylindrical, compressed posteriorly. Head short; mouth surrounded by a large circular horny sucking disk, with horny plates as follows: (a) marginal series, continuous, cusps small; (b) supraoral, numerous; (c) laterals, 4 pairs, cusps strongly developed; (d) infraoral, in single row, small; (e) supraoral bar with 3 strong cusps; (f) infraoral bar with strongly developed cusps; (g) linguals, 3, anterior with median cusp small; 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. Fin folds: dorsal (2), median, high, distinctly separated; ventral, median, very 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 sucking disk around the mouth, the horny plates on the disk and tongue, laterals in 4 pairs, supraoral bar with 3 cusps, infraoral plates in single row, the small median cusp on the anterior lingual 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 tridentata* (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, by rapid movements of their bodies, they make redds in which their eggs are intermixed with gravel. Death usually occurs soon after spawning. The eggs hatch in a few



FIGURE 12. Pacific lamprey. *Entosphenus tridentatus* (Gairdner) 1836

weeks. The young, known as an *ammocoete*, burrows into the mud along the margin of the stream where it feeds upon vegetable material. During this period the larva differs in many structural respects from the adult, particularly in having a projecting oral hood instead of a horny sucking disk surrounding the mouth, in having no teeth, and in having rudimentary eyes. Toward the end of the freshwater 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 fisherman for "brands". While the Pacific lamprey is not marketed commercially in Canada, it should be as edible as is the European lamprey, which in early times was considered a great delicacy and known as the diet of kings.

Range: Southern California to Gulf of Alaska.

### River lamprey

*Lampetra ayresii* (Günther) 1870

Body elongate, somewhat cylindrical, compressed posteriorly. Head short; mouth surrounded by a circular horny sucking disk, with horny plates as follows: (a) marginal series continuous, cusps small; (b) supraoral numerous; (c) laterals, 3 pairs, cusps strongly developed; (d) infraoral, absent; (e) supraoral bar with 2 low cusps; (f) infraoral bar with strongly developed cusps; (g) lingual, 3, anterior with median cusp large; 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. Fin folds: dorsal (2), median,

high, separated; ventral, median, very low, continuous around posterior end of body with caudal fin fold; caudal, somewhat rounded. Colour: metallic blue black on dorsal surface, colour extending onto caudal fin fold, not reaching to margin, pale to silver on sides and ventral surface, somewhat yellowish on fin folds.

Length to 12 inches.

Distinguished by the large sucking disk around the mouth, the horny plates on the disk and tongue, laterals in 3 pairs, supraoral bar with 2 cusps, an absence of infraoral plates, the large median cusp on the anterior lingual and the 7 gill pores on each side of the body commencing close behind each eye.



FIGURE 13. River lamprey. *Lampetra ayresii* (Günther) 1870

The river lamprey was first taken in British Columbia waters in 1942 off Discovery Island from the digestive tract of a lingcod by G. Morrel and was recorded in 1958 by V. D. Vladykov and W. I. Follett. The specimen is now in the Provincial Museum at Victoria. These authors have shown that this species is distinct from the European river lamprey, *L. fluviatilis*. Other individuals have been taken near Ladysmith, in English Bay, off the Sechelt peninsula and in the mouth of the Skeena River attached to a coho salmon. Little is known of the life history of the river lamprey, although in California it probably spawns from the end of April through May in various streams. Like the young of all other lampreys the ammocoetes live in the silt of the streams for one or more years and then migrate to sea.

Range: Northern California to northern British Columbia.

## 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 to 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 (Chondrichthyes), comprises four subclasses, two of which embrace the living species: the Euselachii, sharks and rays; and the Holocephali, chimaeras and ratfishes.

### 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 they are greatly enlarged and constitute the teeth.

This subclass is divided into two orders: the Pleurotremata, sharks; and 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.

#### Family **HEXANCHIDAE**

#### Cow sharks

The cow sharks have the origin of the single dorsal fin far back on the body, well behind the origin of the pelvic fins; an anal fin is present; there is no keel on the caudal peduncle and the upper lobe of the caudal fin is somewhat elongate; the gill slits are small, the last one or two being at the base of the pectoral fin.

The members of this family are bottom-living forms, mostly of warm seas; only 6 or 7 species exist today but fossil species were numerous.

#### **Sevengill shark**

*Notorynchus maculatum* Ayres 1855

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.

Length to 8 feet.

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

The sevengill 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 it in 1935,



FIGURE 14. Sevengill shark. *Notorynchus maculatum* Ayres 1855

in the errata to their *Fishes of the American Northwest*, under the name *Notorynchus maculatus* Ayres. 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. It was recorded in 1946 by Clemens and Wilby as *Notorhynchus cepedianus* (Péron), the spotted cow shark.

Range: Southern California to northern British Columbia.

#### Sixgill shark

*Hexanchus corinum* Jordan and Gilbert 1880

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 sixgill shark was first taken in British Columbia waters in August, 1925, at Departure Bay on a set-line. This specimen, a female 8½ feet in length, was 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 sixgill shark is captured frequently in



FIGURE 15. Sixgill shark. *Hexanchus corinum* Jordan and Gilbert 1880

purse seines, especially during the herring fishing season, is taken also on set-lines and in sunken nets, trawls and salmon traps and has been used in reduction plants in the manufacture of oil and meal. It is known as the mudshark in the Strait of Georgia and was recorded in 1946 by Clemens and Wilby as *Hexanchus griseus* (Bonnaterre), the mud shark.

Range: Southern California to Gulf of Alaska.

#### 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 ALOPIIDAE

#### Thresher sharks

The thresher sharks have the origin of the first dorsal fin behind the pectoral fins; a small anal fin is present; there is no keel on the caudal peduncle and the upper lobe of the caudal fin is very greatly elongate; the gill slits are very small, the fifth above the pectoral fin.

These sharks are pelagic and worldwide in distribution.

#### 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, 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.



FIGURE 16. Thresher shark. *Alopias vulpinus* (Bonnaterre) 1788

Distinguished by the exceedingly elongate caudal fin.

The thresher shark was first taken in British Columbia waters on 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. On August 24, 1945, a 200-pound individual was reported taken in Goose Bay on a troll by Mr W. Olsen. On July 24, 1949, a specimen about 4 feet in length was caught on a salmon troll in Saanich Inlet by Mr D. Keirs. In September of the same year Mr D. Burnett took a specimen approximately 12 feet in length in a gill net in Johnstone Strait. A female approximately 18 feet in length taken off San Pedro, California, contained 4 young each about 4 feet in length. The thresher shark is abundant in tropical waters where it reaches its largest size. It is a swift swimmer, feeding at or near the surface; it eats 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 Johnstone Strait, Vancouver Island.

The mackerel sharks have the origin of the first dorsal fin above the pectoral fins; a very small anal fin is present; there is a large keel on each side of the slender caudal peduncle and the caudal fin is lunate, the upper lobe not being greatly elongate; the gill slits are moderately large, the fifth in front of the pectoral fin.

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 fast movement. They are pelagic sharks of wide distribution, particularly in the northern seas.

**Salmon shark***Lamna ditropis* Hubbs and Follett 1947

Body elongate, somewhat stout, rounded; caudal peduncle rather slender, keel on each side, prominent, secondary keel below and behind on caudal fin. Head moderate; snout prominent, pointed, slightly depressed; mouth ventral; teeth large, sharp; eye large, high on head. 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 fin, 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, usually blotched with black in adults.

Length to 10 feet.



FIGURE 17. Salmon shark. *Lamna ditropis* Hubbs and Follett 1947

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

The salmon 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 of British Columbia from the Strait of Georgia to Hecate Strait. Individuals up to 8½ feet in length are abundant at times 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. Probably it is the species which causes much damage to fishermen's nets. It was recorded in 1946 by Clemens and Wilby as *Isurus nasus* (Bonnaterre), the mackerel shark.

Range: Northern California to Bering Sea.

#### Family CETORHINIDAE

#### Basking sharks

The basking sharks have the origin of the first dorsal fin behind the pectoral fins; a small anal fin is present; there is a prominent keel on each side of the caudal peduncle and the caudal fin is moderately large; the gill slits are very large and in front of the pectoral fins.

The basking sharks attain a large size, a specimen 30 feet in length was recorded as having a weight of 8,600 pounds. They are very sluggish selachians depending upon plankton for their food and are the only sharks known on the coast that possess gill rakers.

#### **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 high on body 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, second small; anal, small, length much less than that of first dorsal; pelvic, abdominal, moderate; pectoral, large; caudal, heterocercal, lunate. Scales: placoid. Colour: bluish gray to brownish gray on dorsal surface; paler on ventral surface.

Length to 45 feet.

Distinguished by the keel on each side of the caudal peduncle, the long 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 mistaken frequently for remains of sea serpents, particularly when the jaws are 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



FIGURE 18. Basking shark. *Cetorhinus maximus* (Gunner) 1765

common in the open sea off the coast, and is world-wide in its distribution. At certain times it is somewhat gregarious. In Barkley Sound basking sharks at times appear in schools of up to several dozen. Because of the damage they do to salmon nets there, when they accidentally become entangled, in 1956 a fisheries patrol boat was fitted with an underwater knife or sharp ram, about 4 feet in length. With this apparatus several hundred basking sharks have been killed (up to 1959). 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 long closely set gill rakers.

The name basking shark 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 Gulf of Alaska.

The cat sharks have the origin of the first dorsal fin above the pelvic fins; there is a large anal fin; there is no keel on the caudal peduncle and the caudal fin is nearly in line with the axis of the body; the gill slits are moderate in size, the fifth and sometimes the fourth above the base of the pectoral fin.

These sharks inhabit the southern seas and the species recorded from British Columbia apparently reaches its northern distribution in this area.

**Brown cat 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 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.

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



FIGURE 19. Brown cat shark. *Apristurus brunneus* (Gilbert) 1891

The brown cat 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 Biological Station at Nanaimo for identification. A specimen 3½ inches in length was secured September 1, 1941, in English Bay in a shrimp trawl. Another individual was caught on a dogfish set line in December, 1944, in Howe Sound at a depth of approximately 170 fathoms. Small numbers are taken on dogfish gear in the Strait of Georgia off the mouth of the Fraser River at depths of approximately 100 fathoms. Numerous individuals have been taken in the course of exploratory trawling by the Fisheries Research Board at depths of 75



to 190 fathoms, between Gabriola Island and Cape Lazo. From studies made in California waters it is known that the egg-case is slightly over 2 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 egg may be seen within. It was recorded as the brown shark by Clemens and Wilby in 1946.

Range: Southern California to Strait of Georgia.

Family CARCHARHINIDAE

Blue sharks

The blue sharks have the origin of the first dorsal fin behind the pectoral fins; a small anal fin; there is no keel on the caudal peduncle and the caudal fin is moderate in size; the gill slits are small, the fifth and sometimes the fourth above the base of the pectoral fin.

These sharks are pelagic, usually bluish above and whitish below. They are distributed widely, very active and voracious. One member of the family, *Carcharhinus nicaraguensis*, inhabits Lake Nicaragua and is the only known strictly freshwater shark.

**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, 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;



FIGURE 20. Blue shark. *Prionace glauca* (Linnaeus) 1758

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*", on the west coast of Vancouver Island and who stated that individuals were caught there frequently by trollers, in 1925. The species would seem to be rather common along the west coast of Vancouver Island in the summer months as it has been taken quite often during the fishing seasons. It has been reported also off the west coast of the Queen Charlotte Islands. Little is known of the life history but the young are born, as many as 30 at a time. It is a very active shark and feeds upon whatever fishes it may encounter, even those in fishermen's nets, and hence is considered extremely voracious.

Range: Southern California to Gulf of Alaska.

### Soupfin shark

*Galeorhinus zyopterus* Jordan and Gilbert 1883

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 half that of first dorsal; pelvic, abdominal; pectoral, length less than twice height of first dorsal, not sabre-shaped; caudal, heterocercal, upper lobe broad, lobule large. Scales: placoid, small. Colour: dark bluish to dusky grey 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.



FIGURE 21. Soupfin shark. *Galeorhinus zyopterus* Jordan and Gilbert 1883

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 soupfin shark was first recorded from British Columbia waters in 1891 by Ashdown Green who reported it to be rather common along the coast. Dr W. F. Thompson recorded a specimen 5 feet 7 inches in length 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 during the years of World War II. 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, seaperch, rockfish and squid. The fins of this shark, because of their gelatinous rays, make a soup much prized by the Chinese in California, hence the common name. The vitamin "A" content of the liver oil is very high and during the 1940's a fishery for this shark was developed along the coast from California to British Columbia. Fishing took place in about 25 fathoms with gill nets, or with set lines baited with herring and suspended about 6 feet from the bottom. It was recorded in 1946 by Clemens and Wilby as *Galeorhinus galeus* (Linnaeus).

Range: Southern California to northern British Columbia.

#### Suborder SQUALOIDEA

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

##### Family SQUALIDAE

##### Dogfishes

The dogfishes have the origin of the first dorsal fin behind the pectoral fins; there is no keel on the caudal peduncle and the small caudal fin is somewhat depressed; the gill slits are small, the fifth usually at least partially above the base of the pectoral fin.

The dogfishes are small sharks abounding in all seas and occurring frequently in very large schools. There may be a large spine in front of each dorsal fin which, before birth, is capped by a small knob. The females usually enter shallow water and give birth to the young.

##### **Pacific dogfish**

*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, small. Fins: dorsal (2), each with large spine anteriorly; anal, absent; 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 Pacific dogfish 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 Captain 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. Occasionally it may be observed swimming at the surface with the dorsal fins exposed, particularly where crustaceans, known as "pink" feed, are abundant.



FIGURE 22. Pacific dogfish. *Squalus suckleyi* (Girard) 1854

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. Tagging has demonstrated that as a rule the dogfish does not travel great distances but one individual tagged on October 6, 1944, at Willapa Bay, Washington, was recaptured on February 25, 1953, off the northern end of Honshu Island in Japan, a direct distance of over 5000 miles, or over 7000 miles along the coast. The dogfish feeds upon practically all of the smaller fishes, especially herring, pilchards, anchovies, smelts and sandlances, upon squid and pelagic crustaceans when they appear in large numbers, and even upon young dogfish on occasion. It is also a scavenger, feeding upon offal from fish canneries and reduction plants and refuse dumped at sea.

Prior to 1880 a reduction plant was in operation at Skidegate for the manufacture of oil from dogfish. Subsequently several small reduction plants were established on the British Columbia coast to produce oil and meal; the latter having a high nitrogen content, making it valuable as a fertilizer. About 1940 dogfish livers were found to contain a high vitamin "A" content. For some years they were eagerly sought for with gill nets and set-lines, and the fishery was highly profitable. The cheaper production of vitamin "A" synthetically resulted in a sharp

curtailment of the fishery about 1948. This shark sometimes is referred to as grayfish. The AFS/ASIH Committee lists it as the spiny dogfish, not distinguishing it from *Squalus acanthias* of the Atlantic.

Range: Southern California to Gulf of Alaska.

Family DALATIIDAE

Sleeper sharks

In the sleeper sharks the origin of the first dorsal fin is behind the pectoral fins; the anal fin is absent; there are no keels on the caudal peduncle and the caudal fin is moderately upturned and somewhat large.

These sharks usually have no spines before the dorsal fins. They are large, sluggish and of worldwide distribution.

**Pacific sleeper shark**

*Somniosus pacificus* Bigelow and Schroeder 1944

Body elongate, stout, deep anteriorly, rounded. Head large; snout blunt; mouth ventral. Spiracle large, close behind eye; gill slits, 5, moderate. 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 of each dorsal fin.

The Pacific 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 and recorded it as *Somniosus microcephalus* (Bloch). A second individual 11 feet 6 inches in length was found on January 29, 1934, on Comox Spit. Since this 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 waters. Little is known of the early life history and whether it



FIGURE 23. Pacific sleeper shark. *Somniosus pacificus* Bigelow and Schroeder 1955

deposits eggs or liberates young is uncertain. It is rapacious, feeding upon almost anything of an animal nature as well as upon carrion. It was recorded in 1946 by Clemens and Wilby as *Somniosus microcephalus* (Schneider), the sleeper shark.

Range: Southern California to Gulf of Alaska.

### Order HYPOTREMATA

In this order the body proper is elongate, depressed and almost elliptical in cross section. The dorsal fins, when present, are far back on the body. 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 usually are 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" usually is restricted to the members of the family Rajidae.

In this suborder there are two families, the Rajidae, or skates, and the Dasyatidae, 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.

### 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 outside the fin outline. Head depressed; snout long,

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.

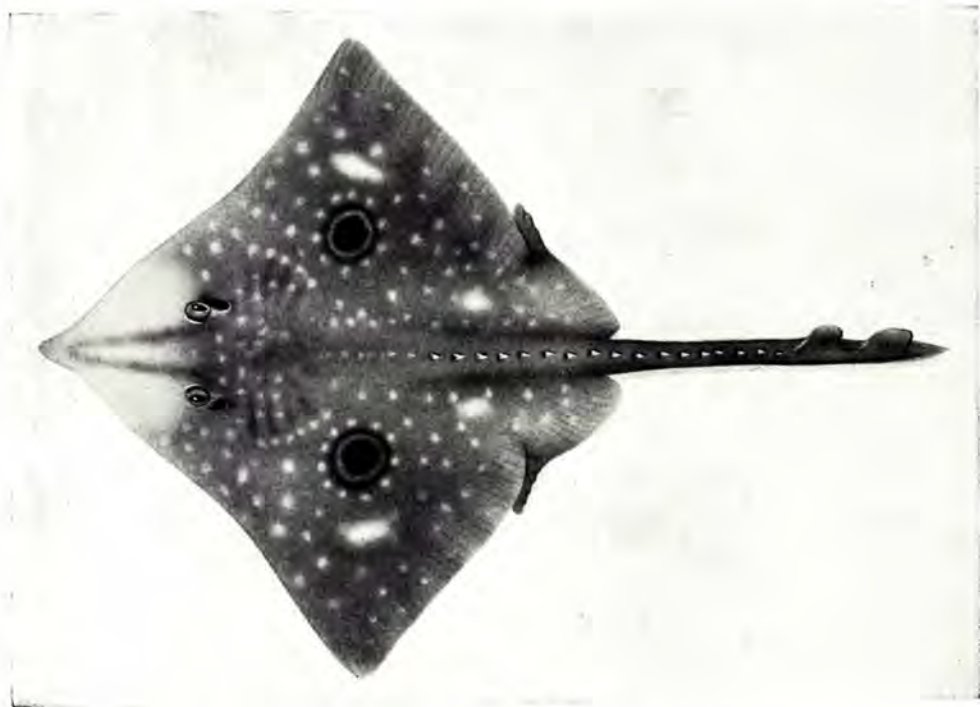


FIGURE 24. Big skate. *Raja binoculata* Girard 1854

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-case of a large individual is about 1

foot in length, does not possess tendrils, and may contain from 2 to 7 eggs. A case obtained on 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. 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. A female specimen taken in Vancouver Harbour, in February, 1943, measured 6 feet in length and weighed approximately 200 pounds.

Range: Southern California to Gulf of Alaska.

### Longnose 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 outside the fin outline. Head depressed; snout long, 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 longnose 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-case is 3 to 5 inches in length, possesses tendrils, and usually contains one egg only. The pectoral fins of the longnose skates are sold as "wings." Although these appear on the market they are considered less palatable than those of the big skate.

Range: Southern California to southeastern Alaska.



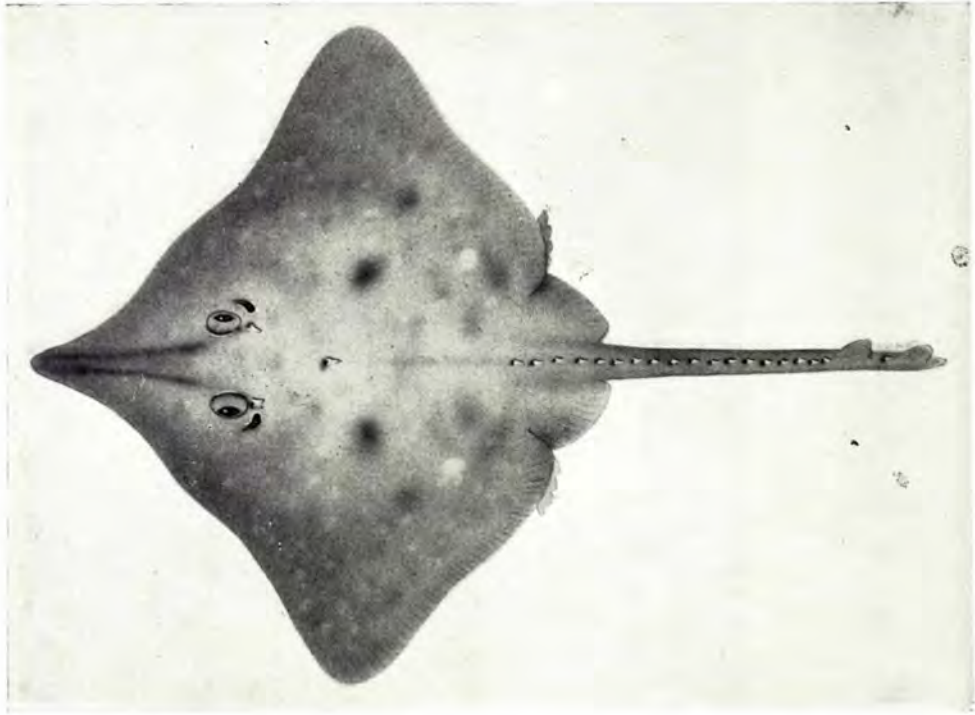


FIGURE 25. Longnose skate. *Raja rhina* Jordan and Gilbert 1880

**Starry 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 inside the 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", less distinct than in *Raja binoculata*, may be present in some specimens.

Length to 2 feet 6 inches.

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 starry skate was first taken in British Columbia waters on August 28, 1891, west of Port San Juan by the *Albatross*, station 3447, Lat. 48° 30' N, Long. 124° 36' W. depth 116 fathoms, and recorded in 1895 by C. H. Gilbert. This skate

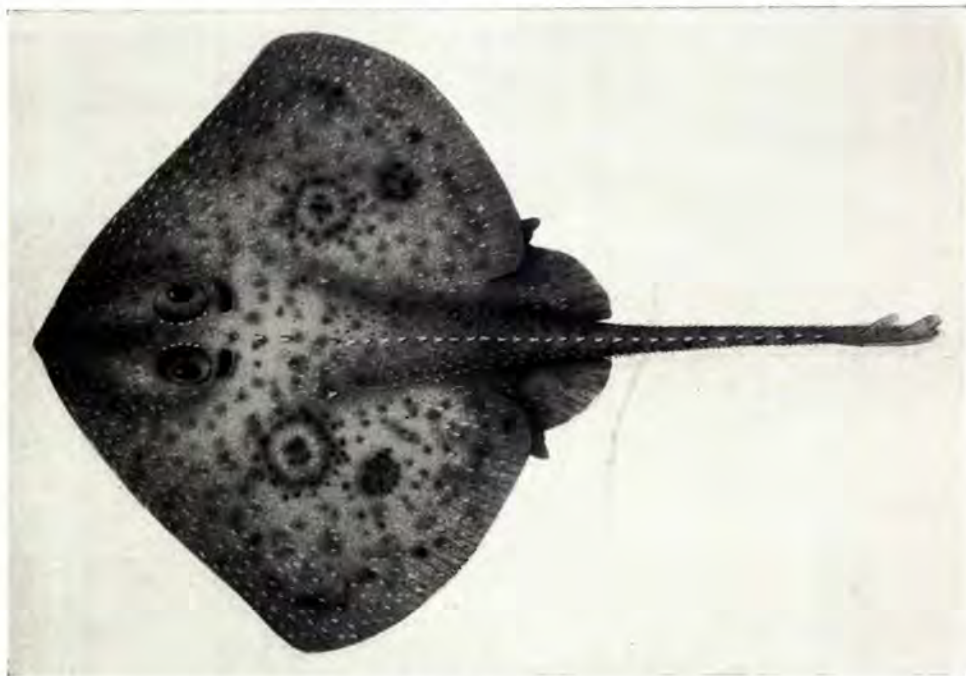


FIGURE 26. Starry skate. *Raja stellulata* Jordan and Gilbert 1880

has been secured in the Strait of Georgia, at Ucluelet and off the Queen Charlotte Islands. Little is known of the life history but 2 small individuals, less than 5 inches in length with the yolk-sac still attached, were obtained in June and July, 1909, at Ucluelet. This species was recorded as the prickly skate by Clemens and Wilby in 1946.

Range: Southern California to Gulf of 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 inside the 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 continuous row from behind head to first dorsal fin, 27 to 33, very large; on shoulder girdle near middle of body, 1 to 2, large; on orbital rim, none; in male, in patch near top 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 of each side of tail near 17th to 19th spines, which may not be evident in larger specimens.

Length to 2 feet 9 inches.

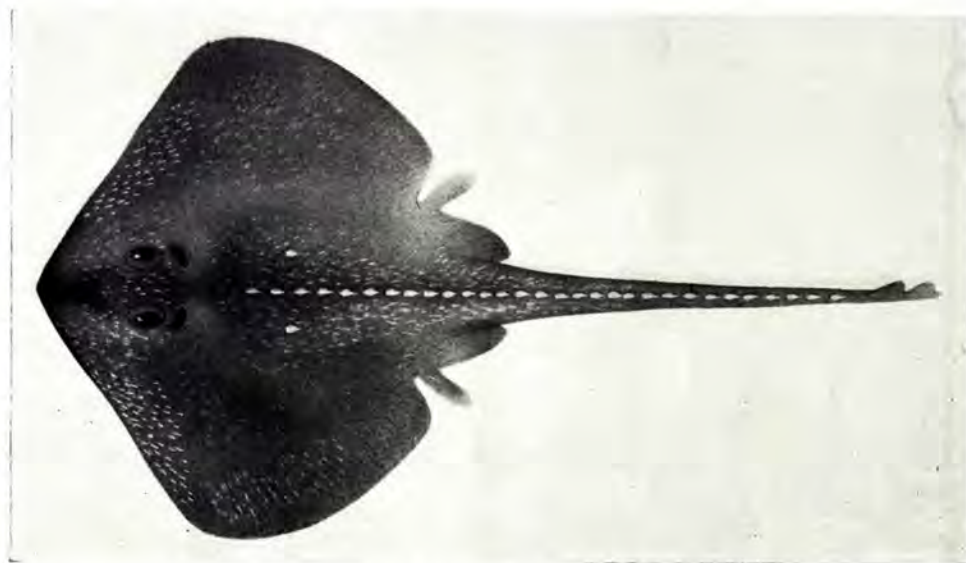


FIGURE 27. Black skate. *Raja kincaidii* Garman 1908

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 on 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 Biological Station at Nanaimo. 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 on February 2, 1941, in Satellite Channel by Dr G. C. Carl and is now in the Provincial Museum at Victoria.

Range: Southern California to Gulf of Alaska.

## Deepsea 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 inside the 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), 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.

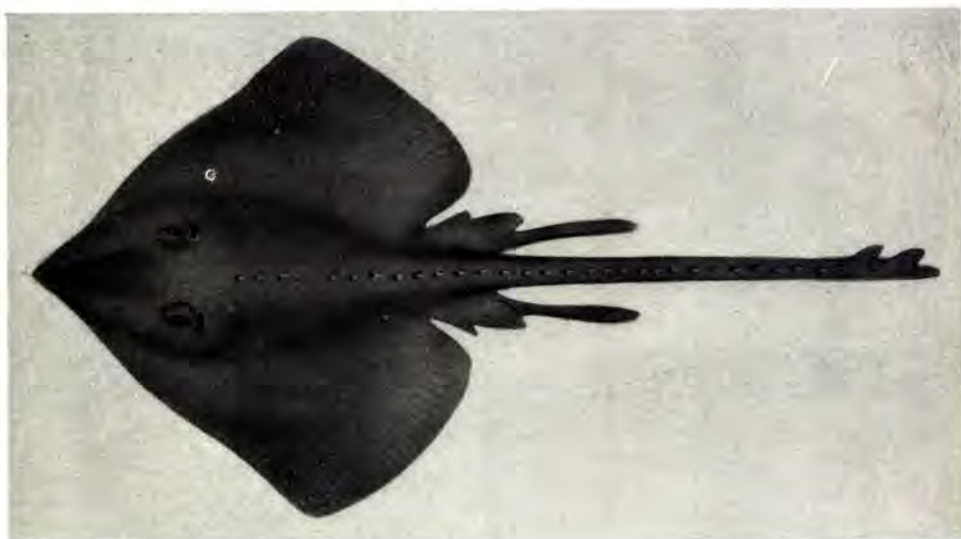


FIGURE 28. Deepsea skate. *Raja abyssicola* Gilbert 1895

Distinguished by the weak snout, the continuous row of spines on the mid-dorsal line of the tail only, the 3 stout spines on the mid-dorsal line of the body and the absence of large spines from each shoulder girdle.

The deepsea skate is represented by a single specimen taken on September 3, 1890, west of Morseby Island by the *Albatross*, station 3342, Lat.  $52^{\circ} 39' N.$ , Long.  $132^{\circ} 38' W.$ , 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.

Range: Off the west coast of the Queen Charlotte Islands.

In the stingrays 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.

**Diamond stingray***Dasyatis dipterurus* Jordan and Gilbert 1880

Body greatly elongate, depressed anteriorly; very slender posteriorly, produced into whip-like tail  $1\frac{1}{2}$  times length of body; outline between tip of snout and tip of pectoral fin convex so that a line drawn between these two points lies wholly inside the 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 dorsal and ventral folds. 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.



FIGURE 29. Diamond stringray. *Dasyatis dipterurus* Jordan and Gilbert 1880

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

The diamond stingray 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. Since no specimen of sting ray taken in British Columbia waters is in existence, the name assigned to the species seen by Dr Williamson is tentative. *D. dipterurus* is a species of more southern waters but until the capture and critical examination of a British Columbia specimen is made it seems advisable to use the above name. This ray is much feared by fishermen. The stout spine of 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. Formerly it was recorded as the rat-tailed sting ray (Clemens and Wilby, 1946).

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 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 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.

**Pacific electric ray**

*Torpedo 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 ventral. Spiracle large, behind eye; gill slits, 5, on ventral surface. Skin entirely smooth. Fins: dorsal (2), far back on body; anal, absent; pelvic, abdominal. 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.

