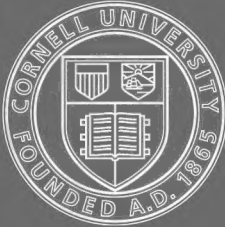


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An annotated list of Puget Sound fishes,



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STATE OF WASHINGTON
DEPARTMENT OF FISHERIES

AN ANNOTATED LIST
OF
PUGET SOUND FISHES

By TREVOR KINCAID
University of Washington
SEATTLE, WASHINGTON

Prepared at the Request of and Issued by
L. H. DARWIN
State Fish Commissioner

August 20, 1919

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1919

Hon. L. H. Darwin, State Fish Commissioner, Seattle, Washington.

In compliance with your request, herewith data and illustrations of 115 of the more common varieties of the nearly 200 kinds of fish life of Puget Sound.

TREVOR KINCAID,
University of Washington.

Seattle, Washington, August 18, 1919.

AN ANNOTATED LIST OF PUGET SOUND FISHES.

By TREVOR KINCAID, University of Washington.

Prepared at the Request of and Issued by

L. H. DARWIN,
State Fish Commissioner.

So many inquiries have been made in recent years in regard to our native fishes, it was deemed advisable to publish a brief popular survey of our fish fauna for the benefit of those interested in the marine life of this region.

The most recent list of the species of fish found in Puget Sound was published by Professor E. C. Starks of Stanford University in 1911. He enumerates 168 forms of fish' life known to exist in our waters or recorded from contiguous Canadian territory with the presumption that they occur in Puget Sound. Several species have come to light since his paper was published and there is little doubt the number of kinds of fish in this region will be increased to at least 200 in the near future.

Many of the species now on record are extremely rare, although this may simply mean we do not know where or how to search for them. In some cases but a single specimen has ever been seen and a number are recorded from a knowledge of less than half a dozen examples. Some are strays from southern waters or have straggled down from Alaska, while others have been swept into Puget Sound by some unusual circumstance from the open ocean where they normally reside.

The richness of the Puget Sound fauna is doubtless due to the fact that we have here a meeting place for two great centers of marine evolution. Many species of animals originally developed in Alaska have gradually extended their range till they reached the Sound, while from the other great center off the shores of California a similar migration has occurred in times past. Thus Puget Sound is the southern limit of the distribution of many northern forms, while it is likewise the northern limit of a number of southern species.

The greatest diversity of fishes within our territory is to be found in the waters about the San Juan Islands, where a surprising diversity in depth and shore conformation make for a remarkable display of marine life. The central and southern sections of the Sound are, however, well provided with representatives of the finny tribes, as may well be seen when the proper equipment is brought into use to compel them to emerge from their hidden haunts.

Owing to the limits of space it was deemed inadvisable to give detailed descriptions of the various species, but rather to point out a few of the more salient characteristics and to depend mainly on the use of copious illustrations to delineate as many as possible of the local forms. For those desiring to study our fishes in a more extended manner we would advise the use of the great monograph of the fishes of America published by Jordan and Evermann as Bulletin 47 of the

United States National Museum, which is a veritable monument to the patience and taxonomic skill of the authors. For similar reasons it has been decided not to incorporate analytical keys of the species, as these involve a technical knowledge of fish anatomy which the average person is not likely to attempt to master. A further limitation of the present list is the exclusion of species confined to fresh water.

When we pass from the classification of our native fishes to a discussion of their habits and economic relations we discover a great hiatus, since little has been done along these lines except when some immediate economic stimulus has provided the spur to effort. Hardly a beginning has been made in this field of investigation.

Of the species listed at least 70 are definitely known to be of value as human food, but of course, many of these are not customarily marketed. Some of them are too small, others are rare or else do not attract the public taste in competition with well established food fishes. It is on the other hand rather obvious that most of the smaller varieties furnish food for the larger edible fish, and hence are of great indirect value in the maintenance of our fisheries.

In assembling the illustrations used in this report numerous sources were drawn upon. The majority of the cuts were originally published in the great monograph of American fishes previously mentioned and were made under the direction of Dr. David Starr Jordan of Stanford University. Several were taken from a bulletin of the United States Fish Commission dealing with the fishes of Alaska, written by Dr. B. W. Evermann. Professor Starks of Stanford has contributed a number of the important papers on the fishes of Puget Sound and several of his illustrations have been utilized. Use has also been made of figures prepared by Dr. Charles H. Gilbert, who has published many valuable papers dealing with the fishes of the Pacific. In a number of cases no illustration could be found in the literature available. To assist in the identification of such species closely similar forms, belonging to the same genus, have been illustrated for comparison.

In attempting to point out the salient characteristics of the species enumerated in the following list, it is necessary to use some of the technical phraseology of the ichthyologist and a cut is therefore given to illustrate the more important superficial features in the structure of a fish. Where doubt exists as to the identification of fishes found in our waters, specimens may be sent to the College of Fisheries at the University of Washington where material is at hand for more exact comparison.

Many of our fishes are so seldom seen, even by persons in close contact with fishing operations, but few of them have received common names, and many of these are more or less misleading. The names presented in the following pages are offered in the hope of filling this hiatus, although better ones will no doubt be evolved for many of the species as they become more familiar.

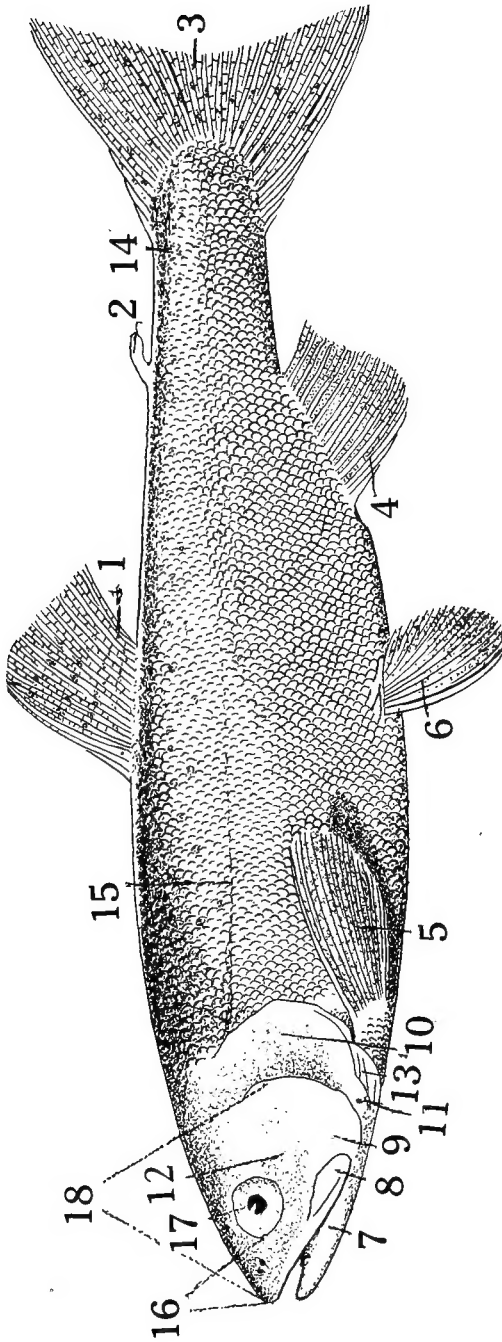


DIAGRAM OF A SALMON TO SHOW THE GENERAL EXTERNAL STRUCTURE

- | | | |
|------------------|---------------------------|----------------------|
| 1. Dorsal fin. | 7. Lower jaw. | 13. Branchiostegals. |
| 2. Adipose fin. | 8. Upper jaw. | 14. Caudal peduncle. |
| 3. Caudal fin. | 9. Lower part of cheek. | 15. Lateral line. |
| 4. Anal fin. | 10. Opercle. | 16. Snout. |
| 5. Pectoral fin. | 11. Lower opercular area. | 17. Eye. |
| 6. Ventral fin. | 12. Cheek. | 18. Head. |

FAMILY 1. LAMPREY EELS; PETROMYZONIDAE.

In the strict sense of the word the lampreys are not really fish at all, but they are so fish-like in character it is customary to include them in a list of this group of vertebrates. They may be recognized by their elongate eel-like form, the absence of both the pectoral and ventral fins and the peculiar character of the mouth. No jaws are present, but in their place we have a sucking apparatus analogous to that of a leech.

Two species of lampreys occur in Puget Sound. The Sea Lamprey, *Entosphenus tridentatus* (Gairdner), (Fig. 1) is a large species, several feet in length, which may be recognized by the form of the dorsal fin, the latter being divided into two separate parts. It has migratory habits similar to those of the salmon, leaving the sea and ascending the rivers to spawn. The Brook Lamprey, *Lampetra cibaria* (Girard), is a smaller species about five inches long. It differs from the Sea Lamprey in the form of the dorsal fins which are connected together so as to form a continuous structure. The Sea Lamprey is edible but is not commonly employed as food.

FAMILY 2. THE COW-SHARKS; HEXANCHIDAE.

Two species of this family are found in our waters. The Common Cow-Shark, *Hexanchus griseus* (Gmelin), (Fig. 3) is the most frequently seen of our larger sharks. It can easily be recognized by the presence of a single dorsal fin and the existence of six gill-clefts or openings into the gill chamber. It attains a great size, specimens over 28 feet in length being on record.

The Spotted Cow-Shark, *Notorhynchus maculatus* (Ayres), (Fig. 2) is a smaller and less common variety. Like the Cow-Shark it has a single dorsal fin, but the gill-clefts are seven in number. It is more slender in form than its relative, and as its name indicates it is covered with large black spots on a gray ground-color.

FAMILY 3. BLUE SHARKS; GALEIDAE.

Here belongs the beautiful Blue Shark, *Prionace glauca* (Linnaeus), (Fig. 4). This species attains dimensions of 25 feet but specimens of this size are rare in our waters. Two dorsal fins are present, but these do not have spines connected with them. The snout is long and sharp and the pectoral fin is elongate and wing-shaped. As suggested by the name, the color of this fish is bright blue-gray above and pale beneath.

FAMILY 4. CAT-SHARKS; SCYLLIORHINIDAE.

Only one member of this family is known to inhabit the Sound and it is very rare. The only specimens seen by the writer were taken in Hoods Canal. The Brown Cat-Shark, *Catulus brunneus* (Gilbert) may be recognized immediately by the peculiar form of the tail, which

is bent downwards and not upwards as is almost invariably the case in other sharks. There are two dorsal fins, neither of which is provided with spines.

FAMILY 5. SCYMNOID SHARKS; DALATIDAE.

Here belongs the great Sleeper Shark, *Somniosus microcephalus* (Bloch). This species has no anal fin. The fins are all small and spines are lacking in the two dorsals. They are large clumsy fish, attaining dimensions of 25 feet, and are extremely ferocious.

FAMILY 6. DOG FISHES; SQUALIDAE.

The most abundant of the sharks in our waters is the omnipresent Dog Fish, *Squalus sucklii* (Girard), (Fig. 5). It differs from the preceding species in that it has two dorsal fins, each provided with a long sharp spine. The anal fin is lacking and the lower lobe of the tail is comparatively small. This species has come into prominence recently, under the sobriquet of Grayfish, as an article of food. Owing to difficulties encountered in canning the packing of Grayfish has ceased for the present, but an excellent smoked product is put up, which commands a ready sale. The value of the Dogfish in producing oil and fertilizer has long been recognized and great quantities have been taken from the Sound and utilized for these purposes.

FAMILY 7. RAYS AND SKATES; RAJIDAE.

