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A Key to the Families of Marine Fishes of the West Coast

By EDWIN C. STARKS, Stanford University

This key treats of the families of marine fishes that are represented by species that have been found within a depth of 100 fathoms on the western coast of the United States, exclusive of Alaska.

The only publication that it is possible to use for the identification of west coast species of fishes is Jordan and Evermann's "Fishes of North and Middle America." On account of the large number of families there treated of, the key is difficult to use. This key, being restricted to a much smaller fauna, will simplify the use of Jordan and Evermann's work on western fishes.

The characters here used do not define the families as a whole; but they serve as a means of identification of the families as restricted by the fishes that happen to occur within the limits of the locality here considered. For instance, "Body tapering backwards to a point" is not a character that defines the family Soleidae, but it is a character of the only member of that family that is found on our coast. Hence this key is in most cases useless for the identification of these same families as represented in other localities.

A zoological key is arranged to consider alternative characters; one character being under a figure (as 10) as contrasted with the same figure prime (10'). In some cases a second, third, or greater number of alternatives are used (10" or 10'''). If, on consulting the key, the characters under the first number do not fit the specimen at hand, try those under the first alternative number. When they do fit, read on down as far as they continue to fit; and when they do not fit, skip to the alternative number where they do. Thus go as far as possible and the family name will be found.

Suppose, for instance, we have a horse mackerel whose family we wish to find. Under the bony fishes we find that the first character (under A) depends upon whether or not the ventral fins are on the abdomen. We find that they are not, but that they are thoracic as under the alternative heading (B). Starting at 1, we find the eyes

are not both on the same side of the head, so we skip to 1', which correctly describes them. Under the next number, 3, the character, "gill opening behind lower part of pectoral base," does not fit, and we turn to 3', which does. Under 4, we find that our specimen has no bony stay extending back from eye, and hence the alternative is 4'. The ventral fins are not united as under 9, and we turn to 9'. Under 10, "body with scales" is correct. Under the next number, 11, top of head with a sucking disk is not correct, but 11' is. Pectoral rays are not detached as under 12, but are entire as under 12'. The condition of the ventral rays is as described under 13. As the dorsal rays are not followed by finlets, as under 14, we go to 14'. Under the next number, 15, we find the lateral line is armed with bony plates as described, and as we can go no further in the key, we correctly conclude that our specimen is a member of the family Carangidae.

In the preparation of a key of the length of this one, it is inevitable that mistakes and discrepancies occur. Many of these are nearly impossible to detect except by the actual application of the key to specimens. Though the key has been used to some extent by students of ichthyology at Stanford University, and some of its mistakes thus corrected, it is very probable that its more extended use will reveal others. When mistakes are found, the author will be grateful to be informed of them.

Since this key was written, representatives of a few additional families have been taken on our coast. These are so rare, or so seldom taken, that it does not seem worth the rather considerable amount of work that would be necessary to change the key to include them. They are here separately listed with their characters.

1.1. Family TETRAGONURIDAE (The Square Tails)

Represented by *Tetragonurus cuvieri*, taken on the southern California coast. The body is covered with hard, grooved scales, arranged in oblique rows; two sharp keels on each side of tail; the teeth comblike and in a single row; the spinous dorsal about half as high and twice as long as the rayed dorsal; the anal shorter than the second dorsal and nearly under it.

1.2. Family MACRORHAMPHOSIDAE (The Snipe Fishes)

Represented by *Macrorhamphosus hawaiiensis*, taken off the southern California coast. The body is short and rather deep; covered with thick rough scales; the very small mouth at the end of a long tube; the second spine of the dorsal is very long and stout.

1.3. Family MULLIDAE (The Goat Fishes)

Represented by *Upeneus dentatus*, taken on the southern California coast. The presence of a pair of long, fleshy appendages just under the tip of the lower jaw will at once identify this family.

1.4. Family LOPHOTIDAE (The Ribbon Fishes)

Represented by *Lophotes cepedianus*, recently taken on the southern California coast. It is band-like, being exceedingly thin for its depth and length, and covered with thin, silvery skin. Its head rises to a thin crest with a high spine in front of it. Following this is a long dorsal fin running the whole length of the back. The caudal fin is very small, and the anal is close under it.