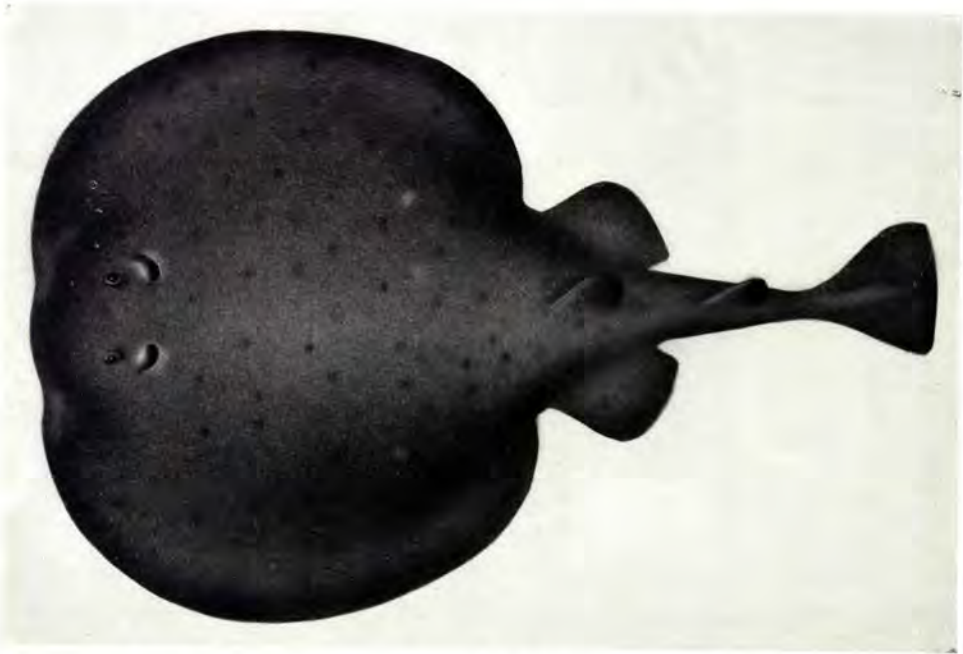


FIGURE 30. Pacific electric ray. *Torpedo californica* Ayres 1855

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

The Pacific 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 on September 1, 1928, at Nootka, and is now in the collection of the Biological Station at Nanaimo. In 1938, 1940, 1941, and 1954, other individuals were reported from the west coast of Vancouver Island. Two specimens were on display in the Vancouver Aquarium for several weeks during June and July, 1941. Each was about 3 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. On August 4, 1960, a female measuring 2 feet 1 inch was caught about 5 miles off Wiah Point, Queen Charlotte Islands, by Mr J. Brown. A weight of over 50 pounds has been recorded. It was recorded in 1946 by Clemens and Wilby as *Tetranarce californica* Ayres.

Range: Southern California to Queen Charlotte Islands.

### 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 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

In the chimaeras the body tapers gradually posteriorly, the head is large, the snout is pointed to bluntly rounded, the teeth are prominent, chisel-like and the pectoral fins are large and paddle-like. 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 ratfish, *Hydrolagus colliciei*. The word *Hydrolagus* means water hare, referring to the somewhat rabbit-like mouth.

#### Ratfish

*Hydrolagus colliciei* (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 chisel-like bony plates; nostrils, 2, immediately anterior to mouth; eye large; operculum fleshy, forming single opening from gill chamber. Skin: 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. A female ratfish is shown in colour on Plate I following page 224. Figure 31 is a male.

The ratfish was first recorded from British Columbia waters in 1866 by J. K. Lord as *Chimaera Coleii* (evidently a misprint for *colliei*). 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, but on occasion may appear in very shallow shore waters. The eggs are deposited in elongated, ridged, brown capsules about 5 inches in length. These have been observed by Dr A. L. Pritchard set upright in the mud in the intertidal zone of Masset Inlet. The young, when they leave



FIGURE 31. Ratfish. *Hydrolagus colliei* (Lay and Bennett) 1839

the egg-cases, are small replicas of the adults and are obtained commonly 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 ratfish consists largely of fishes, but in part of mussels and other invertebrates. The liver oil is extracted readily by mild heating. It is clear and of a slightly yellowish colour, and produces no gummy residue. It is used for lubricating 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 southeastern 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 fused to the skull. The nostrils are paired and located on the dorsal surface of the head, each with 1 or 2 openings. The gill opening on each side of the body is covered with an operculum which usually is bony.

The class Pisces (Osteichthyes) comprises three subclasses, the Palaeopterygii, the Neopterygii and the Crossopterygii. The last is not represented in British Columbia 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 among British Columbia fishes. It includes the family Acipenseridae, the sturgeons.

#### Family ACIPENSERIDAE

#### Sturgeons

In the sturgeons the body is elongate, and bears 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 the 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 the 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 and other invertebrates, 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 grey.

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



FIGURE 32. White sturgeon. *Acipenser transmontanus* Richardson 1836

large numbers entered the Fraser River, proceeding to Pitt and Harrison Lakes and some even to the North Thompson and upper Fraser River as far as Fraser and Stuart Lakes where they were captured by means of set lines, spears and gill nets. The largest sturgeon recorded is one weighing 1,387 pounds, although one weighing over 1,800 pounds was reported as having been taken near Mission City. The following statement is taken from the Daily Columbian, New Westminster, B.C. August 14, 1897. "The largest of which any authentic record has been kept was one weighing 1,387 pounds, which was caught opposite this city in the early days by one of W. H. Vianen's fishermen. Governor Seymour and others were at the wharf when it was landed from the boat, and they sent it to Victoria, where it created quite a furor." The white sturgeon is undoubtedly a very slow-growing fish. Due to intensive fishing large specimens are now rarely taken. Individuals are caught occasionally in salmon gill nets at the mouth of the Fraser River and sometimes in otter trawls in the Strait of Georgia. A few are taken 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 other 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 Gulf of 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 ending opposite anus.

Length to 7 feet.



FIGURE 33. Green sturgeon. *Acipenser medirostris* Ayres 1854

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 on August 30, 1908, near Victoria, and the specimen (13½ inches in total length) is now in the 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. It has been reported off the west coast of Vancouver Island by fishermen, especially by trawlers operating off Kyuquot Sound. 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 inferior to the white sturgeon.

Range: Southern California to Gulf of 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 at least 15 are known from British Columbia waters.

## Order ISOSPONDYLI

In this order the premaxillary 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 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.

The families, the Clupeidae and Engraulidae, are 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 herrings, pilchards and shads. 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 predaceous fishes such as coho and chinook salmon, cod, lingcod and dogfish. Furthermore they are eaten extensively by marine waterfowl and seals.

#### **Pacific 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 20; 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, 51 to 54; on ventral surface modified as 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 13 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 Pacific 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 Indians at Stuart Island. The herring is very abundant



FIGURE 34. Pacific herring. *Clupea pallasii* Valenciennes 1847

throughout the coastal waters of British Columbia. It spawns in the winter and early spring months in the southern portion of the Province, somewhat later in the northern portion, coming into the shore waters in large schools and depositing pale amber, translucent, adhesive eggs in enormous numbers on eelgrass, seaweeds, rocks, wharf piles and other materials. Heavy storms may loosen the eggs and on occasion vast quantities of eggs, eelgrass and debris may form long windrows on beaches. The eggs hatch in about two weeks, depending on the temperature of the water. Maturity is reached in the second, third and fourth years and an age of eight or more years may be attained. The food consists of plankton crustaceans largely. In turn, the 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, especially gulls and migrating ducks; the larvae by fishes and various plankton feeders, including invertebrates such as jellyfish, comb-jellies and crustaceans; the larger herring are consumed by sharks, fishes, waterfowl, seals and sea lions. The wonder is that so many individuals survive to maturity.

The distribution and migrations of herring have been revealed by the use of internal tags similar to those used in pilchards with their recovery by means of electromagnets or electronic tag detectors. The studies have shown that herring occur along the British Columbia coast in a series of more or less localized population, but that some intermingling takes place among these. Each population appears

to have an annual migration between an inshore spawning area and an open sea feeding ground where plankton crustaceans constitute the chief food. Perhaps the longest migration is that of the southern population which enters the southern portion of the Strait of Georgia and spawns along the shores of Vancouver and associated islands, after which most individuals proceed to feeding grounds off the entrance to Juan de Fuca Strait.

The herring fishery is a major one in British Columbia, the largest in tonnage caught and second in value. Large quantities of herring are taken annually in purse seines and gill nets for reduction to oil and meal, for canning and smoking, for the fresh fish market and for bait. In earlier years much of the catch was pickled by the "Scotch" cure, and during the 1920's and 1930's many herring were dry-salted for export to the Orient. In the 1955-56 season, the total catch amounted to slightly over 250,000 tons having a landed value of over \$7,000,000.

Range: Southern California to Bering Sea.

### Pilchard

*Sardinops sagax* (Jenyns) 1842

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), 17 to 20; anal, 17 to 19; 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, 52 to 60; 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 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 16½ inches.

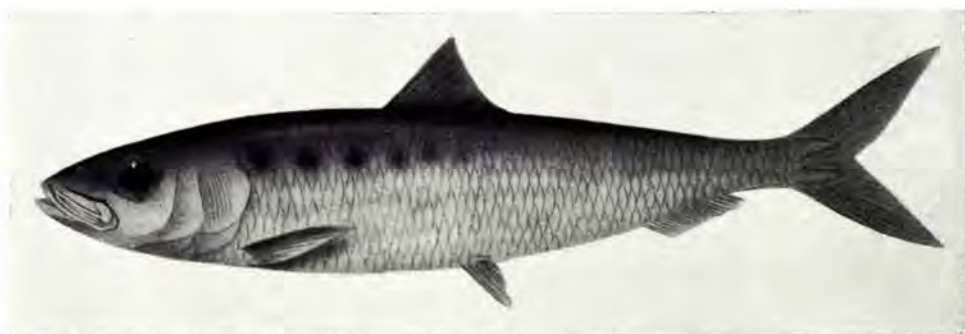


FIGURE 35. Pilchard. *Sardinops sagax* (Jenyns) 1842

Distinguished by the terete form of body, the fine almost parallel striae on the operculum, the uniform round black spots along the sides of the body and the pair of specialized 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. Some years later it was discovered that the fish appeared in large schools off the west coast of Vancouver Island during early July and disappeared in late September or early October, although some individuals often remained in the inlets throughout the winter. In some years considerable numbers extended into the Queen Charlotte Islands area and even into southeastern Alaska. Occasionally a few entered the Strait of Georgia and Queen Charlotte Strait. Tagging experiments, in which small metal tags were inserted in the body cavities of the pilchards and recovered by strong electromagnets in the reduction plants, showed that there was a definite north and south migration between California and British Columbia waters. Investigations have revealed that spawning takes place chiefly off the California coast about 100 miles offshore between Point Conception and San Diego. The eggs, which are pelagic, are liberated for the most part in March, April and May. 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 centre of population of the pilchard is off the southern California coast, essentially in the spawning area. In the 1920's and 1930's when the population was large, very large numbers of adult pilchards moved northward during the spring and summer months and provided an important fishery off the coasts of British Columbia, Washington and Oregon.

In California, where the pilchard is known as the sardine, the highest catch amounted to 791,320 tons in 1936-37. There, large quantities are canned and marketed as the California sardine but a considerable tonnage is utilized for the production of oil and meal. In British Columbia, the highest catch was approximately 86,300 tons in 1929. Of this amount, 81,250 tons were reduced to oil and meal, 4,900 tons were canned and 150 tons were frozen for bait. The total value of the pilchard production in British Columbia in that year was \$2,500,000, and the investment in fishing and plant equipment was over \$3,000,000.

The size of the pilchard stock varied somewhat from year to year and consequently the numbers of fish migrating northward varied annually. Eventually, the stock became so small that practically no fish reached the British Columbia coast in 1939 or subsequently, and the pilchard fishery disappeared from British Columbia waters. It is possible that in due course the stock will become rehabilitated and a fishery in these waters restored.



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. The canned product is an excellent human food.

The young of the pilchard is a true sardine. The latter name was first applied to the young of the Mediterranean pilchard and is associated with the island of Sardinia. Young herring are now canned in various parts of the world and sold under the market name of "sardine".

The species was recorded in 1946 by Clemens and Wilby as *Sardinops caerulea* (Girard). The name recommended by the AFS/ASIH committee is Pacific sardine.

Range: Southern California to southeastern Alaska.

### 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 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.

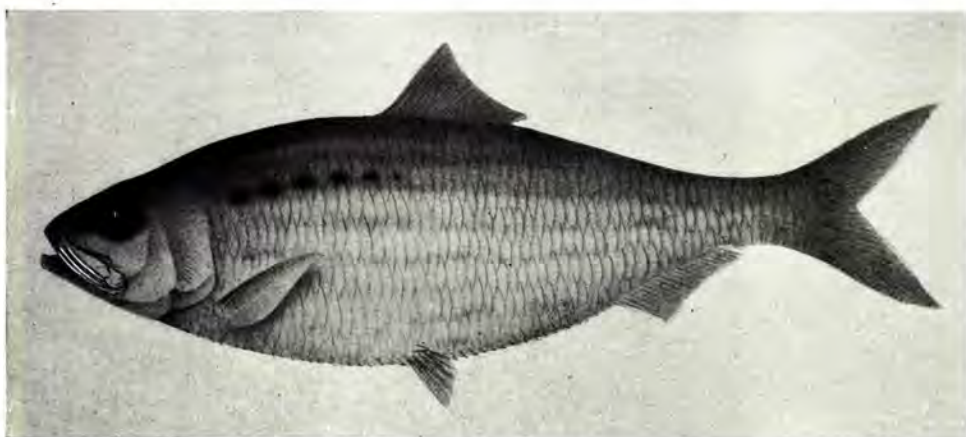


FIGURE 36. Shad. *Alosa sapidissima* (Wilson) 1812

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, and Kamchatka. The shad has been caught in increasing numbers in the Fraser River in gill nets and small 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 7 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. The name American shad is recommended by the AFS/ASIH committee.

Range: Southern California to Gulf of Alaska.

#### Family ENGRAULIDAE

#### Anchovies

In the anchovies the body is slender and covered with cycloid scales. The mouth is large and subterminal, overhung by a prominent snout. There is no adipose fin or lateral line. There is a fleshy appendage at the base of each pelvic fin. The origin of the dorsal fin is behind that of the pelvic fins.

#### **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 on maxillary and mandible numerous, fine; eye large, near tip of 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

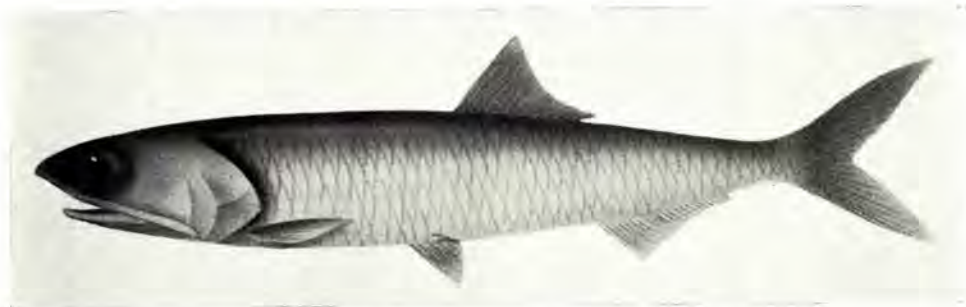


FIGURE 37. Anchovy. *Engraulis mordax* Girard 1854

Port Hardy. Spawning occurs apparently 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 7 years may be attained. The food consists largely of plankton crustaceans. Anchovies are utilized for the production of oil and meal and small numbers are canned, pickled in brine and made into paste. The name northern anchovy is recommended by the AFS/ASIH committee.

Range: Southern California to northern end of Vancouver Island.

### Suborder SALMONOIDEA

The fishes in this suborder have an adipose fin and usually a lateral line but no photophores or luminous spots on the body or the head. They inhabit marine waters, from brackish areas to great depths, as well as fresh water.

Three families are represented in the marine waters of British Columbia: Salmonidae, Osmeridae and Argentinidae.

#### Family SALMONIDAE

#### Salmons

In the salmons the body is ellipsoid, moderately stout and covered with small cycloid scales. The lateral line is well developed. The adipose fin is prominent 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 the family are the Atlantic salmon, the trouts, chars and the Pacific salmons, all of which are important commercial or sport fishes.

The Atlantic salmon and the trouts are placed in the genus *Salmo*. They are distinguished readily from the Pacific salmons by the presence of 8 to 12 rays in the anal fin and 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; *kelt*—a fish which has spawned and is thin and in poor condition. All these terms may be applied to the life history of the steelhead trout and some of them to the life histories of the Pacific salmons. With reference to the latter, the term grilse (or more often, *jack*) has been applied to those coho, chinook and sockeye which are maturing in their 2nd or 3rd year of life after spending one winter in the sea. Alternatively, *grilse* may mean a small chinook or coho salmon, caught in salt water, which is not in condition to spawn later the same year.

The chars comprise the genus *Salvelinus*. They have 8 to 12 rays in the anal fin as do the trouts, but they lack teeth on the shaft of the vomer. 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*.

The Pacific salmons are placed in the genus *Oncorhynchus* and include five British Columbia species—pink, coho, chinook, chum and sockeye. They are characterized by a comparatively large anal fin with 13 to 19 rays.

The Pacific 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 young have large yolk-sacs and are known as *alevins*. They remain in the gravel beds until the yolk-sacs are absorbed and they 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 freshwater 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. As the young fish enter the sea they are displaced northwestward by the inshore coastal current whose waters have a salinity of less than 33.6 parts per thousand and a temperature less than 15°C. (59°F.) They avoid the offshore subtropic waters of the trans-Pacific drift and California current, whose waters have a salinity of 34 parts per thousand and over and a temperature of approximately 20°C. (68°F.). It appears certain that many of the salmon from the streams of British Columbia reach the waters of the Alaska gyral, complete their growth there and then migrate southeastward to their natal streams. Much of the knowledge of the marine distribution of the salmon is the result of the

investigations of the three countries, Canada, Japan and the United States, associated in the International North Pacific Fisheries Commission.

During the ocean residence 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 a red colour appears 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, yielding an average annual catch of approximately 180,000,000 pounds, having a landed value of about \$25,000,000.

#### **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, fleshy; anal, 8 to 10; 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.

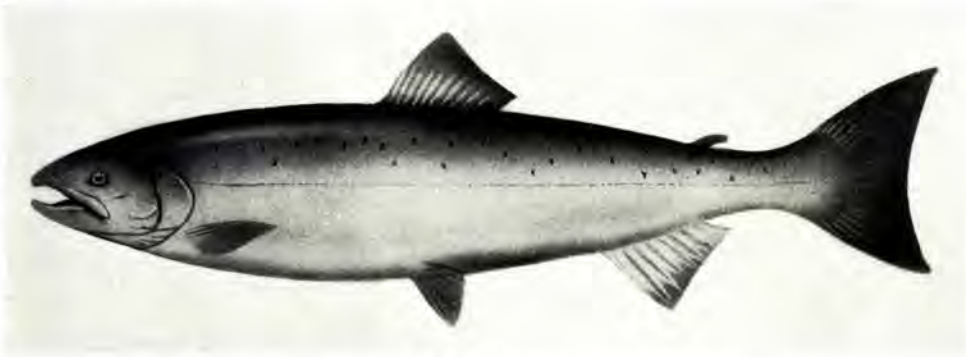


FIGURE 38. Atlantic salmon. *Salmo salar* Linnaeus 1758

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 waters in 1905, through the transfer of eggs from the Canadian Atlantic coast to the Cowichan Lake hatchery by the Canada 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 liberation 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. Although the species has failed to become established, the record is included here because of its historic interest. 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 1 or 2 years, then migrate to sea and mature at 3, 4, or 5 years of age. Like the steelhead and cutthroat trouts, they may live after spawning and return to the sea; they may later return to fresh water to spawn a second or third time, although probably 75% do not survive the first spawning. 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 trouts, it might be well to point out that trouts were once supposed to be confined to fresh water while the salmon, *Salmo salar*, spent part of its life in salt water. 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*), and that use of the name salmon has become accepted here.

Range: Northern California to Vancouver Island.

### **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; rakers on first gill arch, 16 to 19. Fins: dorsal (1), 10 or 11; adipose, small, slender, fleshy; anal, 9 to 12; 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 Canada 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 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 established also 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 seagoing 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



FIGURE 39. Brown trout. *Salmo trutta* Linnaeus 1758

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 only at certain times of the day. The food is similar to that of the coastal cutthroat 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* 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; rakers on first gill arch 17–21; Fins: dorsal (1), 10 to 12; adipose, small, slender, fleshy; anal, 8 to 12; 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 161. 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.



FIGURE 40. Steelhead trout. *Salmo gairdnerii* Richardson 1836

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 3rd, 4th or 5th year of life, after 2 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 1 or 2 years in fresh water and may travel considerable distances in the open ocean. A steelhead tagged in the Gulf of Alaska has been taken off Gray's Harbour, Washington, and two others tagged in the same area have been taken in Puget Sound. Some individuals remain in fresh water all their lives and are then known as "rainbows". The term rainbow trout, which is the species name recommended by



the AFS/ASIH committee, 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 population of the steelhead trout known as the Kamloops trout 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. It is most frequently secured in the numerous streams along the coast, or just off their mouths. The food in the sea consists of crustaceans, squid, herring and other fishes. Individuals have been taken weighing as much as 36 pounds.

Range: Southern California to Gulf of Alaska.

### Coastal cutthroat 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; rakers on first gill arch, 15 to 22. Fins: dorsal (1), 8 to 11; adipose, small, slender, fleshy; anal, 8 to 12; pelvic, abdominal, each with fleshy appendage at base; caudal, truncate. Lateral line: slightly decurved, then straight. Scales: cycloid; in oblique rows above lateral line, 120 to 180. 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.



FIGURE 41. Coastal cutthroat trout. *Salmo clarkii clarkii* Richardson 1836

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 cutthroat), the long head and the more or less rounded body.

The coastal cutthroat trout was first recorded from British Columbia waters in 1866, without date of locality of capture, by J. K. Lord as *Fario stellatus*. The cutthroat is common along the whole coast in the sea as well as in the adjacent streams and lakes. A subspecies, the Yellowstone cutthroat, *Salmo clarkii lewisi*, 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 cutthroats spawn usually from February to May in small streams, although in the Cowichan River system they have been found to spawn as early as December. The young may descend to the sea in their second or third years, 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 sandlance, salmonoids, rockfishes, seaperches, sculpins and flatfishes as well as crustaceans; while in fresh water it consists of insects, both aquatic and terrestrial, freshwater shrimps and small fishes. Weights up to 17 pounds have been recorded from inland lakes. The cutthroat is much prized as a game fish, both in fresh and salt water. Small specimens caught in salt water frequently are called "sea trout".

Range: Northern California to southeastern Alaska.

### **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; rakers on first gill arch, 14 to 22. 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, 186 to 254. Colour: olive green to brown on dorsal surface with pale yellow spots; red to orange spots on sides numerous, small; vermiculations on back and dorsal fin, absent or weak; sea-run individuals silvery.

Length to 3 feet.

Distinguished by the pale yellow spots on the back and the red to orange spots on the sides of the body, the faint vermiculations or their absence 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

Captain 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 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



FIGURE 42. Dolly Varden. *Salvelinus malma* (Walbaum) 1792

salmon eggs. It is the native red-spotted char of the Province, varying in size and coloration according to the water inhabited. Individuals occurring north of Vancouver Island tend to show faint vermiculations on the back. While not generally regarded as highly as the steelhead and cutthroat trouts, it nevertheless ranks as a splendid sport fish. Weights up to 30 pounds have been recorded.

Range: Northern California to Bering Sea.

#### Brook trout

*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; rakers on first gill arch, 16 to 22. Fins: dorsal (1), 8 to 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, 197 to 236. 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 dorsal fin and the teeth only on the head of the vomer.

The brook trout 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 show a similar habit on the



FIGURE 43. Brook trout. *Salvelinus fontinalis* (Mitchill) 1815

Pacific. The brook trout is a char, and sometimes has been called the speckled char. It is an eastern cousin of the Dolly Varden, 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 trout is one of the most beautiful of sport fishes. Whether it becomes 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 southeastern Alaska.

#### **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, 24 to 35. 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 205. 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.



FIGURE 44. Pink salmon. *Oncorhynchus gorbuscha* (Walbaum) 1792

Distinguished by the small scales, the 24 to 35 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 and 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 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 "humpbacks" in the early days of the fishery. Usually the fish remain near tidal waters but some will travel upstream for considerable distances, as for example, to Babine River on the upper reaches of the Skeena River. The young go to sea as fry and reach maturity at two years of age.

In many places there is a large spawning run in one year and a small one in the next, but elsewhere the runs of successive years may be approximately equal in size. In some streams there are no runs at all in alternate years. Since the fish mature almost invariably at 2 years of age (from time of egg deposition), there can be practically no interbreeding between the populations of the even-numbered and odd-numbered years in any stream. In the southern portion of the Province the large runs have been in the odd years while in the northern portion the large runs have tended to be in the even years. The ocean movements are not fully known but the migrations may be extensive. Some individuals marked as fry in Massett

Inlet have been captured in the Strait of Georgia. Tagging experiments have shown that schools pass through both Juan de Fuca and Johnstone Straits on their return journey to the Fraser River and other streams. The food consists chiefly of crustaceans but squid and fishes also may be eaten. The weight at maturity is usually between 3 and 5 lb but weights up to 10 lb have been recorded. The pink salmon is taken commercially in purse seines, gill nets and traps. Quite frequently specimens are caught on trolling gear. Practically the entire catch is canned.

Range: Northern California to Bering Sea.

**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, 13 to 16; in young, up to 3 or 4 inches in length, 2nd and 3rd rays usually longer and stouter than remainder; pelvic, abdominal, each 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 140. Pyloric caeca: 45 to 83. 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. No black pigment in mouth along bases of teeth of lower jaw. Flesh pink to red. 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 2½ inches.



FIGURE 45. Coho salmon. *Oncorhynchus kisutch* (Walbaum) 1792

Distinguished by the black spotting confined to the back and the upper lobe of the caudal fin, the absence of black pigment along the bases of the teeth, the needle-like firmly set teeth and the 19 to 25 rough widely spaced rakers on the first gill arch. The young are readily recognized by the elongate anterior rays in the anal fin, the orange tinge on the lower fins and the elongate parr marks. The coho is illustrated in colour on Plate II following page 224.

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 streams but a few migrate to sea in either the 1st or the 3rd year. Growth is rapid. Maturity is attained usually in the 3rd year (at the end of the 3rd summer); but it frequently occurs in the 2nd year among males (which are then called jacks), or rarely in the 4th year. In the Strait of Georgia young coho salmon at the beginning of their third year have deep blue backs and bright red flesh and are referred to commonly as "blueback" salmon. The food of the coho salmon consists largely of herring and sandlance but includes other small fishes, squid and an assortment of crustaceans. The average weight at maturity is from 6 to 12 pounds but weights up to 31 pounds have been recorded. The coho salmon is captured by troll, purse seine, gill net and trap. The bulk of the catch is marketed fresh or is frozen, but some is canned and marketed either as coho or blueback salmon. This species also provides a considerable amount of sport fishing, in trolling and fly-casting, principally in salt water. The name silver salmon is applied frequently to the coho salmon in United States waters.

Range: Northern California to Bering Sea.

### **Chinook 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, 18 to 30, rough, widely spaced. Fins: dorsal (1), 10 to 14; adipose, stout, fleshy; anal, 13 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, 130 to 165. 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; black pigment in mouth along bases of teeth. 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 black pigment along the bases of the teeth and the loose conical teeth, in mature individuals. The young are readily recognized by the strongly developed parr marks.

The chinook 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, which begins in the late spring and reaches a maximum in early autumn, is chiefly to the large rivers. The young may go to sea during the first year or remain at least a year in the streams or lakes. Growth is rapid in the sea and maturity is attained in the 3rd to 7th year, but usually in the 4th or 5th. Maturing 2nd- and 3rd-year males are called *jacks*, and the small immature fish of both sexes are referred to by sport fishermen as *grilse*. Grilse average approximately 2½ pounds dressed, or 3



FIGURE 46. Chinook salmon. *Oncorhynchus tshawytscha* (Walbaum) 1792

pounds in the round, while jacks are 2½ to 4 pounds dressed and 3 to 4½ pounds in the round.

Tagging operations have shown that long distances may be travelled, as for example, from the Aleutian Islands to the Columbia River, from Hippa Island to Marshfield, Oregon, and from Barkley Sound to the Sacramento River, California. Since it is accepted that chinook salmon usually return to their natal streams, it is evident that the young salmon must have travelled equally long or longer distances during their feeding and growing years. The food consists chiefly of herring and sandlance, 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 chinook 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 126 pounds have been recorded. Commercial fishing is by troll, purse seine, gill net and



trap, and the catch is canned, frozen, smoked and dry-salted. Large quantities are sold as fresh spring salmon. In many areas the chinook salmon provides excellent sport fishing, as for example, off Campbell and Oyster Rivers, off Comox, and at Rivers Inlet, where large individuals are caught by sport tackle and are called "tyee" salmon. In the United States various additional names are applied to this species, such as "king" and "quinnat" salmon. In Canada the name "spring" salmon has been in general use but by international agreement among ichthyologists the name chinook has been adopted.

Range: Southern California to Bering Sea.

### **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, 18 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 186. 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 4 inches.



FIGURE 47. Chum salmon. *Oncorhynchus keta* (Walbaum) 1792

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 19 to 26 smooth widely spaced rakers on the first gill 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, even as far as Teslin Lake in the Yukon River system. The young go to sea during the first spring, and maturity is reached in the 3rd or 4th year of life. Little is known of the ocean migration routes but two individuals, tagged 165 miles west of Cape Spencer and 20 miles west of Cape Bartolome, Alaska, respectively, have been recovered in Johnstone Strait. 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 33 pounds have been recorded. Fishing is by purse seines, gill nets and traps and the catch is chiefly canned, dry-salted and frozen. The name "dog" salmon often was and still is used for the species—a name which may refer to the very large teeth developed by breeding males, or to the fact that this species was formerly used principally for dog food in some districts.

Range: Northern California to Bering Sea.

### **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, 28 to 40, long, slender, rough, closely set. Fins: dorsal (1), 11 to 16; adipose, small, slender, fleshy; anal, 13 to 18; 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 145. Pyloric caeca: 60 to 115. Colour: greenish blue on dorsal surface with fine black 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 lateral line.

Length to 2 feet 9 inches.

Distinguished by the 28 to 40 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 the 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 its spawning colours as *Salmo lycaodon*. The species is abundant along the whole coast. The spawning migration takes place during the summer and early autumn months. The adults enter rivers fed by lakes and may spawn below the lakes but usually pass through them and spawn in the tributary streams, or in some cases along the lake shores. Upon hatching in the following spring the young enter the lakes where they spend usually one, frequently two and occasionally three years; they then start their migration to the ocean, usually between March and May. A few individuals may 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",



FIGURE 48. Sockeye salmon. *Oncorhynchus nerka* (Walbaum) 1792

"Kennerly's salmon" or "little redfish", and sometimes locally as "silver trout". Some of the sea-run stock may remain in fresh water and mature in their 2nd, 3rd or 4th years of life, and are called "residual" sockeye or simply "residuals". Anadromous sockeye salmon usually mature in their 4th or 5th year of life, but sometimes large numbers of males mature in their 3rd year, when they are known as "jack" sockeye. Fewer individuals spawn in their 6th or 7th year.