The Rays are near relatives of the Sharks but are recognized by their strange flattened form. The wing-like extensions at the sides of the body represent the greatly modified pectoral fins of other fish. The tail is produced into a long whip-like structure and the gill openings are on the under side of the body. The eggs are laid in large brown cases from which the young escape when the yolk has been absorbed.

Three members of this family inhabit our waters. The Spotted Ray, *Raja binoculata* (Girard), is our commonest species. It becomes very large, specimens weighing over a hundred pounds being on record. The common name of this form is derived from the presence of two large eye-like spots on the back of the fish when it is young. These become faint as the animal grows older. The most distinctive structural feature of the Spotted Ray is the shape of the ventral fin which is regularly concave on its free margin. The Snouted Ray, *Raja rhina* (Jordan and Gilbert), is similar to the Spotted Ray but the snout is sharper and the ventral fins are of a different shape, a large rounded notch being present on the free border. The Spiny Ray, *Raja stellulata* (Jordan and Gilbert), (Fig. 6) resembles the two species just described, but differs in the presence of a great number of small spines over the surface of the body. The snout is blunt and rounded and the ventral fin is deeply notched on its free margin.

EXPLANATION OF FIGURES.

1. Sea Lamprey, *Entosphenus tridentatus* (Gairdner).
2. Spotted Cow-Shark, *Notorhynchus maculatus* (Ayres).
3. Cow-Shark, *Hexanchus griseus* (Gmelin).
4. Blue Shark, *Prionace glauca* (Linnaeus).
5. Dogfish, *Squalus sucklii* (Girard).
6. Spiny Ray, *Raja stellulata* (Jordan and Gilbert).
7. Ratfish, *Chimaera colliaei* (Lay and Bennett).
8. Sturgeon, *Acipenser* sp.
9. Pacific Herring, *Clupea pallasii* (Cuvier and Valenciennes).
10. Snipe Eel, *Nemichthys avocetta* (Jordan and Gilbert).
11. California Sardina, *Sardinia caerulea* (Girard).
12. Northern Anchovy, *Engraulis mordax* (Girard).
13. Shad, *Alosa sapidissima* (Wilson).
14. Dog Salmon or Chum, *Oncorhynchus keta* (Walbaum).



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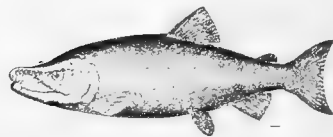
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FAMILY 8. RAT-FISHES; CHIMAERIDAE.

The common Rat-fish, *Chimaera colliaci* (Lay and Bennett), (Fig. 7) is our only representative of this curious group, which bridges the gap between the elasmobranch and teleost fishes. The gill openings are not exposed as in the shark but are protected by an operculum as in the higher fishes. The head is clumsy and irregular and the body tapers off to a long slender tail. The teeth resemble the incisors of a rat, which accounts for the common name. The eyes are large, prominent and of an opalescent greenish color. In the male a strange knobbed structure is found attached to the top of the head. The body is beautifully mottled with gray and silvery white. The rat-fish is valuable for the oil which is extracted from the liver.

FAMILY 9. STURGEONS; ACIPENSERIDAE.

Members of this family are recognized by the absence of scales which are replaced by rows of great bony plates which extend along the sides. The snout is shovel-shaped and has five long barbels hanging down in front of the mouth.

Two species of sturgeon occur in our waters. The White Sturgeon, *Acipenser transmontanus* (Richardson), (Fig. 8) is a fish which attains an immense size, specimens weighing 1,000 pounds having been taken. Like the salmon it ascends the rivers to spawn. The sturgeon is a valuable food fish and the roe is suitable for the manufacture of caviare. It was so eagerly fished it has become quite scarce.

The Green Sturgeon, *Acipenser medirostris* (Ayres), is a near relative of the White Sturgeon but does not attain such a great size. It is of a peculiar greenish hue, with light olive stripes on the ventral surface. It is not valued as a food fish and by some is thought to be poisonous, although this belief is not justified.

FAMILY 10. SNIPE EELS; NEMICHTHYIDAE.

The Pacific Snipe Eel, *Nemichthys avocetta* (Jordan and Gilbert), (Fig. 10) is a strange and comparatively rare fish. It is a long snake-like creature, about two feet in length and one-third of an inch in thickness. The jaws are long and slender like the beak of a snipe, hence the name. It is almost transparent and is practically invisible as it swims through the water.

FAMILY 11. HERRINGS; CLUPEIDAE.

The members of this family, of which we have three species in our local waters, are constructed upon the plan of the common herring. The body is covered with large rounded scales. There is no adipose fin and the ventral fins are located well back on the under side. The tail is deeply forked. There are no scales on the head.

The Pacific Herring, *Clupea pallasii* (Cuvier and Valenciennes), (Fig. 9) is very closely related to the herring of the Atlantic. It is one of our most important food fishes and is destined to form the basis of an immense industry in the years to come. The young fish are already packed in great quantities on the California coast as sardines, and in Alaska the salting of herring has assumed considerable proportions.

The California Sardine, *Sardinia caerulea* (Girard), (Fig. 11) resembles the herring but can be distinguished from the latter at a glance by the presence of a fan-shaped group of ridges on the gill cover. The lack of teeth in the roof of the mouth is also diagnostic as these are not present in the sardine. This fish is closely allied to the pilchard of Europe and is a most desirable food fish as it is superior in many respects to the herring.

The Shad, *Alosa sapidissima* (Wilson), (Fig. 13) is not native to our waters but was introduced into the Pacific a number of years ago and has now multiplied extensively. The general anatomical peculiarities of the shad follow the lines of the herring, but the body is deeper and the breast and belly possess saw-like serrations. It spawns in fresh water. This species is little appreciated as a food fish on the Pacific Coast, but is growing in importance.

FAMILY 12. ANCHOVIES; ENGRAULIDAE.

This family is closely related to the herrings, but may be distinguished by the large size of the mouth and the overhanging snout, which extends beyond the mouth opening.

The Northern Anchovy, *Engraulis mordax* (Girard), (Fig. 12) is a slender, graceful fish with a bluish back and silvery sides. It is a valuable food fish, but is little used at present, although some are canned as sardines on the California coast. The species attain a length of 7 inches.

FAMILY 13. SALMON AND TROUT; SALMONIDAE.

From an economic standpoint this family of fishes overshadows all others on the Pacific Coast, since it includes the five species of Pacific Salmon which form such a conspicuous feature in the preserved fish trade of the world.

The most characteristic structure in the anatomy of members of this group is the curious organ known as the adipose fin. This is not confined to the Salmonidae, however, as it exists in several other families of fishes. The ventral fins are far back on the body. The body is covered with circular scales, but these are absent from the head. The dorsal-fin has from 9 to 15 rays. A lateral line is present on the side. Three genera are represented in our fauna.

The fish known commercially as Pacific Salmon are zoologically different from the Atlantic Salmon, the former belonging to the genus *Oncorhynchus* while the latter is a species of *Salmo*. The technical differences between these two genera are rather finely drawn, but the crucial point is in the count of the rays in the anal fin. In *Salmo* the number ranges from 9 to 12, while in *Oncorhynchus* there are from 14 to 20. Five species of Pacific Salmon exist in our waters.

The Chinook Salmon, *Oncorhynchus tshawytscha* (Walbaum), (Fig. 15) is the noblest of the salmon tribe since it outranks all other species in size and quality. Specimens are on record weighing more than 100 pounds. In different parts of its range it has been given a number of common names such as Tyee, King, Quinnot, Spring, etc. The technical points that mark this species from its relatives are as follows. The gillrakers number from 20 to 25. The scales are of medium size, 135 to 155 in longitudinal series. The branchiostegal rays number from 15 to 19. The back and upper fins are marked with round black spots.

The Sockeye, *Oncorhynchus nerka* (Walbaum), (Fig. 17) is known in other parts of its range as Blueback and Red Salmon. It is of immense economic importance because it constitutes the main run of salmon in the rivers of Alaska and British Columbia. It is discriminated by the following combination of characters. The gillrakers are numerous, ranging from 30 to 40. The scales are large. The count of scales on the lateral line is about 130, while the number of branchiostegal rays is from 13 to 15. The color is clear blue above and silvery on the sides. In the adult there is no black spotting, but in the young fish obscure markings are present. During the breeding period the color changes, more or less dark red appearing on the back and sides. The Sockeye attains a length of two feet and a weight of from 3 to 7 pounds. It does not run in rivers that are unconnected with lakes.

The Silver Salmon or Coho, *Oncorhynchus kisutch* (Walbaum), (Fig. 16) stands third in commercial importance among the Salmon. It attains a length of 15 inches and a weight of from 3 to 8 pounds. It is particularly abundant in Puget Sound and is particularly valuable as a fresh product. The Silver can be recognized by its peculiar bluish green back and silvery sides. Spots are absent except a few obscure markings on the upper portions of the body. The scales are relatively large, with 125 to 135 in longitudinal series. The anal fin has 13 or 14 rays while the branchiostegals number the same.

The Humpback or Pink Salmon, *Oncorhynchus gorbuscha* (Walbaum), (Fig. 18) is the smallest species in the genus, attaining a weight of 3 to 6 pounds. It is regarded as of inferior merit as a canned product but considerable quantities of it are put up for the market. It may be distinguished by the scales, which are very small,

with more than 200 in longitudinal series, and by the large oblong markings on the tail fin. The number of anal rays is 15 while in the branchiostegals 11 or 12 are present. The color of the back is blue, that of the sides silvery. Numerous small black dots are scattered over the dorsal surface.

The Dog Salmon or Chum, *Oncorhynchus keta* (Walbaum), (Fig. 14) is an abundant species in Puget Sound, but has not been utilized extensively until recent years, when the pressure for fish has brought it into the market. The scales are of medium size, with 135 to 155 in longitudinal series. The anal rays and branchiostegals both vary from 13 to 14. The color is dusky above, with the sides paler. Black markings are absent or faintly indicated. The Dog Salmon attains a weight of 11 or 12 pounds. It runs in quite small streams and spawns near the sea.

The genus *Salmo* contains species that are, zoologically speaking, close kin to the Atlantic Salmon. We have three species in this region, but only two appear in the salt water.

Salmo gairdneri (Richardson), (Fig. 19) is the scientific name of the fish known as the Steelhead or Salmon Trout. This is one of our most valuable food fishes, since it is abundant in all of our coastal streams and attains a considerable size. Specimens may weigh up to 20 pounds, although the average is apt to be 5 or 6. Unlike the Pacific Salmon the Steelhead does not perish after spawning, but like its relative, the Atlantic Salmon, may return to the sea. Great quantities of this species are used, both fresh and canned. The Steelhead may be immediately separated from the Pacific Salmon by the lesser number of rays in the anal fin, the usual count being 11. The back of the Steelhead is dark blue and the sides silvery with a band of rose color running lengthwise. Numerous small black dots are scattered over the upper surface of the body, but not extending below the lateral line. The strip of red on the lower jaw so characteristic of the Cut-throat Trout, is lacking.

The Cut-throat Trout, *Salmo mykiss* (Walbaum), (Fig. 20) is ordinarily thought of as a fresh-water fish, but it descends to the estuaries of the rivers which it inhabits and may be found in salt water at considerable distances from any stream. It is extremely variable in its characteristics, and in some instances is hard to distinguish from the steelhead. The most constant mark of the species is the streak of red on the lower jaw, which gives rise to the common name. The scales are smaller than in the Steelhead, and the black spotting is spread over the area below the lateral line and intensified in the region of the tail.

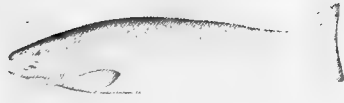
The Dolly Varden Trout, *Salvelinus malma* (Walbaum), (Fig. 21) is technically not a trout at all, but a charr. It has a number of common names including Bull Trout, Oregon Charr, etc. Aside from the

EXPLANATION OF FIGURES.