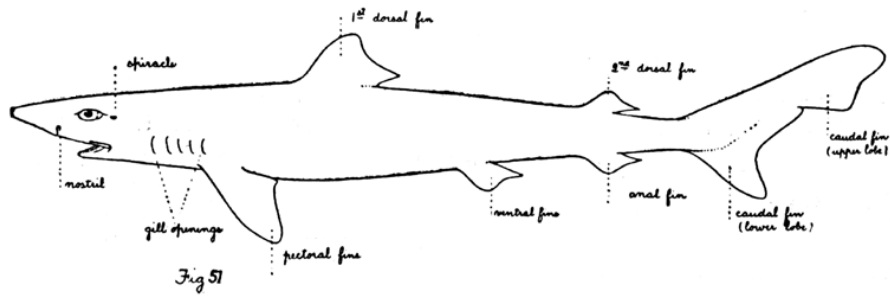


FIG. 1. Example of a shark.
 FIG. 1. Example of a shark

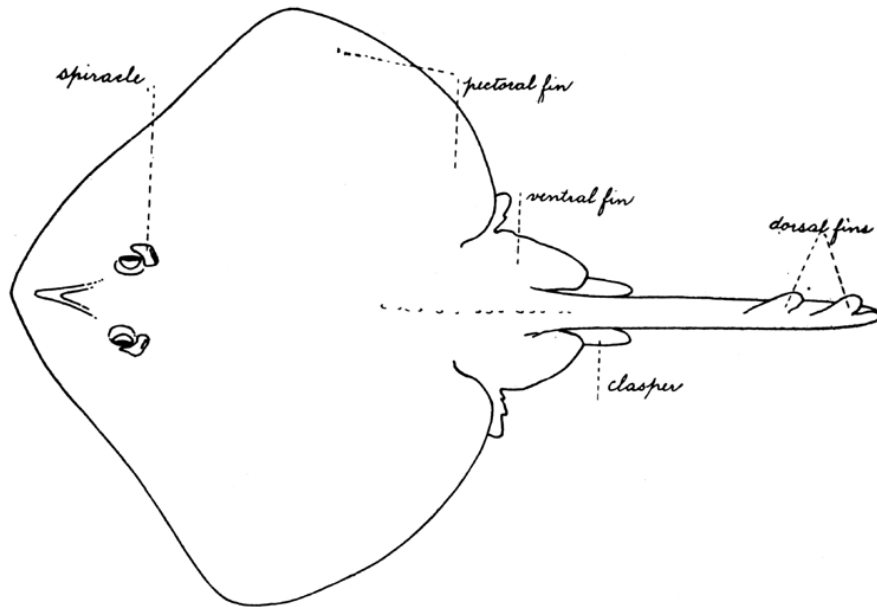


FIG. 2. Example of a skate with notched ventrals.
 FIG. 2. Example of a skate with notched ventrals

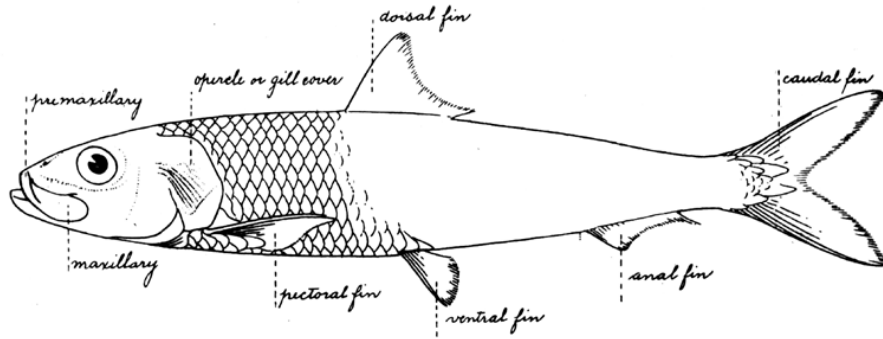


FIG. 3. Example of a fish with abdominal ventrals.

FIG. 3. Example of a fish with abdominal ventrals

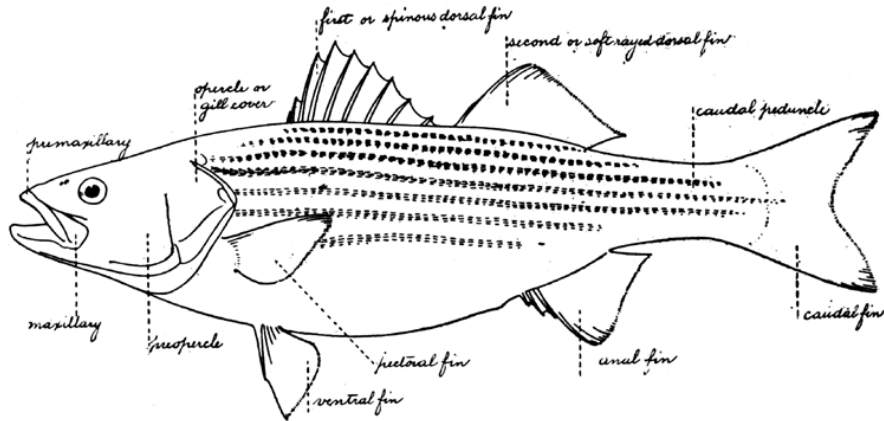


FIG. 4. Example of a fish with thoracic ventrals.

FIG. 4. Example of a fish with thoracic ventrals

Classes of Fishes and Fish-like Vertebrates.