Information concerning the movements in the ocean is still 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 at Seymour Narrows, also in 1925, 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. Observations in 1958 on the movements of the Adams River population of the Fraser River suggested that these fish may have migrated from the Gulf of Alaska area. They

appeared in very large numbers at the entrance to Queen Charlotte Sound and very many proceeded along the east coast of Vancouver Island to the Fraser River, while the main body followed the west coast of the Island and entered Juan de Fuca Strait. Sockeye salmon tagged south of Kodiak Island, in the western part of the Gulf of Alaska, have been recovered in Johnstone Strait, in the Strait of Georgia, at the San Juan Islands and at Roberts Creek, British Columbia. An individual tagged near the middle of the Gulf of Alaska ( $55^{\circ}$  N,  $148^{\circ}$  W) was recovered in the Babine River, as was another tagged south of the middle Aleutian Islands ( $175^{\circ}$  W). 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  $15\frac{1}{2}$  pounds have been recorded. The sockeye salmon is taken chiefly in gill nets at the mouths of rivers, 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 salmons for canning purposes because of the deep red colour and the flavour of its flesh. This fish is known as the "red salmon" in Alaska and the "blueback" on the Columbia River.

Range: Southern Oregon to Bering Sea.

#### Family OSMERIDAE

#### Smelts

In the smelts the body is slender and covered with numerous small cycloid scales. A lateral line is well developed and an adipose fin is present. There are no fleshy appendages at the bases of the pelvic fins. 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, frequently have longer paired fins and 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 in salt or 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.

#### **Eulachon**

*Thaleichthys pacificus* (Richardson) 1836

Body elongate, more or less slender. Head elongate; snout pointed; mouth terminal, large; maxillary not reaching below posterior margin of eye; teeth hooked, on jaws small, usually deciduous at spawning time, on vomer, small, on palatines and tongue small, slender; 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 males 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.



FIGURE 49. Eulachon. *Thaleichthys pacificus* (Richardson) 1836

Distinguished by the origin of the dorsal fin behind the origins 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 4 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 large rivers during March, April and May to spawn. The fish matures at 2 and 3 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 2 or 3 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 chinook 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 candlefish. 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 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: oolachon, oolichan, oulachon and ulchen.

Range: Northern California to Bering Sea.

**Longfin 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 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 or 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 two conspicuous rows, one on each side of midline, extending from head to caudal peduncle.

Length to 6 inches.



FIGURE 50. Longfin smelt. *Spirinchus dilatatus* Schultz and Chapman 1934

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.

The longfin 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 on January 4, 1929, from Burrard Inlet in a shrimp trawl by Dr A. A. Berkley Needler and was recorded in 1935 by L. P. Schultz and A. C. DeLacy. This individual is now in the Vancouver City 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 longfin 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; 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: Northern California to northern British Columbia.

**Surf 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, origin distinctly in front of origin of pelvic fins; adipose, small, slender; anal, 14 to 16;



FIGURE 51. Surf smelt. *Hypomesus pretiosus* (Girard) 1954

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 origins of the pelvic fins.

The surf 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 surf smelt forms part of the food of the chinook 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 silver smelt, which name was used in 1946 by Clemens and Wilby.

Range: northern California to southeastern Alaska.

### Toothed smelt

*Osmerus dentex* Steindachner 1870

Body elongate, compressed. Head elongate; snout pointed; mouth terminal, large, strongly oblique, maxillary extending to point behind eye; teeth well developed, on jaws small, slender, on vomer, 2, large, canine-like, on tongue, large, strong, hooked; opercle smooth, without striae. Fins: dorsal (1), about 10, origin above origin of pelvic; adipose, small; anal, about 13; pelvic, 8, abdominal; pectoral, 14, much shorter than head; caudal, furcate. Lateral line: very slightly



FIGURE 52. Toothed smelt. *Osmerus dentex* Steindachner 1870



decurved, then straight. Scales: cycloid, moderate; on lateral line, 66 to 69. Colour: pale olive on dorsal surface; bluish on sides with distinct band along lateral line; shading to silvery with gold on ventral surface.

Length to 6½ inches.

Distinguished by the origin of the dorsal fin above the origin of the pelvic fin, the unstriated operculum and the large mouth with the 2 large teeth on the vomer.

The toothed smelt was first recorded from British Columbia waters in 1913 by A. Halkett from the Nass River. A second record is that of a specimen which was taken in June, 1954, in Barkley Sound by Mr R. E. Johannes, and is now in the museum of the Institute of Fisheries at the University of British Columbia. The species is known also as the Arctic smelt, that being the name recommended by the AFS/ASIH committee.

Range: Vancouver Island to Bering Sea.

### Capelin

*Mallotus villosus* (Müller) 1777

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; 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 limit 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 2 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 3 or 4 years. The food consists of small crustaceans, including

euphausiids. The capelin forms part of the food of chinook and coho salmon and probably other piscivorous animals, such as dogfish and water fowl. 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. It was recorded in 1946 by Clemens and Wilby as *Mallotus catervarius* (Pennant).

Range: Juan de Fuca Strait to Bering Sea.



FIGURE 53. Capelin. *Mallotus villosus* (Müller) 1777

Family ARGENTINIDAE

Deepsea smelts

In the deepsea smelts the body usually is slender, sometimes stout, and is covered with large cycloid scales. The mouth is small with small teeth. The eye is large, sometimes directed upward. The lateral line may be present or absent. The adipose fin is prominent and there is no fleshy appendage at the base of each pelvic fin. The colours usually are brown or black.

**Smoothtongue**

*Leuroglossus stilbius* Gilbert 1890

Body elongate, slender; caudal peduncle stout. Head long, slightly compressed; snout long; mouth terminal, lower jaw projecting; maxillary scarcely reaching anterior margin of eye; teeth small, absent from tongue; eye large, diameter about 3.2 in length of head; interorbital space nearly flat. Fins: dorsal (1), 9 to 12; adipose, slender; anal, 12 to 14; pelvic, abdominal; caudal, furcate. Lateral line: present, very inconspicuous. Scales: cycloid, deciduous. Colour: silvery; dusky on dorsal surface and fins; black on lining of mouth, gill cavities and on peritoneum.

Length to 6 inches.

Distinguished by the pointed head with the projecting lower jaw, the long snout and the absence of teeth from the tongue.

The smoothtongue was first taken in British Columbia waters on July 15, 1915, off Five Finger Island in the Strait of Georgia near Nanaimo and was recorded in 1956 by D. M. Cohen as being in the collection of the University of Washington. On May 22, 1959, an adult individual was taken near Tofino in a

vertical haul between 115 and 62 fathoms by Mr R. McHardy and the specimen is now in the collection of the Institute of Fisheries at the University of British Columbia. Specimens in spawning condition were taken on March 26, 1950, in southeastern Alaska at a depth of 220 fathoms. The name recommended by the AFS/ASIH committee is California smoothtongue.

Range: Southern California to Gulf of Alaska.



FIGURE 54. Smoothtongue. *Leuroglossus stilbius* Gilbert 1890

**Slender blacksmelt**

*Bathylagus pacificus* Gilbert 1890

Body elongate, slender; caudal peduncle slender. Head long, 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, absent. Fins: dorsal (1), 8 to 10; adipose, small; anal, 18 to 20; pectoral, 7 to 11; 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 7½ inches.

Distinguished by the very large eyes, the 7 to 11 rays in the pectoral fin, the more than 30 scales in oblique rows above the midline of the body, and the absence of a ridge from the top of the head.



FIGURE 55. Slender blacksmelt. *Bathylagus pacificus* Gilbert 1890

The slender blacksmelt was first taken in British Columbia waters on March 30, 1930, west of the Queen Charlotte Islands by the International Fisheries Commission, station 331C, Lat. 53° 23' N, Long. 137° 32' W, depth between 379 and 488 fathoms and recorded in 1940 by W. M. Chapman. Additional specimens were taken between April 29, 1930, and May 21, 1931, in the same general area and between the same depths. In May, 1957, very young individuals were obtained in vertical plankton hauls between 80 and 0 fathoms by H.M.C.S. *Oshawa* off the northwest tip of Vancouver Island and west of Moresby Island.

Range: Southern California to Bering Sea.

### Stout blacksmelt

*Bathylagus milleri* Jordan and Gilbert 1898

Body elongate, deep anteriorly; caudal peduncle, slender. Head long, 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 ridge strongly developed. Fins: dorsal (1), 7 to 9; adipose, small; anal, 23 to 27; pectoral, 12 to 15; 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 6½ inches.



FIGURE 56. Stout blacksmelt. *Bathylagus milleri* Jordan and Gilbert 1898

Distinguished by the very large eyes, the 12 to 15 rays in the pectoral fin, the scales in oblique rows above midline of body fewer than 30 and the presence of a median ridge on the top of the head.

The stout blacksmelt was first taken in British Columbia waters on March 16, 1929, south of Cape St. James by the International Fisheries Commission, station 184B, 51° 44' N, Long. 131° 17' W, depth between 216 and 324 fathoms.

Between March 17, 1929 and January 9, 1934, specimens were obtained at nine other stations in the same general vicinity. It was recorded in 1946 by Clemens and Wilby as the big-scaled black smelt.

Range: Southern California to Bering Sea.

### Barreleye

*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 isthmus with broad free fold posteriorly. Fins: dorsal (1), 11 or 12, far back on body; adipose, elongate, slender; anal, 14; pelvic, 10, abdominal, very elongate, inserted somewhat high on 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, 23 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.



FIGURE 57. Barreleye. *Macropinna microstoma* Chapman 1939

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 barreleye was first taken in British Columbia waters on 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 of the type, was secured on March 28, 1932, west of Graham Island, station 621C, Lat. 53° 50' N, Long. 134° 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 6 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  $\frac{1}{4}$  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: Southern California to Gulf of Alaska.

### Suborder STOMIATOIDEA

The fishes of this suborder have photophores which are in definite rows on the body: a ventral row from the branchiostegal region to the caudal peduncle and a shorter lateral row from above the pectoral fin to the origin of the anal fin. Other luminous dots and patches may be present. The pectoral fins are placed low; the dorsal and anal fins usually are far back on the body. The mouth is terminal with the cleft extending almost the length of the head. The gill openings are very wide.

Five families are represented in British Columbia waters: Gonostomatidae, Sternoptychidae, Melanostomiatidae, Malacosteidae and Chauliodontidae.

#### Family GONOSTOMATIDAE

#### Anglemouths

In the anglemouths 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 anglemouth**

*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 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 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 the body and the small needle-like teeth.

The veiled anglemouth was first taken in British Columbia waters on 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



FIGURE 58. Veiled anglemouth. *Cyclothone microdon* (Günther) 1878

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 started from 2,900 fathoms. The distribution is world wide.

Range: Southern California to Bering Sea.

Family STERNOPTYCHIDAE

Hatchetfishes

In the hatchetfishes the body is 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 hatchetfish**

*Argyropelecus sladeni* Regan 1908

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: bright silvery, overlying brown to black substratum; silvery to white on fins; black on margins of photophores.

Length to 2½ inches.

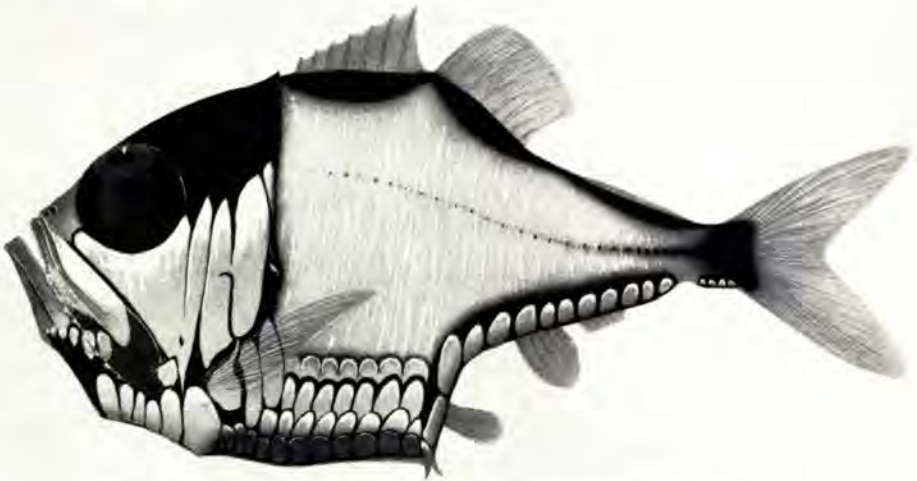


FIGURE 59. Silvery hatchetfish. *Argyropelecus sladeni* Regan 1908

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 bright silvery coloration.

The silvery hatchetfish was first taken in British Columbia waters on June 13, 1935, in English Bay off Jericho Beach by Mr Y. Kondo at a depth of about 30 fathoms in a shrimp trawl and was recorded in 1946 by Clemens and Wilby as *Argyropelecus olfersii* (Cuvier). A second individual was obtained on March 14, 1953, by Mr E. McDermid off the mouth of the Fraser River and recorded in 1956 by W. E. Barraclough. A third specimen was found on April 6, 1959, on the beach in Peder Bay, Sooke Harbour, by Mrs Joan Yates. The species is worldwide in distribution and occurs at depths down to somewhat over 2000 fathoms.

Range: Southern British Columbia.



In the dragonfishes 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 and both are close to the small caudal fin; the pelvic fins are well behind the midlength of the body and the adipose fin is absent; the pectoral fins are usually composed of rays which may be greatly elongate, reduced or absent in some species. Photophores usually occur in two main series along the lower side of the body.

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

**Highfin dragonfish***Bathophilus flemingi* Aron and McCrery 1958

Body elongate, slender, almost cylindrical. Head short, length 5.4 to 6.1 in standard length; mouth terminal, very large, gape almost full length of head; teeth, on anterior of jaws large, simple, acute; anterior pair fixed, remainder depressible; none on vomer; one or more on palatines; eye very small, partially covered with skin; barbel on lower jaw much longer than body, slender, tapering. Fins: dorsal (1), 15 or 16, very far back on body; adipose, absent; anal, 16 or

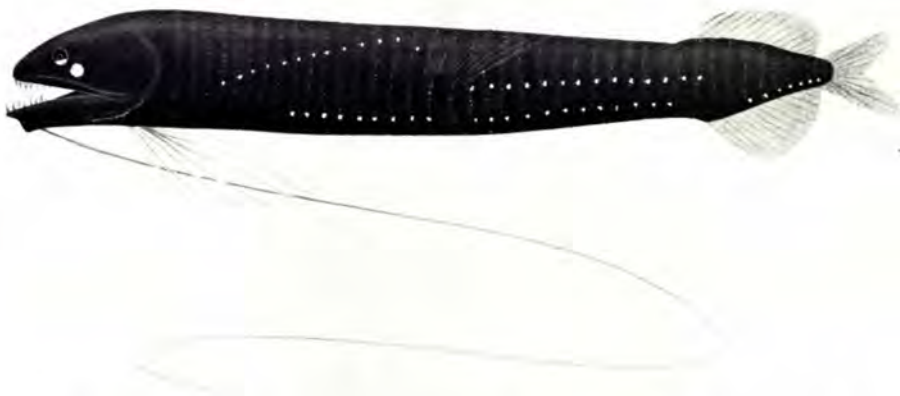


FIGURE 60. Highfin dragonfish. *Bathophilus flemingi* Aron and McCrery 1958

17, very far back, origin slightly behind that of dorsal; pelvic, 15 to 17, abdominal, high on side, above midline of body, lacy, delicate; pectoral, 5 to 7, rays very long, lacy, delicate; caudal, small, furcate. Lateral line: absent. Scales: absent. Photophores: on body in two rows to anal fin; ventrolateral row, 27 or 28; ventral row, isthmus to pelvic fin, 10 to 19, pelvic fin to anal fin, 6 to 13, above anal fin, 5 to 7. Luminous organs: on head, suborbital, 1, small; postorbital, 1, large, close to suborbital. Colour: dark brown to black.

Length to  $6\frac{1}{8}$  inches.

Distinguished by the elongate body with the very posterior position of the dorsal and anal fins and the lacy delicate pelvic fins high on each side of the body.

The highfin dragonfish was first taken in British Columbia waters on September 21, 1957, Lat.  $48^{\circ} 15' N$ , Long.  $130^{\circ} 05' W$ , depth 65 fathoms by the M. V. *Brown Bear*, research vessel of the Department of Oceanography, University of Washington and recorded in 1958 by W. Aron and P. McCrery. Additional specimens have been taken to the south and west of the above station during the same expedition and subsequently.

Range: Washington to southern British Columbia.

#### Arrow dragonfish

*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; absent from vomer and palatines; on tongue in two rows of 6 or 7 each, large, fanglike; 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,



FIGURE 61. Arrow dragonfish. *Tactostoma macropus* Bolin 1939

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  $13\frac{1}{2}$  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 the body and the large teeth on the jaws and on the tongue.

The arrow dragonfish was first taken in British Columbia waters on April 14, 1932, south of Cape St. James by the International Fisheries Commission, station 665C, Lat.  $51^{\circ} 16' N$ , Long.  $130^{\circ} 35' W$ , depth between 379 and 487 fathoms. A second specimen was secured on January 3, 1935, station 1256C. Lat.  $51^{\circ} 15' N$ , Long.  $131^{\circ} 37' W$ , between the same depths. From 1957 to 1959 considerable numbers of individuals were captured off the northwest coast of Vancouver Island at depths between 17 and 125 fathoms in mid-water trawls. 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. The species was recorded as the arrow-fish in 1946 by Clemens and Wilby.

Range: Northern California to Queen Charlotte Sound.

#### Family MALACOSTEIDAE

#### Loosejaws

In the loosejaws the body is elongate, slender, without scales. The mouth is relatively very large, the teeth are well developed in both jaws, some fanglike, small on tongue and palatines. There is no membrane between the lower jaw and the hyoid arch and thus no floor to the mouth. The head is capable of being thrown back and the lower jaw thrust forward. A mental barbel usually is present; it is filamentous, shorter than the length of the body and ends in a bulb. The dorsal and anal fins are far back on the body, close to the small caudal fin, and enclosed for two-thirds of their heights in flesh. There is no adipose fin. The pectoral and pelvic fin rays are free and elongate. The photophores occur in two series along the lower side of the body.

#### Loosejaw

*Aristostomias scintillans* (Gilbert) 1915

Body moderately stout, deepest behind head. Head moderate, bluntly rounded; mouth large, gape extending far posteriorly; teeth large on premaxillary, small on maxillary; on mandible large anteriorly, small posteriorly; small on tongue and palatines; absent from vomer; eye moderate; barbel long, filamentous, tip enlarged. Fins: dorsal (1), 21 to 23, very far back on body; adipose, absent; anal, 25 to 29, origin below that of dorsal; pelvic, 6 or 7, abdominal, rays free,

elongate; pectoral, 4 or 5, rays free, elongate; caudal, small, furcate. Lateral line: absent. Scales: absent. Photophores: in two series along lower portion of body; lateral series extending from branchiostegals to point above origin of anal fins; ventral series extending from branchiostegals to end of caudal peduncle. Luminous organs: on head, one, subocular; one, postocular, large, oval. Colour: on body black; on luminous organs, subocular, red; postocular, green; tip of barbel, pink.

Length to 8 inches.



FIGURE 62. Loosejaw. *Aristostomias scintillans* (Gilbert) 1915

Distinguished by the elongate body with the dorsal and anal fins far back, the pectoral and pelvic fins with the elongate free rays and the filamentous barbel with the enlarged tip.

The loosejaw was first taken in British Columbia waters July 27, 1957, Lat.  $50^{\circ} 21' N$ , Long.  $138^{\circ} 44' W$ , depth 16 fathoms, by the M. V. *Brown Bear* and recorded in 1960 by W. Aron.

Range: California to British Columbia.

#### Family CHAULIODONTIDAE

#### Viperfishes

In the viperfishes the body is elongate and slender, covered with large thin cycloid scales which do not overlap, a feature which is associated with a distensible body wall and an ability to engulf large prey. The head is large and may be thrown backward because of a ball and socket arrangement between the skull and the enlarged first vertebra. The mouth with its large gape may then take an almost vertical position. There are many large, curved, fang-like teeth, slightly barbed at their ends. The dorsal fin is far forward on the body with the first ray separate and much elongated; dorsal and ventral adipose fins are present.

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

#### Fanged viperfish

*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, absent from tongue; eye large, diameter 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: dorsal large; ventral low, preceding anal fin; anal, 10 to 12, rather small, far back, slightly larger than dorsal 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 8½ inches.

Distinguished by the elongated body, the very long fang-like teeth in the gaping mouth, the presence of two adipose fins and the two rows of photophores along the lower portion of the body.

The fanged viperfish was first taken in British Columbia waters on August 29, 1888, off the Queen Charlotte Islands near Cape St. James by the *Albatross*, station 2860, Lat. 51° 23' N, Long. 130° 34' W, depth 876 fathoms, and 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. In April, 1947, an individual was obtained off the mouth of the Fraser River at a



FIGURE 63. Fanged viperfish. *Chauliodus macouni* Bean 1890

depth of 40 fathoms. Additional specimens were taken in 1957 off the west coast of Vancouver Island at a depth of 125 fathoms. The food consists in part of the arrow-worm, *Sagitta*, and shrimps.

Range: Southern California to Gulf of Alaska.

#### 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); an adipose fin usually is present (present in British Columbia

species). The scales, when present, are cycloid. There appears to be an interesting association between scaling, distensible body wall and size of food organisms among the fishes of the order Iniomi and related oceanic fishes. In these forms, reduction in scaling or loss of scales is associated with elasticity of stomach and body wall and with feeding upon relatively large prey such as fishes, crustaceans and squids. The members of the order Iniomi demonstrate a sequence in this regard as will be pointed out in the discussions of the groups.

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

#### 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. Scallation is fully developed.

One family, the Myctophidae, is represented in these waters.

#### Family MYCTOPHIDAE

#### Lanternfishes

In the lanternfishes photophores and luminous organs are numerous on the head and body, hence the common name for the family. The photophores have definite positions, never above the lateral line, and are named accordingly as shown in Figure 10 on page 34. Variations in the positions and numbers of these structures occur among the various species and thus form a useful means for identification. The members of this family are fully scaled and feed upon small planktonic crustaceans, such as copepods, euphausiids, amphipods and arrow-worms.

#### **Bigeye lanternfish**

*Electrona arctica* (Lütken) 1892

Body elongate, stout, greatest depth 3 to 3.9 in standard length, in front of dorsal fin; caudal peduncle, moderately slender. Head large, deep, anterior profile rounded; mouth terminal, large; premaxillary extending to point behind eye; maxillary greatly expanded posteriorly, not entering gape; 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; Op<sub>1</sub>, absent; Op<sub>2</sub>, above and behind maxillary; PLO, well below base of pectoral fin, above, slightly behind PO<sub>2</sub>; PVO<sub>1</sub>, behind PLO, above interspace between PO<sub>2</sub> and PO<sub>3</sub>; PVO<sub>2</sub>, at base of pectoral fin; VLO, about midway between, forming straight line with PVO<sub>2</sub> and SAO<sub>1</sub>; SAO<sub>1</sub>, behind VLO above VO<sub>3</sub>; SAO<sub>2</sub>, on same level, above origin of anal fin; SAO<sub>3</sub>, about half distance between lateral line and AO<sub>1</sub>; Pol, absent:

PO, 5, on same level, interspace large between PO<sub>2</sub> and PO<sub>3</sub>; VO, 4, on same level; AO, 15 to 18, in single continuous series; Prc, 2, well separated from 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 $\frac{3}{4}$  inches.



FIGURE 64. Bigeye lanternfish. *Electrona arctica* (Lütken) 1892

Distinguished by the 15 to 18 anal photophores in a continuous row, the absence of a posterolateral photophore, the large eyes, the large anal fin and the expanded maxillary at the posterior edge of the mouth.

The bigeye lanternfish was first taken in British Columbia waters on 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 taken also by the Commission at 12 other stations in the vicinity of the Queen Charlotte Islands. Other individuals were obtained in 1957 off the west coast of Vancouver Island at depths between 17 and 125 fathoms. The species was described originally in 1939 by W. M. Chapman as *Myctophum oculeum*. It was renamed in 1944 as *Electrona thompsoni* Chapman and so recorded in 1946 by Clemens and Wilby. The species is now recognized as *E. arctica*.

Range: California to Gulf of Alaska.

#### **Blue lanternfish**

*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, premaxillary 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 long, tip reaching to point above insertion 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, 45 to 50. Photophores: Dn, small, deeply embedded; Suo, small; Vn, large; Op<sub>1</sub>, small; Op<sub>2</sub>, large; PLO, small, below level of upper ray of pectoral fin, covered by subopercle; PVO<sub>1</sub>, immediately below subopercle; PVO<sub>2</sub>, at base of pectoral fin, about above PO<sub>3</sub>; VLO, on level with PVO<sub>2</sub>, above insertion of pelvic fin; SAO<sub>1</sub>, above and slightly behind posterior VO; SAO<sub>2</sub>, behind SAO<sub>1</sub>, slightly above, directly above origin of anal fin; SAO<sub>3</sub>, near midlateral position, above origin of anal fin; Pol, 1, above posterior AO<sub>a</sub>; PO, 5 to 8, in straight line and on same level; VO, 5 to 7, on same level; AO, in two series, AO<sub>a</sub>, 9 to 12, AO<sub>p</sub>, 3 to 5 (not always same number on both sides of body); Prc, 1, widely separated from posterior AO<sub>p</sub> but on same level. Luminous organs; in male, supracaudal only, from base of adipose fin to base of caudal; 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 5 inches.

This species is illustrated in colour in the Frontispiece.



FIGURE 65. Blue lanternfish. *Tarletonbeania crenularis* (Jordan and Gilbert) 1880

Distinguished by the low position of the suprapectoral photophore, the single precaudal photophore, the elongate supracaudal luminous organ in the male, the short lateral line and the slender caudal peduncle.

The blue lanternfish was first taken in British Columbia waters on 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 11 others in Queen Charlotte Sound at depths



between 54 and 487 fathoms. In 1957 numerous trawl catches indicated the wide distribution of this lanternfish off the west coast of Vancouver Island at depths between 17 and 125 fathoms. The species is taken frequently near the surface at night. Specimens have been obtained from the stomachs of albacore from California to British Columbia. In 1952 nine individuals found on the beach in southern California had fed entirely upon *Euphausia pacifica*. A species, *Tarletonbeania taylori*, has been described from the North Pacific but its characters intergrade with those of *T. crenularis* and *T. taylori* may prove to be merely one expression of a population complex of *T. crenularis*. It appears best at this time to consider *T. taylori* as a possible subspecies.

Range: Southern California to southeastern Alaska.

**Bigfin lanternfish**      *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; premaxillary 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 22, moderate, insertion below insertion of dorsal; pelvic, 8, abdominal; pectoral, moderate, tip reaching to point well behind insertion of pelvic; caudal, furcate. Lateral line: slightly decurved, then straight. Scales: cycloid, moderate; in lateral line, 38 to 42. Photophores: Vn, small, deeply embedded; Op<sub>1</sub>, small; Op<sub>2</sub>, large; PLO, in advance of pectoral fin, about midway between lateral line and base of pectoral fin; PVO<sub>1</sub>, about midway between PVO<sub>2</sub> and PO<sub>1</sub>; PVO<sub>2</sub>, near base of lower pectoral fin rays; VLO, above origin of pelvic fin, about midway between lateral line and base of pelvic fin; SAO<sub>1</sub>, above interspace between VO<sub>2</sub> and VO<sub>3</sub>; SAO<sub>2</sub>, above VO<sub>4</sub>; SAO<sub>3</sub>, close to lateral line above



FIGURE 66. Bigfin lanternfish. *Myctophum californiense* Eigenmann and Eigenmann 1889

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  $AO_p$ , Prc<sub>2</sub>, posterior to and slightly higher than Prc<sub>1</sub>. 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  $4\frac{1}{2}$  inches.

Distinguished by the presence of two precaudal photophores well separated from the anal photophores, the position of the suprapectoral photophores above the pectoral fin and the anal photophores in two groups, the anterior series of 6 or 7 and the posterior series 8 to 10.

The bigfin lanternfish was first recorded from British Columbia waters in 1864 from the neighbourhood of Vancouver Island by A. Günther as *Scopelus boops*. In 1958 W. Aron recorded 3 individuals taken in 1957 off the west coast of Vancouver Island at a depth of 17 fathoms. It was taken frequently from 1956 to 1959 northwest of Vancouver Island, in surface waters.

Range: Southern California to Gulf of Alaska.

### Theta lanternfish

*Diaphus theta* Eigenmann and Eigenmann 1890

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; premaxillary extending to point well behind eye; teeth small, villiform; eye large, diameter 2.6 to 3.2 in length of 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



FIGURE 67. Theta lanternfish. *Diaphus theta* Eigenmann and Eigenmann 1890

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; Op<sub>1</sub>, small; Op<sub>2</sub>, large; PLO, above base of pectoral fin; PVO<sub>1</sub>, about midway between PO<sub>1</sub> and PVO<sub>2</sub>; PVO<sub>2</sub>, in front of lower rays of pectoral fin; VLO, behind base of pectoral fin directly above base of pelvic; SAO<sub>1</sub>, behind and slightly above VO<sub>5</sub>; SAO<sub>2</sub>, behind and above SAO<sub>1</sub>; SAO<sub>3</sub>, behind and above SAO<sub>2</sub>, about midway between it and lateral line; Pol, 1, above interspace between posterior AO<sub>a</sub> and anterior AO<sub>p</sub>; PO, 5, PO<sub>1</sub> under opercle, interspace between PO<sub>1</sub> and PO<sub>2</sub> long, PO<sub>4</sub>, slightly elevated; VO, 5, VO<sub>2</sub> and VO<sub>3</sub> much elevated; AO, in two series, AO<sub>a</sub>, 4 to 6, AO<sub>p</sub>, 4 to 7; Prc, 4, in curve following base of caudal fin; Prc<sub>1</sub>, separated from posterior AO<sub>p</sub> by interspace slightly greater than that between AO<sub>a</sub> and AO<sub>p</sub>. 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 4½ inches.

Distinguished by the 4 precaudal photophores, the large dorsonasal photophore, 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 theta lanternfish was first taken in British Columbia waters on September 2, 1891, off Port San Juan by the *Albatross*, station 3459, Lat. 48° 24' N, Long. 124° 24' W, depth 123 fathoms and recorded in 1895 by C. H. Gilbert. It was recorded in 1946 by Clemens and Wilby as *Diaphus rafinesquii* (Cocco), the white-spotted lanternfish. The species 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 11 stations at depths between 54 and 325 fathoms. Off the coast of Washington and British Columbia the species has been found at depths from 17 to 584 fathoms and in Alaskan waters at 922 fathoms. Larvae have been taken off the California coast but not in British Columbia waters. Adults have been obtained in salmon stomachs.

Range: Southern California to Gulf of Alaska.