15. Chinook or Spring Salmon, *Oncorhynchus tshawytscha* (Walbaum).
16. Silver or Cho Salmon, *Oncorhynchus kisutch* (Walbaum).
17. Sockeye or Red Salmon, *Oncorhynchus nerka* (Walbaum).
18. Humpback or Pink Salmon, *Oncorhynchus gorbuscha* (Walbaum).
19. Steelhead Trout, *Salmo gairdneri* (Richardson).
20. Cut-throat Trout, *Salmo mykiss* (Walbaum).
21. Dolly Varden Trout, *Salvelinus malma* (Walbaum).
22. Surf Smelt, *Hypomesus pretiosus* (Girard).
23. Eulachon or Candlefish, *Thaleichthys pacificus* (Richardson).
24. Pacific Smelt, *Osmerus thaleichthys* (Ayres).
25. Lantern Fish, *Myctophum* sp.
26. Lancet Fish, *Plagyodus ferox* (Lowe).
27. Sparkler, *Arctozenus coruscans* (Jordan and Gilbert).
28. Sand Lance, *Ammodytes personatus* (Girard).
29. Tube Snout, *Aulorhynchus flavidus* (Gill).



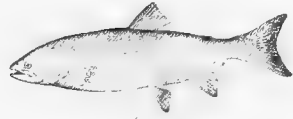
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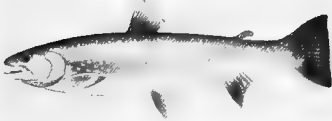
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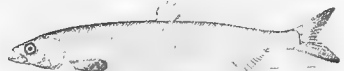
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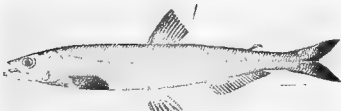
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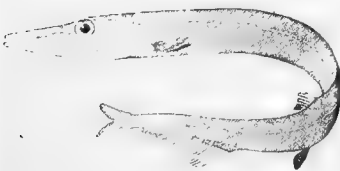
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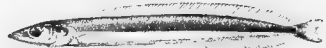
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anatomical peculiarities of this fish its color distinguishes it immediately from all allied forms. The sides are marked with round red spots which extend as smaller markings to the back. The delicate reticulate coloration, so characteristic of the brook trout and other charrs, is lacking. Like the Cut-throat Trout, the Dolly Varden is primarily a fresh water fish, and is merely a visitor in the brackish and salt water where it is so frequently found.

FAMILY 14. SMELTS; ARGENTINIDAE.

The smelts have much in common with the Salmonidae in structure. As in the latter an adipose fin is present. The ventral fins are small and are near the middle of the body. The dorsal fin is short and nearly median. The tail fin is deeply forked. Three genera are represented in our fauna, each with a single species.

The Surf Smelt, *Hypomesus pretiosus* (Girard), (Fig. 22) is an excellent food fish common in Puget Sound. It attains a length of a foot. The body is covered with scales of moderate size. The angle of the jaw extends to the middle of the eye, while anteriorly the lower jaw protrudes beyond the upper. It is light olive in color with a silvery band along the side. The eggs are laid in the surf.

The Eulachon or Candlefish, *Thaleichthys pacificus* (Richardson), (Fig. 23) is the finest of the smelts. The flesh is oily and of very delicate texture. The scales are small and firmly set in the skin. The mouth is large and the angle of the jaw extends beyond the middle of the eye. The color is pale with numerous fine dark dots over the upper surface. They are about a foot long and enter the rivers to spawn early in the spring.

The Pacific Smelt, *Osmerus thaleichthys* (Ayres), (Fig. 24) is a common fish in our waters, but is not highly regarded for its food value. It is smaller than the other smelts and its flesh is soft, although of agreeable flavor. The scales are of moderate size and loosely attached. The teeth are better developed than in the allied forms, those on the tongue being unusually large. The pectoral fins are elongated, reaching to the base of the ventrals.

FAMILY 15. LANTERN FISHES; MYCTOPHIDAE.

These are small deep-water fishes somewhat resembling smelt, since a small adipose fin is present. The scales are of relatively great size and along the sides occur a number of round clear spots, which in the live fish are phosphorescent, giving these fish their common name. Two species of this family occur in our waters. *Myctophum californiense* (Eigenmann and Eigenmann), (Fig. 25) may be termed the Pacific Lantern-fish. No figure of this species was available and an allied species of *Myctophum* has been reproduced in the accompanying cuts. Bean's Lantern-fish, *Tarletonbeania crenularis* (Jordan and Gilbert) is

an allied form known from a few examples taken at widely separated points. It differs from *Myctophum* in the absence of a lateral line, as well as in other anatomical details.

FAMILY 16. LANCET FISHES; PLAGYODONTIDAE.

In this family we have one of the rare species occasionally seen on our coast. The Lancet-fish, *Plagyodus ferox* (Lowe), (Fig. 26) is a large and ferocious creature, with long sharp teeth set in the wide opening mouth. The body tapers from head to tail and the dorsal fin, which is very high, extends nearly its whole length. The tail is long and deeply forked. The length of the fish is about three feet.

FAMILY 17. THE PARALEPIDS; PARALEPIDIDAE.

The rare fish known as *Arctozenus coruscans* (Jordan and Gilbert), (Fig. 27) which may be termed the Sparkler, is the only member of this family recorded from our region. Only one specimen is known to exist. It was taken at Port Townsend in 1880. The Sparkler is a small fish resembling a miniature Barracuda and is noteworthy for a row of phosphorescent spots on the lower jaw, which suggests the common name.

FAMILY 18. SAND LANCES; AMMODYTIDAE.

The common Sand Lance, *Ammodytes personatus* (Girard), (Fig. 28) is the sole type of this family found locally. It is a small silvery fish, six to eight inches in length, found along our shores, and having the peculiar habit of burying itself in the sand. The jaws are without teeth and the ventral fins are lacking. The dorsal fin is low and continuous. The body is covered with small scales and ends in a deeply forked tail. They are edible and are used also for bait.

FAMILY 19. TUBE-SNOUTS; AULORHYNCHIDAE.

In this family we have small odd-looking fish with the snout drawn out into a tubular projection. The eyes are large. Scales are absent and the tail is small and deeply forked. Our only species is the common Tube-snout, *Aulorhynchus flavidus* (Gill), (Fig. 29).

FAMILY 20. STICKLEBACKS; GASTEROSTEIDAE.

Sticklebacks are usually classed as fresh water fish, since they are abundant in interior lakes and streams, but marine and brackish water species are present along our coast. The Alaska Stickleback, *Gasterosteus cataphractus* (Pallas), (Fig. 30) is our local marine form. It is a small fish devoid of true scales, the latter being replaced by a series of large vertical oblong plates. The dorsal fin is preceded by several free spines and a large stout spine is developed in connection with the ventral fin. The damage done by the Stickleback is out of

proportion to his size as he is able to kill the fry of larger fish, notably the salmon, for which reason the Stickleback is known locally as the Salmon Killer.

FAMILY 21. PIPEFISHES; SYNGNATHIDAE.

Fishes of this family are the nearest relatives we have of the sea-horses so common in southern waters. The group is represented with us by the Gray-lined Pipe fish, *Syngnathus griseolineatus* (Ayres), (Fig. 31). The body is extremely long and slender and is enclosed in a tough covering of bony plates. The snout is long and narrow, terminating in toothless jaws. The tail fin is small and fan-shaped, while the ventrals are absent. Fishes of this genus have unusual breeding habits, the male possessing a pair of pouches on the under side of the body in which the female places the eggs till they are hatched.

FAMILY 22. BARRACUDAS; SPHYRAENIDAE.

The Silver Barracuda, *Sphyraena argentea* (Girard), (Fig. 32) is not a common fish in Puget Sound, as this is the northern limit of the species, which is notably abundant in the waters of California. The Barracuda may be recognized by its long pike-shaped body, large mouth and projecting lower jaw. The teeth are long and sharp. The two dorsal fins are small and widely separated. The lateral line is straight. The scales are small. It is a valuable food fish, but is not taken in sufficient numbers to enter into the market.

FAMILY 23. FIATOLES; STROMATEIDAE.

Like the Barracuda, our local representative of the Stromateidae, the California Pompano or Butterfish, *Rhombus simillimus* (Ayres), (Fig. 34) may be regarded as a straggler from more southern climes, since it is comparatively rare in Puget Sound. Lacking a suitable illustration of the local species, a cut of a closely related form has been utilized in the plates.

The species known on the Pacific Coast as the California Pompano is not a true Pompano, since the latter belongs in an entirely different family of fishes, the Carangidae. The resemblance between the two types is quite superficial.

In the Butterfish or California Pompano the body is greatly flattened sidewise, and terminates in a mouth armed with feeble teeth. The cheeks are covered with scales, and the lateral line is well developed. The anal fin is much like the dorsal, and the tail is broadly forked. It attains a length of 10 inches and is a good food fish.

FAMILY 24. MACKERELS; SCOMBRIDAE.

Fishes of this family may be recognized by the unusual character of the dorsal fin, since the last rays are detached and form a series of separate finlets. The same structure appears in the anal fin. The head is pointed and the colors are richly metallic.

The California Bonito, *Sarda chilensis* (Cuvier and Valenciennes), is a large fish two to three feet in length and weighing 12 to 16 pounds. It is rare in our waters. The body is a dark metallic blue and the tail has a keel on either side.

The Chub Mackerel, *Scomber japonicus* (Hutunyn), is a near relative of the true Mackerel, but is a much less valuable fish. The latter *Scomber scomber* (Linnaeus), (Fig. 33) is the form figured in the plates. The Chub Mackerel is rare in Puget Sound. It has two keels on either side of the base of the tail fin. The color is blue with a number of wavy streaks of black on the back above the lateral line.

FAMILY 25. RAG-FISHES; ACROTIDAE.

A rare straggler from the outer ocean is our sole representative of this family, namely Willoughby's Rag-fish, *Acrotus willoughbyi* (Bean), (Fig. 36). The first specimen of this fish was taken on the outer coast of Washington but examples have now been taken as far south as Tacoma in Puget Sound. It is a strange fish, measuring between five and six feet in length, entirely devoid of scales, with a large caudal fin and lacking the ventral fins. The body is soft and yielding, as the bones are cartilaginous, indicating a normal deep-water habitat.

FAMILY 26. POMFRETS; BRAMIDAE.

The Pomfret, *Brama raii* (Bloch), is reported from the northern section of Puget Sound. It is an excellent food fish. The body is compressed, of an oblong shape and covered with small scales. The mouth is very oblique. The dorsal and anal fin each have their three anterior rays developed as spines. The color is sooty gray with black on the vertical fins. It attains a length of three or four feet.

FAMILY 27. HIGH-BROWS; ZAPRORIDAE.

This is a rare and curious fish not yet observed in Puget Sound, but as it was taken on the inner coast of Vancouver Island it is probable it will be taken on our side of the line. It has a large coarse head with an elevated front which caused the learned savant who described it to call it *Zaprora silenus*. (Fig. 35). Since the Greek from which the generic name is derived may be freely translated as "high-brow" the writer is responsible for the common name here applied.

EXPLANATION OF FIGURES.