1. Mouth a sucking disk without jaws; a single median nostril; body eel-shaped, with gill openings pore-like, 6 to 14 in number on each side; skeleton membranous or fibrocellular----- (*Lamprcy Eels*) *MARSIPOBRANCHI*
- 1'. Mouth normal with well developed jaws; nostrils not single or median.
2. Skeleton cartilaginous, 5 to 7 gill openings with one exception.(')----- (*Sharks, Skates, and the Chimaeras*) *ELASMOBRANCHI*
- 2'. Skeleton at least partly bony (indicated by bony gill cover)----- (*Bony Fishes*) *TELEOSTOMI*

FAMILIES OF LAMPREY EELS.

1. Eyes covered by skin and aborted; gill openings remote from head, 11 to 13 in number on each side----- (*The Hag Fishes*) *HEPTATREMIDAE*
- 1'. Eyes developed; gill opening close behind head, 7 in number on each side----- (*The Lampreys*) *PETROMYZONIDAE*

FAMILIES OF SHARKS, SKATES AND CHIMAERAS.

A. GILL OPENINGS 5 TO 7 IN NUMBER.

1. Gill openings not wholly on lower surface of body; body not depressed into a disk (except in one species having the gill openings contained in a deep notch on side of body, see 11').
2. Gill openings 6 or 7 on each side----- (*The Cow Sharks*) *HEXANCHIDAE*
- 2'. Gill openings 5 on each side.
3. Anal fin present.
4. Dorsal fins each provided with a strong spine----- (*The Bullhead Sharks*) *HETERODONTIDAE*
- 4'. Dorsal fins not provided with spines.
5. First dorsal over or behind the ventrals----- (*The Cat Sharks*) *SCYLLIORHINIDAE*
- 5'. First dorsal more or less in advance of ventrals.
6. Caudal fin not lunate, and with a well developed notch towards its tip; side of caudal peduncle without a keel.
7. Caudal fin forming less than one-third of the total length of the fish; eye with a nictitating membrane.
8. Head normally formed----- (*The Requiem Sharks*) *GALEIDAE*
- 8'. Head mallet-shaped by the extension of the sides----- (*The Hammer-headed Sharks*) *SPHYRNIDAE*
- 7'. Caudal fin forming more than one-half of the total length----- (*The Thresher Sharks*) *ALOPHIIDAE*
- 6'. Caudal fin lunate; a notch scarcely developed towards its tip; side of caudal peduncle with a well developed keel.
10. Gill openings of moderate size----- (*The Mackerel Sharks*) *LAMNIDAE*
- 10'. Gill openings very large, nearly meeting under the throat; teeth very small----- (*The Basking Sharks*) *CETORHINIDAE*
- 3'. Anal fin absent.
11. Shape of body normal (as deep as broad).
12. Dorsal fins each with a stout spine----- (*The Dog Fishes*) *SQUALIDAE*
- 12'. Dorsal fins without spines----- (*The Sleeper Sharks*) *DALATIIDAE*
- 11'. Body depressed or flattened to a disk; a deep notch at the "neck" in which the gill openings lie----- (*The Angel Sharks*) *SQUATINIDAE*

*The one exception has a smooth silvery skin; sharp chisel-edged dental plates; a long, sharp spine to the first dorsal only (sharks with dorsal spines have one to each of the two dorsals); and the tail tapering to a fine point (*The Chimaeras*).

- 1'. Gill openings altogether on the ventral surface of the body; body and fins forming a depressed disk.
13. Tail thick and with 2 dorsal fins; no long serrated spine or sting on top of tail.
14. Skin everywhere perfectly smooth.....(*The Electric Rays*) *NARCOBATIDAE*
- 14'. Skin rough with large scattered spines; sometimes in the young confined to rows on the tail.
15. Caudal fin well developed; ventrals not notched on posterior edges.....(*The Guitar Fishes*) *RHINOBATIDAE*
- 15'. Caudal fin absent or represented only by a slight fold of skin; dorsals near tip of tail; ventrals notched behind.....(*The Skates*) *RAJIDAE*
- 13'. Tail slender or often whip-like; dorsal fin single or wanting; back of tail normally with a long serrated spine or sting (sometimes duplicated; occasionally absent).
16. Eyes on top of head; no dorsal fin in front of sting.....(*The Sting Rays*) *DASYATIDAE*
- 16'. Eyes at sides of head; a single dorsal fin in front of sting.
17. Teeth large, flat, paved, and few in number; head without appendages in front...(*The Eagle Rays*) *MYLIOBATIDAE*
- 17'. Teeth numerous and small; head with a pair of horn-like appendages just under the edge in front.....(*The Sea Devils*) *MANTIDAE*
- AA. GILL OPENING SINGLE; TAIL EXTENDING TO A FINE POINT; FIRST DORSAL WITH A LARGE SHARP SPINE; SKIN SILVERY AND WITHOUT SCALES; BLUNT SNOUT PROJECTING OVER MOUTH.....(*The Rat Fishes*) *CHIMAERIDAE*

FAMILIES OF BONY FISHES.