**Smallfin lanternfish** *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; premaxillary 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 to 10, abdominal;

pectoral, minute, length about equal to diameter of eye, tip far in advance of origin of pelvic; caudal, furcate. Lateral line: slightly decurved, then straight. Scales: cycloid, moderate; on lateral line, 35 to 38. Photophores: Cn, small; Op<sub>1</sub>, small; Op<sub>2</sub>, large; PLO, in advance of pectoral fin, about midway between lateral line and base of pectoral fin; PVO<sub>1</sub>, well in front of PO<sub>2</sub>, about below PVO<sub>2</sub>; PVO<sub>2</sub>, in front of base of pectoral fin; VLO, about midway between lateral line and VO<sub>1</sub>; SAO<sub>1</sub>, behind and slightly above posterior VO; SAO<sub>2</sub>, behind and above SAO<sub>1</sub>; SAO<sub>3</sub>, behind and above SAO<sub>2</sub>; Pol, 1, about one third distance from lateral line to insertion of anal fin; PO, 5 or 6, PO<sub>4</sub> much elevated, above interspace between PO<sub>3</sub> and PO<sub>5</sub>; VO, 3 to 5, following contour of abdomen; AO, in two series, AO<sub>a</sub>, 5 to 7, AO<sub>p</sub>, 6 to 8; Prc, 4, separated from AO<sub>p</sub>, evenly spaced, Prc<sub>4</sub> 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.

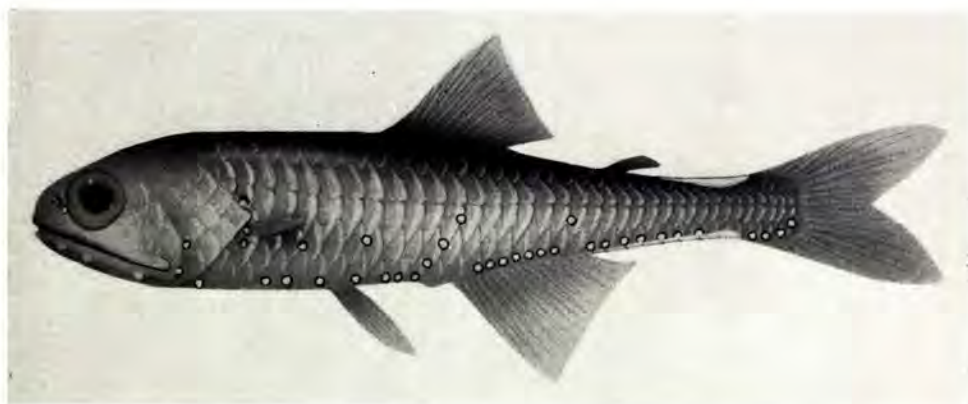


FIGURE 68. Smallfin lanternfish. *Lampanyctus leucopsarus* (Eigenmann and Eigenmann) 1890

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 smallfin lanternfish was first taken in British Columbia waters on 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 and is the most commonly taken lanternfish north of 50° north latitude. Between 1929 and 1959 many specimens have been obtained from Juan de Fuca Strait to Alaska at depths ranging from 17 to 650 fathoms. It is found occasionally in salmon stomachs.

Range: Southern California to Bering Sea.

## Pinpoint lanternfish

*Lampanyctus regalis* (Gilbert) 1891

Body elongate, slender, greatest depth 5 to 5.9 in standard length, in front of dorsal fin. Head elongate, bluntly pointed; mouth terminal, large, premaxillary 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; Op<sub>1</sub>, small; Op<sub>2</sub>, moderate; PLO, high, about one-quarter distance from lateral line to base of pectoral fin; PVO<sub>1</sub>, above interspace between PO<sub>1</sub>, and PO<sub>2</sub>, PVO<sub>2</sub>, at base of uppermost ray of pectoral fin; VLO, above insertion of pelvic fin, close to lateral line; SAO<sub>1</sub>, about midway between lateral line and interspace between VO<sub>2</sub> and VO<sub>3</sub>; SAO<sub>2</sub>, behind SAO<sub>1</sub> about midway between lateral line and origin of anal fin; SAO<sub>3</sub>, close to lateral line, behind SAO<sub>2</sub>; Pol, 2, Pol<sub>1</sub>, close to posterior end of AO<sub>n</sub> series, Pol<sub>2</sub> close to lateral line; PO, 5, PO<sub>4</sub> much elevated; VO, 4 or 5, on same level; AO, in two series, AO<sub>a</sub>, 6 to 8, AO<sub>p</sub>, 7 or 8; Prc, 4, first two on level with AO<sub>p</sub> series, Prc<sub>3</sub> above and behind Prc<sub>2</sub>, Prc<sub>4</sub> 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.



FIGURE 69. Pinpoint lanternfish. *Lampanyctus regalis* (Gilbert) 1891

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 caudal peduncle in contact with the lateral line.

The pinpoint lanternfish was first taken in British Columbia waters on March 15, 1929, off Queen Charlotte Sound by the International Fisheries Commission,

station 183C, Lat.  $51^{\circ} 47' N$ , Long.  $131^{\circ} 02' W$ , 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*. There were 10 other specimens taken by the Commission at 10 other stations at depths ranging from 54 to 487 fathoms. This species was called the small-eyed lanternfish in 1946 by Clemens and Wilby.

Range: Southern California to Gulf of Alaska.

### Broadfin lanternfish

*Lampanyctus ritteri* Gilbert 1915

Body elongate, greatest depth 5 to 5.3 in standard length, in front of dorsal fin. Head elongate, bluntly pointed; mouth terminal, very large, premaxillary extending to point far behind eye; teeth small, villiform; eye small, diameter 5.6 to 7.1 in length of head. Fins: dorsal (1), 13 to 15, large; adipose, moderate; anal, 17 to 19, large, origin below middle of dorsal; pelvic, 8, abdominal; pectoral, moderate, reaching to point slightly in advance of origin of pelvic; caudal, furcate. Lateral line: slightly decurved, then straight. Scales: cycloid, moderate; on lateral line, 37 to 38. Photophores: small, the more ventral divided by slightly curved, horizontal black septa, similar to *Diaphus*; Ce, small; Vn, moderate; Bu, small, just above tip of premaxillary;  $Op_1$ , small;  $Op_2$ , moderate; PLO, high, slightly below lateral line;  $PVO_1$ , above interspace between  $PO_1$  and  $PO_2$ ;  $PVO_2$ , at base of uppermost ray of pectoral fin; VLO, over middle of pelvic base, midway between pelvic base and lateral line;  $SAO_1$ , about over  $VO_3$ ;  $SAO_2$ , above origin of anal fin, slightly lower than  $SAO_1$ ;  $SAO_3$ , over interspace between first and second  $AO_n$ , touching lateral line;  $Pol_2$ , 2,  $Pol_1$ , above and behind last  $AO_n$  series,  $Pol_2$ , in line with last  $AO_n$  and  $Pol_1$  touching lateral line;  $PO_5$ , 5,  $PO_4$ , much elevated, almost over  $PO_3$ ;  $VO_4$ , 4, on same level;  $AO$ , in two series,  $AO_n$ , 6 to 8,  $AO_p$ , 8 or 9;  $Prc_4$ , 4, first three continuous with last  $AO_p$  in gently ascending arc,  $Prc_4$ ,



FIGURE 70. Broadfin lanternfish. *Lampanyctus ritteri* Gilbert 1915

touching lateral line. Luminous organs: supracaudal, 2 or 3, touching base of caudal fin; infracaudal, 5 to 7, extending from  $AO_{p2}$  or  $AO_{p3}$  to  $Prc_1$ . Colour: brownish black to metallic blue, lighter on sides; dusky on fins.

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

Distinguished by the elongate body, photophores on the ventral portion of the body divided by slightly curved horizontal septa and the last precaudal photophore touching the lateral line and widely separated from the third.

The broadfin lanternfish was first taken in British Columbia waters on July 23, 1957, by the M. V. *Brown Bear*, haul 4, Lat.  $49^{\circ} 06' N$ , Long.  $127^{\circ} 16' W$ , depth 122 fathoms, and recorded in 1958 by W. Aron. Three specimens were obtained ranging from  $3\frac{1}{2}$  inches to 5 inches in length. During the next month in the same general area 13 other individuals were taken.

Range: California to British Columbia.

### Fangtooth lanternfish

*Ceratoscopelus townsendi* (Eigenmann and Eigenmann) 1887

Body elongate, greatest depth about 4.2 in standard length, in front of dorsal fin. Head elongate, rounded; mouth terminal, very large, premaxillary extending to point far behind eye; teeth small, villiform, a single small fang-like tooth on each side of vomer; eye large, diameter about 3 in length of head. Fins: dorsal (1), 13 or 14, large; adipose, moderate; anal, 14, large, origin below insertion of dorsal; pelvic, 8, abdominal; pectoral, long, tip reaching to point above anus;

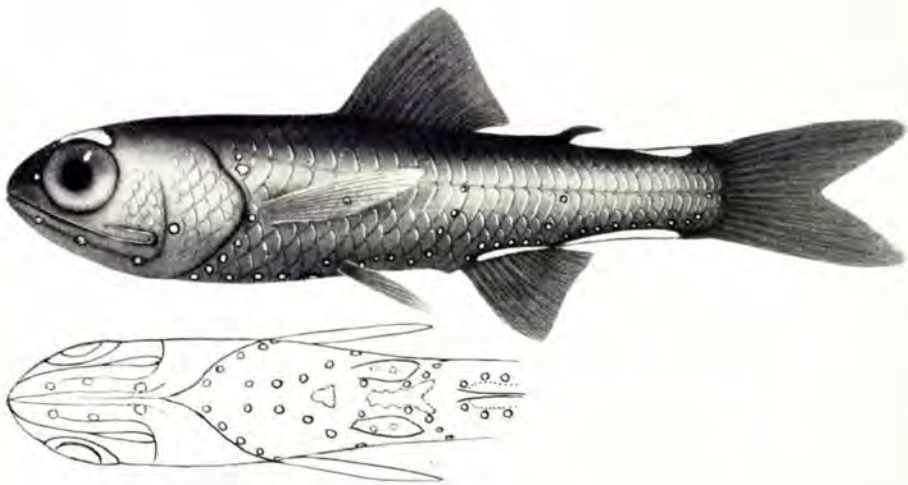


FIGURE 71. Fangtooth lanternfish. *Ceratoscopelus townsendi* (Eigenmann and Eigenmann) 1887

caudal, furcate. Lateral line: slightly decurved, then straight. Scales: cycloid, moderate; on lateral line, about 37. Photophores: Vn, small; Op<sub>1</sub>, small; Op<sub>2</sub>, large; PLO, over PVO<sub>1</sub>, close to lateral line; above and slightly in front of PO<sub>2</sub>; PVO<sub>2</sub>, at base of pectoral fin; VLO, about midway between base of pelvic fin and lateral line; SAO<sub>1</sub>, above and behind VO<sub>5</sub>; SAO<sub>2</sub>, above and behind SAO<sub>1</sub>; SAO<sub>3</sub>, above and behind SAO<sub>2</sub>, touching lateral line; Pol, 2, Pol<sub>1</sub>, above and behind last AO<sub>a</sub>; Pol<sub>2</sub>, above and behind Pol<sub>1</sub> touching lateral line; PO, 5, PO<sub>5</sub> slightly elevated; VO, 5, in gentle arc; AO, in two series, AO<sub>a</sub>, 5 or 6; AO<sub>p</sub>, 5 or 6; Prc, 4, first three close behind AO<sub>p</sub> series, Prc<sub>4</sub> in contact with lateral line. Luminous organs: numerous; supraorbital long, broad; one below PLO; two small organs above and between PO<sub>1</sub> and PO<sub>2</sub>; on ventral surface before ventral fins, small, triangular; behind pelvic fins, large, y-shaped; supracaudal, 3 to 5, close to caudal fin; infracaudal, 9 to 11, between anal and caudal fins. Colour: black; metallic bluish reflections from opercles and scales; dusky on median fins; little colour on paired fins.

Length to 7¼ inches.

Distinguished by the 2 fangs on the vomer, the large eyes, the luminous organs above the eyes and the triangular and Y-shaped patches on the ventral surface.

The fangtooth lanternfish was first taken in British Columbia waters on September 17, 1957, by the M.V. *Brown Bear*, haul 125, Lat. 48° 58' N, Long. 144° 21' W, depth 16 fathoms. The two specimens obtained were recorded in 1958 by W. Aron along with two others obtained during the same week in the area nearby. The specimens are in the collection of the University of Washington.

Range: Southern California to southern British Columbia.

### **Patchwork lanternfish**

*Notoscopelus resplendens* Richardson 1844

Body elongate, slender, greatest depth about 6 in standard length, in front of dorsal fin. Head elongate, bluntly pointed. Mouth terminal, very large, maxillary extending to point far behind eye; teeth small, cardiform; eye moderately small, diameter about 4.5 in length of head. Fins: dorsal (1), about 21, large; adipose, small; anal, about 19, large, origin slightly behind middle of dorsal fin base; pelvic, 8, abdominal; pectoral, short, tip not reaching to origin of pelvic fin; caudal, furcate. Lateral line: slightly decurved, then straight. Scales: cycloid, moderate; on lateral line, 41 or 42. Photophores: small; Ce, absent; Vn, absent; Dn, elongate; Bu, absent; Op<sub>1</sub>, small; Op<sub>2</sub>, larger; PLO, high, almost touching lateral line, well in advance of PVO<sub>2</sub>; PVO<sub>1</sub>, at base of pectoral fin; PVO<sub>2</sub>, above base of pectoral fin, between it and PLO; VLO, above origin of pelvic fin and closer to lateral line; SAO<sub>1</sub>, above and behind VO<sub>5</sub>; SAO<sub>2</sub>, above and behind SAO<sub>1</sub>; SAO<sub>3</sub>, above and behind SAO<sub>2</sub>, close to lateral line; Pol, 2, Pol<sub>1</sub>, above last AO<sub>a</sub>, close to lateral line; Pol<sub>2</sub>, behind Pol<sub>1</sub>; PO, 5 or 6, PO<sub>1</sub>, close to operculum, PO<sub>2</sub>, separated by large interspace, PO<sub>3</sub> to PO<sub>5</sub> evenly spaced, PO<sub>5</sub> slightly elevated; VO, 5, on same level; AO, in two series; AO<sub>a</sub>, 9, AO<sub>a1</sub>, slightly depressed, AO<sub>a9</sub>, slightly



elevated;  $AO_p$ , 6 or 7, about evenly spaced;  $Prc$ , 4, in two groups,  $Prc_1$  and  $Prc_2$  close to ventral margin of caudal peduncle;  $Prc_3$  and  $Prc_4$ , widely separated from  $Prc_2$ , in ascending series close to lateral line. Luminous organs: supracaudal, large; small glands below  $PLO_1$ ,  $PVO$ ,  $VLO$ ,  $SAO$ , last  $AO_a$ ,  $Pol$  and last two  $Prc$  photophores. Colour: dark brown.

Length to  $5\frac{1}{2}$  inches.

Distinguished by the elongate body, the long high dorsal fin, the 2 posterolateral photophores one behind the other close to the lateral line, and the 4 precaudal photophores in pairs, the first close to the ventral surface of the caudal peduncle, the second close to the lateral line.



FIGURE 72. Patchwork lanternfish. *Notoscopelus resplendens* Richardson 1844

The patchwork lanternfish was first taken in British Columbia waters on July 7, 1958, by the M.V. *Brown Bear*, cruise 199, haul 57, Lat.  $49^{\circ} 24' N$ , Long.  $140^{\circ} 38' W$ , depth 16 fathoms. Two specimens were taken by W. Aron, recorded in 1960, as *Notoscopelus elongatus*, and are now in the collection of the University of Washington at Seattle.

Range: Southern California to British Columbia.

#### Suborder ALEPISAUROIDEA

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. The eyes are high on the head. The pectoral fins are low on the body. Photophores and luminous organs are absent.

Four families are represented along the British Columbia coast: Scopelarchidae, Paralepididae, Anopteroideidae and Alepisauridae.

In the pearleyes the body is short or moderately elongate, little compressed, and covered with cycloid scales. The mouth is large with an array of needle-like teeth, some of which are somewhat fang-like and depressible. The eyes are large, sometimes directed upward, and tend to be tubular. The dorsal fin is small, well forward on the body and its origin may be in front of or behind the origin of the pelvic fins. An adipose fin is present. The anus is near the anal fin. The scaling is fully developed.

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

**Pearleye***Neoscopelarchoides dentatus* Chapman 1939

Body elongate, slender. Head relatively short; mouth terminal, very large; premaxillary reaching to point below eye; lower jaw projecting; teeth on upper jaw small, on lower jaw and palatines, large, needle-like; eye moderately large, directed upward. Fins: dorsal (1), 6 or 7, small, origin behind that of pelvic; adipose, slender, insertion above that 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: absent. Colour: brown on dorsal surface; lighter on ventral surface; light pearly area on outer margin of eye. Larval stages: translucent, almost transparent in abdominal area.

Length to 7 inches.



FIGURE 73. Pearleye. *Neoscopelarchoides dentatus* Chapman 1939

Distinguished by the elongate body, the upwardly directed eyes with the large oval pearly area on each, the large mouth with the needle-like teeth on the lower jaw and the small pectoral and large pelvic fins.

The pearleye was first taken in British Columbia waters on 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 6 other specimens, obtained at 6 other stations during the next 5 years by the Commission, were recorded

in 1939 by W. M. Chapman. The depths recorded were all between 54 and 488 fathoms. The name recommended by the AFS/ASIH committee is northern pearleye.

Range: California to Gulf of Alaska.

Family PARALEPIDAE

Barracudinas

In the barracudinas the body is elongate and somewhat barracuda-like in appearance. The head is long and pointed, the mouth large and the jaws armed with strong pointed teeth, some of which are fang-like and depressible. The scales, when present, are cycloid, moderate to large in size and deciduous; scales may be present on the head. There are scale-like structures on the lateral line. A pair of fleshy carinae is present between the pelvic fins and the anal. The dorsal fin is located behind the middle of the body; the pelvic fins may be anterior or posterior to the dorsal; an adipose fin is present. The anus is near the pelvic fins. There is a definite tendency toward a reduction in scaling associated with the capture of relatively large prey.

**Slender barracudina**

*Lestidium ringens* (Jordan and Gilbert) 1881

Body elongate, slender, somewhat compressed, depth behind head 11.5 to 16.2 in standard length; fleshy carinae between anus and anal fin well developed. Head elongate, compressed, length 4.7 to 5.3 in standard length; snout elongate, pointed; interorbital space flat with two longitudinal ridges; mouth terminal, moderately large, not reaching vertical from eye; tip of lower jaw slightly elevated; teeth, on premaxillaries, 3 or 4, anterior depressible canines followed by many backwardly directed and these by series of forwardly directed canines; on mandible, 6 to 10 large depressible canines followed by short fixed teeth; on palatines, 2 to 7, large depressible canines, each with small fixed canine at base, followed by single row of 5 to 7 fixed canines on margin; gill rakers in form of single row of about 4 stout teeth on each basal plate; eye large, diameter 4.1 to 5.2 in length of head. Fins: dorsal (1), 9 to 12, well back on body, origin well behind origin of pelvic; adipose, small; anal, 28 to 33, far back on body, highest anteriorly; pelvic, 8 or 9, abdominal; pectoral, 11 or 12, moderate; caudal, furcate. Anus behind pelvic fins



FIGURE 74. Slender barracudina. *Lestidium ringens* (Jordan and Gilbert) 1881

before vertical from origin of dorsal fin. Lateral line: almost straight, ending at base of caudal fin. Scales: absent. Colour: light olivaceous on dorsal surface; silvery on sides with dark punctulations.

Length to  $8\frac{1}{2}$  inches.

Distinguished by the elongate scaleless body, the ventral fleshy carinae between the anus and the anal fin, the origin of the dorsal fin well behind the origins of the pelvic fins and the single row of stout teeth on each basal plate forming the gill rakers.

The slender barracudina was first taken in British Columbia waters on July 23-24, 1957 in a night haul by the M.V. *Brown Bear*, haul 5, Lat.  $49^{\circ} 08' N$ , Long.  $127^{\circ} 25' W$ , depth 16 fathoms. On May 10, 1958, one was taken at the Fisheries Research Board station F.M. 10, Lat.  $51^{\circ} N$ , Long.  $130^{\circ} W$ , depth 27 fathoms or less, and the specimen is now in the collection of the Biological Station at Nanaimo. Other individuals were taken in 1958 and 1959 by the *Brown Bear*.

Range: California to British Columbia.

### **Ribbon barracudina**

*Notolepis coruscans* (Jordan and Gilbert) 1881

Body elongate, slender, compressed, depth behind head, about 11 in standard length; fleshy carinae between anus and anal fin, moderately developed. Head elongate, compressed, length 3.8 to 4.3 in standard length; snout elongate, pointed; interorbital space concave with two longitudinal ridges; mouth terminal, moderately large, not reaching vertical from eye; tip of lower jaw slightly elevated; teeth: on premaxillaries, 6 small depressible canines, followed by short fixed teeth; on mandible, numerous small depressible canines in two rows; on palatines, 5 or 6, widely spaced canines each with small fixed canine at base, followed by 29 or 30 short fixed canines on margin; gill rakers in form of many scattered small needle-like teeth on each basal plate; eye small, diameter about 6.4 in length of head. Fins: dorsal (1), 9 to 13, well back on body, origin well in front of origin of pelvic; adipose, small; anal, 27 to 34, far back on body, large, moderately high; pelvic, 8 or 9, abdominal; pectoral, 11, small; caudal, furcate. Anus between pelvic fins. Lateral line: almost straight, ending over middle of anal fin. Scales: present in adult only. Colour: dusky olivaceous on dorsal surface; silvery on sides, speckled with brown dots.

Length to  $9\frac{1}{4}$  inches.



FIGURE 75. Ribbon barracudina. *Notolepis coruscans* (Jordan and Gilbert) 1881

Distinguished by the very elongate body, the ventral fleshy carinae between the anus and the anal fin, the origin of the dorsal fin in front of the origins of the pelvic fins and the small needle-like teeth on the basal plates forming the gill rakers.

The ribbon barracudina has not definitely been recorded from British Columbia waters but since the type was taken in the Strait of Juan de Fuca, recorded in 1881 by D. S. Jordan and C. H. Gilbert, it is included herein, particularly as it has been taken off the coast of Washington in recent years.

Range: California to Strait of Juan de Fuca.

#### Family ANOPTERIDAE

#### Daggertooths

In the daggertooths the body is very elongate, soft and flexible. The head is large and the snout is long and pointed. The jaws are long, the premaxillary and mandibular teeth are small; those on the palatines are in two rows, large, curved forward. Gill rakers are absent. The scales are cycloid, thin and loosely attached, they occur chiefly on the under surface and are slightly enlarged on the lateral line. The dorsal fin is absent but an adipose fin is present. The anus is located between the pelvic and anal fins.

There is but one species in the family. It is a carnivorous fish of wide distribution but is not known to occur in tropical waters.

#### Daggertooth

*Anopterus pharao* Zugmayer 1911

Body very elongate, slender, little compressed. Head elongate, much compressed; snout long; mouth terminal, large, widely cleft; premaxillary reaching to point below posterior of eye, narrow, thin; maxillary long, thin, reaching behind premaxillary but not entering gape; lower jaw reaching past upper, with mandibular process pointing forward; teeth: on premaxillary numerous, minute, sharp; on palatine in two rows, large, depressible, dagger-like; gill rakers, absent; eye, large; striae on opercle. Fins: dorsal (0); adipose, small; anal, 14 to 17, small; pelvic, 9 to 11, abdominal, very small; pectoral, 12 to 16, low, base horizontal, length about twice that of pelvic; caudal, deeply furcate. Anus two-thirds distance between pelvic fins and anal. Lateral line: straight; pores, 75 to 83. Scales: cycloid, thin, loosely attached, on under surface of body; enlarged on lateral line. Colour: silvery to dusky; blackish on caudal fin; inky black on tips of pectoral fin rays; whitish on adipose with blackish anterior margin; black on tips of jaws, branchiostegal membranes and inner surface of operculum.

Length to 3 feet 5 inches.

Distinguished by the very elongate body, the large dagger-like teeth and the absence of a dorsal fin.

The daggertooth was first obtained in British Columbia waters from stomachs of albacore taken in 1947 off the west coast of Vancouver Island during an albacore investigation by the Fisheries Research Board and recorded in 1959 by F. Neave. In 1948, additional specimens were observed in albacore stomachs by

R. F. Scigel. One specimen was identified and recorded by Hubbs, Mead and Wilimovsky in 1953. Three additional individuals were obtained in 1956 by the *M. V. Challenger* and recorded in 1959 by F. Neave as follows: 1 specimen, in June, Lat. 48° N, Long. 145° W, in the stomach of a steelhead; 1 specimen, on August 14, Lat 50° N, Long 130° W, in the stomach of a blue shark; 1 specimen, in September, Lat 52° N, Long 140° W, in the stomach of a pomfret. The stomachs of these specimens were filled with juvenile greenlings, *Hexagrammos superciliosus*. Another individual was caught in mid-October, 1958, off the weathership *Stone-town*, Lat. 50° N, Long. 145° W, by Mr H. Watkins in a dipnet.

Range: California to Bering Sea.



FIGURE 76. Daggertooth. *Anotopterus pharao* Zugmayer 1911

Family ALEPISAUROIDAE

Lancetfishes

In the lancetfishes the body is large, elongate, compressed and scaleless. The mouth is large with many immovable fang-like teeth. The dorsal fin is very long and high. Luminous organs are absent.

The members of this family are all large and slender with soft bodies and distensible stomach and body walls. They inhabit the ocean depths and are known for the most part from specimens cast up on the shore.

**Pacific lancetfish**

*Alepisaurus borealis* Gill 1862

Body elongate, slender, compressed; snout long; mouth terminal, widely cleft; premaxillary reaching to margin of preopercle; teeth: on premaxillary numerous, minute, sharp; on mandible 1, large, anterior, followed by 12 small, 4 large, about 12 small to moderate, increasing in size posteriorly; on palatine very large, fang-like, 2 anterior, 1 posterior; eye very large, high; 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 deep groove and thus become invisible; adipose, small; anal, 15 to 17, small; pelvic, 8 or 9, abdominal; pectoral, long, low, 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 steely blue reflections; black on pectoral, adipose and caudal fins; silvery gray to dusky on pelvic and anal fins.

Length to 6 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 Pacific lancetfish 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. It 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. Up to 1946 specimens had been secured near Victoria, in Quatsino Sound, off Kains and Triangle 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 the Kains Island individual was only 30 fathoms. In October, 1958, Mr H. Watson of the Canadian weathership *Stonetown* at Station *Papa*, Lat. 50° N, Long. 145° W, took a specimen 4 feet 8½ inches in length on a longline at an estimated depth of 400 fathoms. In November, 1958, Mr W. Sovde took a lancetfish by gaffing it in a kelp patch off Oyster Bay, the first record for the Strait of Georgia. The flaccid body and fragile fins of this fish suggests that it is an inhabitant of deep water. The food is somewhat varied. Individuals from halibut banks usually contain squid and octopi whose capture evidently is facilitated by the fang-like teeth. Other specimens have been found to have eaten herring, lanternfishes, hake, rockfishes,

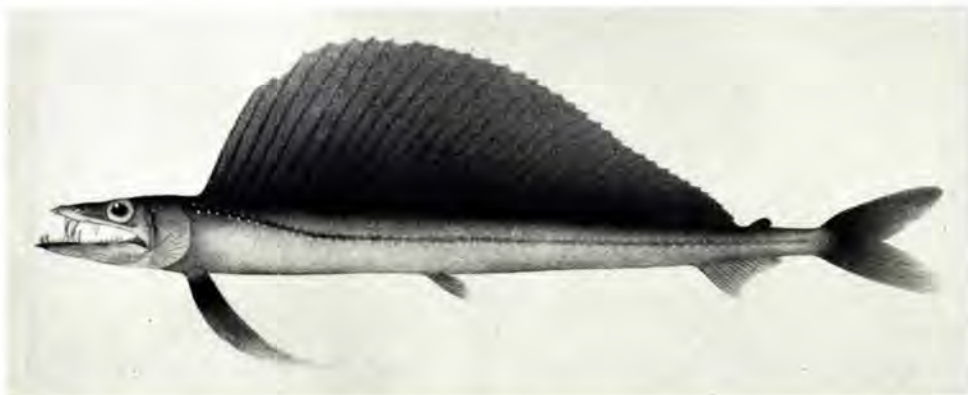


FIGURE 77. Pacific lancetfish. *Alepisaurus borealis* Gill 1862

soft sculpins (*Gilbertidia sigalutes*), poachers and spiny lumpsucker (*Eumicrotremus orbis*). The species was recorded in 1946 by Clemens and Wilby as *Alepidosaurus aesculapius*, the handsaw-fish.

Range: Southern California to Bering Sea.

## Order SYNENTOGNATHI

In this order the body is somewhat elongate and the head is pointed. The jaws are more or less prolonged in the non-flying forms. The fins are supported by rays only; the dorsal fin is far back on the body and is similar to and above the anal fin; the pelvic fins are abdominal. The lateral line is 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, the premaxillaries forming the upper portion of the gape. 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 flyingfishes.

### Pacific 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, behind vertical from origin of anal fin, followed by 5 or 6 finlets; anal 12 to 14, followed by 5 to 7 finlets; pelvic, 6, 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 to blue on dorsal surface; silvery on ventral surface; pale on pelvic and anal fins; more or less dusky on other fins.

Length to 14 inches.



FIGURE 78. Pacific saury. *Cololabis saira* (Brevoort) 1850

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



The Pacific 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). It is common off the west coast of Vancouver Island and in 1958 a few individuals were taken in the same area at depths between 17 and 125 fathoms. Others specimens have been taken in Queen Charlotte Strait and Sound, Hecate Strait and Masset Inlet. Saury eggs possess short filaments which stick to floating objects. On September 7, 1958, Dr W. English and Mr J. Simmons found saury eggs attached to a hydrophone that had been suspended 50 feet deep in water of 18°C, off southern Vancouver Island. The larvae are pelagic. Saury food includes fish eggs and larvae; they, in turn, are eaten by albacore. Sauries usually occur in widespread schools and may be taken regularly in purse seines. Since they are excellent as a food fish they may in time become of commercial importance as they now are in Japan. Because of the habit of jumping out of the water this fish sometimes is referred to as the skipper.

Range: Southern California to Gulf of Alaska.

### Order APODES

In this order the body is extremely elongate. The maxillary forms the major portion of the upper jaw, the premaxillary not being evident because of fusions 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 sometimes is reduced to a filament; the pelvic fins are absent (abdominal in fossil forms). 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 are not known to occur on the coast of British Columbia.

#### Family NEMICHTHYIDAE

#### Threadfishes

In the threadfishes the body is exceedingly slender and the jaws are long, almost needle-like and recurved, the upper being somewhat the longer. The threadfishes apparently inhabit fairly deep water but appear occasionally 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 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: slightly decurved, then straight; pores in single row, about 156, large, open. Scales: absent. Colour: uniform black.

Length to 18 inches.