30. Alaska Stickleback, *Gasterosteus cataphractus* (Pallas).
31. Gray-lined Pipe-fish, *Syngnathus griseolineatus* (Ayres).
32. Barracuda, *Sphyræna* sp.
33. Mackerel, *Scomber* sp.
34. Pompano or Butterfish, *Rhombus* sp.
35. High Brow, *Zaprora silenus* (Jordan).
36. Willoughby's Rag Fish, *Acrotus willoughbyi* (Bean).
37. Bridled Surf-fish, *Brachyistius frenatus* (Gill).
38. Viviparous Perch, *Cymatogaster aggregatus* (Gibbons).
39. White Perch, *Damalichthys argyrosomus* (Girard).
40. Viviparous Perch, a female with the young enclosed.
41. White Surf-fish, *Phanerodon furcatus* (Girard).



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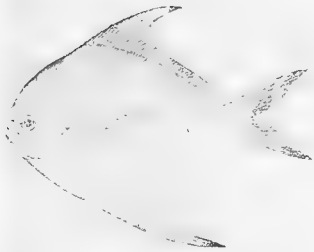
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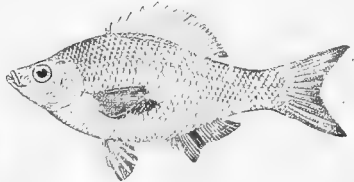
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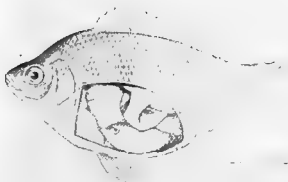
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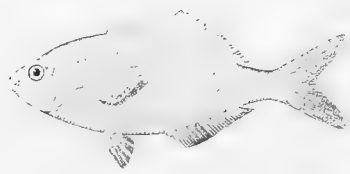
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FAMILY 28. SURF-FISHES; EMBIOTOCIDAE.

This family is one of the most characteristic groups of fishes found on the Pacific Coast. Their main distribution is southern, but we have in our fauna seven species, some of which are exceedingly abundant in Puget Sound. They are small perch-like fish from 6 to 18 inches in length. The anal fin has three spines and more than 15 soft rays. The lower pharyngeals are united.

The White Perch or Pacific Porgee, *Damalichthys argyrosomus* (Girard), (Fig. 39) is a species attaining a length of 15 inches. It is very abundant, but is not regarded highly as a food fish, the flesh being dry and tasteless. The dorsal fin has 10 spines and 23 rays. The color is pale with a silvery luster.

The Striped Perch, *Taeniotoca lateralis* (Agassiz), is a brightly colored fish rather common in the Sound. It is reddish above, becoming bright orange below. The rows of scales have blue edgings which gives the fish a delicately striped appearance. It is edible and attains a weight of two pounds.

The Common Surf Fish or Black Perch, *Embiotoca jacksoni* (Agassiz), is a species with a somewhat mottled and variable coloration. The ground color is brown, shading into yellow on the under side, and variegated with mottlings of blue, red or yellow. The sides have a number of faint vertical dusky bars. It attains a length of 12 inches and is classed as one of our edible fishes.

The Bridled Surf-fish, *Brachyistius frenatus* (Gill), (Fig. 37) is one of the rarer species of this group. It is greenish brown above, shading into coppery red on the belly. The scales are flecked with blue and black dots. The fins are all bright red. It reaches a length of eight inches.

The Silver Surf Fish, *Amphistichus argenteus* (Agassiz), is recorded from the Straits of Fuca. Its general coloration is silvery, the sides being ornamented with vertical bars and spots of brassy green. It is abundant on sandy shores and reaches a length of one foot.

The White Surf Fish, *Phanerodon furcatus* (Girard), (Fig. 41) is recorded from Vancouver Island and enters the Straits of Fuca. It is light olive above, shading into silvery below.

The Viviparous Perch, *Cymatogaster aggregatus* (Gibbons), (Fig. 38) is exceedingly abundant in Puget Sound. The schools of young may be seen swimming about wharves in shallow water and are spoken of as Shiners. It is the smallest of the species in this family, attaining a length of six inches. Specimens vary greatly in details of color, some of the individuals being very dark. The scales have groups of black points which unit to suggest a longitudinal striping. These stripes are interrupted by several vertical bands of yellow. This species is edible but its small size renders it unsuitable for the market.

The strange habit of this fish, in common with other members of this family, of bringing forth its young alive, has attracted considerable attention, since this phenomenon is rare in the fish world. As many as 36 young in various stages of development have been found in the brood sack of the mother animal.

FAMILY 29. CROAKERS; SCIAENIDAE.

The only representative of this large family of southern fishes that extends its range into our territory is the California White Sea Bass, *Cynoscion nobilis* (Ayres). As might be expected, it is rare with us. It is a large fish, attaining a weight of 20 to 80 pounds. The body is compressed and is covered with ctenoid scales. The head is large and scaly and the caudal fin is rounded. The dorsal fin is notched to make two distinct parts. The color is bluish with fine spotting. Lacking a picture of this species, we have used a drawing of an allied but somewhat different species belonging to the same genus (Fig. 42).

FAMILY 30. HEAD FISHES; MOLIDAE.

On several occasions in recent years specimens of the immense Head-fish, *Orthogoriscus mola* (Bloch), (Fig. 43) have been brought into Seattle from the Straits of Fuca and from the open sea beyond the Cape. Specimens are on record weighing nearly a ton. The name of the species is derived from the curious formation of the body, which has the appearance of a great head minus the major part of the trunk. The great dorsal and anal fins stand one above the other, while the tail fin has a sinuous outline.

FAMILY 31. ROCK-FISHES; SCORPAENIDAE.

This family constitutes one of the most important and valuable groups of fishes found on the Pacific Coast. About 260 species are on record throughout the world, of which 13 are known to inhabit Puget Sound. They are bass-like in appearance with spines on the operculum. The dorsal is continuous but notched so as to mark the two portions of the fin. The head is crossed by ridges which in many cases terminate in spines. In this, as in several of the families that follow, a characteristic feature is the presence of a bony bar extending from beneath the eye across the cheek. All of our Puget Sound Rock-fishes belong in the genus *Sebastes*.

The Black Rock-fish, *Sebastes melanops* (Girard), (Fig. 44) is one of our abundant species. It is 20 inches in length and is a valuable food fish. It is dark greenish brown in color blotched with slaty black.

The Priest-fish, *Sebastes mystinus* (Jordan and Gilbert), (Fig. 45) is very much like the preceding but has a spine over each eye. It

is even darker in color than the Black Rock Fish, the prevailing hue on the upper surface being slaty black. The sides are paler and somewhat mottled. It is not so common as *S. melanops*.

The Orange Rock-fish, *Sebastes pinniger* (Gill), (Fig. 46) is a large and handsome representative of the family. It is richly colored, the ground tint being gray, but this is mottled with large areas of orange. It is abundant in deep water.

The Red Rock-fish or Red Snapper, *Sebastes ruberrimus* (Cramer), is the largest of this group of fishes, attaining a length of 30 inches or over. In color it is a brilliant vermilion. It is common in deep water and is brought to market in considerable quantities.

The Alaska Red Rock-fish, *Sebastes introniger* (Gilbert), is of the same reddish cast as the Red Rock-fish but is smaller and differs in certain details of anatomical structure.

Three small species of *Sebastes* named by Professor Starks, *S. deani* (Fig. 48), *S. clavilatus* (Fig. 47), and *S. emphaeus* (Fig. 49), occur in the San Juan Islands. They are somewhat similar in appearance, the ground color being reddish brown with irregular darker mottling over the back and sides.

Dall's Rock-fish, *Sebastes auriculatus dalli* (Eigenmann and Beeson), is a variation of the Brown Rock-fish found in more southern waters. It is pale brown with mottlings of darker color. This is a common shallow water species.

The Yellow-backed Rock-fish, *Sebastes maliger* (Jordan and Gilbert), (Fig. 52) is reported as being abundant in the northern section of Puget Sound. It reaches a weight of 6 pounds. In color it is light brown with rich mottlings of yellow on the back and extensive yellow markings on the breast and under parts.

The Yellow-spotted Rock-fish, *Sebastes nebulosus* (Ayres), is a common variety in the Sound. The general coloration is black but the body is spotted and speckled with yellow. It is a good food fish, although rather small, as it measures about one foot in length.

The Black-banded Rock-fish, *Sebastes nigrocinctus* (Ayres), (Fig. 50) is a large and beautiful species, attaining a length of 2 feet. It is not common in the Sound, but is reported as abundant in the Straits of Fuca. Specimens are taken about the San Juan Islands. It is orange red in color with five vertical bars of black.

The Northwestern Rock-fish, *Sebastes caurinus* (Richardson), (Fig. 52) is a species that is taken in abundance in the Sound and constitutes an important food fish. It is dark brown in color washed with copper.

FAMILY 32. GREENLINGS; HEXAGRAMMIDAE.

This family is represented in our fauna by five species. In these the body is covered with fine scales and the dorsal fins are united. A single nostril is present on either side of the head. The anal fin is elongate. They are carnivorous fishes of medium or large size inhabiting the kelp beds of the North Pacific. Three of our species are classed in the genus *Hexagrammos* and constitute the true greenlings. They differ from the other members of the family in that the lateral line is branched, as many as five parallel lines being present on the side. The greenlings are often called Rock-trout and Kelp-cod. As they are in no wise related to either the trout or the cod family it would seem unfortunate to saddle these names upon the fishes.

The Ten-lined Greenling, *Hexagrammos decagrammus* (Pallas), (Fig. 55) attains a length of 18 inches and is an excellent food fish. Five distinct divisions of the lateral line may easily be traced across each side of the fish. Two pairs of small dermal flaps are present on the head in this form, whereas only one pair occurs in other species of greenlings. Scales are present over the entire surface of the cheek.

The Red Greenling, *Hexagrammos superciliosus* (Pallas), (Fig. 53) can be separated from the preceding by the absence of one of the pairs of small fleshy flaps on the head. It is extremely variable in color and is often finely mottled, which make the common name somewhat of a misnomer. Scales are present on the sides of the head except over the bony stay and the interopercular bone. It is equal in size and food value to the preceding species.

Steller's Greenling, *Hexagrammos stelleri* (Tilesius), (Fig. 56) resembles the preceding species, but the cheeks and opercular bones are almost free from scales and the dermal flaps are much smaller. As in the other species, there is a wide range of color.

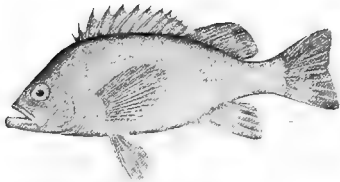
The Ling Cod, *Ohiodon elongatus* (Girard), (Fig. 54) which is also known as the Cultus Cod and Blue Cod, is one of our large and valuable food fishes. It is marketed in the fresh state in large quantities. Efforts have been made to can it, but the results have not been entirely satisfactory. It attains a weight of 60 pounds and a length of five feet.

The Ling-cod, which by the way is related neither to the Lings nor to the Cods, may be distinguished from other members of its family by the presence of a single lateral line, the large mouth with powerful teeth, and the development of spines on the preoperculum. The ground color is dark brown, much mottled with rusty spots, shading into bluish green on the under side.

The Painted Greenling, *Oxylebius pictus* (Gill), (Fig. 57) is one of our most brilliantly colored fishes. It is common about docks where it may be seen nosing up and down the piles. It attains a length of

EXPLANATION OF FIGURES.