A. VENTRAL FINS PRESENT; ABDOMINAL (the pelvic girdle not connected with the shoulder girdle).

1. Dorsal fins 2; the anterior chiefly of soft rays, the posterior chiefly adipose.
2. Body scaleless; dorsal fin very long and high; teeth fanglike.....(*The Fang Fishes*) *PLAGYODONTIDAE*
- 2'. Body covered with scales.
3. Front of dorsal little if any behind middle of body.
4. Sides without photophores, or shining spots.
5. Head without scales.
6. Maxillary extending behind eye in adult; a scaly appendage above ventral base; stomach with many pyloric coeca.....(*The Salmon Family*) *SALMONIDAE*
- 6'. Maxillary not extending behind eye; ventral without appendage; stomach with few pyloric coeca...(*The Smelts*) *ARGENTINIDAE*
- 5'. Head with scales.....(*The Lizard Fishes*) *SYNODONTIDAE*
- 4'. Sides of body with photophores (shining spots).....(*The Lantern Fishes*) *MYCTOPHIDAE*
- 3'. Front of dorsal considerably behind middle of body.....(*The Sudis Fishes*) *PARALEPIDIDAE*

FAMILIES OF BONY FISHES—Continued.

A. VENTRAL FINS PRESENT—Continued.

- 1'. Dorsal fin single, composed chiefly of soft rays not preceded by disconnected spines; no adipose dorsal present.
7. Upper lobe of caudal fin much longer than lower lobe; body with large bony plates, each with a sharp keel or spine.....(*The Sturgeons*) ACIPENSERIDAE
- 7'. Upper lobe of caudal fin not the longer; body without plates.
8. Pectoral fin enlarged to form an organ of flight.....(*The Flying Fishes*) EXOCOETIDAE
- 8'. Pectoral fin not excessively enlarged.
9. One or both jaws excessively prolonged.
10. Both jaws prolonged.....(*The Needle Fishes*) ESOCIDAE
- 10'. Lower jaw prolonged.....(*The Half-beaks*) HEMIRAMPHIDAE
- 9'. Jaws not excessively prolonged.
11. Head with scales.....(*The Killifishes*) POECILIIDAE
- 11'. Head without scales.
12. Lateral line present.....(*The Lady Fishes*) ALBULIDAE
- 12'. Lateral line absent.
13. Mouth terminal; not excessively large; maxillary not nearly reaching to gill opening.....(*The Herrings*) CLUPEIDAE
- 13'. Mouth inferior; below a tapering snout; mouth very large; maxillary reaching nearly to gill opening.....(*The Anchovies*) ENGRAULIDAE
- 1''. Dorsal fin preceded by free spines.
14. Ventral fin with 1 spine and 1 ray; the snout not prolonged and tubular.....(*The Stickle-backs*) GASTEROSTEIDAE
- 14'. Ventral fin with 1 spine and 5 rays; the snout prolonged to a tube.....(*The Flute-mouth Fishes*) AULORHYNCHIDAE
- 1'''. Dorsal fins 2; the anterior of spines connected by membrane; the posterior chiefly of soft rays.
15. Pectoral with the lower 5 to 8 rays detached, prolonged, and filamentous.....(*The Threadfins*) POLYNEMIDAE
- 15'. Pectoral fins entire.
16. Teeth strong; unequal; lateral line present.....(*The Barracudas*) SPHYRAENIDAE
- 16'. Teeth small or wanting; lateral line absent.
17. Anal with 2 or 3 spines.....(*The Mulletts*) MUGILIDAE
- 17'. Anal spine single.....(*The Silversides*) ATHERINIDAE
- 1'''''. Dorsal fin single; of soft rays; followed by a series of detached rays or finlets.....(*The Sauries*) SCOMBRESOCIDAE

B. VENTRAL FINS THORACIC (placed not far behind base of pectorals, and internally connected with shoulder girdle), or JUGULAR (placed in front of pectorals).