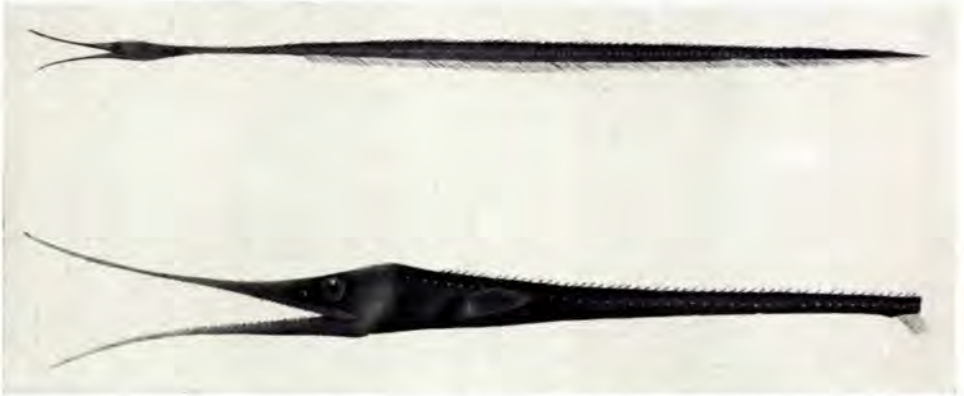


FIGURE 79. Snipe eel. *Avocettina gilli* (Bean) 1890

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 on 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. A single specimen was obtained. It is the only one known from British Columbia waters and was recorded in 1940 by W. M. Chapman.

Range: Northern British Columbia to southeastern Alaska.

### **Threadfish**

*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 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  $7\frac{1}{2}$  inches.



FIGURE 80. Threadfish. *Nemichthys avocetta* Jordan and Gilbert 1880

Distinguished by the extremely slender body without pelvic fins, the elongate recurved jaws, the anus near the head, the 3 rows of pores along the lateral line, the body ending in an elongate filament and the reversed coloration of the body.

The threadfish 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 on 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 Institute of Fisheries, 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 threadfish is the result of swimming upside down is not known but an African catfish, *Synodontus*, is brown to black on the ventral surface and pale silvery gray on the dorsal surface and is known to swim upside down. The names brittle watersnake, glass snake, avocet and threedeel have been applied to this fish.

Range: Oregon to northern British Columbia.

#### 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 is composed of dorsal rays above and anal rays below, usually with one or more rays, sometimes filamentous, representing the true caudal fin. This pseudocaudal structure is here referred to as a caudal fin. Frequently there is a barbel near the tip of the lower jaw.

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

#### 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 long and deeply notched.

#### Pacific 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 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 2 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.

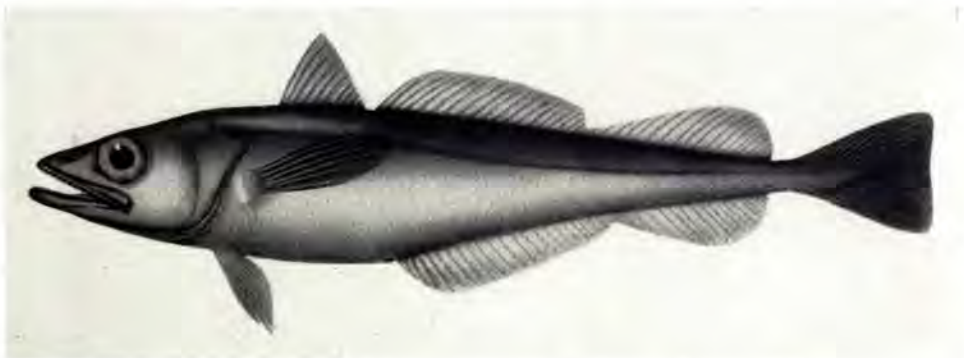


FIGURE 81. Pacific hake. *Merluccius productus* (Ayres) 1855

The Pacific 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 *Merlucius 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 Gulf of Alaska.

#### Family GADIDAE

#### Cods

In the cods the mouth is terminal with the lower jaw projecting, or included, or subterminal. A barbel usually is 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 an important commercial group. In the north Pacific area occur the whiting, tomcod, Pacific cod and longfin cod. These are represented by closely related species in the Atlantic, where haddock, pollack and several other species of lesser economic value also occur. There is one freshwater member of the family, namely the burbot (ling, lawyer, or loche), which is found 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 erroneously have been called "cods", such as: the rockfishes (rock cods), Scorpaenidae; the greenlings (tommy-cod), Hexagrammidae; the sablefish (black cod), *Anoplopoma fimbria*; the lingcod (cultus cod), *Ophiodon elongatus*. None of the above fishes is closely related to the true cod, *Gadus*, and it would be advisable to suppress the common names given in brackets.

#### Whiting

*Theragra chalcogrammus* (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 of head; barbel on lower jaw, minute or absent. 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 a short third band.

Length to 3 feet.

Distinguished by the 3 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 on August 2, 1881, at the head of Kingcome Inlet by Captain 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 depths where it feeds upon various crustaceans, herring and sandlance. In the Strait of Georgia considerable

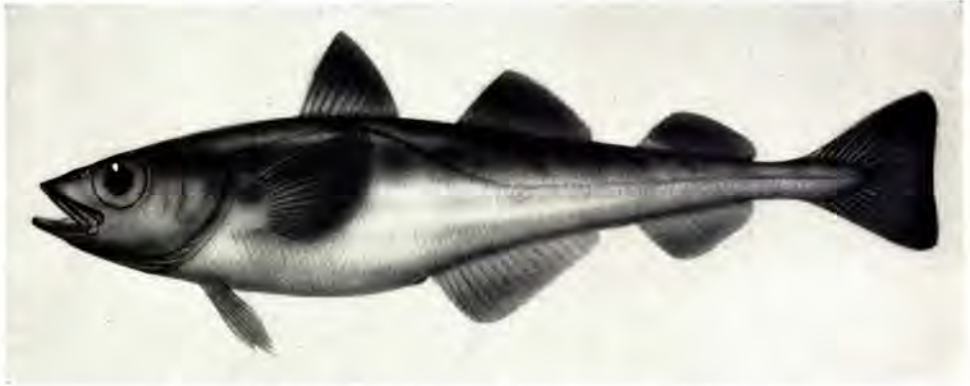


FIGURE 82. Whiting. *Theragra chalcogrammus* (Pallas) 1811

quantities are caught in trawls and find a ready market, primarily as mink food. The name walleye pollack has been used for this species in the United States but the fishermen in British Columbia know the fish as the whiting, and this name is used here. 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 number 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. chalcogrammus chalcogrammus*, while those of southern British Columbia and Washington have the lower fin ray counts and are referred to as *T. chalcogrammus fucensis*. It is likely that the two groups referred to above will be found to be the extremes of the species range and therefore merely geographical population groups or races. Undoubtedly intergrading forms occur along the coast of British Columbia. The name recommended by the AFS/ASIH committee is walleye pollock.

Range: Northern California to Bering Sea.

#### **Pacific 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.



FIGURE 83. Pacific tomcod. *Microgadus proximus* (Girard) 1854

Distinguished by the 3 dorsal fins, the position of the anus below the first dorsal fin and the small barbel on the lower jaw.

The Pacific 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 Gulf of Alaska.

#### **Pacific 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 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.



FIGURE 84. Pacific cod. *Gadus macrocephalus* Tilesius 1810

Distinguished by the 3 dorsal fins, the position of the anus below the second dorsal fin and the long barbel on the lower jaw.

The Pacific cod was first taken in British Columbia waters on July 27, 1881, at Quadra Island in Drew Harbour, by Captain 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 subsequently was shown by L. P. Schultz and A. D. Welander in 1935 to be a *Gadus macrocephalus*. The species is exploited as far south as Oregon, but is particularly important in the north. It is the true cod of the Pacific, resembling the Atlantic species, *G. morrhua*, very closely in appearance and habits. There is a seasonal migration from deep to shallow water in the spring of the year. Specimens have been taken at depths of 200 fathoms as well as in shallow water around wharves. Spawning takes place in the late winter 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 sandlances form a considerable proportion, as well as various crustaceans. By 1958 it had become the most important species in the British Columbia and Washington trawl fisheries, with an annual catch exceeding 20 million pounds. The main fishing grounds are off the lower west coast of Vancouver Island, in Queen Charlotte Sound and northern Hecate Strait. Cod are marketed chiefly as fillets and "fish sticks", but a small quantity is sold fresh or smoked. The cod is an excellent food product if after capture it is dressed immediately and iced with a minimum of handling.



Tagging has demonstrated considerable movement within the Strait of Georgia, with some emigration to the west coast of Vancouver Island and outer Washington coast. Cod have a much faster growth rate in the Strait of Georgia than in colder regions of the North Pacific. They reach an average length of 24 inches by 3 years of age, and by that time all but a few have reached maturity.

Range: Central California to Bering Sea.

**Longfin cod**

*Antimora rostrata* Günther 1878

Body elongate, tapering 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 elongate, second fin long, low; anal (1), 39 to 42, deeply notched; pelvic, 6 or 7, thoracic, first ray 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.

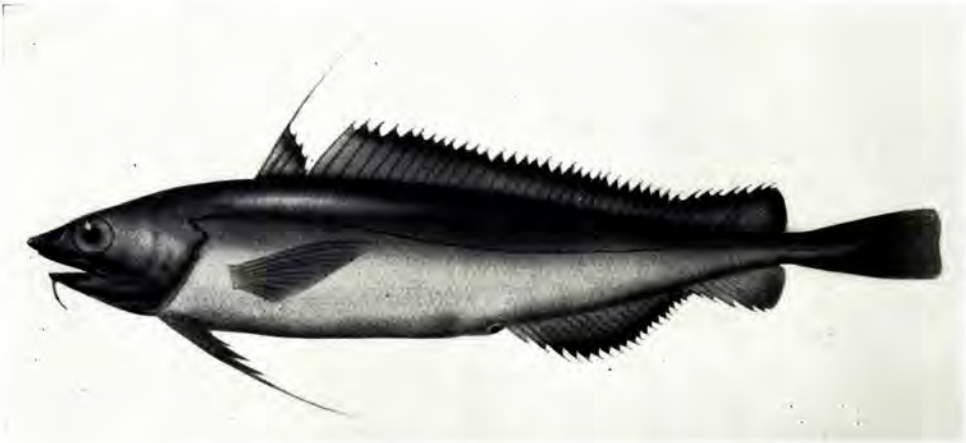


FIGURE 85. Longfin cod. *Antimora rostrata* Günther 1878

Distinguished by the presence of 2 dorsal fins, the first short, the second very long, the single deeply notched anal fin and the short acutely pointed snout.

The longfin cod was first taken in British Columbia waters on August 29, 1888, when 2 specimens were obtained near Cape St. James by the *Albatross*, station 2860, Lat. 51° 23' N, Long. 130° 34' W, depth 876 fathoms. A subsequent specimen was secured September 3, 1890, west of Moresby Island, *Albatross* station 3342, depth 1,588 fathoms. These first 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 W. C. Schroeder to be synonymous with *A. rostrata* Günther of the Atlantic. On August 17, 1960, Mr M. Kestnes, captain of the *Sentinella*, obtained an individual 15 inches in length about 15 miles southwest of Kyuquot Sound, Lat. 49° 49' N, Long. 127° 41' W, depth 250 fathoms. The specimen was recorded by Ketchen and Wilson (1961) and is now in the Institute of Fisheries of the University of British Columbia.

Range: Southern California to Bering Sea.

Family CORYPHAENOIDIDAE

Rattails

In the rattails 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 pointed to filamentous; the pelvic fins have the outer ray greatly elongate.

This is a large family of deepwater fishes of wide distribution. The term grenadiers sometimes is applied to the members of this group.

**Smoothscale rattail**

*Coryphaenoides 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 with minute spines, 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,



FIGURE 86. Smoothscale rattail. *Coryphaenoides cyclolepis* (Gilbert) 1895

pointed. Lateral line: decurved then straight. Scales: cycloid, small, keeled, spinules few or absent. Colour: dark brown on dorsal surface; black on 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 pointed 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 smoothscale rattail is known from 2 specimens taken on 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; the other, a syntype, is in the Natural History Museum of Stanford University. This fish was recorded in 1946 by Clemens and Wilby as *Dolloa cyclolepis* (Gilbert), the smooth-scaled grenadier.

Range: Off the Queen Charlotte Islands.

#### Filamented rattail

*Coryphaenoides 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 with strong spines on upper half, second fin very long, low, inconspicuous, interspace more than half

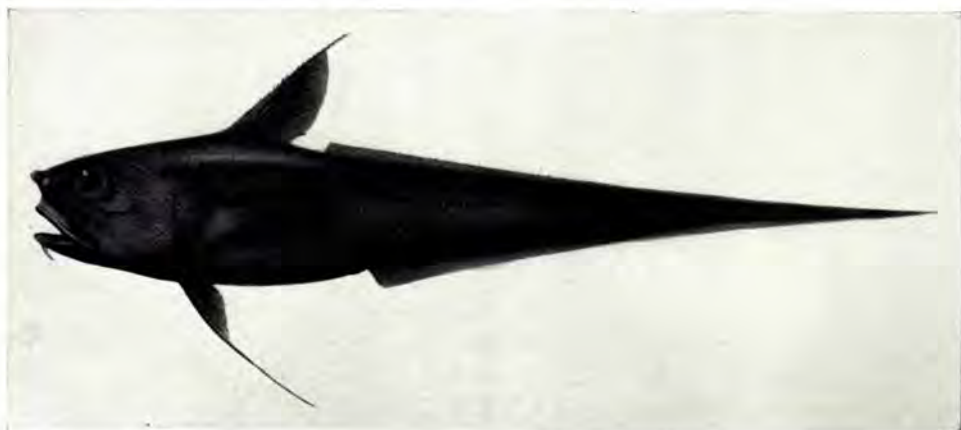


FIGURE 87. Filamented rattail. *Coryphaenoides filifera* Gilbert 1895

length of base of first dorsal fin; anal (ray count, unknown), long, low; pelvic, 9 or 10, thoracic; caudal, pointed. 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  $22\frac{1}{2}$  inches.

Distinguished by the pointed caudal fin, the presence of a short barbel on the lower jaw, the interspace between the dorsal fins more than half the length 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 rattail is known from 3 specimens taken on 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. This fish was recorded in 1946 by Clemens and Wilby as *Chalinura filifera* Gilbert, the filamented grenadier.

Range: Off the Queen Charlotte Islands.

### **Roughscale rattail**

*Coryphaenoides 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 in outer series not enlarged; eye large, diameter about 3.5 in length of head; barbel on lower jaw long, about equal in length to length of snout. Anus below second dorsal fin. Fins: dorsal (2), 11 to 13—111+, first short, high, first ray very short, second elongate with minute spines; 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, pointed. Lateral line: decurved, then straight. Scales: cycloid, small, keeled, spinules numerous, short, rigid. Colour: brown to black on dorsal surface; lighter on ventral surface.

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

Distinguished by the pointed 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.

The roughscale rattail was first taken in British Columbia waters in 1882 by Mr J. G. Swan who discovered a specimen in the stomach of a furseal 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. This fish was recorded in 1946 by Clemens and Wilby as *Macrurus acrolepis* Bean, the rough-scaled grenadier.

Range: Southern California to Gulf of Alaska.



FIGURE 88. Roughscale rattail. *Coryphaenoides acrolepis* (Bean) 1883

#### Order ALLOTRIIGNATHI

In this order the peculiar arrangement of the protractile premaxillary and maxillary bones permits the mouth to be protrusible. 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 diversity of shape, structure and size of the various fishes in this group is amazing. It includes 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

#### Moonfishes

In the moonfishes the body is deeply ovate and much compressed. The dorsal fin is very high anteriorly and the caudal fin is broadly lunate. It is remarkable for the large size attained and its brilliant coloration.

There is a single species in the family.

#### Opah

*Lampris regius* (Bonnaterre) 1788

Body ovate, deep, much compressed; caudal peduncle short, slender. Head deep, compressed; mouth terminal, moderate; premaxillary 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; 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 sides and 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.

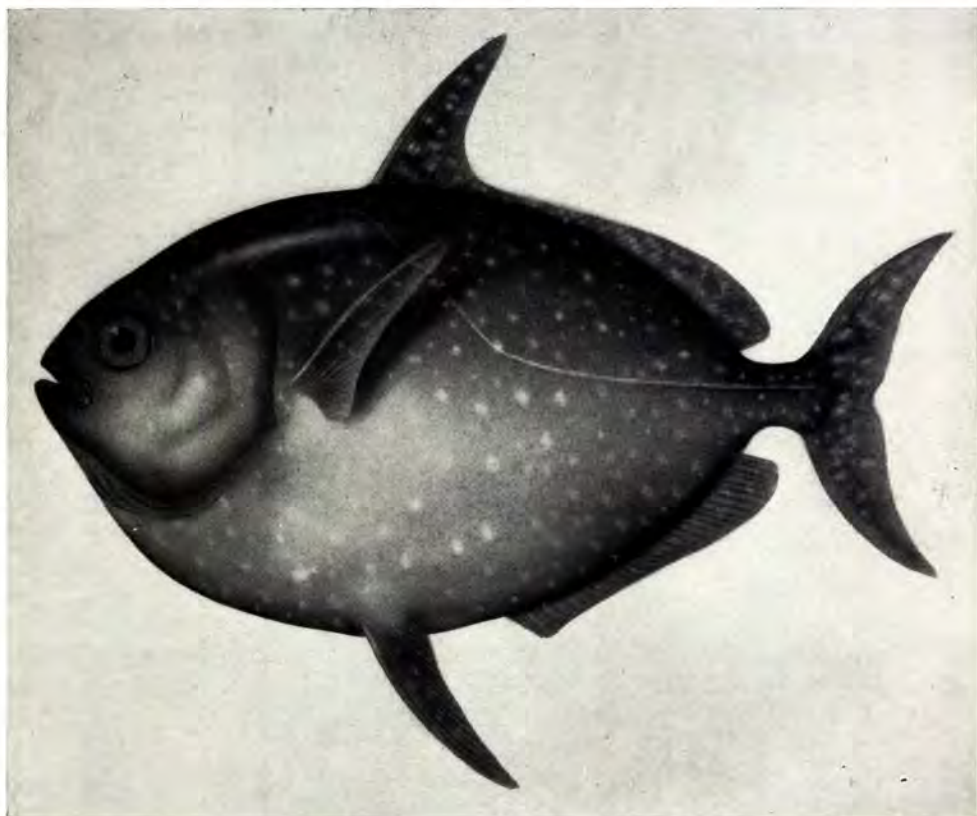


FIGURE 89. Opah. *Lampris regius* (Bonnaterre) 1788

Distinguished by the deep ovate, much compressed body, the dorsal fin high and falcate in front, the silvery spotting and the bright coloration. An opah is shown in colour on Plate III following page 224.

The opah was first taken in British Columbia waters on 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 strikingly 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: moonfish, mariposa and Jerusalem haddock. The name opah itself is of west African origin.

Range: Southern California to Gulf of Alaska.

#### Family TRACHYPTERIDAE

#### Ribbonfishes

In the ribbonfishes 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, at times individuals are observed swimming at the surface of the water and specimens are sometimes found washed up on the shore.

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

#### **King-of-the-salmon**

*Trachypterus rexsalmonorum* 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 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, is 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



FIGURE 90. King-of-the-salmon. *Trachipterus rexsalmonorum* Jordan and Gilbert 1894

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. The food of a 29-inch California specimen consisted of two small rockfish, one lanternfish, several squid and octopi and numerous small crustaceans.

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 more or less protrusible premaxillaries. The anterior portions of the vertical fins are sometimes spinous; the pelvic fins are thoracic, each with 1 spine and 3 to 13 rays; the caudal fin usually has 19 principal rays, the outer two unbranched, and usually 3 to 5 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 11 families in the order, two of which, the Caristiidae and Melamphaidae, are represented in British Columbia waters.

### Family CARISTIIDAE

### Manefishes

In the manefishes the dorsal fin is long, extending from the nape almost to the caudal fin; it is high, especially anteriorly, so as to have the appearance of a flowing mane. There is a fleshy sheath along the base of both the dorsal and anal fins. The head is deep and the snout is blunt. The eye is large and there are muciferous channels on the head. The scales are small and thin.

### Manefish

### *Caristius macropus* (Bellotti) 1903

Body ovate, compressed, deep, depth about 2 in standard length. Head short, blunt, deep; mouth terminal, oblique; teeth small, slender on jaws, vomer and palatines; snout blunt; eye large, diameter 3.5 in length of head. Fins: dorsal (1), 31 to 34, first two rays short, third longest, almost reaching base of caudal fin; anal, 18 to 22; pelvic, I, 5, thoracic, greatly elongate; pectoral, 17 to 19; caudal, I, 17, I, rounded. Lateral line: indistinct. Scales: cycloid, small, irregularly arranged. Colour: uniform grayish brown.

Length to 12 $\frac{1}{2}$  inches.

Distinguished by the very long high dorsal fin, the long pelvic fins and the high blunt head.

The manefish was first taken in British Columbia waters on March 29, 1954, SSW of Esteban Point in 210 fathoms. The single specimen, the only one known from these waters, was obtained by Mr P. Buholm and recorded in 1957 by A. D. Welander, D. L. Alverson and P. Bergman. The species occurs in the waters around Japan and in the northern Atlantic Ocean.

Range: Southern British Columbia.

### Family MELAMPHAIDAE

### Melamphids

In the melamphids the head is deep, the snout is blunt and the cranial bones are usually 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 muciferous tubes. The scales are large.

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



FIGURE 91. Manefish. *Caristius macropus* (Bellotti) 1903

**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  $3\frac{7}{10}$  inches.

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

The crested melamphid has been taken once in British Columbia waters, on February 9, 1939, off the west coast of Moresby Island by the International Fisheries Commission, station 1763C, Lat.  $52^{\circ} 23' N$ , Long.  $132^{\circ} 04' W$ , in a vertical net haul, depth between 487 and 379 fathoms. The single specimen

obtained was lent from the Commission's collections by the Director, Mr H. A. Dunlop, who also supplied the accompanying data, heretofore unpublished.  
Range: Northern British Columbia to Gulf of Alaska.



FIGURE 92. Crested melamphid. *Melamphaes rugosus* Chapman 1939

**Highsnout melamphid**

*Melamphaes lugubris* Gilbert 1890

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, broad 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 93. Highsnout melamphid. *Melamphaes lugubris* Gilbert 1890

The highsnout melamphid is known from British Columbia waters by a single specimen taken on 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; it was recorded in 1939 by W. M. Chapman as *Melamphaes cavernosus* and so recorded in 1946 by Clemens and Wilby.

Range: Northern British Columbia to Gulf of Alaska.

#### Order ZEOMORPHI

In this order the fishes have deep compressed bodies and are frequently of a rhomboidal shape. The mouth is protrusible and the teeth are feeble.

The order includes two families, only one of which is represented in British Columbia waters.

#### Family ZEIDAE

#### John Dories

In the John Dories the body is short, deep and compressed, with or without scales, sometimes with enlarged scales in form of enlarged tubercles.

#### **Coster dory**

*Alloctytus verrucosus* (Gilchrist) 1908

Body short, very deep, much compressed, rhomboidal; caudal peduncle slender. Head large, deep, compressed; mouth terminal, large, protrusible; lower jaw slightly longer than upper; teeth small; eye extremely large, diameter about 2 in length of head. Fins: dorsal (1), VI, 30 to 34, first spine short, second to sixth very stout, decreasing in length posteriorly, rayed portion rounded, high posteriorly, origin at highest point of body; anal, II or III, 28 to 32, spines short, stout, rayed portion similar to rayed dorsal; pelvic, I, 6, thoracic, spine stout; pectoral, small, rounded; caudal, rounded. Lateral line: very highly arched over pectoral fin, decurved to posterior third of body, then straight. Scales: cycloid, small; on lateral line, 88 to 90; on cheek and ventral surface of body enlarged; on ventral surface anterior to anal fin in "zipper-like" arrangement; in form of raised tubercles in two series, upper below and behind pectoral fin in slight arc to spinous portion of anal fin, lower from base of pelvic to anal fin. Colour: yellow to brown.

Length to 7 inches.

Distinguished by the very large eyes, the rhomboidal shape, the stout spines in the dorsal, anal and pelvic fins, the highly arched lateral line and the enlarged tubercles on the sides of the body.

The coster dory was first taken in British Columbia waters in 1956 by the *Celtic*, Lat. 50° N, Long. 150° W, in a gill net and recorded in 1957 by A. D. Welander, R. C. Johnson and R. A. Hajny. This is the only known record from the north Pacific and the species had been known previously only from the vicinity of South Africa and New Zealand.

Range: West of the coast of British Columbia.



FIGURE 94. Coster dory. *Allocyttus verrucosus* (Gilchrist) 1908

#### Order HETEROSOMATA

In this order the body is greatly compressed, somewhat rounded on the eyed side, flat on the blind side. In the adult flatfishes both eyes are on one side of the head. The scales are cycloid or ctenoid, or both, sometimes tuberculate. The fins are all composed of soft rays; the dorsal and anal fins are long; the pelvic fins are thoracic, usually with 6 rays, occasionally 5; the pelvic girdle is directly attached to the cleithra. Although the flatfishes are a very specialized group they have certain characters which indicate a relationship with the Percomorphi.

In the young flatfishes the body is upright and symmetrical with an eye on each side of the head. Very soon a metamorphosis takes place, during which one eye migrates to the opposite side of the head, so that eventually both eyes are on the upper or darker-coloured side. The fish then settle to the bottom and swim horizontally.

By controlling the contraction and expansion of chromatophores of various colours flatfishes have the remarkable ability of being able to change their shades and colour patterns to blend with the immediate surroundings. These changes are through visual stimulation.

Flatfishes are mostly predaceous and carnivorous, feeding upon small fishes, crustaceans, worms and other small invertebrates. They live mostly in water of moderate depth, a few extending to deep water, while some live close inshore. The eggs are small, pelagic, and are produced in great numbers.

The order comprises 5 families, of which 2 are represented in British Columbia waters.

Family BOTHIDAE

Sanddabs

In the sanddabs the eyes and coloured surface are on the left side of the fish (sinistral). The pelvic fin of the eyed side is exactly on the edge of the abdominal ridge.

The term sanddab is here applied to the members of the family Bothidae only.

**Mottled sanddab**

*Citharichthys sordidus* (Girard) 1854

Body elongate, moderately slender, much compressed, sinistral. Head deep; mouth terminal, moderate; lower jaw projecting; snout rounded; diameter of lower eye longer than length of snout; interorbital space moderate, concave; ridge above lower eye high, sharp, bony, naked. Fins: dorsal (1), 86 to 102; anal, 67 to 81; pelvic, 6, thoracic, that of eyed side on edge of abdominal ridge; caudal, truncate to rounded. Lateral line: nearly straight. Scales; imbricated, rather thin, deciduous, cycloid on both sides of body; on lateral line, 61 to 70. Colour: dull brown on eyed side, irregularly mottled with black; soiled white to light brown on blind side; black on dorsal, anal and caudal fins; dull orange spots and blotches on males in life; in young, light olive green on eyed side, finely and sparsely speckled with brown, black and orange, particularly on fins.

Length to 13 $\frac{3}{4}$  inches.

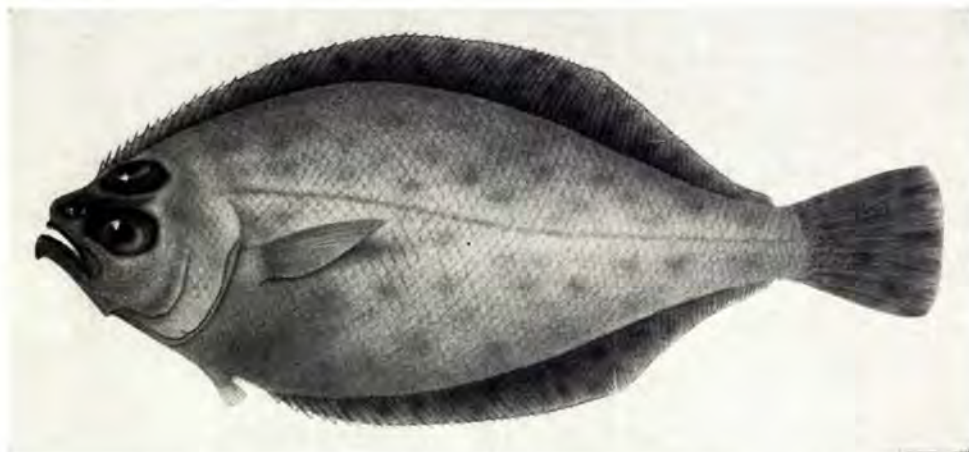


FIGURE 95. Mottled sanddab. *Citharichthys sordidus* (Girard) 1854

Distinguished by the mottled coloration on the eyed side of the body, the pelvic fin of the eyed side being exactly on the edge of the abdominal ridge and the 61 to 70 scales on the lateral line.

The mottled sanddab was first taken in British Columbia water on June 21, 1882, at Calvert Island in Safety Cove by Captain H. E. Nichols and recorded in 1883 by T. H. Bean. It is fairly common in the Strait of Georgia and has been captured off the west coast of Vancouver Island, in Johnstone Strait and in Milbanke Sound in waters of moderate depths. This sanddab has been utilized by Chinese immigrants who split and dried it. Fishermen from the British Isles sometimes refer to this fish as the megrim. The name recommended by the AFS/ASIH committee is Pacific sanddab.

Range: Southern California to Bering Sea.

### Speckled sanddab

*Citharichthys stigmaeus* Jordan and Gilbert 1882

Body elongate, moderately slender, much compressed, sinistral. Head deep; mouth terminal, moderate; jaws equal; snout rounded; diameter of lower eye equal to length of snout; interorbital space narrow, flat to convex; ridge above lower eye, absent. Fins: dorsal (1), 79 to 92; anal, 59 to 72; pelvic, 6, thoracic, that of eyed side on edge of abdominal ridge; caudal, truncate to rounded. Lateral line: nearly straight. Scales: imbricated, deciduous, cycloid on both sides of body; on lateral line, 52 to 58. Colour: olive brown on eyed side, finely and sharply

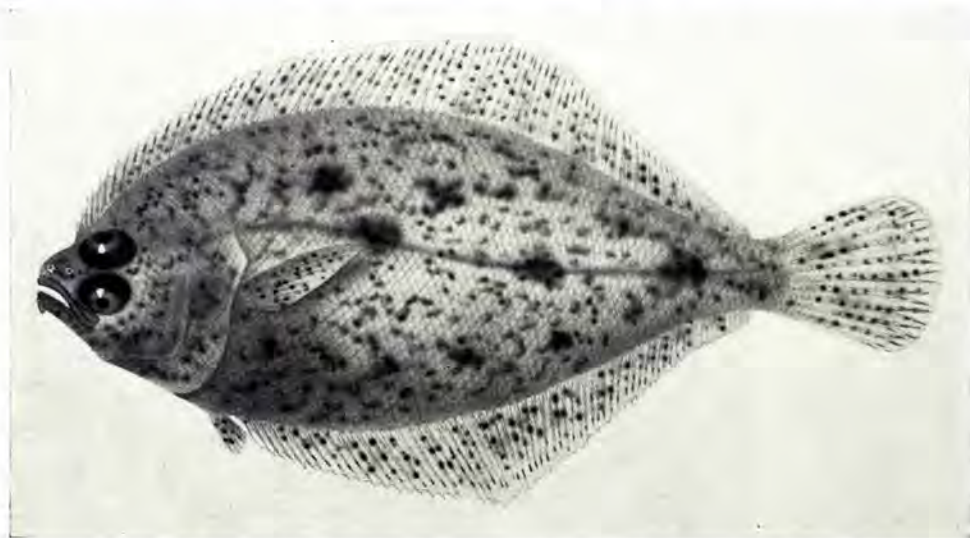


FIGURE 96. Speckled sanddab. *Citharichthys stigmaeus* Jordan and Gilbert 1882

speckled with black; soiled white to cream on blind side; in young, on eyed side, nearly uniform gray, finely speckled with black, resembling sandy beach in coloration.