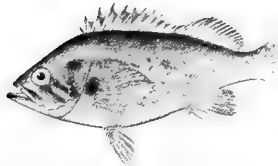
42. Sea Bass, *Cynoscion* sp.
43. Head-fish or Giant Sun-fish, *Orthogoriscus mola* (Bloch).
44. Black Rock-fish, *Sebastes melanops* (Girard).
45. Priest Fish, *Sebastes mystinus* (Jordan and Gilbert).
46. Orange Rock-fish, *Sebastes pinniger* (Gill).
47. *Sebastes clavilatus* (Starks).
48. Dean's Rock-fish, *Sebastes deani* (Starks).
49. *Sebastes emphaeus* (Starks).
50. Black-banded Rock-fish, *Sebastes nigrocinctus* (Ayres).
51. Northwestern Rock-fish, *Sebastes caurinus* (Richardson).
52. Yellow-backed Rock-fish, *Sebastes maliger* (Jordan and Gilbert).
53. Red Greenling, *Hexagrammos superciliosus* (Pallas).



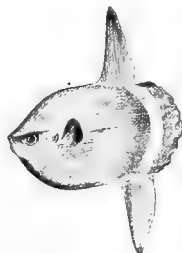
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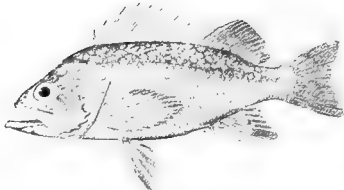
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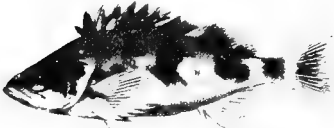
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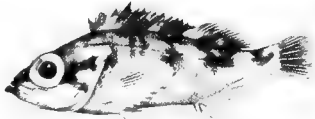
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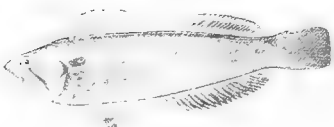
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10 inches. The body is relatively deeper than in other members of this family and the snout is acutely pointed. The sides are traversed by alternate vertical stripes of black and of pale orange. It is not used for food.

The Broad-finned Greenling, *Zaniolepis latipinnis* (Girard), may be recognized by the great height of the dorsal fin and the presence of several exceedingly long free spines at its anterior end. The scales are small and very rough. It is edible but is not abundant. Its length is about 12 inches.

FAMILY 33. SKIL-FISHES; ANOPLPOMATIDAE.

This family is a small one, containing but two genera, each with a single species, but both of these are of great interest. The group is closely allied to the preceding family, the *Hexagrammidae*, and by some authors the two are united.

The Black Cod or Skil-fish, *Anoplopoma fimbria* (Pallas), (Fig. 58) which is of course no relative of the true cod, has come into extensive use as a food fish in recent years, and is now supplied abundantly in our markets. It attains a length of two feet or more and, as its name indicates, is very dark in color. The body is gracefully formed, with two well-separated dorsal fins. The tail fin is set on an elongated base and is formed for speed. The scales are minute and ctenoid. The anal fin has three spines. Two nostrils are present on either side.

The Giant Sea-bass, *Erilepis zonifer* (Lockington), (Fig. 59) was originally described in 1880 from a specimen one foot in length taken at Monterey, California, but in recent years it has been discovered to exist in the North Pacific as a fish of great size, measuring 8 feet in length and of considerable weight. It is not related to the true sea-bass which belongs to the family *Serranidae*, a group not represented in our fauna. No better name has been suggested for the fish up to the present time.

Erilepis resembles the Black-cod, but is a much larger species, as has been indicated, and differs in the form of the body, which is much deeper and bass-like. The dorsal fins are united, the point of union being indicated by a deep notch. No specimens have been taken within the limits of Puget Sound, but a number of examples have been captured on the neighboring Canadian shore.

FAMILY 34. SCULPINS; COTTIDAE.

This is an immense family of fishes, represented in our waters by 28 species. The group is a difficult one to define on account of the wide range of characters. In common with several families already discussed these fishes have a bony bar across the cheek. The head is usually spiny. The dorsal fins are as a rule separate or slightly con-

nected. The tail fin is rounded at the margin and the pectoral is large. A lateral line is present. The preoperculum is usually provided with one or more spines. The ventral fins are attached to the thoracic region. Very few of the sculpins are used as food, although the larger species may be classed among our edible fishes.

Jordan's Sculpin, *Jordania zonope* (Starks), (Fig. 60) is a small species about four inches in length. It has an unusually long dorsal fin. The ventral fins have one spine and five rays. The back is covered with rough scales.

The Perch-like Sculpin, *Radulinus asprellus* (Gilbert), (Fig. 61) is a slender species five or six inches in length with two spines on the operculum and a very short spinous dorsal fin. The back is covered with rough scales. A series of keeled plates is present on the lateral line.

The Darter Sculpin, *Radulinus voleoides* (Gilbert), is like the preceding but smaller, being only 3 or 4 inches in length. The space between the eyes is covered with scales, whereas in *R. asprellus* this space is scaleless.

Bean's Sculpin, *Triglops beani* (Gilbert), (Fig. 62) is a long slender fish, 5 to 7 inches in length, bearing upon each side a row of bony plates along the base of the dorsal fin. The breast is without scales, but the skin is thrown into fine cross folds. The color is olive brown with a stripe of dark brown along the side and four large blotches on the back.

The Spotted Sculpin, *Triglops macellus* (Bean), is similar to the preceding, but has a conspicuous black spot on the snout just above the edge of the maxillary.

The Rough-backed Sculpin, *Chitonotus pugetensis* (Steindachner), (Fig. 62) has the back clad with rough scales above the lateral line. The preoperculum has a long spine armed with three antler-like processes. The lateral line has a row of keeled scales. The fish is 6 inches in length.

The Broad-headed Sculpin, *Stelginotus latifrons* (Gilbert and Thompson), (Fig. 63) is a bright green species with a broad interspace between the eyes, and lacking spines on the head. A single curved spine is present on the preoperculum. It is a rare form, only two specimens having been taken, both at Friday Harbor.

Meany's Sculpin, *Ruscarius meanyi* (Jordan and Starks), (Fig. 66) is apparently a rare species since no additional specimens have been secured since the types were collected in Port Orchard in 1895. It was named in honor of Professor Edmond S. Meany of the University of Washington. The back of the fish is covered with rough scales, the head being particularly rough. There are no bony plates along the base

of the dorsal fin. The spine on the preoperculum is long and bifurcate. The length of the specimens was one and one-half inches.

The Northern Sculpin, *Icelinus borealis* (Gilbert), (Fig. 65) has a set of enlarged plates along the lateral line and another series along the back, but the space between these is devoid of scales. There are a number of processes on the preoperculum. No filamentous spines are developed in connection with the dorsal fin. The length is 4 inches.

The Reindeer Sculpin, *Tarandichthys filamentosus* (Gilbert), is so named from the antler-like processes on the preopercular spine, which suggest the horns of the reindeer. Another striking feature is the development of the anterior spines of the dorsal fin which are lengthened and filamentous. This species is three and one-half inches in length.

The Star-topped Sculpin, *Astrolytes fenestralis* (Jordan and Gilbert), is about five inches in length, and is distinguished by the presence of a number of star-shaped scales on the top of the head. The lateral line is unarmed and the preopercular spine is provided with a single hooked process. None of the dorsal spines are filamentous in form.

Harrington's Sculpin, *Axyrias harringtoni* (Starks), (Fig. 68) was first taken at Port Ludlow, Washington, in 1895 and was named in honor of Dr. Mark W. Harrington, who was at that time President of the University of Washington. It was later found in the San Juan Islands by Mr. Starks. It is about four inches long and has a considerable development of short cirri on the top of the head. The space between the eyes is concave. The ground color is olive with five bars of brown on the back.

Artedi's Sculpin, *Artedius lateralis* (Girard), is another of the small sculpins. It is similar to *Axyrias* but is five inches in length, the cirri are absent from the top of the head, and the space between the eyes is flat. In color it is richly mottled with olive, red and black.

The Red Sculpin or Irish Lord, *Hemilepidotus hemilepidotus* (Tilesius), (Fig. 67) is one of our larger species, extending over 18 inches. The back and sides have two separate bands of rough scales and the spinous dorsal is notched.

The Great Sculpin or Kalog, *Myxocephalus polyacanthocephalus* (Pallas), (Fig. 74) is a species which attains a length of two feet. The top of the head is covered with small warty protuberances. The preopercle has three strong straight spines. The dorsal fins are barely in contact.

The Buffalo Sculpin, *Enophrys bison* (Girard), (Fig. 71) is one of our common species. It is about a foot in length and has a long simple spine on the preopercle. The body is without scales, but along the lateral line there is a band of coarse bony plates.

The Smooth Sculpin, or Cabezon, *Leptocottus armatus* (Girard), (Fig. 70) is abundant everywhere throughout the Sound region. The skin is smooth and the head is oblong. No cirri are developed. The preopercular spine is strong, with two or three points hooked upwards. The dorsal fins are separate. It attains a length of 12 inches.

The Marbled Sculpin, *Scorpaenichthys marmoratus* (Girard), is the largest of our cottoid fishes since it attains a length of 30 inches and a weight of 20 to 25 pounds. It is used for food but the flesh is coarse. The skin is smooth and the ventral fin has one spine and five rays.

The Round-headed Sculpin, *Blennicottus globiceps* (Girard), is a species with a perfectly smooth skin lacking both scales and prickles. The preopercular spine is short and blunt with the point turned upwards. The snout is very blunt. It reaches a size of 4 to 7 inches.

The Moss-dwelling Sculpin, *Oxycottus embryum* (Jordan and Gilbert), (Fig. 73) is a small species found living among the rocks and seaweeds along the shore. In its structure it is very similar to the following species, the main difference being in the form of the spine on the preoperculum. In *Oxycottus* it is simple while in *Oligocottus* it is forked. This species varies greatly in color, ranging from green to maroon. It is less than three inches in length and is quite rare.

The Johnny or Tide-pool Sculpin, *Oligocottus maculosus* (Girard), (Fig. 72) exists in countless numbers along our shores, and every pool left by the retreating tide has its quota. It is one of our smallest species, seldom measuring as much as three inches. The skin is smooth and the color ranges widely from green to gray or crimson, the darker mottling being also highly variable. The fins are prettily barred. The preopercular spine is slender and forked.

The Woolly Sculpin, *Dasycottus setiger* (Bean), (Fig. 69) is a species having a very large head with numerous bony tubercles over its surface. The skin covering the head supports a large number of filamentous growths which suggest the common name. The skin is without scales and the preoperculum bears two spines at its angle. The tail fin is rounded in outline. It attains dimensions of 8 inches.

Kincaid's Sculpin, *Malacottus kincaidi* (Gilbert), is related to the two preceding species. It is entirely devoid of scales and the spinous dorsal is separated from the posterior part of the fin by a deep notch. The preoperculum is armed with three slender diverging spines. A series of mucous pores is arranged along the lateral line and similar pores are scattered over the surface of the head. All of the fins are more or less barred and mottled. The back and sides are gray with a number of irregular dark blotches.

The Sailor-fish, *Nautichthys oculo-fasciatus* (Girard), (Fig. 75) is a species of such unusual appearance one would hardly take it to be of

EXPLANATION OF FIGURES.

54. Ling-cod or Cultus-cod, *Ophiodon elongatus* (Girard).
55. Ten-lined Greenling, *Hexagrammos decagrammus* (Pallas).
56. Steller's Greenling, *Hexagrammos stelleri* (Tilesius).
57. Painted Greenling, *Oxylebius pictus* (Gill).
58. Black-cod or Skilfish, *Anoplopoma fimbria* (Pallas).
59. Giant Sea-bass, *Erilepis zonifer* (Lockington).
60. Jordan's Sculpin, *Jordania zonope* (Starks).
61. Perch-like Sculpin, *Radulinus asprellus* (Gilbert).
62. Bean's Sculpin, *Triglops beani* (Gilbert).
63. Broad-headed Sculpin, *Stelginotus latifrons* (Gilbert and Thompson).
64. Rough-backed Sculpin, *Chitonotus pugetensis* (Steindachner).
65. Northern Sculpin, *Icelinus borealis* (Gilbert).
66. Meany's Sculpin, *Ruscarius meanyi* (Jordan and Starks).
67. Red Sculpin or Irish Lord, *Hemilepidotus hemilepidotus* (Tilesius).
68. Harrington's Sculpin, *Axyrius harringtoni* (Starks).