1. Both eyes on same side of head.
2. Body tapering backwards to a point; anal and dorsal not separated from caudal; skin and scales extending over preopercle-----(*The True Soles*) SOLEIDAE
- 2'. Body not tapering to a point behind; dorsal and anal separate from caudal; edge of preopercle evident -----(*The Flounders*) PLEURONECTIDAE
- 1'. Both eyes not on same side of head.
3. Gill opening behind lower part of pectoral base-----(*The Angler Fishes*) ANTENNARIIDAE
- 3'. Gill opening in front of pectoral base.
4. A bony stay extending back from lower part of eye across cheek just under the skin, or else the side of the head entirely covered with bony plates.
5. Head entirely covered with bony plates.
6. Body with ordinary scales; pectoral with 3 lower rays detached and finger-like-----(*The Gurnards*) TRIGLIDAE
- 6'. Body as well as head incased in bony plates; pectoral fin entire----- (*The Sea Poachers*) AGONIDAE
- 5'. Head not covered with bony plates.
7. Slit behind fourth gill reduced to a small pore or wanting.
- 7-a. Gill opening not extending to opposite lower pectoral ray-----(*The Horsehead Sculpins*) RAMPHOCOTTIDAE
- 7'a. Gill opening extending down to at least lower pectoral ray.
8. Body wholly or partly naked or covered with prickles, but never completely covered with scales; anal spines obsolete -----(*The Sculpins*) COTTIDAE
- 8'. Body uniformly covered with scales; anal spines, 3-----(*The Rock Fishes*) SCORPAENIDAE
- 7'. Slit behind fourth gill larger than a pore-----(*The Greenlings*) HEXAGRAMMIDAE
- 4'. No bony stay, or plates on head as above.
9. Ventral fins completely united with each other-----(*The Gobies*) GOBIIDAE
- 9'. Ventral fins not united.
10. Body covered with scales.
11. Top of head covered with a large sucking disk composed of transverse plates-----(*The Remoras*) ECHENEIDIDAE
- 11'. Top of head without sucking disk.
12. Pectoral fin with its lower 5 to 9 rays detached and elongate, and at a distance below the rest of the fin-----(*The Threadfins*) POLYNEMIDAE
- 12'. Pectoral fin entire.

¹Including *Anoplopomidae*.

FAMILIES OF BONY FISHES—Continued.

B. VENTRAL FINS THORACIC OR JUGULAR—Continued.

- 13. Ventral fins each with 5 rays and preceded by a more or less evident spine (sometimes grown fast to first ray).
- 14. Dorsal and anal each followed by detached rays or finlets-----(*The Mackerels*) SCOMBRIDAE
- 14'. Dorsal not followed by finlets.
- 15. Lateral line armed posteriorly with a series of large keeled plates or scales -----(*The Horse Mackerels and Yellowtails*) CARANGIDAE
- 15'. Lateral line not armed as above.
- 16. Vomer with teeth.
- 17. Dorsal fin continuous (without notch) and without distinct spines.
- 18. Dorsal fin beginning on head and running nearly the length of the back; caudal fin forked-----(*The Dolphins*) CORYPHAENIDAE
- 18'. Dorsal fin not beginning on head; caudal rounded or truncate.
- 19. Lateral line running high, not far from the dorsal base, and not reaching the caudal fin -----(*The Ranquils*) BATHYMASTERIDAE
- 19'. Lateral line if present not high on the back, but reaching to the caudal fin-----(*The Rag Fishes*) ICOSTEIDAE
- 17'. Dorsal fin not continuous and with a spinous portion.
- 20. Anal fin preceded by two spines scarcely connected with the rest of the fin -----(*The Horse Mackerels and Yellowtails*) CARANGIDAE
- 20'. Anal fin not preceded by disconnected spines.
- 21. Tail with a keel on each side-----(*The Horse Mackerels and Yellowtails*) CARANGIDAE
- 21'. Tail without a keel.
- 22. Upper edge of maxillary slipping for its full length under edge of preorbital when mouth is closed-----(*The Rudder Fishes*) KYPHOSIDAE
- 22'. Maxillary not slipping under edge of preorbital posteriorly-----(*The Sea Basses*) SERRANIDAE
- 16'. Vomer without teeth.
- 23. Teeth brush-like (fine, long, even, and movable)----- (*The Spade Fishes*) EPHIPPIDAE
- 23'. Teeth not brush-like.
- 24. Scales just before middle of body 3 or 4 times deeper (vertically) than long (horizontally) ----- (*The Pomfreys*) BRAMIDAE
- 24'. Scales not as above.