Length to 6 inches.

Distinguished by the speckled coloration on the eyed side of the body, the pelvic fin on the eyed side being exactly on the edge of the abdominal ridge and by the 52 to 58 scales on the lateral line.

The speckled sanddab was first taken in British Columbia waters in June, and July, 1909, at Ucluelet by C. H. Young and W. Spreadborough when five specimens were obtained and they were recorded in 1920 by B. A. Bean and A. C. Weed. The speckled sanddab is known from the west coast of Vancouver Island and the west coast of Moresby Island and is secured frequently in trawls in the Strait of Georgia from shallow water to 40 fathoms. It is of little commercial importance because of its small size.

Range: southern California to southeastern Alaska.

#### Family PLEURONECTIDAE

#### Flounders

In the flounders the eyes and coloured surface are typically on the right side of the fish (dextral). The pelvic fins are symmetrically arranged, one on each side of the abdominal ridge.

The family may be divided into two groups. In one, as exemplified by the halibuts and related species, the mouth is large and symmetrical, the maxillary extends to the pupil of the eye or behind and the teeth are well developed on both sides of the jaws, associated with the habit of actively pursuing fishes for food. In the other, the mouth is small and asymmetrical, the maxillary does not extend to the pupil of the eye, and the teeth are confined largely to the sides of the jaws on the unpigmented side of the head, associated with the habit of feeding upon invertebrates and small fishes of the sea bottom.

Although the flounders are typically dextral there are occasional exceptions, as for example the starry flounder, which frequently may be sinistral, and the halibut, which occasionally is so. There are, as well, cases in which pigmentation may develop on both sides of the body, this condition is known as ambicoloration.

In regard to the common names used in referring to members of the family Pleuronectidae in western Canadian waters, there is a confusion of terminology. Early settlers from the borders of the North Sea were faced with a new fauna, quite unlike that to which they were accustomed. Instead of applying new names to the new fishes they attempted to use the names of fishes which they already knew. For example, the term brill has attained common usage, although the species *Scophthalmus rhombus* does not occur in these waters, and the term sole has been applied loosely to many species, none of which are in the family Soleidae.



The common names as herein used have been selected from a list drawn up by an international group of Fishery biologists and representatives of the fishing industry in an attempt to attain uniformity of usage for market and statistical purposes.

The flounders are confined to cool seas.

**Arrowtooth flounder**

*Atheresthes stomias* (Jordan and Gilbert) 1880

Body rather elongate, slender, much compressed, dextral. Head elongate; mouth terminal, very large, nearly symmetrical, gape wide; maxillary extending to point behind eye; teeth well developed on both sides of jaws, arrow-shaped; snout, pointed; upper eye on margin of head. Fins: dorsal (1), 93 to 115; anal, 81 to 99; pelvic, 6, thoracic; caudal, slightly lunate. Lateral line: slightly decurved, then straight, no arch or accessory branch. Scales: unevenly imbricated, rather large, irregular in size, thin; ctenoid on both sides of body; on lateral line, about 135, no spine before anal fin. Colour: brown on eyed side, darker on margins of scales; white on blind side, finely dotted with black.

Length to 2 feet 9 inches.

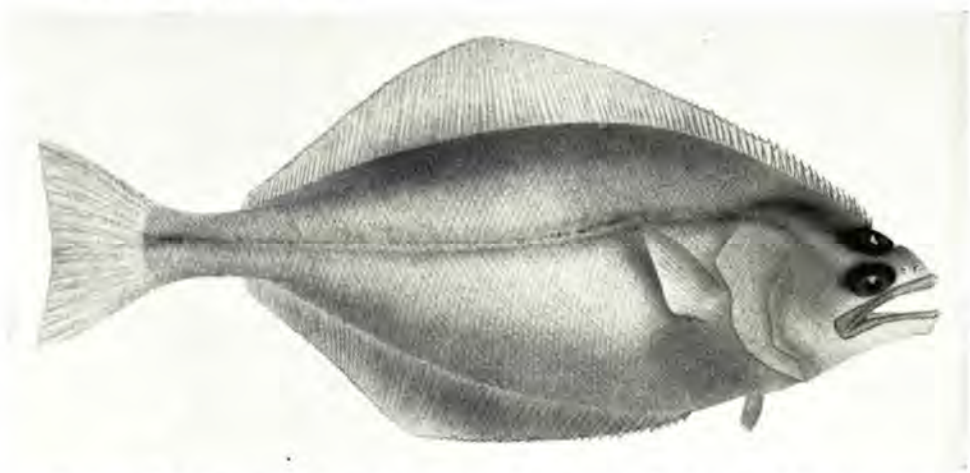


FIGURE 97. Arrowtooth flounder. *Atheresthes stomias* (Jordan and Gilbert) 1880

Distinguished by the very large jaws extending behind the eyes, the arrow-shaped teeth and the left eye on the upper margin of the head.

The arrowtooth flounder was first taken in British Columbia waters on August 28, 1891, west of Port San Juan by the *Albatross*, station 3448, Lat. 48° 31' N, Long. 124° 39' W, depth 98 fathoms and recorded in 1895 by C. H. Gilbert. The species is common along the whole coast, especially northward, where it occurs in shallower water than to the southward. It is obtained frequently with the halibut in 10 to 100 fathoms but up to the present has been marketed but little in Canada

except for mink feed, for which up to 7,000,000 pounds have been used in one year. Most of the catch comes from trawling grounds off the west coast of Vancouver Island and on the Cape Scott Bank. The food consists, at least in part, of shrimps and herring. Other names are turbot and long-jaw flounder, the latter used by Clemens and Wilby in 1946.

Range: Northern California to Bering Sea.

**Pacific halibut**

*Hippoglossus stenolepis* Schmidt 1904

Body elongate, rather slender, compressed, dextral; very rarely sinistral. Head elongate; mouth terminal, large, nearly symmetrical, gape wide; maxillary extending to point below eye; teeth well developed on both sides of jaws, conical; snout pointed; eyes large, upper eye slightly posterior to lower. Fins: dorsal (1), 89 to 109; anal, 64 to 81; pelvic, 6, thoracic; caudal, slightly lunate. Lateral line: distinctly arched over pectoral fin, no accessory branch. Scales: imbricated, very small, narrow, cycloid on both sides of body; on lateral line, 150 or more. No spine before anal fin. Colour: dark brown on eyed side, irregularly blotched with lighter; white on blind side, rarely with dark.

Male: length to 4 feet 7 inches.

Female: length to 8 feet 9 inches.



FIGURE 98. Pacific halibut. *Hippoglossus stenolepis* Schmidt 1904

Distinguished by the lunate caudal fin, the arched lateral line and the narrow smooth scales.

The Pacific halibut was first recorded from British Columbia waters in 1866 by J. K. Lord as "*Pleuronectes hippoglossus* of Linnaeus", on the basis of the

examination of a single specimen over 300 pounds in weight. In 1891 Ashdown Green recorded the species as *Hippoglossus vulgaris*. Subsequently the species was considered identical with Atlantic species, *Hippoglossus hippoglossus*, until P. J. Schmidt, in 1904, proposed the new specific name *stenolepis* on the basis of certain scale and other characters. The halibut is very abundant along the whole Pacific coast of Canada, which, in fact, appears to be the area of greatest primeval abundance and it is one of the most important commercial fishes of British Columbia. It occurs from very shallow waters to depths of at least 600 fathoms, but for the most part from 30 to 225 fathoms. Spawning takes place from November to January in well defined areas of depths from 150 to 225 fathoms. A large female of 140 pounds may have as many as 2,700,000 eggs. The eggs and larvae drift passively with the currents at depths down to 375 fathoms gradually rising toward the surface as development proceeds and drifting into shallow water with the inshore surface currents. By early spring transformation is complete and the young fish settle to the bottom in the shallow waters of sandy bays and inshore banks. With advancing size and age they move into deeper water. The females are faster growing than the males. The age of maturity of the females is 8 to 16 years with an average of 12, while that of the males is considerably earlier. Males may attain a weight of 40 pounds and an age of 25 years; females may attain a weight of 470 pounds and an age of 35 years or more. Tagging operations have shown that the immature halibut move within very restricted areas whereas mature fish may migrate extensively to and from the spawning grounds, a few individuals travelling as much as 2,000 miles. The food consists of fishes, crabs, clams, squid and other invertebrates. Much of the information concerning the life history of the halibut is the result of the extensive investigations of the International Pacific Halibut Commission (formerly called the International Fisheries Commission).

The halibut is caught on set-lines, the unit of line being the "skate"; these are run out on off-shore relatively shallow areas known as banks, ranging in depth from 10 to 150 fathoms, rarely to 500 fathoms. Formerly the usual bait was frozen herring, but in recent years Pacific cod and octopus have been increasingly favoured. In the early days of the fishery the gear was set from dories but at the present time the baited lines are payed out directly from the powerboats.

The 1958 Canadian landings amounted to nearly 29,000,000 pounds. The total value of the above catch to the fishermen was about \$6,000,000. The value of the livers and viscera used for the production of vitamin "A" was about \$165,000 in addition to the above.

Range: Southern California to Bering Sea.

#### **Flathead sole**

*Hippoglossoides elassodon* Jordan and Gilbert 1880

Body elongate, moderately slender, much compressed, dextral. Head moderately deep; mouth terminal, large symmetrical, gape wide; maxillary reaching to point below pupil of eye; teeth well developed on both sides of jaws, in single

row on each jaw; snout, pointed. Fins: dorsal (1), 72 to 90, first rays not elongate; anal, 57 to 71; pelvic, 6, thoracic; caudal, double truncate. Lateral line: flatly arched then straight; no accessory branch. Scales: imbricated, small, not deciduous; ctenoid on eyed side; cycloid on blind side, except on caudal peduncle and on band on each side of lateral line; in diagonal row between dorsal fin and lateral line at widest part of body, 40 to 50; on lateral line, 87 to 100. Spine before anal fin well developed, exposed. Colour uniform gray to olive brown on eyed side, sometimes blotched with dusky brown; white on blind side; dusky blotches on dorsal and anal fins.

Length to 18 inches.

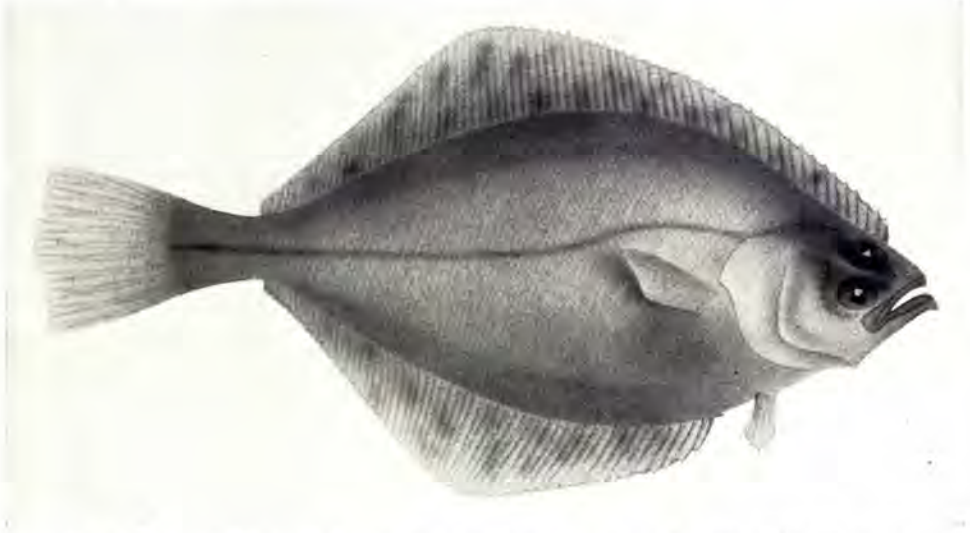


FIGURE 99. Flathead sole. *Hippoglossoides elassodon* Jordan and Gilbert 1880

Distinguished by the small scales (40 to 50 in a diagonal row from the dorsal fin to the lateral line at the widest part of the body), the smooth scales on the blind side of the body except on the caudal peduncle and along the lateral line and the teeth in one row on each side of the upper jaw.

The flathead sole was first taken in British Columbia waters on September 2, 1891, west of Jordan River by the *Albatross*, station 3460, Lat. 48° 25' N, Long. 124° 10' W, depth 53 fathoms and recorded in 1895 by C. H. Gilbert. The species is common in the Strait of Georgia area in moderately shallow water and occurs northward through Hecate Strait. The food consists of annelids, crustaceans and molluscs. The flathead sole is obtained frequently in shrimp and otter trawls, but rarely finds a market as a food fish. Local names include paper sole and cigarette paper, the latter being applied to immature individuals.

Range: Washington to Bering Sea.

**Slender sole**

*Lyopsetta exilis* (Jordan and Gilbert) 1880

Body elongate, slender, much compressed, dextral. Head narrow, pointed; mouth terminal, moderate, symmetrical, gape wide; maxillary extending to point below anterior margin of eye; teeth moderate, well developed on both sides of jaws, on upper jaw in two rows; snout bluntly pointed; eyes large. Fins: dorsal (1), 72 to 88, first rays not elongate; anal, 57 to 65; pelvic, 6, thoracic; caudal, rounded. Lateral line: flatly arched, then straight; no accessory branch. Scales: imbricated, large, thin, deciduous; ctenoid on both sides of body; in diagonal row between dorsal fin and lateral line at widest part of body, 20 to 24; on lateral line, 65 to 73; on dorsal, anal and caudal fins, small. Spine before anal fin well developed, exposed. Colour: pale brown on eyed side, minute dark points outlining margin of each scale; pale orange yellow to white on blind side.

Length to 12 inches.

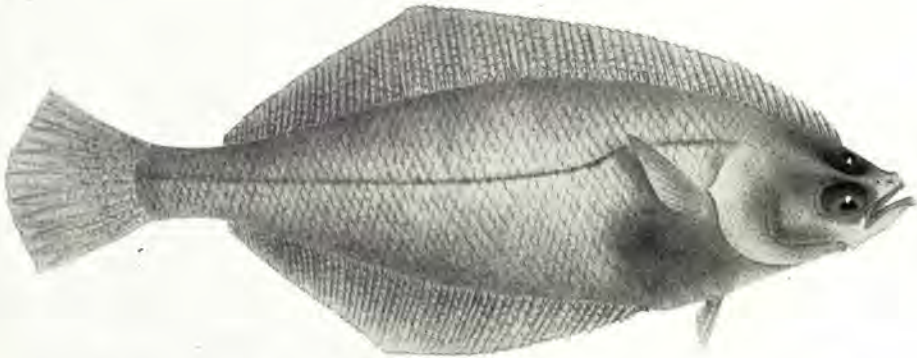


FIGURE 100. Slender sole. *Lyopsetta exilis* (Jordan and Gilbert) 1880

Distinguished by the slender body, the moderately large mouth, the large rough deciduous scales on both sides of the body and the pale brown coloration.

The slender sole was first taken in British Columbia waters on June 19, 1903, in Nanaimo Harbour by the *Albatross*, station 4191, Lat. 49° 11' N, Long. 123° 54' W, depth 54 fathoms and recorded in 1907 by B. W. Evermann and E. L. Goldsborough. The species is common in the Strait of Georgia and has been obtained on the west coast of Vancouver Island and in Hecate Strait, especially in Skidegate Inlet. It occurs frequently in the vicinity of rocky areas. While inhabiting moderate depths, it has been reported in California waters from 280 fathoms. The slender sole is captured in trawls but seldom is placed on the market.

Range: Southern California to southeastern Alaska.

## Brill

*Eopsetta jordani* (Lockington) 1879

Body elongate, moderately slender, much compressed, dextral. Head deep; mouth terminal, large nearly symmetrical, gape wide; maxillary extending to point slightly behind pupil of eye; teeth well developed on both sides of jaws, on upper jaw in two rows, on lower jaw in single row; snout, rounded. Fins: dorsal (1), 87 to 101, first rays not elongate; anal, 67 to 79; pelvic, 6, thoracic; caudal, double truncate. Lateral line: slightly decurved then straight, no accessory branch. Scales: imbricated, small, deciduous; ctenoid on eyed side; cycloid on blind side; in diagonal rows between dorsal fin and lateral line at widest part of body, about 30; on lateral line, 88 to 100. Spine before anal fin well developed, exposed. Colour: uniform olive brown on eyed side; white on blind side; dusky blotches on dorsal and anal fins, faint.

Length to 2 feet 3½ inches.

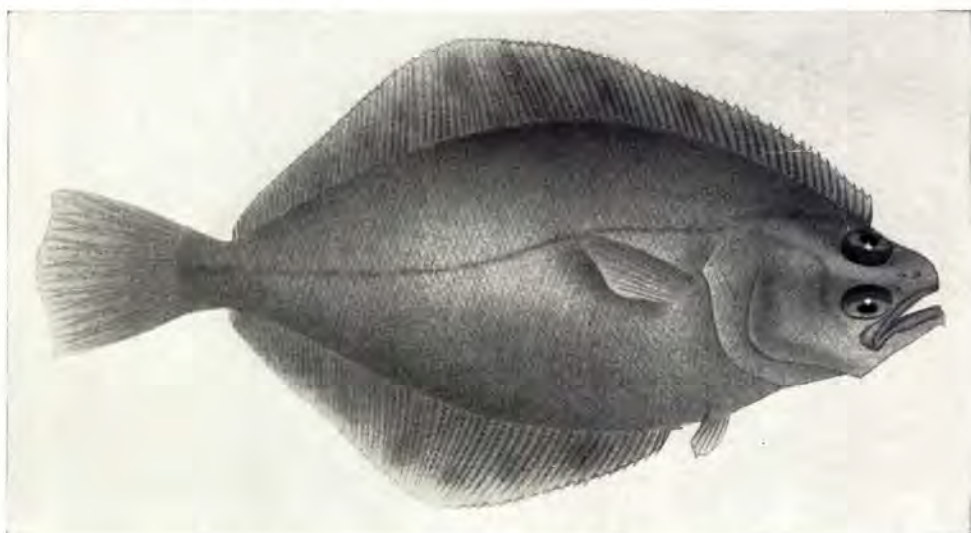


FIGURE 101. Brill. *Eopsetta jordani* (Lockington) 1879

Distinguished by the small scales (about 30 in a diagonal row between the dorsal fin and the lateral line at the widest part of the body), the smooth scales completely covering the blind side of the body, and the teeth in 2 rows on each side of the upper jaw.

The brill was first taken in British Columbia waters on August 4, 1881, at Calvert Island in Safety Cove by Captain H. E. Nichols, at a depth of 16 fathoms and recorded in the same year by T. H. Bean at *Hippoglossoides Jordani* Lockington. The species has been abundant off the west coast of Vancouver Island and in Hecate Strait, where it is captured in otter trawls. In 1958 the catch off British Columbia was only 3 million pounds, compared to 14 million in 1948. The food

consists of euphausiids, herring, sandlance and anchovies. The brill is known to spawn off Esteban Point at a depth of approximately 200 fathoms. Tagging has shown a to-and-fro migration between this spawning area and Hecate Strait. Females may reach an age of 18 years. The specific name was given in honour of the great ichthyologist, Dr David Starr Jordan. In United States waters this fish is known as the petrale and petrale sole, and this name is recommended by the AFS/ASIH committee. The word petrale is Mexican and means rocky.

Range: Southern California to Gulf of Alaska.

#### Sand sole

*Psettichthys melanostictus* Girard 1854

Body elongate, moderately deep, much compressed, dextral; caudal peduncle, deep. Head deep; mouth terminal, moderate, nearly symmetrical, gape wide; maxillary extending to point below pupil of eye; teeth large, well developed on both sides of jaws; snout rounded; eyes small; interorbital space broad. Fins: dorsal (1), 72 to 88, beginning in front of eye, first 8 or more rays greatly elongate, exerted; anal, 53 to 66; pelvic, 6, thoracic; caudal, rounded. Lateral line: slightly decurved, then straight; accessory dorsal branch short, close to base of dorsal fin, passing backward to point above posterior tip of operculum, ending in small crook. Scales: imbricated; ctenoid on eyed side; cycloid on blind side; on lateral line, 98 to 112; on bases of dorsal, anal and caudal fin rays. Spine before anal fin well developed,

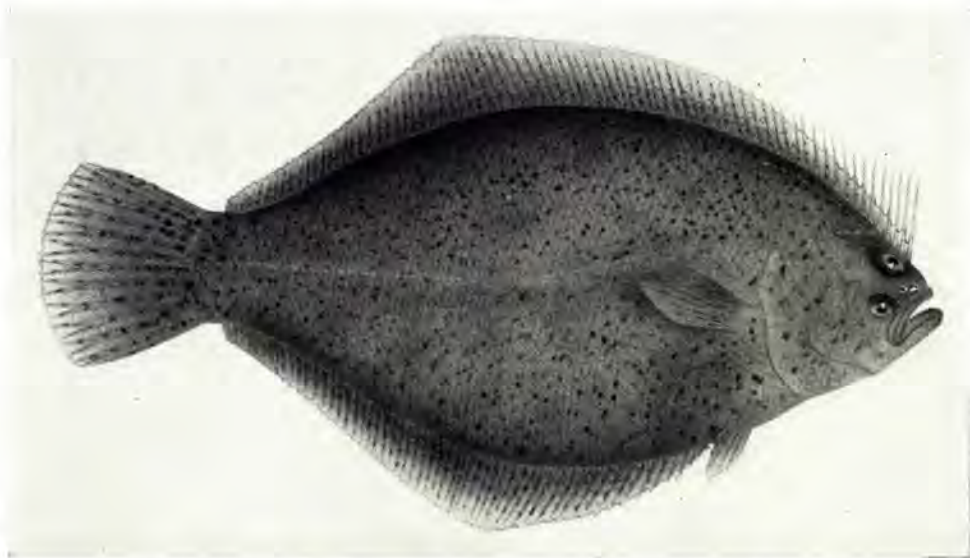


FIGURE 102. Sand sole. *Psettichthys melanostictus* Girard 1854

exposed. Colour: light green on eyed side with tinge of light brown, everywhere finely speckled with black; general colour that of the sandy beach; white on blind side; dull yellow on tips of dorsal and anal fins in large specimens.

Length to  $24\frac{3}{4}$  inches.

Distinguished by the long free rays in the anterior end of the dorsal fin, the deep caudal peduncle and the accessory dorsal branch of the lateral line.

The sand sole was first recorded from British Columbia waters in 1891 by Ashdown Green. The first definite locality is for the Queen Charlotte Islands, given in 1901 by W. H. Osgood. The species is common in the Strait of Georgia and occurs along the west coast of Vancouver Island and as far north as Rose Spit. It is taken commonly on sandy bottoms in trawls. Crustaceans, worms and small molluscs constitute the chief food, while anchovies have been reported in some specimens from California waters. The sand sole has a delicate flavour.

Range: Northern California to Bering Sea.

**Roughscale sole**                      *Clidoderma asperrimum* (Temminck and Schlegel) 1846

Body elongate, deeply ovate, compressed, dextral; caudal peduncle, deep. Head deep; mouth terminal, moderate, asymmetrical, gape small on eyed side; length of maxillary on blind side nearly half that of head; lips moderate; teeth stout, conical, in two rows on both jaws, stronger on eyed side; snout moderate, rounded; eyes large, somewhat protruding, upper slightly posterior to lower, interorbital ridge low, narrow. Fins: dorsal (1), 82 to 89, moderate, origin on blind

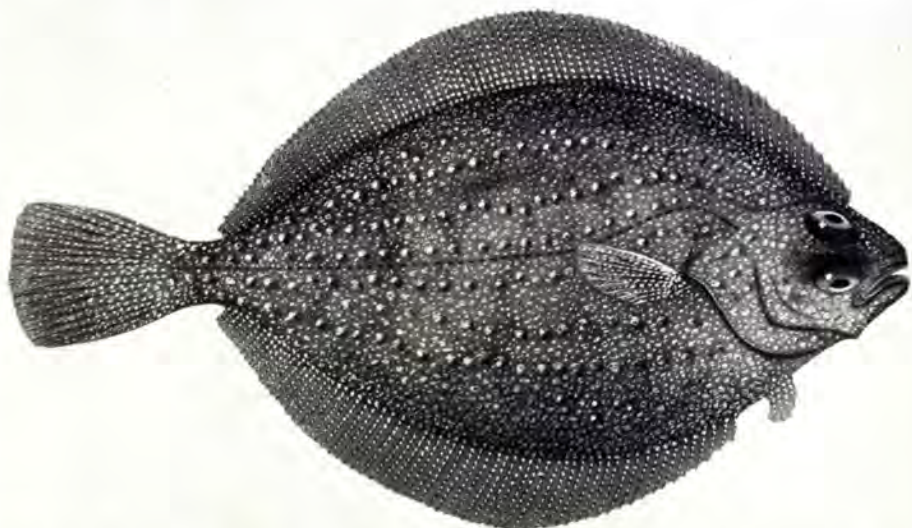


FIGURE 103. Roughscale sole. *Clidoderma asperrimum* (Temminck and Schlegel) 1846



side slightly before eye; anal, 63 to 72, moderate; pelvic, 6, thoracic; caudal, deep, rounded. Lateral line: arched over pectoral fin, then straight; supratemporal branch short, above eye. Scales: modified into rough bony tubercles, on eyed side, larger tubercles arranged in six more or less definite longitudinal rows, smaller tubercles on snout, on skin around eye, on dorsal and anal fin rays. No spine before anal fin. Colour: brown on eyed side; gray on blind side.

Length to 22½ inches.

Distinguished by the ovate body, the rows of rough tubercles on the body, and the long maxillary on the blind side of the head.

The roughscale sole was first taken in British Columbia waters on March 9, 1955, 24 miles southwest of Esteban Point, Lat. 49° 04' N, Long. 127° 53' W, by Lars Svege of the otter trawler *St. John*, at a depth between 185 and 190 fathoms. This specimen was about 22½ inches in length and was recorded in 1957 by A. D. Welander, D. L. Alverson and P. Bergman. It is now in the collection of the University of Washington at Seattle. The species is well known in Japan.

Range: Southern British Columbia.

#### **Curlfin sole**

*Pleuronichthys decurrens* Jordan and Gilbert 1880

Body elongate, deeply ovate, much compressed, dextral; caudal peduncle, deep. Head deep; mouth terminal, small, asymmetrical, gape narrow; lips thick; teeth chiefly on blind sides of jaws; snout short, blunt; eyes large protruding, closely set, obscuring interorbital space; interorbital ridge narrow, prominent tubercle at each end, two or three other tubercles behind upper eye. Fins: dorsal (1), 67 to 79, high, origin on blind side at angle of mouth, first 9 to 12 rays on blind side; anal, 46 to 52; high; pelvic, 6, thoracic; caudal, deep, rounded. Lateral line: slightly decurved, then straight; accessory dorsal branch long, close to dorsal fin, passing backward to point about midlength of body. Scales: well separated, deeply embedded in tough skin; cycloid on both sides of body; on lateral line, 80 to 91; present on fins. Spine before anal fin small, exposed, sharp. Colour: brown to black on eyed side, mottled, finely spotted, no black spot on middle of body; creamy white on blind side; very dark on all fins.

Length to 12 inches.

Distinguished by the deeply ovate body with the high dorsal and anal fins, the embedded scales and the origin of the dorsal fin on the blind side of the body at the angle of the mouth with the first 9 to 12 rays on the blind side of the body.

The curlfin sole was first taken in British Columbia waters on July 21, 1916, near Rivers Inlet and was recorded in 1936 by L. P. Schultz and A. C. DeLacy. The specimen is now in the Royal Ontario Museum at Toronto. A second individual has been examined through the kindness of Dr J. L. Hart. It was obtained October 31, 1944, in Queen Charlotte Strait off Hope Island in an otter trawl at a depth of 25 fathoms, and is now in the collection of the Biological Station at Nanaimo.

This sole is abundant on the Hecate Strait Flats where the young predominate. In California waters this species has been taken at depths ranging from 21 to 291 fathoms. This is not a commercial species in Canada.

Range: Southern California to southeastern Alaska.

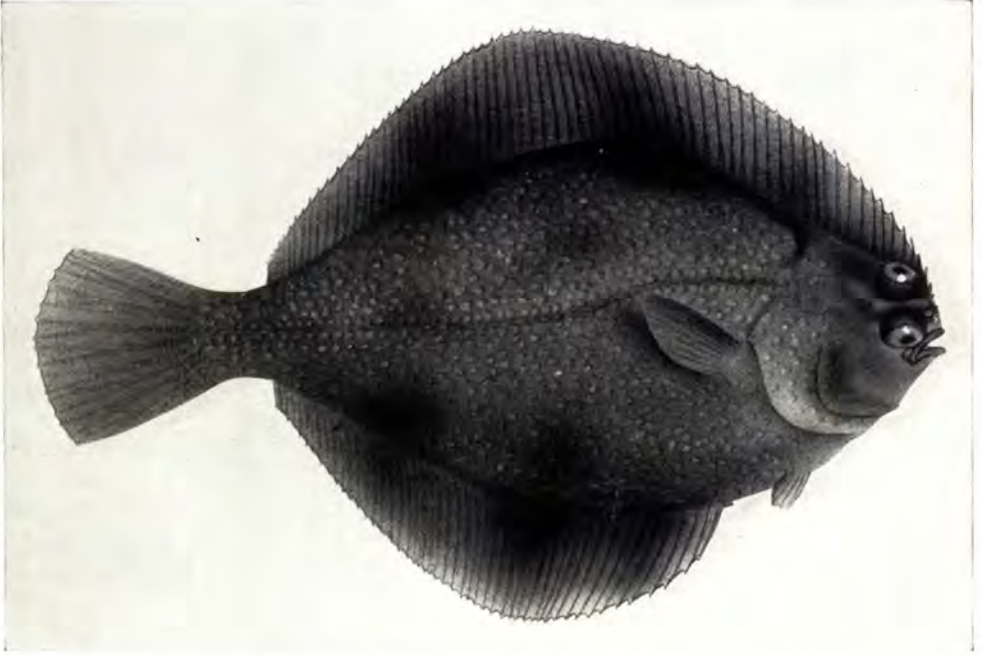


FIGURE 104. Curlfin sole. *Pleuronichthys decurrens* Jordan and Gilbert 1880

**C-O sole**

*Pleuronichthys coenosus* Girard 1854

Body elongate, deeply ovate, much compressed, dextral; caudal peduncle deep. Head deep; mouth terminal, small, asymmetrical, gape narrow; lips thick; teeth chiefly on blind sides of jaws; snout short, blunt; eyes large, protruding, closely set, obscuring interorbital space; interorbital ridge prominent, small downwardly projecting tubercle posteriorly. Fins: dorsal (1), 65 to 78, high, origin on blind side, first 5 or 6 rays on blind side; anal, 46 to 56, high; pelvic, 6, thoracic; caudal, deep, rounded. Lateral line: slightly decurved, then straight; accessory dorsal branch long, close to dorsal fin, passing backward to point about midlength of body. Scales: deeply embedded in tough skin, well separated; cycloid on both sides of body; on lateral line, 61 to 70; present on fins. Spine before anal fin small, exposed, sharp. Colour: dark brown to black on eyed side, conspicuous black spot

approximately size of eye on middle of body, sometimes similar spot on middle of caudal fin; dark bar sometimes across base of caudal fin, particularly conspicuous in young fish; creamy white on blind side; very dark on all fins.