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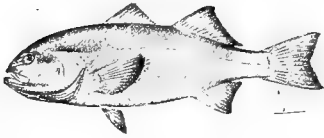
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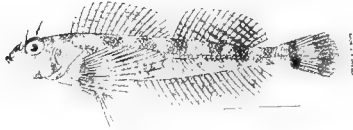
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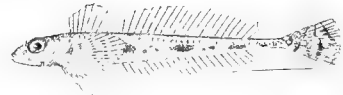
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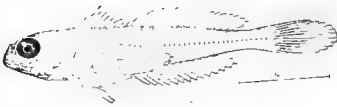
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the sculpin family. Its name is derived from the formation of the first dorsal fin, which is short and greatly elevated so as to suggest a triangular sail. Another striking characteristic is a broad band of black which passes diagonally through the eye. It is perhaps to be expected that a deep-water sailor-fish would carry a black eye. Specimens range up to 6 inches in length.

The Cirrhated Sculpin, *Blepsias cirrhosus* (Pallas), (Fig. 76) is another species that departs rather widely from the general run of Sculpins. Its body is compressed so as to be quite thin and the head is comparatively small. The skin is devoid of scales, but is covered with small prickles. The first dorsal is elevated and is divided into two portions by a deep notch, the second portion being much the smaller. The second dorsal and the anal fin are relatively large. In color it is dark olive above, shading into yellow beneath. The back and sides are marked with black blotches and with several areas having a metallic sheen. Mature specimens are about 6 inches in length.

The Red-finned Sculpin, *Ascelichthys rhodorus* (Jordan and Gilbert), (Fig. 77) is a smooth species in which the ventral fins are entirely absent. The dorsal fins are connected by a membrane. In the living fish the first dorsal fin is edged with bright crimson. It is reported as abundant at Neah Bay.

The Tadpole Sculpin, *Psychrolutes paradoxus* (Gunther), (Fig. 78A) is one of the smallest of the *Cottidae*. It is seldom more than two inches in length, and is devoid of both scales and spines. The body is covered with loose movable skin. The color is creamy white mottled with dark blotches.

Gilbert's Sculpin, *Gilbertidia sigalutes* (Jordan and Starks), is similar to *Psychrolutes* but differs among other things in the shape of the dorsal fin, which is much larger in *Gilbertidia* and more elevated in front. The color of Gilbert's Sculpin is dusky, with hazy darker markings on the back about the front of the dorsal and above the base of the tail. It is two and one-half inches in length.

FAMILY 35. GRUNT-FISHES; RHAMPHOCOTTIDAE.

This is a small family, containing but a single genus with one known species of fish. It is allied to the great family of the sculpins, but has characters which link it up to another important group known as the Sea-poachers or *Agonidae*.

The Grunt-fish, *Rhamphocottus richardsoni* (Gunther), (Fig. 78B) is one of the most singular of our local species. The head is very large in proportion to the body and is rough with a number of projecting bony prominences, which would delight the heart of a fish phrenologist. The skin is without scales which are replaced by small prickles. The first dorsal is small, fitting into a groove in the back. The lower rays

of the pectoral fin are free from the membrane. The eyes are large and prominent. The color is creamy white, with irregular oblique stripes passing downward across the sides. Mature specimens are about three inches in length. When lifted from the water these fish produce a peculiar vibrant grunting sound which has caused the application of the above common name.

FAMILY 36. SEA-POACHERS; AGONIDAE.

This family, sometimes known as Alligator Fishes, is related to the Sclupins but may be recognized by the armature of bony plates which encloses the body. Most of our twelve species are of small size, and none are of any direct value as food for man. Many of the forms are of singular appearance.

The Spineless Sea-poacher, *Aspidiophoroides inermis* (Gunther), may be recognized by its close-fitting vestiture of smooth plates and the lack of sharp angles or spines. No figure of our local species was available so a closely allied form, native to Alaska, is used to illustrate the type (Fig. 79).

The Masking Sea-poacher, *Bothragonus swani* (Steindachner), (Fig. 81) is unquestionably the most singular fish inhabiting Puget Sound. The head is greatly out of proportion to the body, and in the top of the cranium there is a deep oval pit about the margin of which is a series of tooth-like spines, thus simulating a widely opened mouth. When viewed from above there is the suggestion of a caricature of the human countenance, the great pit in the skull representing the mouth, while the surrounding plates are grouped to simulate the forehead, cheeks, nose and chin. Only two specimens are known to exist. The type was collected at Port Townsend in 1876 by Judge Swan, after whom the species was named by Steindachner, and is now in the collection of the Imperial Austrian Museum in Vienna. The second specimen was taken in the San Juan Islands, and is now in the collection of the University of Washington.

The Four-horned Sea-poacher, *Hypsagonus quadricornis* (Cuvier and Valenciennes), (Fig. 85) is a singular fish with four rows of spines along each side of the body. The first dorsal is relatively large and high. On the top of the head are four strong horn-like spines which suggest the common name. The general color is gray, with several vertical bands of black across the body and fins.

Pallas' Sea-poacher, *Pallasina aix* (Starks), is a species with a long slender body and an elongated tubular snout. The plates enclosing the body are keeled, but lack spines. An allied form, *P. barbata*, (Fig. 80) is figured in the plates.

The Sturgeon Sea-poacher, *Podothecus acipenserinus* (Pallas), (Fig. 82) has a general appearance which suggests a small sturgeon. A fringe of barbels depending from the snout increases the similitude.

The Inky Sea-poacher, *Averruncus emmelane* (Jordan and Starks), (Fig. 84) has a very rough external surface, and is covered everywhere with rough coarse plates and spines. The general coloration is so dark as to suggest the above specific name. The ground color is, however, relieved through the presence of some beautiful white markings, especially on the fins, which are handsomely mottled.

The Black-finned Sea-poacher, *Bathyagonus nigripinnis* (Gilbert), is a long slender fish with rough spiny exterior, and with the pectoral fins divided by a notch into two portions, the lower section being composed of simple spines. All of the fins are intensely blue-black. This species has been recorded from the outer coast of Washington, but no specimens have been reported from Puget Sound.

The Broad-headed Sea-poacher, *Xeneretmus latifrons* (Gilbert), is a familiar form in Puget Sound. In common with three other species of this genus which follow, it has a peculiarly formed pectoral, this fin being divided by a deep notch into two portions, the lower of which is composed of greatly thickened rays which are simple and longer than those of the upper lobe. The interorbital space is unusually narrow in the Broad-headed Sea-poacher which gives this form its specific name.

The Three-spined Sea-poacher, *Xeneretmus triacanthus* (Gilbert), (Fig. 83) differs from the preceding in minor anatomical details.

The Alaskan Sea-poacher, *Xeneretmus alaskanus* (Gilbert), is the third of these closely related forms. It differs from the two preceding forms in having three vertical spines on the rostral plate rather than one. The breast is composed of numerous plates.

The Weak-spined Sea-poacher *Xeneretmus infraspinatus* (Gilbert), is very similar to *X. alaskanus*.

The Pitted Sea-poacher, *Odontopyxis trispinosus* (Lockington), rather suggests the Masking Sea-poacher but is much more slender in build. A pit is present on the top of the head but lacks the inwardly projecting spines of *Bothragonus*.

FAMILY 37. LUMP SUCKERS. CYCLOPTERIDAE.

Here we have a small family of short, thick fishes having a ventral sucker-like organ formed by a modification of the ventral fins. By means of this structure they are able to cling to rocks or other submerged objects, a peculiarity which has led to the assignment of the common name. The body is covered with a skin lacking in scales and either smooth or warty. The spinous dorsal is distinct. Two species of these odd fish are recorded from our waters.

The Warty Lump-sucker, *Eumicrotremus orbis* (Gunther), attains a length of four inches. It is rounded in form and swims clumsily. The skin is covered with numerous warty projections. It is fairly common.

The Smooth Lump-sucker, *Lethotremis vinolentis* (Jordan and Starks), (Fig. 86) is known by a single specimen. It is a tiny sub-globular fish, half an inch in length, with a smooth skin and two distinct dorsal fins.

FAMILY 38. SEA-SNAILS; LIPARIDAE.

A group of tadpole-shaped fishes with a loose scaleless skin. The dorsal fins are joined to form a continuous structure. The ventral fins are modified as in the preceding group to form a sucking disk. Seven species of this family are on record from this region. All of these are placed in the genus *Liparis* and the specific distinctions are in some cases so technical they are hard to discriminate. Most of them are of small size, rarely more than six inches in length. The several species may be enumerated as follows:

Green's Sea-snail, *Liparis greeni* (Jordan and Starks), (Fig. 87).

Flora's Sea-snail, *Liparis florum* (Jordan and Gilbert).

Beautiful Tooth Sea-snail, *Liparis callyodon* (Pallas), (Fig. 88). The origin of the scientific name of this species is rather odd. When it was first studied by Pallas in 1811 in material derived from Alaska he noticed the peculiar tricuspid teeth of the fish, and he therefore called it *callyodon*, a Greek word meaning beautiful tooth.

Round-finned Sea-snail, *Liparis cyclopus* (Gunther).

Denny's Sea-snail, *Liparis dennyi* (Jordan and Starks). Named in honor of Mr. Charles L. Denny of Seattle.

Straits Sea-snail, *Liparis fucensis* (Gilbert).

Beautiful Sea-snail, *Liparis pulchellus* (Ayres).

FAMILY 39. RONQUILS; BATHYMASTERIDAE.

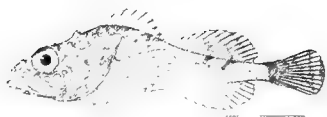
This small family is represented by a single species in Puget Sound. It is known as Jordan's Ronquil, *Ronquilus jordani* (Gilbert). (Fig. 89). The body in this fish is elongated, suggesting the blenny type, and the skin is covered with small ctenoid scales which extend onto the cheeks. Along the lateral line the scales are enlarged. There are no barbels, crests or spines on the head. The dorsal fin is long and high, and the anal has a similar formation. The lateral line is conspicuous and high up on the side. The coloration is quite variable, some specimens being much more beautifully marked than others.

FAMILY 40. GOBIES; GOBIDAE.

Although five species of this family are recorded from Puget Sound or adjacent waters, none of them seem to be common. Most of them are quite small, rarely exceeding a few inches. The body is slender and clothed with scales. The lateral line is absent. The distinctive

EXPLANATION OF FIGURES.

69. Wolly Sculpin, *Dasycottus setiger* (Bean).
70. Smooth Sculpin, *Leptocottus armatus* (Girard).
71. Buffalo Sculpin, *Enophrys bison* (Girard).
72. Johnny or Tide-pool Sculpin, *Oligocottus maculosus* (Girard).
73. Moss-dwelling Sculpin, *Oxycottus embryum* (Jordan and Gilbert).
74. Great Sculpin or Kalog, *Myoxocephalus polyacanthocephalus* (Pallas).
75. Sailor-fish, *Nautichthys oculoasciatus* (Girard).
76. Cirrhated Sculpin, *Blepsias cirrhosus* (Pallas).
77. Red-finned Sculpin, *Ascelichthys rhodorus* (Jordan and Gilbert).
- 78A. Tadpole Sculpin, *Psychrolutes paradoxus* (Gunther).
- 78B. Grunt-fish, *Rhamphocottus richardsoni* (Gunther).
79. Spineless Sea-poacher, *Aspidiophoroides* sp.
80. Pallas' Sea-poacher, *Pallasina* sp.
81. Masking Sea-poacher, *Bothragonus swani* (Steindachner).
82. Sturgeon Sea-poacher, *Podothecus acipenserinus* (Pallas).