25. Dorsal and anal fins without distinct spines-----(*The Rag Fishes*) ICOSTEIDAE
- 25'. Dorsal and anal spines present.
26. Anal spines, 1 or 2.
27. Lateral line ending under soft dorsal-----(*The Demoiselles*) POMACENTRIDAE
- 27'. Lateral line, if present, ending at, or on, caudal fin.
28. Dorsals separated, or with a notch between them; no posterior canines on upper jaw-----(*The Croakers*) SCIAENIDAE
- 28'. Dorsals continuous; upper jaw with posterior canines-----(*The Blanquillos*) MALACANTHIDAE
- 26'. Anal spines 3.
29. Anal with more than 17 soft rays.
30. Soft dorsal and anal so covered with scales that the rays are nearly hidden-----(*The Rudder Fishes*) KYPHOSIDAE
- 30'. Soft dorsal and anal not densely covered with scales----(*The Viviparous Surf-fishes*) EMBIOTOCIDAE
- 29'. Anal with 16 or fewer soft rays.
31. Dorsal spines 9 or 10.
32. Cheeks and opercles with scales.
33. Anal rays 6 to 8-----(*The Mojarras*) GERRIDAE
- 33'. Anal rays 15 or 16-----(*The Viviparous Surf-fishes*) EMBIOTOCIDAE
- 32'. Cheeks and opercles naked-----(*The Wrasse-fishes*) LABRIDAE
- 31'. Dorsal spines 11 to 15.
34. Teeth large and canine-like, fixed, and sloping obliquely forward; scales cycloid-----(*The Wrasse-fishes*) LABRIDAE
- 34'. Teeth freely movable, in bands, with the outer teeth shorter than the inner, stained brown, and each one divided into 3 points at its tip; scales ctenoid--(*The Rudder Fishes*) KYPHOSIDAE
- 34''. Teeth villiform, not as in 34'; scales ctenoid-----(*The Grunters*) HAEMULIDAE
- 13'. Ventrals each with more than 5 rays, preceded by a more or less evident spine.
35. Ventrals with 7 soft rays.
36. Dorsals divided into 3 well separated fins; the anal into 2; a barbel under tip of lower jaw more or less developed-----(*The Codfishes*) GADIDAE
- 36'. Dorsal divided into 2 fins; the first short; the second long and with a deep notch; anal similar to soft dorsal; no barbel on lower jaw-----(*The Hakes*) MERLUCCIIDAE
- 35'. Ventral with about 15 soft rays; dorsal fin single, elevated in front--(*The Opahs*) LAMPRIDAE

FAMILIES OF BONY FISHES—Continued.

B. VENTRAL FINS THORACIC OR JUGULAR—Continued.

- 13". Ventrals each with less than 5 rays, and with or without a spine.
36. Upper jaw prolonged into a sword-----(*The Marlinspike Swordfishes*) *ISTIOPHORIDAE*
- 36'. Upper jaw not prolonged.
37. Dorsal composed of spines only-----(*The Blennies*) *BLENNIDAE*
- 37'. Dorsal with spines anteriorly and soft rays posteriorly.
38. Pectoral fin entire.
39. Body entirely covered with bony plates-----(*The Sea Poachers*) *AGONIDAE*
- 39'. Body not covered with bony plates-----(*The Blennies*) *BLENNIDAE*
- 38'. Pectoral fin divided into 2 parts; the lower part composed of 3 stout appendages; head covered with bony plates-----(*The Gurnards*) *TRIGLIDAE*
- 37". Dorsal of soft rays only.
40. Body tapering to a blunt point behind; dorsal and anal continuous around caudal.
41. Gill membranes joined to the isthmus-----(*The Eel-pouts*) *ZOARCIDAE*
- 41'. Gill membranes free from the isthmus-----(*The Cusk Eels*) *OPHIDIIDAE*
- 40'. Body not tapering to a point; the caudal fin distinct--(*The Brotuloid Fishes*) *BROTULIDAE*
- 10'. Body naked and smooth, or armed with tubercles, prickles, or scattered bony plates, but never uniformly covered with scales.
42. Breast with a sucking disk.
43. Gill membranes free from isthmus; a single soft dorsal placed posteriorly-----(*The Cling-fishes*) *GOBIESOCIDAE*
- 43'. Gill membranes joined to the isthmus.
44. Skin smooth; dorsal somewhat hidden by the lax skin, long and continuous, or with a short portion anteriorly more or less separated by a notch-----(*The Sea Snails*) *LIPARIDAE*
- 44'. Skin with tubercles or spines; two dorsal fins well separated and about of equal length-----(*The Lump Suckers*) *CYCLOPTERIDAE*
- 42'. Breast without a sucking disk.
45. Dorsal and anal followed by detached rays or finlets--(*The Mackerels*) *SCOMBRIDAE*
- 45'. Dorsal and anal without finlets.
46. Upper jaw prolonged into a sword--(*The Marlinspike Swordfishes*) *ISTIOPHORIDAE*
- 46'. Upper jaw not prolonged into a sword.
47. A bony stay extending across cheek just under the skin from lower level of eye.
48. Gill opening small, not extending below lower edge of pectoral fin-----(*The Horshead Sculpins*) *RAMPHOCOTTIDAE*