Length to 14 inches.

Distinguished by the deeply ovate body with the high dorsal and anal fins, the embedded scales, and the origin of the dorsal fin on the blind side of the body opposite the anterior margin of the upper eye with the first 5 or 6 rays on the blind side of the body.



FIGURE 105. C-O sole. *Pleuronichthys coenosus* Girard 1854

The C-O sole was first recorded from British Columbia in 1891 by Ashdown Green. The first definite locality record is that of four specimens taken in 1908 in Departure Bay by Messrs C. H. Young and W. Spreadborough and recorded in 1920 by B. A. Bean and A. C. Weed. The species is abundant in the Strait of Georgia and has been taken off the west coast of Vancouver Island. The young are common in summer in shallow water but the adults frequently inhabit deep water. The C-O sole is captured in small quantities by trawls in deep water, and small numbers are marketed although the tough skin makes filleting somewhat difficult. Fishermen sometimes call these fish popeyes because of the protruding eyes.

Range: Southern California to southeastern Alaska.

## Lemon sole

*Parophrys vetulus* Girard 1854

Body elongate, slender, much compressed, dextral. Head slender, pointed; mouth terminal, small, asymmetrical, gape narrow; teeth chiefly on blind sides of jaws; snout bluntly pointed; eyes large, upper somewhat posterior to lower, entering profile; interorbital space narrow, ridge high. Fins: dorsal (1), 72 to 92; anal, 54 to 70; pelvic, 6, thoracic; caudal, somewhat truncate. Lateral line: slightly decurved, then straight; accessory dorsal branch long, close to dorsal fin, passing backward to point above pectoral fin, varying in length from midpoint to tip. Scales: imbricated; cycloid on both sides of body anteriorly; ctenoid posteriorly; on lateral line, 89 to 105; ctenoid on check; absent from fins. Spine before anal fin small, exposed, sharp. Colour: uniform yellowish brown on eyed side; light yellow to white, tinged with reddish brown on blind side, particularly under head. Young variously coloured from gray to brown, minutely spotted, often of sandy appearance on dorsal surface. In young less than 2 inches in length there are often 2 bright yellow lines on the ventral surface, one below the base of the dorsal and one above the base of the anal fin.

Length to 22½ inches.



FIGURE 106. Lemon sole. *Parophrys vetulus* Girard 1854

Distinguished by the pointed head, the accessory dorsal branch to the lateral line and the scales on the body smooth anteriorly and rough posteriorly.

The lemon sole was first recorded from British Columbia waters in 1862 from Victoria by A. Günther as a new species, *Pleuronectes digrammus*, on the basis of 2 specimens, each about 8 inches in length, obtained by H. M. S. *Plumper* and presented to the British Museum by Earl Russell. The species is common in the Strait of Georgia and in northern Hecate Strait, where it is taken in trawls at depths

between 20 and 50 fathoms on sandy to muddy bottoms. Ovaries of large females have been found to contain approximately 2,000,000 eggs. Spawning occurs from February to April. The eggs are pelagic and are transparent white to pale bluish purple in colour. Young lemon soles spend their first year of life close to the inter-tidal zone, but move to deeper water as they grow older. The food consists of small crabs, shrimps, worms, brittlestars, clam siphons and small molluscs. Males attain a length of 15 to 16 inches at 13 years and females 18 to 20 inches at 16 years. Lemon soles move about freely; one tagged at the Goose Islands in Queen Charlotte Sound was captured in California waters about 700 miles south. Another tagged in the Strait of Georgia was recovered off Eureka, California, about 600 miles distant. In 1958, the lemon sole catch from British Columbia waters was over 2 million pounds, most of which came from northern Hecate Strait. This is the choicest of the small flatfishes, having a very delicate flavour, and fillet of sole is usually this species. It has been given the name lemon sole because of its resemblance in shape and colour to the lemon sole of European waters. In the United States the name English sole is applied, and this has been recommended by the AFS/ASIH committee.

Range: Southern California to Gulf of Alaska.

#### **Butter sole**

*Isopsetta isolepis* (Lockington) 1880

Body elongate, slender, much compressed, dextral. Head slender; mouth terminal, small, asymmetrical, gape narrow; teeth chiefly on blind sides of jaws; snout bluntly rounded; eyes small; interorbital space narrow, flat. Fins: dorsal (1), 78 to 92; anal, 58 to 69; pelvic, 6, thoracic; caudal, rounded. Lateral line: slightly decurved, then straight; accessory dorsal branch close to dorsal fin, passing backward to point above pectoral fin, varying from midpoint to tip. Scales: imbricated, rather large, strongly ctenoid on eyed side; chiefly cycloid on blind side; on lateral line, 78 to 84; ctenoid on head and fin rays. Spine before anal fin small, exposed, sharp. Colour: gray, irregularly blotched and spotted with yellow or green on eyed side; white on blind side; bright lemon yellow on tips of dorsal and anal fin rays.

Length to 18 inches.

Distinguished by the rough scales on the eyed side of the body including the head and the fins, the accessory dorsal branch to the lateral line and the bright lemon colour on the tips of the dorsal and anal fins.

The butter sole was first taken in British Columbia waters in the summer of 1928, off San Juan Harbour and the specimen is now in the Royal Ontario Museum at Toronto. An individual was secured on May 16, 1934, in Clayoquot Sound west of Flores Island at a depth of 27 fathoms by the *Wm. J. Stewart* expedition. Occasionally specimens are obtained in the Strait of Georgia, and large numbers are taken off the west coast of Vancouver Island. Large numbers are taken in otter trawls in northern Hecate Strait. This species is found frequently on

a soft, silty bottom. During the winter months a large segment of the Hecate Strait stock moves into Skidegate Inlet where spawning occurs from March to late April. The eggs are white in colour. Considerable numbers are marketed as fillets and large quantities are utilized as mink feed.

Range: Southern California to southeastern Alaska.

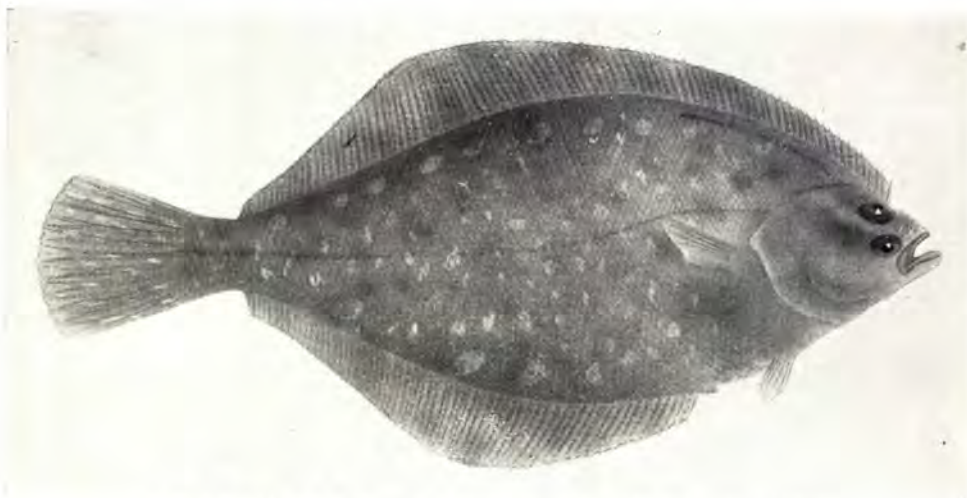


FIGURE 107. Butter sole. *Isopsetta isolepis* (Lockington) 1880

#### **Forkline sole**

*Inopsetta ischyra* (Jordan and Gilbert) 1881

Body moderately slender, much compressed, dextral. Head slender, pointed; mouth terminal, small, asymmetrical, gape narrow; teeth on both sides of jaws; snout bluntly pointed; eyes moderate, upper slightly posterior to lower, entering profile, interorbital space narrow, ridge moderate. Fins: dorsal (1), 68 to 76; anal, 49 to 57; pelvic, 6, thoracic; caudal, somewhat rounded. Lateral line: slightly decurved, then straight; accessory dorsal branch short, forked posteriorly, extending to point above operculum. Scales: imperfectly imbricated; ctenoid on both sides of body; on lateral line, 76 to 86; extending onto dorsal and anal fins. Spine before anal fin small, exposed, sharp. Colour: olive brown on eyed side, variously mottled with lighter and darker; pale on blind side; dorsal and anal fins with faint black bars.

Length to 18 inches.

Distinguished by the low flat curve in the lateral line with the short forked accessory branch not extending behind the operculum, and the rough scales on both sides of the body and on the dorsal and anal fins.

The forkline sole was first taken in British Columbia waters on May 7, 1954, off the west coast of Vancouver Island near Clo-oose by Captain Smith of the trawler *Frank Winfield*, at a depth of 26 fathoms. Three others were observed by



FIGURE 108. Forkline sole. *Inopsetta ischyra* (Jordan and Gilbert) 1881

W. E. Barraclough taken in Sydney Inlet south of Esteban Point. Additional specimens have been taken in the Strait of Georgia in Fanny and Union Bays. The species is reported occasionally from Washington. It has been suggested that this sole is a hybrid but until its status is clarified it seems advisable to record it as a species.

Range: Washington to Bering Sea.

**Rock sole**

*Lepidopsetta bilineata* (Ayres) 1855

Body elongate, deeply ovate, much compressed, dextral. Head deep; mouth terminal, small, asymmetrical, gape narrow; teeth chiefly on blind sides of jaws; snout bluntly rounded. Fins: dorsal (1), 67 to 82; anal, 51 to 64; very high, pelvic, 6, thoracic; caudal, double truncate. Lateral line: prominently arched over pectoral fin, then straight; accessory dorsal branch short, close to dorsal fin, passing backward to point anterior to posterior tip of operculum. Scales: imbricated; ctenoid on eyed side, some tuberculate; chiefly cycloid on blind side; extending onto dorsal, anal and caudal fin rays; on lateral line, 72 to 85. Spine before anal fin sharp, exposed. Colour: variable, usually deep brown on eyed side, frequently mottled with dark, occasionally with scattered small red spots or pale blotches; reddish yellow to white on blind side; brown to black interrupted streaks on rays of dorsal, anal and caudal fins.

Length to 22½ inches.

Distinguished by the deeply ovate body, the prominent arch in the lateral line, the short accessory dorsal branch and the rough tuberculated scales on the eyed side of the body.

The rock sole was first recorded from British Columbia waters in 1866 by J. K. Lord as *Pleuronectes bilineatus* and *P. umbrosus*, without date or locality of capture. The first specific record was that of a specimen taken in June, 1882, at Broughton Island in Carter Bay by Captain H. E. Nichols and recorded in 1883 by T. H. Bean. The species is abundant along the coast and the young are common in the shallow waters where they may be captured with beach seines in sandy to gravelly areas just offshore from eelgrass beds. It is very abundant from Cape Scott northward through Hecate Strait to Dixon Entrance at depths from 17 to 70 fathoms. In 1958 the catch from British Columbia trawling grounds was more than 5 million pounds.

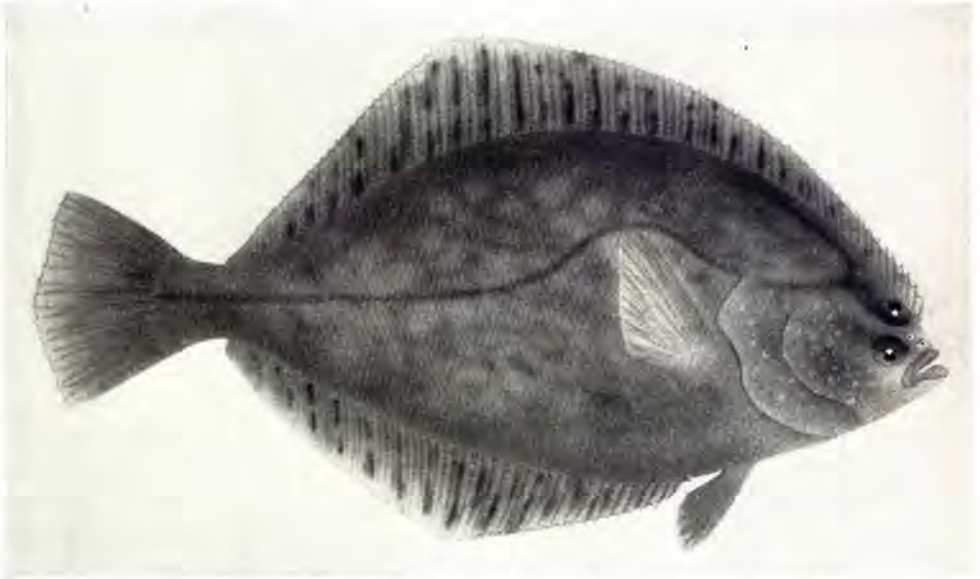


FIGURE 109. Rock sole. *Lepidopsetta bilineata* (Ayres) 1855

While casting with a wet fly for cutthroat trout in Departure Bay, Mr C. J. Keighley took several of these soles weighing about half a pound each. Spawning takes place from late winter to early spring. The eggs are bright yellow orange in colour. The food consists largely of brittlestars, small crabs, shrimps, clam siphons, other invertebrates and sandlance. The flesh is very palatable, although not considered quite as desirable as that of the lemon sole, *Parophrys vetulus*. This fish is also known as the roughback sole.

Range: Southern California to Bering Sea.

#### **Yellowfin sole**

*Limanda aspera* (Pallas) 1811

Body elongate, deeply ovate, compressed, dextral. Head moderately deep; mouth terminal, small, asymmetrical, gape narrow; teeth chiefly on blind sides of jaws; snout bluntly rounded, shorter than diameter of eye; eyes moderately large;



interorbital space narrow. Fins: dorsal (1), 61 to 69; anal, 48 to 58; pelvic, 6, thoracic; caudal, slightly rounded. Lateral line: prominently arched over pectoral fins; no accessory branch. Scales: slightly imbricated; ctenoid on both sides of body; on lateral line, 73 to 89; extending onto rays of dorsal, anal and caudal fins. Spine before anal fin sharp, exposed. Colour: light brown on eyed side, mottled with darker brown; white on blind side, sometimes faintly tinged with yellow; orange-yellow on fins with faint dark bars on dorsal and anal fins.

Length to 15 inches.



FIGURE 110. Yellowfin sole. *Limanda aspera* (Pallas) 1811

Distinguished by the prominent arch in the lateral line over the pectoral fin, the absence of an accessory branch, the scaly fins and the orange-yellow colour of the fins.

The yellowfin sole was first taken in British Columbia waters in June, 1882, at Port Simpson and in Cardenas Bay by Captain H. E. Nichols and recorded in 1883 by T. H. Bean. The species has been recorded from the Queen Charlotte Islands and is commonly taken in Skidegate Inlet, Hecate Strait, by otter trawls. A specimen was taken in July, 1954, in Barkley Sound in a beach seine by R. E. Johannes. This is the southernmost record for the species. The food consists in part of hydroids, worms, molluscs and brittlestars. This fish appears only occasionally in market landings. It is also known as the northern sole.

Range: Barkley Sound to Bering Sea.

**Dover sole***Microstomus pacificus* (Lockington) 1879

Body elongate, slender, compressed, dextral; caudal peduncle very short. Head slender, short; mouth terminal, small, asymmetrical, gape narrow, nearly equal on each side; teeth chiefly on blind sides of jaws, never more than 3 in either jaw on eyed side; snout bluntly rounded; eyes small, lower in advance of upper; interorbital space low; gill opening not extending above base of uppermost pectoral fin ray. Fins: dorsal (1), 90 to 116; anal, 80 to 96; pelvic, 6, thoracic; pectoral, small, that on eyed side not elongate, length much less than that of head; caudal, rounded. Lateral line: nearly straight, rather indistinct; no accessory branch. Scales: imbricated, very small, cycloid, deciduous, uniform over body; on lateral line, 137 to 146. Mucous secretion in form of profuse slime. No spine before anal fin. Colour: uniform light to dark brown on eyed side; somewhat lighter on blind side; dusky on fins, more intense towards tips of rays.

Length to 2 feet 4 inches.



FIGURE 111. Dover sole. *Microstomus pacificus* (Lockington) 1879

Distinguished by the abundance of slime, the nearly straight and indistinct lateral line without accessory branch, and the gill openings not extending above the bases of the uppermost pectoral fins.

The Dover sole was first taken in British Columbia waters on August 28, 1891, west of Port San Juan by the *Albatross*, station 3447, Lat. 48° 30' N, Long. 124° 36' W, depth 116 fathoms and recorded in 1895 by C. H. Gilbert. The species is distributed generally along the coast from Juan de Fuca Strait to the Queen Charlotte Islands especially in Hecate Strait, occurring on muddy bottoms usually at depths below 30 fathoms. It has been found at depths from 33 to 516 fathoms. Spawning occurs from December to February when up to 230,000 eggs may be

produced by a single female. The Dover sole is fairly abundant in the Strait of Georgia off the mouth of the Fraser River, where it is secured in trawls along with the lemon sole, *Parophrys vetulus*. However, the main fishing areas are along the west coast of Vancouver Island and in Queen Charlotte Sound. In 1958 the catch from all grounds adjacent to the British Columbia coast exceeded one million pounds. Dover soles produce a large amount of slime, which is particularly undesirable in the trawl as it covers other fishes, giving the catch a whitish mucilaginous coating. Because of this characteristic the Dover sole is not as valuable as other flatfishes although the flesh is very palatable. It is hard to fillet but has a market primarily as mink feed. This fish is also known as the slime sole and slippery sole.

Range: Southern California to Bering Sea.

### Deepsea sole

*Embassichthys bathybius* (Gilbert) 1891

Body elongate, slender, compressed, upper and lower thirds highly compressed, dextral; caudal peduncle very short, slender. Head moderate, short; mouth terminal, small, asymmetrical, gape narrow; teeth nearly equally developed on both sides of jaws, broad, incisor-like, slightly notched at tips, at least 7 in jaws on eyed side; snout rounded; eyes large, upper slightly posterior to lower; inter-orbital ridge high, narrow; gill opening barely reaching to base of uppermost pectoral fin ray. Fins: dorsal (1), 111 to 117, origin above posterior part of eye; anal, 96 to 98; pelvic, 5 to 6, thoracic, small; pectoral, small, that on eyed side small, length much less than that of head; caudal, rounded. Lateral line:



FIGURE 112. Deepsea sole. *Embassichthys bathybius* (Gilbert) 1891

slightly arched over pectoral fin; then straight; no accessory dorsal branch. Scales: cycloid, small; on lateral line, about 165. Spine before anal fin sharp, exposed. Colour: brown, becoming darker towards margins of body, black on dorsal and anal fin rays at tips; coarsely blotched with pale blue on body and fins, so arranged on upper and lower thirds of eyed side as to form five broad bluish blotches; black on lips and branchiostegal membranes; dusky brown on blind side.

Length to  $10\frac{1}{2}$  inches.

Distinguished by the slender body with the upper and lower thirds highly compressed, the high ridge between the eyes, the gill opening barely reaching to the bases of the uppermost pectoral fin rays and the presence of at least 7 teeth in the jaws on the eyed side of the body.

The deepsea sole was first taken in British Columbia waters on September 27, 1951, by the United States Fish and Wildlife Service vessel *John N. Cobb*, Lat.  $48^{\circ} 14' N$ , Long.  $125^{\circ} 02' W$ , depth 116 fathoms, and recorded in 1954 by A. D. Welander and D. L. Alverson. It was a specimen 245 mm in standard length and is now in the collection of the University of Washington at Seattle. This record extends the known distribution of the species northward from California. In California waters this fish has been recorded from depths of 440 and 659 fathoms.

Range: Southern California to southern British Columbia.

### Rex sole

*Glyptocephalus zachirus* Lockington 1879

Body elongate, slender, much compressed, dextral; caudal peduncle very short. Head slender, short; mouth terminal, small, asymmetrical, gape narrow, smaller on eyed side than on blind side; teeth chiefly on blind sides of jaws; snout bluntly rounded; eyes large, lower slightly in advance of upper; gill opening extending above base of uppermost pectoral fin ray. Fins: dorsal (1), 87 to 110; anal, 78 to 93; pelvic, 6, thoracic; pectoral (2), that on eyed side greatly elongate, pointed, much longer than that on blind side, shorter in young but always longer than that on blind side; caudal, rounded. Lateral line: nearly straight; no accessory branch. Scales: imbricated, small, cycloid, uniform over body; on lateral line, 132 to 138. Spine before anal fin sharp, exposed. Colour: uniform light brown on eyed side; white to faintly dusky on blind side; dusky on fins; transparent in young up to 3 inches.

Length to  $23\frac{1}{4}$  inches.

Distinguished by the long pectoral fin on the eyed side of the body, the nearly straight lateral line without an accessory branch and the gill openings extending above the bases of the pectoral fins.

The rex sole was first taken in British Columbia waters on 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. The species is fairly common in the Strait of Georgia and specimens have been obtained from the west coast of Vancouver Island, from the north end of Vancouver Island near

Fort Rupert, from Hecate Strait and from the Queen Charlotte Islands at Rose Spit. The rex sole is captured in trawls operating at depths from 10 to 136 fathoms, but off the Alaskan coast it has been secured at depths down to 350 fathoms. While it usually is considered as very palatable only small numbers appear on the market. In 1958 less than half a million pounds were landed from British Columbia fishing grounds. The terms witch and longfin sole frequently are applied to this fish.

Range: Southern California to Bering Sea.



FIGURE 113. Rex sole. *Glyptocephalus zachirus* Lockington 1879

### **Starry flounder**

*Platichthys stellatus* (Pallas) 1811

Body elongate, deep, much compressed, dextral or sinistral. Head deep; mouth terminal, small, asymmetrical, gape narrow; lower jaw projecting; teeth chiefly on blind sides of jaws; snout bluntly rounded; eyes small. Fins: dorsal (1), 52 to 66; anal, 38 to 47; pelvic, 6, thoracic; caudal, truncate. Lateral line: very slightly decurved, then straight; no accessory branch. Scales: well separated, small, cycloid, chiefly on posterior portion of body; in form of spinous stellate plates, well separated, numerous, on eyed side, more or less in bands on blind side; absent from lateral line. Pores: on lateral line, 63 to 78. Colour: dark brown to nearly black, on eyed side; white to creamy white, on blind side; occasionally blotched; black bands on dorsal and anal fins, 4 to 7, vertical; black stripes on caudal fin, 4 to 6, longitudinal; white, orange yellow or reddish orange areas between bands and stripes, occasionally bands and stripes tinged with orange, more pronounced on large individuals.

Length to 3 feet.

Distinguished by the black bands on the dorsal and anal fins, the black stripes on the caudal fin and the spinous stellate plates.

The starry flounder was first recorded from British Columbia waters, in 1862 by A. Günther as *Pleuronectes stellatus* Pallas, on the basis of a skin from Esquimalt Harbour, collected by H.M.S. *Plumper* and presented to the British Museum by Earl Russell. In 1866, J. K. Lord recorded the species from British Columbia waters under the names of *Platichthys rugosus* and *Pleuronectes stellatus*. This fish is very abundant along the whole coast, living in shallow water on sandy bottoms for the most part, but occasionally occurring in deeper water where it is taken on halibut gear. In 1958 the trawl catch from British Columbia grounds amounted to 300,000 pounds and most of this came from northern Hecate Strait and the Strait of Georgia. Spawning occurs in late winter and early spring. The eggs are pale orange yellow in colour. The young frequently move into streams for



FIGURE 114. Starry flounder. *Platichthys stellatus* (Pallas) 1811

some distances. The food consists of crabs, shrimps, worms, clams and clam siphons, small molluscs and small fishes, including *Lycodopsis pacifica*. This flounder is unusual in that collections have been made with as many as 60% of the individuals with eyes and colour on the left side. Rarely the halibut, lemon sole and flathead sole may be sinistral, while the sanddabs are normally so. Weights up to 20 pounds have been recorded. This fish is also known as the grindstone or emerywheel because of its extreme roughness.

Range: Southern California to Bering Sea.

## Order DISCOCEPHALI

In this order there is a large dorsal adhesive disk extending forward on the head to the tip of the snout. This disk is developed by a flattening of the spinous dorsal fin together with a division of each spine to form a paired series of flattened laminae. The resulting structure is a flat, oval, transversely laminated disk with the laminae denticulated along their free posterior margins. As the disk is applied to the object of attachment, such as a fish, seaturtle, whale or ship, the laminae are raised, creating a series of suction chambers. Backward pressure tends to hold the disk, while a forward movement on the part of the fish releases the suction. Fossil species show a small narrow disk entirely behind the head and having a form more like a normal dorsal fin.

The order is related closely to the Percomorphi and comprises one family with 4 genera and about 10 species, mostly of tropical waters.

### Family ECHENEIDAE

### Remoras

In the remoras the fishes are mostly small but the largest attains a length of over 3 feet. They are predaceous, feeding upon a variety of small fishes, particularly those that school. They are fast swimmers and are said to fight gamely when hooked. They do not harm the host.

Ordinarily these fishes attach themselves to external surfaces but some individuals have been found adhering within the mouths and gillchambers of such fish as the manta, tuna, swordfish and ocean sunfish. This attachment usually is stated to be for protection but is more likely to be a means of increasing the opportunity of gaining food.

Remoras have been used to catch fishes and turtles. A ring to which a cord is attached is fastened around the tail. When the remora is liberated it promptly attaches itself to the moving objects which may then be pulled slowly ashore.

### Whalesucker

### *Remilegia australis* (Bennett) 1840

Body elongate, depressed anteriorly, compressed posteriorly. Head elongate, much depressed, broad; mouth terminal, small, gape wide; maxillary reaching to point below vertical from nostril; upper jaw broad, slightly notched; lower jaw projecting, narrower than upper; teeth in bands, small, villiform, outer row slightly enlarged; snout truncate; eye small; gill membranes separate, free from isthmus. Fins: dorsal (2), XXV to XXVII—20 to 23, spinous fin forming large adhesive disk on upper surface of head and anterior of body, extending to vertical well behind tips of pelvic fins, length about  $2\frac{1}{2}$  in total length, disk broader than head and body, subelliptical, obtusely rounded anteriorly and posteriorly, laminae minutely denticulate, large smooth area on posterior portion roughly triangular, rayed fin low; anal, 20 to 24, low, opposite rayed dorsal; pelvic, I, 5, thoracic, depressible into groove on abdomen, membrane of fifth ray partially adnate to

groove; pectoral, rounded, high on body; caudal, slightly concave. Lateral line: high, decurved anteriorly, straight posteriorly. Scales: embedded, cycloid, minute. Colour: dark gray to brown on dorsal surface; darker on ventral surface; narrow white border on rayed dorsal and anal fins.

Length to 20 inches.



FIGURE 115. Whalesucker. *Remilegia australis* (Bennett) 1840

Distinguished by the very large adhesive disk on the top of the head and anterior portion of the body with the 25 to 27 laminae.

The whalesucker was first taken in British Columbia waters in June, 1907, at Sechart by Mr T. Kermodé and recorded in 1936 by L. P. Schultz and A. C. DeLacy as *Remora remora* (Linnaeus). Three individuals, all about 8 inches in length, were obtained from a blue whale. They are now all in the Provincial Museum at Victoria. More recently specimens have been obtained from a blue whale off California and from a porpoise off Baja California. This is a fish of the tropical seas and rarely is obtained, having been reported from the Indian Ocean, from the Atlantic Ocean southwest of the Cape Verde Islands attached to a dolphin and from the coast of Texas in the vicinity of Corpus Christi.

Range: southern California to Vancouver Island.

#### Order PERCOMORPHI

In this order are included fishes of very diverse form and size. The order was originally set up to cover those fishes having a more or less perch-like form of body. It now includes many groups whose basic characteristics are percoid but whose body forms are very varied. The pelvic fins, when present, are thoracic; the caudal fin never has more than 17 principal rays, the outer two unbranched.

This order embraces many suborders, of which 13 are represented in British Columbia waters.



## Suborder PERCOIDEA

The fishes in this suborder are very diversified in shape but the most generalized have a perch form of body. The pelvic fins are thoracic, each with 1 spine and 5 rays. The many families placed in the suborder are basically similar in detailed structure although they may vary much in general external features.

The following families are represented in British Columbia marine waters: Embiotocidae, Sciaenidae, Histiopteridae, Bramidae and Carangidae.

### Family EMBIOTOCIDAE

### Seaperches

In the seaperches 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 and 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, separated from the body scales by a furrow; 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 members of this family are viviparous.

The family comprises about 20 genera distributed along the shores of the north Pacific. The species are all marine except for one which lives in streams in northern California.

### Walleye seaperch

*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, 21 or more. Fins: dorsal (1), VIII to XI, 25 to 28, spinous portion high, angular, maximum height about middle, higher than rayed portion; anal, III, 30 to 35; pelvic, I, 5, thoracic; caudal, furcate. Lateral line: high on body anteriorly. Scales: cycloid, small; on lateral line, 68 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 to golden 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 walleye seaperch 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 of some importance commercially. Mating has been observed in California waters in November followed by the gestation period of 5 to 6 months with the liberation of 5 to 12 young. The name walleye surfperch is recommended by the AFS/ASIH committee.

Range: Southern California to Juan de Fuca Strait.