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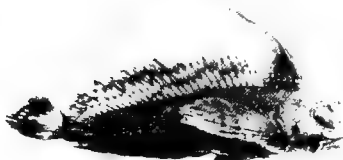
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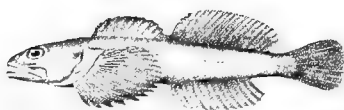
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78 A



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78 B



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characteristic most easily noted is, however, the formation of the pectoral fins, which merge together on the under side of the body to form an imperfect suctorial organ. Most of the species have the habit of burrowing in the sand or mud.

Nichols' Goby, *Rhinogobius nicholsi* (Bean), is our sole representative of a genus which is mainly southern in its distribution. It has six spines in the dorsal fin, whereas the species that follow have seven. It is said to be abundant in some parts of Vancouver Island, but only one specimen has come to hand in the San Juan Islands.

The Shining Goby, *Lepidogobius lepidus* (Girard), must be a rare species as very few have been taken up to this time. It has seven dorsal spines and is clothed with small cycloid scales.

The Long-jawed Goby, *Gillichthys mirabilis* (Cooper), as its name suggests, has the jaw reaching far back, nearly to the base of the pectoral fin. The head and belly are devoid of scales.

The Y-marked Goby, *Quietula Y-cauda* (Jenkins and Evermann) is similar to *Gillichthys*, but with flaps of skin on the shoulder girdle. A row of spots extend along the side of the body, the last assuming the form of the capital "Y" of the Greek alphabet, hence the name.

The Arrow Goby, *Clevelandia ios* (Jordan and Gilbert), (Fig. 90) is a slender species, two inches in length, with four or five spines in the dorsal fin. The scales are minute and cycloid. Specimens were encountered in Hoods Canal when digging in a sandy beach at low tide.

FAMILY 41. TOAD-FISHES; BATRACHIDAE.

Only one species of this small family is native to Puget Sound, but this form, known as the Midshipman or Singing Fish, *Porichthys notatus* (Girard), is one of our commonest fish. It resembles a sculpin, but can be identified immediately by the branching lateral lines which extend across the head and body. Along these lines are distributed shining spots looking like rows of buttons, thus giving rise to the name. The female is frequently met with in collecting along the shore, since she deposits her eggs on the under side of loose rock or other debris, and stands guard over them till they are hatched. When disturbed the fish utters a loud vibrant noise which may be heard at a considerable distance. The illustration used is that of a closely allied species. (Fig. 92).

FAMILY 42. CLING-FISHES; GOBIESOCIDAE.

The Common Cling-fish, *Caularchus meandricus* (Girard), (Fig. 91) is found almost everywhere along our shores. Between the wide-set ventral fins a broad sucking disk is developed, which enables it to cling tightly to rocks or other objects. There is no spinous dorsal fin. Scales are absent. It attains a length of six inches.

FAMILY 43. BLENNIES; BLENNIDAE.

This immense and variable family of fishes is represented with us by thirteen species. They may be recognized by their elongated eel-like form, small ventral fins, which are at times absent, the elongate dorsal fin, and the usually rounded tail fin. Most of the species are of small size and hence the group has little direct economic value.

The Decorated Blenny, *Bryostemma decoratum* (Jordan and Snyder), (Fig. 93) is one of the most striking of our local forms. The top of the head is covered with a growth of branching tentacles which suggested the name of the species. No lateral line is present. The ventral fins are well developed and the surface of the body is covered with small scales. The skin is richly mottled.

The Ornamented Blenny, *Bryostemma nugarum* (Jordan and Williams), (Fig. 94) is closely allied to the preceding species, having the same sort of tufted head, but the coloration is quite different. There is a row of ocellated spots along the middle of the dorsal fin.

The Chameleon Blenny, *Pholis ornatus* (Girard), (Fig. 95) is a worthy recipient of this name on account of its extraordinary range of coloration. It may be red, green, brown or yellow, and various shades in between. The individual blenny does not seem to be able to change its hue as some fishes are known to do. The structural peculiarities of this species are as follows: The lateral line is obsolete and there are two small spines in connection with the anal fin. The ventrals are reduced to a single spine and one ray. The tail fin is well developed, as are the pectorals. The dorsal fin is long and low and is composed of short, stiff spines. It is about one foot long.

The Variable Blenny, *Apodichthys flavidus* (Girard), resembles *Pholis* in its wide range of coloration, varying from green to purple. In this species the ventral fins are lacking and the anal fin is provided with a single stout sheathed spine. A narrow bar of black passes through the eye from the top of the head to the lower part of the cheek. It is about ten inches in length.

The Amphibious Blenny, *Xerperes fucorum* (Jordan and Gilbert), resembles *Apodichthys* but differs in the smaller size of the anal spine and in the reduced size of the pectoral fins. Like the preceding it is extremely variable in color. It is found hiding in masses of sea-weed at low tide and its ability to survive under these conditions has suggested the name.

The Crested Blenny, *Anoplarchus atropurpureus* (Kittlitz), (Fig. 96) can be singled out from its relatives by the presence of a prominent fleshy crest on the top of the head. The body is covered with very small hidden scales. The lateral line is obsolete and the mouth is set obliquely in the head. The dorsal fin is very low. This species is quite variable in color, some specimens being gray, others olive or

brown. The type described by Kittlitz from Alaska in 1858 was evidently a variety with a dark purple shade. Mature specimens are eight inches in length.

The Belted Blenny, *Xiphistes chirus* (Jordan and Gilbert), (Fig. 97) is noteworthy for the presence of several parallel branches of the lateral line, each with many short cross branches. The pectorals are small but well formed. It measures about 12 inches in length. Color variable and more or less mottled. Several dark lines radiate from the eye.

The Rock Blenny, *Xiphidion rupestre* (Jordan and Gilbert), (Fig. 100) is a near relative of the preceding species, but the pectoral fins are extremely minute, not longer than the width of the eye. It lives among the rocks along the shore where it may be found hiding in masses of sea-weed. It is about 12 inches in length. Several bands of color radiate from the eye.

The Dagger Blenny, *Xiphidion mucosum* (Girard), is one of the common Blennies of the Sound waters. It reaches a length of 18 inches and resembles the Rock Blenny very closely. The differences lie in certain relative measurements and in the character of the bands which radiate from the eye. The body tapers off posteriorly after the manner of a dagger, hence the name.

The Barred Blenny, *Plectobranchnus evides* (Gilbert), (Fig. 98) is one of our rare and beautiful fish forms. Only a few specimens have come to light since it was named in 1890. In this species there is no lateral line, the pectorals are long and rounded and the ventrals are well developed. The color is dusky the sides being crossed by a considerable number of narrow whitish bars. It is four inches in length.

The Snake Blenny, *Lumpenus anguillaris* (Pallas), is a long snaky fish with an obsolete lateral line. The paired fins are well developed and the mouth is set obliquely in the head. It measures 18 inches.

The Striped Blenny, *Delolepis virgatus* (Bean), is of the same long snaky type as *Lumpenus*, but the ventral fins are lacking. It is brownish yellow in color with three brown stripes on each side of the body. It attains a length of 30 inches.

The Aleutian Blenny, *Lyconectes aleutensis* (Gilbert), (Fig. 99) is like unto a small edition of the Striped Blenny, but is smaller, measuring about seven inches in length. The body is without scales. The color is reddish. Only two specimens of this fish have ever been taken, one in Alaska and one in Puget Sound.

FAMILY 44. WOLF-FISHES; ANARRHICHADIDAE.

Our representative of this family is the large, powerful, eel-like species known as the Wolf-fish, *Anarrhichthys ocellatus* (Ayres). It measures as much as 8 feet in length and excites great interest wherever it is captured. It is shaped like an eel, but the head is large and wolfish in aspect, with a great array of sharp teeth set in the powerful jaws. The ventral fins are absent. The pectorals are broad and set low down on the body. Color dark green, with numerous faint ocellated spots over the head and body.

FAMILY 45. EEL-POUTS; ZOARCIDAE.

In this family are classified fishes with long eel-shaped bodies covered with small cycloid scales. The head is large, and the mouth is bordered by jaws set with conical teeth. The dorsal and anal fins are very long and the pectorals are small. The lateral line is absent. Three species occur in our fauna.

The Pacific Eel-pout, *Lycodopsis pacificus* (Collett), may be recognized by the black margins on the vertical fins. It reaches a length of 18 inches.

The Short-finned Eel-pout, *Lycodes brevipes* (Bean), can be discriminated by the minute size of the ventral fins, which are only one-third of the distance across the eye.

The Wattled Eel-pout, *Lycodes palearis* (Gilbert), originally described from Alaska, was unknown from Puget Sound till a few specimens were brought up in the trawl at Friday Harbor in 1909. The ventral fins are much longer than in *L. brevipes*, and in *L. palearis* a wide membranous border is present on the inner edge of the mandible, terminating in front in a pair of sharp-pointed flaps, the whole arrangement suggesting wattles. It is 7 inches in length.

FAMILY 46. VIPER-FISHES; SCYTALINIDAE.

The only species classified in this family is the curious Viper Fish, *Scytalina cerdale* (Jordan and Gilbert), (Fig. 101) originally described from Neah Bay and not since found elsewhere. It is a small blenny-like fish with a snaky head. The body is narrowed to a neck behind the head. There is no lateral line. The dorsal fin is very low, the pectorals are small and the dorsal and anal fins are united to the caudal. It burrows in the debris among rocks at low tide.

EXPLANATION OF FIGURES.

83. Three-spined Sea-poacher, *Xeneretmus triacanthus* (Gilbert).
84. Inky Sea-poacher, *Averruncus emmelane* (Jordan and Starks).
85. Four-horned Sea-poacher, *Hypsagonus quadricornis* (Cuvier and Valenciennes).
86. Smooth Lump-sucker, *Lethotremis vinolentis* (Jordan and Starks).
87. Green's Sea-snail, *Liparis greeni* (Jordan and Starks).
88. Beautiful-tooth Sea-snail, *Liparis callyodon* (Pallas).
89. Jordan's Ronquil, *Ronquilus jordani* (Gilbert).
90. Arrow Goby, *Clevelandia ios* (Jordan and Gilbert).
91. Cling-fish, *Caularchus meandricus* (Girard).
92. Midshipman or Singing Fish, *Porichthys* sp.
93. Decorated Blenny, *Bryostemma decoratum* (Jordan and Snyder).
94. Ornamented Blenny, *Bryostemma nugator* (Jordan and Williams).
95. Chameleon Blenny, *Pholis ornatus* (Girard).
96. Crested Blenny, *Anoplarchus atropurpureus* (Kittlitz).
97. Belted Blenny, *Xiphistes chirus* (Jordan and Gilbert).
98. Barred Blenny, *Plectobranchnus evides* (Gilbert).
99. Aleutian Blenny, *Lyconectes aleutensis* (Gilbert).
100. Rock Blenny, *Xiphidion rupestre* (Jordan and Gilbert).