- 48'. Gill opening extending at least to lower edge of pectoral fin ----- (*The Sculpins*) COTTIDAE
- 47'. No bony stay across cheek.
49. Body tapering to a blunt point behind; the dorsal and anal continuous around the caudal.
50. Gill membranes joined to the isthmus ----- (*The Eel-pouts*) ZOARCIDAE
- 50'. Gill membranes free from the isthmus ----- (*The Cusk Eels*) OPHIDIIDAE
- 49'. Body not tapering to a point; caudal fin distinct.
51. Anal fin absent; caudal fin directed obliquely upward ----- (*The King of the Herrings*) TRACHYPTERIDAE
- 51'. Anal fin present; caudal normal.
52. Dorsal spines flexible and not sharp.
53. Dorsal spines flexible but not soft; lateral line and fins without prickles; caudal forked; body band-shaped ----- (*The Band Fishes*) LEPIDOPIDAE
- 53'. Dorsal spines soft and ray-like; lateral line and fins with prickles; tail rounded; body not band-shaped ----- (*The Rag Fishes*) ICOSTEIDAE
- 52'. Dorsal spines stiff and sharp.
54. Lips with fringes; mouth when closed nearly vertical ----- (*The Sand-fishes*) TRICHODONTIDAE
- 54'. Lips not fringed; mouth sometimes oblique, but not nearly vertical.
55. Dorsal with only 1 or 2 very short stiff spines just behind the head; body with many small shining spots arranged in series ----- (*The Toad Fishes*) BATRACHOIDIDAE
- 55'. Dorsal spines very numerous ----- (*The Blennies*) BLENNIDAE

C. VENTRAL FINS ENTIRELY WANTING.

1. Gill membranes united to the isthmus (gill opening sometimes reduced to a small slit high on the side).
2. Gill openings reduced to a small pore ----- (*The Moray Eels*) MURAENIDAE
- 2'. Gill openings larger than a pore.
3. Tip of tail a blunt bony point without trace of caudal fin; front nostril a tube on upper lip opening downward ----- (*The Snake Eels*) OPHICHTHYIDAE
- 3'. Tail and nostrils not as above.
4. Jaws greatly elongate, forming a snipe-like beak; the jaws very slender, almost thread-like ---- (*The Snipe Eels*) NEMICHTHYIDAE
- 4'. Jaws not elongate as above.
5. Snout elongate and tubular, bearing very small toothless jaws at the end; body incased in a bony armor ----- (*The Pipefishes*) SYNGNATHIDAE

FAMILIES OF BONY FISHES—Continued.

C. VENTRAL FINS ENTIRELY WANTING—Continued.

5'. Snout not elongate; mouth and body covering not as above.

6. Breast with a sucking disk.

7. Skin smooth and lax

(The Sea Snails) LIPARIDAE

7'. Skin firm, covered with tubercles, or broad plates bearing spines

(The Lump Suckers) CYCLOPTERIDAE

6'. Breast without a sucking disk.

8. Dorsal fins 2; the first of 3 spines; the first spine very large and rough; body deep

(The Trigger Fishes) BALISTIDAE

8'. Dorsal fin single.

9. Dorsal fin extending along nearly the whole back.

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

(The Wolf-fishes) ANARHICHADIDAE

10'. Teeth and body not as above

(The Blennies) BLENNIDAE

9'. Dorsal not nearly extending along the entire back.

11. Teeth on each jaw confluent into one solid plate.

12. Body compressed and rough

(The Head-fishes) MOLIDAE

12'. Body not compressed; covered with stiff sharp spines

(The Porcupine Fishes) DIODONTIDAE

11'. Teeth on each jaw confluent into two

(The Puffers) TETRAODONTIDAE

1'. Gill membranes free from isthmus.

13. Upper jaw prolonged into a sword

(The Swordfishes) XIPHIIDAE

13'. Upper jaw not prolonged into a sword.

14. Body ovate, deep, compressed; the depth about half the length

(The Butter Fishes) STROMATEIDAE

14'. Body more elongate; the depth not over a third of the length, often much less.

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

16. Dorsal and anal not reaching to caudal; caudal peduncle slender; caudal fin concave behind

(The Great Ray Fishes) ACROTIDAE

16'. Dorsal and anal connected with caudal; caudal peduncle wide; caudal fin rounded

(The Gravel Divers) SCYTALINIDAE

15'. Beginning of dorsal evident, rising more or less abruptly.

17. Gill membranes broadly united to each other.

18. Dorsal fins 2

(The Sculpins) COTTIDAE

18'. Dorsal fin long and single

(The Blennies) BLENNIDAE

17. Gill membranes free from each other, or nearly so.

19. Body with scales.

20. Scales arranged to form oblique folds; caudal forked

(The Sand Lances) AMMODYTIDAE

20'. Scales small and normal; caudal rounded or truncate

(The Flaccid Fishes) ZAPRORIDAE

19'. Body naked; ventrals represented by a pair of flat scale-like spines

(The Scabbard Fishes) LEPIDOPIDAE

GLOSSARY

Abdominal: On the abdomen. Usually referring to the ventral fins when the internal, supporting bones (pelvic girdle) are not attached to the shoulder girdle.

Adipose dorsal: A soft, fleshy dorsal, usually small, that has no supporting rays running through it. The trout has a typical adipose dorsal.

Anal fin (or anal): The unpaired fin on the lower side of the body. Rarely, it is composed of two separate parts. Often its front part is composed of spines.