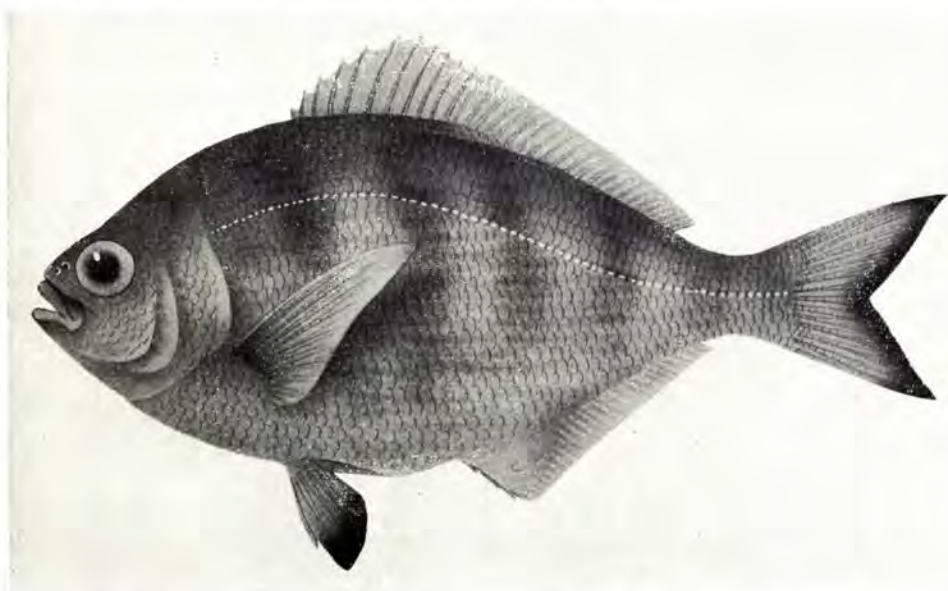


FIGURE 116. Walleye seaperch. *Hyperprosopon argenteum* Gibbons 1854

### Redtail seaperch

*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 (1), IX or X, 25 to 28, spinous portion high, angular, 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, 60 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.

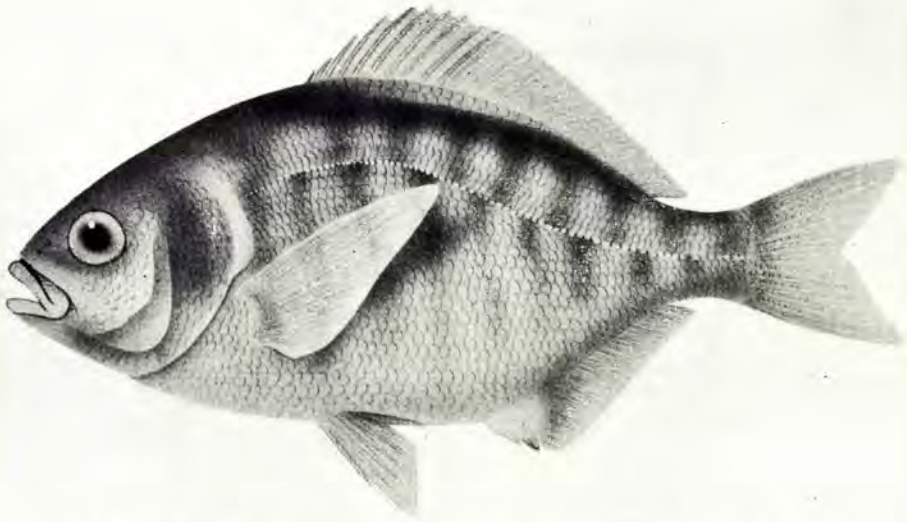


FIGURE 117. Redtail seaperch. *Holconotus rhodoterus* Agassiz 1854

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 redtail seaperch was first recorded from British Columbia waters in 1862 by A. Günther as *Ditrema rhodoterum*, on the basis of 5 specimens from Esquimalt Harbour collected by J. K. Lord. Two individuals were taken April 12, 1948, at Hesquiat on the west coast of Vancouver Island at a depth of 4 fathoms. The name pogy was applied to this species by Clemens and Wilby in 1946, and the name redtail surfperch is now recommended by the AFS/ASIH committee.

Range: Southern California to Vancouver Island.

#### **White seaperch**

*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), IX to XI, 20 to 26, 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, 56 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.



FIGURE 118. White seaperch. *Phanerodon furcatus* Girard 1854

Distinguished by the continuous low margin of the dorsal fin and the silvery coloration.

The white seaperch 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 specimen was evidently *Damalichthys vacca*. The white seaperch is a southern species and may be an uncommon inhabitant of British Columbia waters.

Range: Southern California to Vancouver Island.

### **Pile seaperch**

*Damalichthys vacca* Girard 1885

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), IX to XI, 21 to 25, spinous portion low, last spine slightly more than half length of first ray; rayed portion high anteriorly, margin distinctly concave; anal, III, 25 to 30; pelvic, I, 5, thoracic; caudal, furcate. Lateral line: high on body anteriorly. Scales: cycloid, small; on lateral line, 56 to 69; 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; blotches of darker on upper part of body, 3 or 4, sometimes 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.



FIGURE 119. Pile seaperch. *Damalichthys vacca* Girard 1855

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 pile seaperch 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 years 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 handlines baited with marine worms and affords considerable sport for the youthful angler. This species was called the dusky sea-perch by Clemens and Wilby (1946), and the name pile perch is recommended by the AFS/ASIH committee.

Range: Southern California to southeastern Alaska.

### **Striped seaperch**

*Embiotoca lateralis* L. 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 to 26, spinous portion low, last spine about three-quarters length of first ray, rayed portion high anteriorly; anal, III, 29 to 33, high; pelvic, I, 5, thoracic; caudal, furcate. Lateral line: high on body anteriorly. Scales: cycloid, small; on lateral line, 59 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 head and body; bluish black on dorsal and anal fins except for posterior margins, pronounced in males in spring months; tint of golden yellow on pectoral fins; bluish black on pelvic fins; dusky on caudal fins, bluish black along dorsal and ventral margins in males in spring months.

Length to 15 inches.



FIGURE 120. Striped seaperch. *Embiotoca lateralis* L. Agassiz 1854

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 head and body.

The striped seaperch 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 specimens from Esquimalt Harbour, collected by Mr J. K. Lord, as *Ditrema jacksoni*. These are believed by Dr L. P. Schultz to be the species *lateralis*. The striped seaperch 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. It was recorded in 1946 by Clemens and Wilby as *Taeniotoca lateralis* (Agassiz), the blue sea-perch.

Range: Southern California to southeastern Alaska.

### Shiner seaperch

*Cymatogaster aggregata* 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), VIII to XI, 18 to 23, rayed portion long; anal, III, 22 to 25; pelvic, I, 5, thoracic; caudal, furcate. Lateral line; high on body anteriorly. Scales: cycloid, large; on lateral line, 36 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 portions of sides, particularly on anterior half, bars across sides below lateral line, 3, vertical; males in winter and spring almost entirely black.

Length to 8 inches.



FIGURE 121. Shiner seaperch. *Cymatogaster aggregata* 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 shiner seaperch 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 months 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 local 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 young remain within the female for a considerable time before birth. There is a special arrangement for respiration and apparently food is supplied by the body fluids. The food of the liberated fish consists of small crustaceans and other invertebrates. Frequently the shiner seaperches may be observed around wharves nipping off the appendages of barnacles. This species is popularly called the shiner or yellow shiner. The latter name was used in 1946 by Clemens and Wilby, and the AFS/ASIH committee recommends shiner perch.

Range Southern California to southeastern Alaska.

### **Kelp seaperch**

*Brachyistius frenatus* Gill 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 X, 13 to 16, high, rayed portion short; anal, III, 21 to 25; pelvic, I, 5, thoracic; caudal, furcate. Lateral line: high on body anteriorly. Scales: cycloid, large; on lateral line, 37 to 44; 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 to golden on ventral surface; bluish punctulations in series of longitudinal rows on sides; pale on fins.

Length to 8 inches.

Distinguished by the large scales, the stout caudal peduncle, 13 to 16 rays in the dorsal fin, and the frenum between the lower lip and the symphysis of the lower jaw.

The kelp seaperch 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 7½ 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. It was recorded in 1946 by Clemens and Wilby as *Brachyistius brevipinnis* (Günther), the brown sea-perch. The kelp seaperch is obtained occasionally in the Departure Bay area. Typically they live around the kelps and occur to depths of 15 fathoms: In California they mature in the first year. They are carnivorous, feeding chiefly upon crustaceans. The name kelp perch is recommended by the AFS/ASIH committee.

Range: Southern California to Strait of Georgia.





FIGURE 122. Kelp seaperch. *Brachyistius frenatus* Gill 1862

Family TRICHODONTIDAE

Sandfishes

In the sandfishes 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 sandfishes 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 be discovered eventually in the northern waters of the Province.

**Sandfish**

*Trichodon trichodon* (Tilesius) 1811

Body moderately elongate, deep anteriorly, much compressed. Head moderate, length about 3.5 in standard length; mouth terminal, large, opening 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, procurrent; caudal, furcate. 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 broad procurrent pectoral fins and the absence of scales.

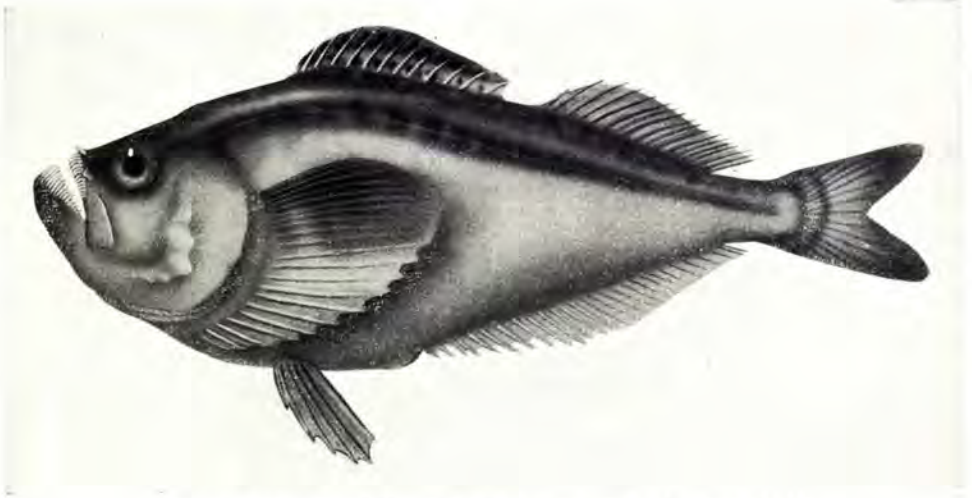


FIGURE 123. Sandfish. *Trichodon trichodon* (Tilesius) 1811

The sandfish 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 mouths of the Skeena and Nass Rivers. Though not obtained frequently it appears to be distributed widely, particularly in Hecate Strait where numbers are taken in otter trawls. It is common in shallow water along the east coast of the Queen Charlotte Islands. A specimen from Wickaninnish Bay (Long Beach), was discovered on 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 chinook salmon. On October 9, 1957, specimens were taken in Swanson Channel by W. Egeland in an otter trawl and are now in the Provincial Museum at Victoria. The name Pacific sandfish is recommended by the AFS/ASIH committee.

Range: Northern California to Bering Sea.

Family SCIAENIDAE

Croakers

In the croakers the body is elongate, somewhat compressed. The premaxillary forms the upper jaw; 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, each with a fleshy appendage at the base.

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 used sometimes as ornaments or carried as "lucky-stones."

### White seabass

*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, 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, 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.



FIGURE 124. White seabass. *Cynoscion nobilis* (Ayres) 1860

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 seabass 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 on July 15, 1906, in a fish trap at

Sherringham Point and is now in the Provincial Museum at Victoria. On September 23, 1958, a specimen was obtained in Toba Inlet. The species is observed rather frequently in Juan de Fuca Strait and on the west coast of Vancouver Island. In California waters it is abundant, ranking high 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 and other invertebrates.

Range: Southern California to southeastern Alaska.

**White croaker**

*Genyonemus lineatus* (Ayles) 1855

Body elongate, somewhat compressed. Head bluntly rounded; mouth sub-terminal, 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; with small fleshy appendage at base; pectoral shorter than head, pointed; 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 to brassy on dorsal surface; prominent on inner base of each pectoral fin, extending onto body.

Length to 13 inches.



FIGURE 125. White croaker. *Genyonemus lineatus* (Ayles) 1855

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 inner base of each pectoral fin, extending onto body.

The white croaker was first taken in British Columbia waters on 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 white croaker 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. This species is also known as kingfish or king-fish; the latter form was used in 1946 by Clemens and Wilby.

Range: Southern California to Vancouver Island.

Family HISTIOPHORIDAE

Boarfishes

In the boarfishes the body is stout and compressed. The head is large with a small terminal mouth in which there are fine teeth on the jaws, sometimes on the vomer. The spines in the dorsal, anal and pelvic fins are strongly developed.

The family consists of a few fishes which ordinarily inhabit fairly deep water and are widely distributed in the oceans.

**Boarfish**

*Pseudopentaceros richardsoni* (Smith) 1849

Body stout, compressed, ovate; depth 2.4 in standard length. Head large, pointed; length about 3 in standard length; mouth terminal, small; lower jaw slightly projecting; maxillary broad posteriorly, not extending to anterior margin of eye; teeth small, conical, in jaws and on vomer. Bones on head and above pectoral fins, strongly striate; eye large, diameter 3.9 in length of head. Fins: dorsal XIII or XIV, 9 or 10, long; anal, IV, 7 to 9; pelvic, I, 5, thoracic, spine strong; pectoral, shorter than head, pointed; caudal, slightly emarginate. Lateral line: highly arched, following dorsal contour of body to point above anus, sharply decurved, then straight. Scales: weakly ctenoid, small, on body and head. Pores: on lateral line, 64 to 66. Colour: bluish brown on dorsal surface, lighter on ventral surface; various shades of red on head; bluish to black on membranes of dorsal fin; orange on spines of anal and pelvic fins, bluish on membranes; iridescent blue on pectoral fins.

Length to 21 inches.

Distinguished by the ovate body, the exposed striate bones of the head and anterior part of the body and the highly arched lateral line.

The boarfish was first taken in British Columbia waters on September 17, 1956, by the M. V. *Paragon*, Lat. 49° N, Long. 150° W, in a gill net set near the surface, and was recorded (1957) by Welander, Johnson and Hajny. Two others were obtained much farther west and south in the same year. A second individual was secured on August 26, 1958, Lat. 50° N, Long. 145° W, (the Canadian

weathership station) by the M. V. *Fort Ross* and it is now in the museum of the Institute of Fisheries at the University of British Columbia. This species has heretofore been reported from the Cape of Good Hope and near New Zealand.

Range: West of Vancouver Island.

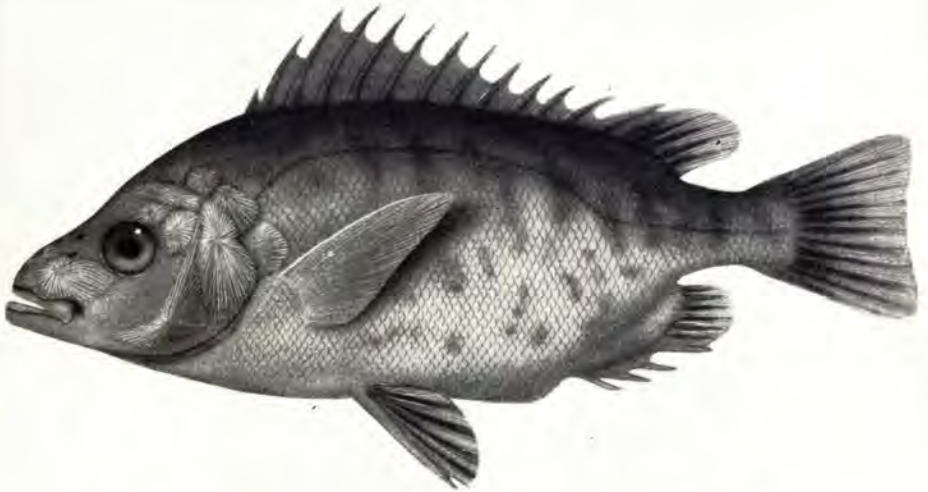


FIGURE 126. Boarfish. *Pseudopentaceros richardsoni* (Smith) 1849

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 distributed widely in both the Atlantic and Pacific oceans. The name *Brama* was applied because of a fancied resemblance to the freshwater 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, I, 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: upcurved 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.

Length to 4 feet.

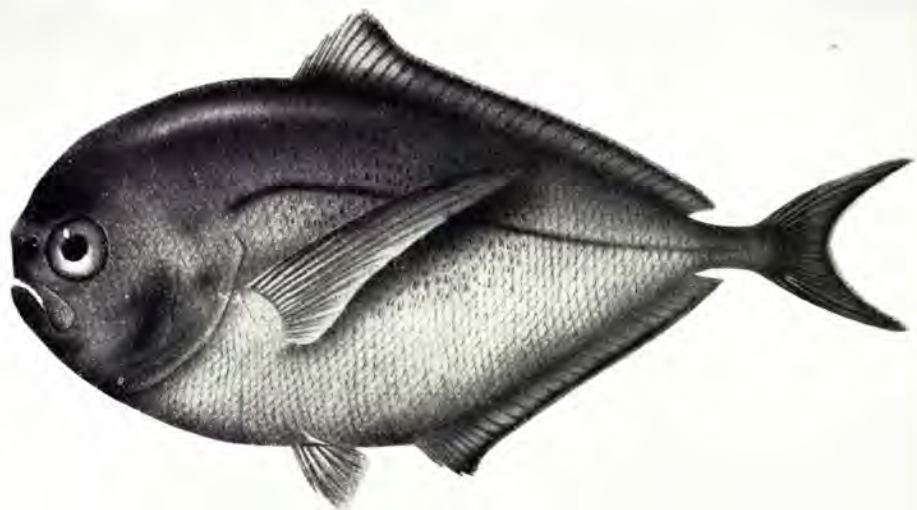


FIGURE 127. Pomfret. *Brama raii* (Bloch) 1791

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 on July 27, 1926, at Ucluelet by Dr H. C. Williamson and is now in the collection of the Royal Ontario Museum of Zoology at Toronto. In most 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 operations. Again, in 1956, they were exceptionally abundant

off the Queen Charlotte Islands where the water temperature was 57°F. The food consisted of squid, fish and crustaceans. The pomfret is also referred to as Ray's bream. It is said to be an excellent food fish.

Range: Southern California to Gulf of Alaska.

#### Family CARANGIDAE

#### Jacks

In the jacks the body is elongate to deep with a very slender caudal peduncle. The scales are cycloid. The lateral line is complete, arched anteriorly, straight posteriorly, sometimes armed with large spinous scales. There are 2 dorsal fins, the first spinous, much shorter than the second and usually depressible in a groove; the first anal fin is small, supported by two spines and the caudal fin is widely forked.

The jacks are pelagic, mostly swift swimmers and are abundant in warm seas.

#### Mackereljack

*Trachurus symmetricus* (Ayres) 1855

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 anteriorly and posteriorly with strong transparent membranes. Fins: dorsal (2), VIII—I, 28 to 38, spinous fin triangular, depressible in groove, much shorter than second, rayed fin high anteriorly, depressible in groove, low posteriorly, followed by free finlet; anal (2), II—I, 22 to 33, anterior fin depressible in groove; posterior fin high anteriorly, low posteriorly, followed by free finlet in adult; pelvic I, 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; accessory lateral line close to base of first dorsal fin, extending usually to base of anterior portion of second dorsal fin. Scales: cycloid; on lateral line, 41 to 54 + 40 to 55, smooth anteriorly, scute-like, spinous posteriorly. Colour: metallic blue on dorsal surface; somewhat silvery on ventral surface.

Length to 2 feet 4 inches.

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 spinous scute-like scales on the posterior straight portion.

The mackereljack was first taken in British Columbia waters on 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 and they were sent to the Biological Station at Nanaimo. During the following 5 years several other individuals were secured in the same general region and one was obtained from Massett Inlet. In December 1944, the attention of the authors



was drawn to a shipment of 5 tons of these fish in cold storage in Vancouver, which had been secured 4 months previously east of Moresby Island in Selwyn Channel in a purse seine. There is a report that about 1939 over 8 tons of mackereljacks had been landed on the west coast of Vancouver Island at Kildonan and after being held in cold storage for several years were reduced finally to oil and meal. The species has been taken quite commonly every summer from 1956 to 1959 inclusive in gill-netting operations of research vessels fishing on the high seas off the British Columbia coast. It was recorded in 1946 by Clemens and Wilby as *Decapterus polyaspis* Walford and Myers, with scad as the English name. The name recommended by the AFS/ASIH committee is jack mackerel.

Range: Northern California to southeastern Alaska.

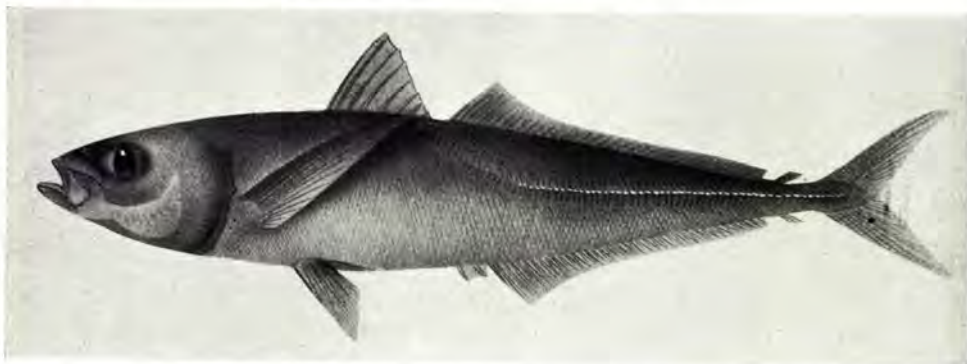


FIGURE 128. Mackereljack. *Trachurus symmetricus* (Ayres) 1855

#### 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 considerable 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.

Among the families included in this suborder are: the Scombridae, mackerels; Istiophoridae, sailfishes and Xiphiidae, swordfishes, but only the first is represented in British Columbia waters.

#### 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 one spine and five rays.

The mackerels travel in schools and 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 tunnies, bonitos, albacores and mackerels, all of which are of great importance as commercial and sport fishes.

### 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: 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.

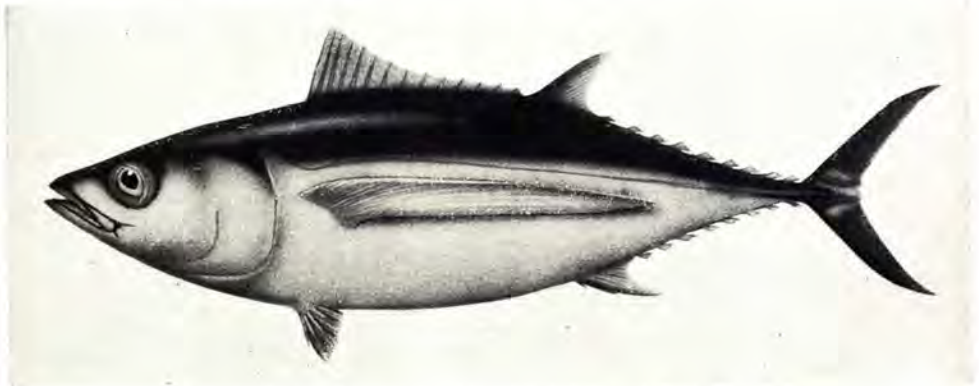


FIGURE 129. Albacore. *Thunnus alalunga* (Gmelin) 1788

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 captured on 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

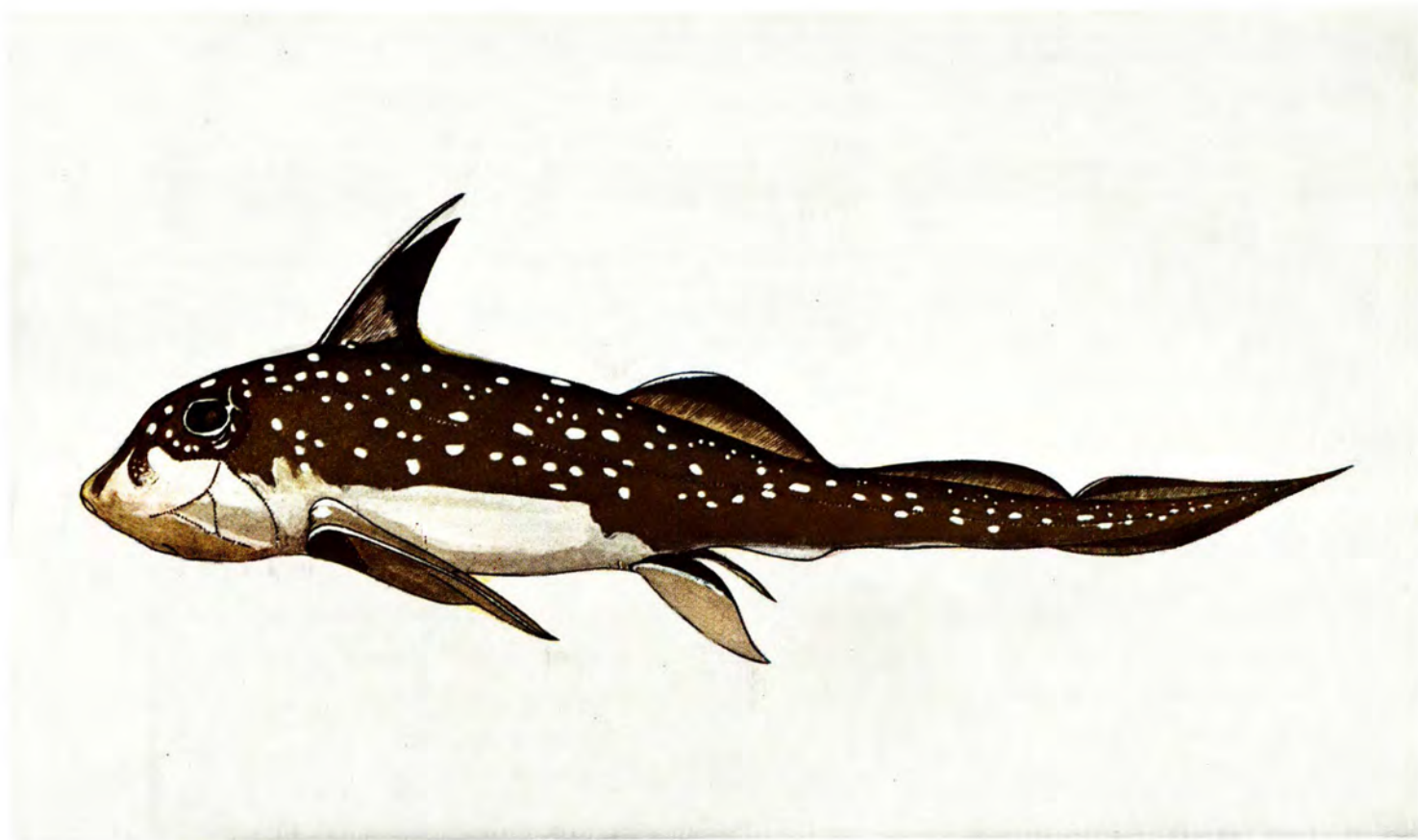


PLATE I. Ratfish (*Hydrolagus collieti*). A female, 24 inches long.



PLATE II. Coho salmon (*Oncorhynchus kisutch*). Above: a breeding male, 28 inches long. Below: a male from salt water, 26 inches long.



PLATE III. Opah (*Lampris regius*). Length 15 inches (to fork of tail).

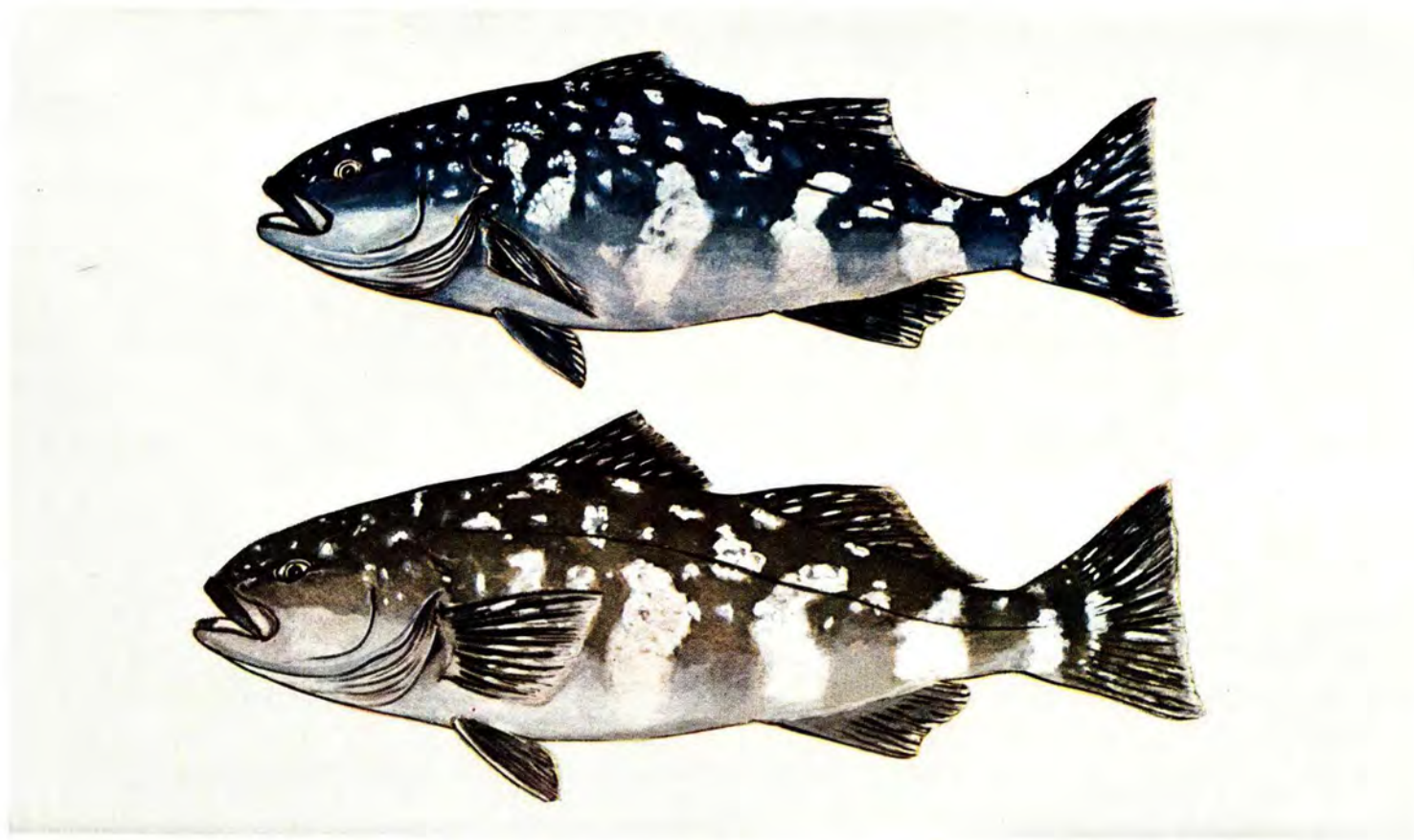


PLATE IV. Skilfish (*Erelepis zonifer*). Two shades of colour, illustrated on a specimen 36 inches long.