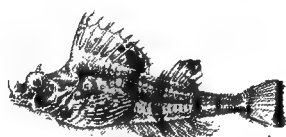
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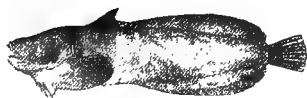
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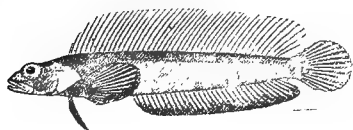
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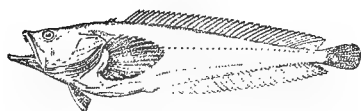
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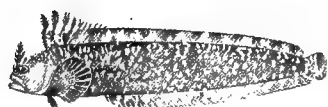
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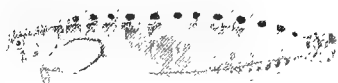
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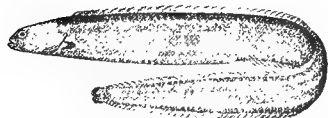
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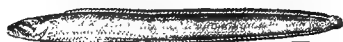
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FAMILY 47. CODS; GADIDAE.

In this group we have the cod and its various relatives. They are readily recognized by the division of the dorsal fin into three separate parts, and by the presence of a barbel on the lower jaw. The anal fin is likewise divided to form two sections. Four species of the cod family occur in our waters.

The Pacific Codfish, *Gadus macrocephalus* (Tilesius), (Fig. 102) differs but little from the cod of the Atlantic, but the species have been regarded as zoologically distinct. The main distribution of the Pacific Cod is on the banks in the North Pacific. It does not occur in sufficient abundance in our waters to constitute a fishery.

The Tom-cod, *Microgadus proximus* (Girard), (Fig. 104) has the appearance of a miniature cod, the young of which it resembles very closely. The technical difference between the two genera is in the position of the vent. In *Gadus* it is below the second dorsal fin, while in *Microgadus* it is in front of the same fin. It is a valuable food fish, attaining a length of about one foot.

The Puget Sound Pollack, *Theragra fucensis* (Jordan and Gilbert) is closely related to the Alaska Pollack, *Theragra chalcogramma* (Pallas), (Fig. 103) which it replaces to the southward. It differs from the cod and Tom-cod in that the lower jaw projects beyond the upper and the barbel is of small size. It is a valuable food fish and attains a length of two feet.

The Cusk-Codling, *Brosmophycis marginatus* (Ayres), is a fish which was formerly classed in the family *Brotulidae* but its relationship with the Cod family having been established it is now placed with the latter. It is an exceedingly rare fish at present since our knowledge of it is based on two specimens, one taken at San Francisco, the other in Puget Sound. It rather does violence to the usual cod type, since the dorsal fin is not divided to form the usual three finlets but is a continuous structure, and the anal is formed on the same type. The ventral fins are developed as long filaments. There are no barbels on the head. The California example measures 12 inches.

FAMILY 48. HAKES; MERLUCCIIDAE.

A family of fishes closely allied to the cods, the differences between the groups being based on technical points in the skeleton. The only species on the Pacific Coast is the Horse Mackerel or Pacific Hake, *Merluccius productus* (Ayres), (Fig. 105). The second dorsal fin is deeply notched but not divided into two separate fins as in the cods. The head is sharply pointed. The scales are very small and are deciduous. The fish is silvery gray in color and attains a length of three feet.

FAMILY 49. RIBBON FISHES; TRACHYPTERIDAE.

The only species of this family recorded from Puget Sound is the remarkable fish known as the King of the Salmon, *Trachypterus rex-salmonorum* (Jordan and Gilbert), (Fig. 106). It is very rare as it appears to be a deep-water species which comes to our shores only through some accidental cause. Its body is from 5 to 7 feet in length, compressed so as to be exceedingly thin and covered with a skin shining like burnished silver. The dorsal fin extends far forward and at its anterior end there is a raised finlet consisting of four greatly lengthened rays. The eye is very large, and the tail-fin, instead of spreading out fan-like in the usual manner, is greatly elongated and directed diagonally upwards.

FAMILY 50. THE FLAT FISHES; PLEURONECTIDAE.

This large family which is represented in our waters by fifteen species contains fishes which are almost without exception of food value, although only a limited number of kinds ordinarily reach the market.

The members of this family are immediately recognized by the characteristic flattened form, the animals actually swimming on one side, with a corresponding distortion of the bodily structure, the most noticeable change being in the position of the eyes, one of these organs necessarily shifting around from the under side. The shifting of the fins is also rather striking in most cases.

The forms commonly called flat fishes include two families, the second of these being the Soles (*Soleidae*). None of the latter occur within our faunal limits, so all of our flat fishes are necessarily halibuts, flounders and turbot.

The Halibut, *Hippoglossus hippoglossoides* (Linnaeus), (Fig. 107) is our largest and, commercially speaking, most important flat fish. The ventral fins are symmetrical and the one on the ventral side is not extended along the ridge of the abdomen. The mouth is but slightly distorted, and the caudal fin is lunate. The scales are small and cycloid in form. The lateral line has a bow anteriorly. It attains a length of 6 to 8 feet and a weight of upwards of 600 pounds, but specimens of these dimensions are naturally rare. Halibut are taken within the limits of Puget Sound, but the commercial catch comes from the banks off Cape Flattery or farther to the north.

Jordan's Flounder, *Eopsetta jordani* (Lockington), is sometimes erroneously called California Sole. The fins and mouth are formed much as in the halibut. The lateral line lacks the bow at the anterior end and is without an accessory dorsal branch. Two rows of teeth are present in the upper jaw, one row in the lower. The scales are small. The fish attains a length of 20 inches and is an excellent food fish, but is not abundant in Puget Sound.

EXPLANATION OF FIGURES.

101. Viper-fish, *Scytalina cerdale* (Jordan and Gilbert).
102. Cod-fish, *Gadus* sp.
103. Pollack, *Theragra* sp.
104. Tom-cod, *Microgadus proximus* (Girard).
105. Pacific Hake, *Merluccius productus* (Ayres).
106. King of the Salmon, *Trachypterus* sp.
107. Halibut, *Hippoglossus hippoglossoides* (Linnaeus).
108. Puget Sound Sand-dab, *Hippoglossoides elassodon* (Jordan and Gilbert).
109. Black-spotted Flounder, *Psettichthys melanostictus* (Girard).
110. Soft Flounder or Plaice, *Citharichthys sordidus* (Girard).
111. Rough Flounder, *Inopsetta ischrya* (Jordan and Gilbert).
112. Rock Flounder, *Lepidopsetta bilineata* (Ayres).
113. Speckled Flounder, *Pleuronichthys nephelus* (Starks and Thompson).
114. Starry Flounder or Diamond Flounder, *Platichthys stellatus* (Pallas).



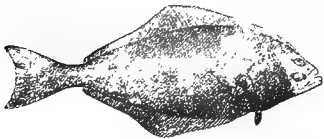
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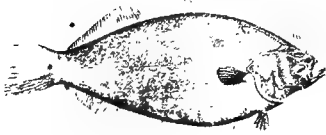
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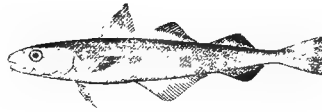
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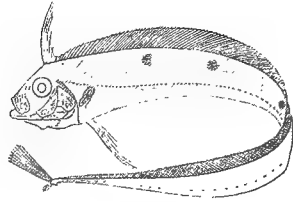
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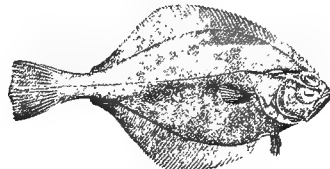
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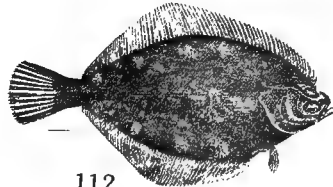
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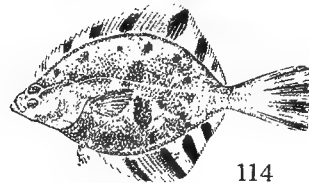
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The Puget Sound Sand-dab, *Hippoglossoides classodon* (Jordan and Gilbert), (Fig. 108) resembles *Eopsetta* but has a single row of teeth in the upper jaw instead of two, and possesses a spine developed in connection with the anal fin. It has a length of 18 inches.

The Slender Flounder, *Lyopsetta exilis* (Jordan and Gilbert), is another relative of *Eopsetta*, but the scales are unusually large and the proportions are more slender.

The Black-spotted Flounder, *Psettichthys melanostictus* (Girard), (Fig. 109) resembles the preceding species but has an accessory branch to the lateral line. It is grayish brown with fine black markings. It is 20 inches long and highly regarded as a food fish.

The Soft Flounder or Plaice, *Citharichthys sordidus* (Girard), (Fig. 110) is our only representative of the tribe of flat fishes known abroad as turbot. They differ from the above described species which are all related rather closely to the halibut and flounder, in possessing a relatively large mouth, and the eye and color is on the left side rather than on the right. The caudal fin is rounded and the ventral fins are dissimilar in form and position. The space between the eyes is concave. This species attains a weight of two pounds but is not highly regarded as a food fish, since the flesh is soft.

The Speckled Flounder, *Citharichthys stigmaeus* (Jordan and Gilbert), is of the same general type as the soft flounder, but with the space between the eyes raised in a sharp ridge. Very few specimens of this species have been taken.

The Scaly-finned Flounder, *Isopsetta isoleis* (Lockington), has a small unsymmetrical mouth, with the bones on the blind side strongly curved. The lateral line has an accessory branch and is arched but slightly in front. The fins are low, and are covered with ctenoid scales. It reaches a length of 15 inches and is a good food fish.

The Rough Flounder, *Inopsetta ischrya* (Jordan and Gilbert), (Fig. 111) is similar to the preceding species but the teeth are incisor-like and the scales are not imbricated. Specimens weigh up to four pounds. It is not common in our waters but is a good food fish.

The Near-eyed Flounder, *Parophrys vetulus* (Girard), is closely related to *Inopsetta* and has the same incisor-like teeth, but the scales are imbricated and the space between the eyes is very narrow.

The Rock Flounder, *Lepidopsetta bilineata* (Ayres), (Fig. 112) is of the same general type as *Isopsetta* and *Inopsetta*, but the lateral line has a distinct arch in front and an accessory branch is developed. The scales are imbricated. In color it is yellowish brown with many pale blotches.

The Starry Flounder or Diamond Flounder, *Platichthys stellatus* (Pallas), (Fig. 114) is one of our most familiar flat fishes, as it is very

common and is constantly seen in the markets. It is immediately recognized by the absence of scales, their place being taken by a corresponding number of stellate tubercles. It is dark brown above with a number of pronounced blotches of black upon the fins. It attains a considerable size, specimens two feet in length being on record.

The Smear-dab or Slippery Sole, *Microstomus pacificus* (Lockington), is a species which secretes an extraordinary amount of mucus when taken from the water, which makes them extremely slippery. The mouth is small and the eyes unusually large. The pectoral fins are of about equal size. No spine is developed at the front end of the anal fin. Ground color, pale brown with darker blotches. The larger specimens weigh upwards of a pound and are used for food.

The Long-finned Flounder, *Glyptocephalus zachirus* (Lockington), is easily recognized by the extraordinary length of the pectoral fin on the upper side, which is fully one-quarter the length of the body. The lateral line is nearly straight. In color it is pale brown, varying to ashy. This species is so thin and the flesh so dry it is not regarded as a desirable food fish.

The Speckled Flounder, *Pleuronichthys nephetus* (Starks and Thompson), is an abundant species in Puget Sound. The lateral line is nearly straight and has a dorsal branch. The scales are large, circular and imbedded in the skin. The lips are thick and have several lengthwise folds. The anal fin is preceded by a spine. In color this species is mottled and speckled in a variegated pattern, but several conspicuous dark spots on the side and others on the tail fin give a distinctive marking to the fish. It attains a length of about a foot.