Anal spine: The spine at the front of the anal fin.

Barbel: A fleshy projection or appendage.

Base: Used to designate that part of the fin that is joined to the body.

Bony stay: A rod of bone. In some fishes a flattened bone running from just under the eye to the preopercle.

Caudal fin: The tail fin.

Caudal forked: Said of the caudal fin when its upper and lower rays diverge or fork from each other.

Caudal peduncle: That part of the fish that holds the caudal fin that is behind the dorsal or anal fins.

Caudal truncate: Said of the caudal fin when it is cut squarely off with its edge neither concave nor convex.

Confluent: Running together.

Ctenoid: Said of scales when they are rough behind with small prickles. The prickles may be felt by passing the finger over the scales in the direction of the head.

Cycloid: Said of scales when they are smooth behind. (*See* ctenoid).

Dorsals continuous: Said of the dorsal fins when they are not separated from each other.

Dorsal fin (or dorsal): The fin or fins on the mid line of the back. It may be composed of both spines and rays or either spines or rays. It may be a single fin, or separated into two or three disconnected parts, or only partially separated by notches.

Dorsal side: The back or upper part.

Eel-shaped: Elongate like an eel.

Fibro-cellular: Membranous, fibrous tissue.

Filamentous: Thread-like or running out into a filament.

Finlets: Small fins unconnected with each other as in the mackerel.

Free spines: Spines not connected to each other by membrane.

Gill membranes: The membranes that are just below the gill chambers on each side. They are strengthened by bony rays and may be connected to each other across the isthmus, or may be separate. They may be connected to the isthmus or be free from it.

Gill openings: The opening or openings at the side of the head leading into the chamber containing the gills.

Isthmus: That part that separates the gill openings below.

Jugular: The ventral fins are said to be jugular when they are placed in front of the pectorals.

Keeled plates or scales: Bearing keels or ridges.

Lateral line: A line of pores extending along the side of the body.

Lunate: Moon-shaped. Usually used for organs shaped like a half moon, as the caudal fin of some sharks.

Maxillary: The upper or hinder of the bones that form the upper jaw. A separate bone, the premaxillary is in front of it.

Nictitating membrane: A partial eyelid like the third eyelid of birds; the membranous fold that partially covers the eye in some sharks.

Opercle: The principal bone that forms the gill cover.

Paired fins: The fins placed side by side. Fins placed end to end are not paired.

Pectoral base: That part of the pectoral fin that is joined to the body.

Pectoral fins (or pectorals): The first or uppermost of the paired fins. (*See* ventral fins).

Pectoral fin entire: Said of the fin when it is not broken up into separate parts.

Pectoral rays: The rays that support the membrane of the pectoral fin.

Pelvic girdle: The internal bones that support the ventral fins.

Photophores: Small definite shining spots on the body and head of some fishes.

Preopercle: The bone that forms a ridge on the gill cover bordering the cheek behind.

Preorbital: A bone just before and slightly below the eye.

Pyloric coeca: Small tubes ending blindly and attached to the stomach behind.

Ray: The supporting rods of a fin when they are composed of many small parts placed end to end. (*See* spine). They are never stiff and sharp and may be branched.

Serrated: Saw-toothed.

Shoulder (or pectoral) *girdle*: The internal bones that support the pectoral fins. They border the gill opening behind in the bony fishes.

Skeleton membranous: Without true bone or cartilage.

Snout: That part of the head in front of the eyes.

Soft dorsal: That part of the dorsal fin that is composed of soft rays.

Spine: Any sharp projecting point. The supporting rods of bone in the fins of fishes that are not composed of separate parts placed end to end. (*See* Ray). A magnifier is usually necessary to distinguish a flexible spine from an unbranched ray. Spines are usually stiff and sharp, and then are easily distinguished from rays, but they may be flexible and soft at the tip. They are never branched as a ray often is.

Spinous dorsal: Said of the dorsal when it is composed of spines. (*See* spine).

Sucking disk: A flattened disk-like part by which a fish may attach itself.

Teeth brush-like: Bristle like.

Teeth paved: Said of the teeth when they are flattened and arranged pavement-like or tile-like.

Thoracic: The ventrals are said to be thoracic when the internal bones that support them are attached to the shoulder girdle. When the ventrals are thoracic their base is only a short distance behind the base of the pectoral.

Truncate: Cut squarely off; neither convex or concave.

Tubercle: A pimple-like projection.

Ventral fins (or ventrals): The paired fins that are usually below the pectoral fins. They may be before or behind the pectorals. Occasionally the pectorals are as low as the ventrals, in which case the ventrals are always behind.

Ventral side: The lower side.

Villiform: Said of teeth when they are very slender and crowded. Resembling coarse plush.

Vomer: An unpaired bone in the roof of the mouth just behind the middle of the upper jaw; often bearing small teeth. The palatines are on each side of it and sometimes bear teeth also.