

IX. RESULTS OF AN ICHTHYOLOGICAL SURVEY ABOUT THE SAN JUAN ISLANDS, WASHINGTON.

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The following pages embody the results of a study of a collection of fishes made about the San Juan Islands in the summer of 1909 by the author while a member of the Puget Sound Marine Station.

The San Juan Islands are situated just north of the Strait of Juan de Fuca, and opposite the lower end of Vancouver Island. The marine station is located at Friday Harbor on San Juan Island, but during the summer it was temporarily moved for a part of the time to Olga on Orcas Island.

Part of the equipment of the biological station was one of the powerful little steamers regularly employed as dredging boats in the shrimp-fishery. She was equipped with a shrimp-dredge or trawl, measuring twelve feet across the mouth, and with a hoisting engine and sufficient steel cable to dredge in depths up to forty-five fathoms. By this means all of the deep-water species were taken.

The author wishes to express his obligations to the individual members of the station for their interest and help in obtaining and preserving these specimens, as well as for the many courtesies and privileges of the station extended to him.

He wishes further to express his obligations to Dr. Bashford Dean for financial aid through the American Museum in New York, enabling him to carry on seining operations on the beaches and also to the two students of Stanford University, Messrs. Launce Scofield and Henry Poor, who gave assistance to that end.

Acknowledgment is also due to the members of the Department of Zoölogy of the University of Kansas, who contributed a collection of fishes largely made on the shrimp-boats, while the latter were pursuing their regular occupation of dredging for shrimps. Among these was a new species of *Sebastes*.

Besides the methods already indicated collecting was done with the aid of set-lines and gill-nets, and several species were only taken in pools left by the receding tide, and under the rocks, at low tide.

The specimens are deposited in the collections of Stanford University, in the Carnegie Museum, and in the American Museum of Natural History. The types of the new species are in the Carnegie Museum.

Family HEXANCHIDÆ.

1. *Hexanchus griseus* (Gmelin).

A large specimen of this species was taken in the trawl by the collectors of the Puget Sound Marine Station near Anacortes in 1908.

In a "Note on *Hexanchus griseus*" (Ann. and Mag. Nat. Hist. (7), XVI, 1905) Mr. C. Tate Regan in comparing specimens of this genus from the Atlantic and Japan with a small one from the Pacific Coast of the United States (*Hexanchus corinus* Jordan and Gilbert) concluded them to be all of the same species.

The species *Hexanchus corinus* was based on the following characters in the original description. "This species is closely related to *Hexanchus griseus*, from the Mediterranean and Eastern Atlantic [also from the West Indies]. It differs chiefly in the form of the teeth of the lower jaw, which are serrated on the inner edge, and have on the upper or outer edge only six cusps instead of eight or nine." The largest of the two typical specimens was forty-three inches in length.

Dr. Jordan recently obtained in the market at San Francisco the head of a specimen of this shark. The animal was six or seven feet in length. The jaws were saved. The teeth of this specimen tend to prove the correctness of Mr. Regan's conclusions, as each tooth of the lower jaw has nine well developed cusps.

As to the serrations on the inner edge of the lower teeth Müller and Henle (Syst. Besch. d. Plagiostomen, p. 81) say of Atlantic specimens "Der innere Rand sehr fein gezähfelt."

Since the above was written a female specimen sixty-seven inches in entire length was received from a market in San Francisco. Its description is here included.

Body robust; moderately tapering backwards; the caudal not much bent upwards. Head, measured obliquely across top from tip of snout to first gill opening, 4.16 in length of body to base of caudal, or twice the length of the caudal. Length of eye equal to half the distance from upper lip to tip of snout, which distance is contained 3.66 times in head (obliquely across top). Nostrils near outer edge of snout; a line drawn between posterior edges of nostrils across snout falls medially a little nearer upper lip than tip of snout. Distance

from posterior angle of mouth to first gill opening one diameter of pupil less than distance from upper lip to tip of snout. A deep pocket of membrane is placed at the angle of the lower jaw and covered by the upper jaw when the mouth is closed. Teeth in lower jaw nearly horizontal; eight cusps on each with sometimes a rudimentary ninth; the inner edge of each tooth finely serrated; the symmetrical median tooth with three or four cusps on each side. A group of sharp slender teeth at center of upper jaw; the other teeth longer, directed towards side of jaw, and with one or two cusps on outer base of each. First gill-opening very long, the others becoming progressively shorter backwards; the last, which is contained 3.2 times in head, is three-fifths of the length of the first. When the skin is stretched flat across the throat the distance between the lower ends of the first gill-openings of opposite sides is equal to the length of the fourth gill-opening.

The front of the dorsal is over, or a very little behind, the posterior end of the ventral base, while the posterior end of the dorsal base is a trifle in front of the middle of the anal base. Distance of base of dorsal from caudal base is contained 1.16 times in postorbital part of head. Anterior slope of dorsal equal to its base, or to base of anal, or to anterior slope of ventral. Posterior margin of dorsal very slightly concave; other fins (except caudal) truncate or convex. Anterior slope of pectoral 1.4 in head. When the pectoral is laid close to the body it reaches half-way between the upper part of its base and base of ventrals. Caudal with a very deep notch towards its tip; its lower lobe scarcely developed; anterior slope of lower lobe contained 4.33 times in length of upper lobe, which is contained 2.2 times in rest of body.

Color dark slate, growing lighter below, but not white; under side of snout soiled white; a narrow light lateral stripe along upper part of side to opposite dorsal.

Family RAJIDÆ.

2. *Raja rhina* Jordan and Gilbert.

The adults were commonly taken on set-lines and the young were dredged in deeper water. The following descriptions are of specimens from various localities from the Gulf of California to Puget Sound.

Specimens of both sexes measured on median line from between the front of the eyes were from thirty to forty inches in length.

The snout is 3 in length to the inner angle of pectoral; the interorbital space from 3.25 to 3.75 in snout; width of interspiracle 2.33 to 2.66 in snout. A line drawn between the outer angles of the body crosses the median longitudinal line twice the length of the snout from the tip of the snout, or varying to half the diameter of the eye less than this distance. The spiracle from its posterior edge to the posterior edge of the iris is equal to the length of the iris, or to the posterior edge of the eye-ball is contained 2 times in the eye-ball. Holding the outer lobe of the ventral straight back and measuring from the bottom of the notch in the posterior edge of the ventral to its tip the distance is equal to the interorbital width, or a little greater. Holding the edge of the anterior ventral lobe so that it is at a right angle with the posterior lobe a deep rounded notch is left in its posterior edge. The anterior half of the rostral ridges are fused together. The nearest point on the edge of the disk from the anterior edge of the eye-ball is equal to the width of the inter-spiracle or a little less. The general outline of the anterior margin of the disk is deeply concave with a slightly convex median area. The least distance from this median area to a straight line drawn from the tip of the snout to the outer edge of the pectoral is equal to the interorbital width, or to one diameter of the pupil less than this. The outer angle of the pectoral is variable in acuteness, but never quite so round as in *Raja inornata*.

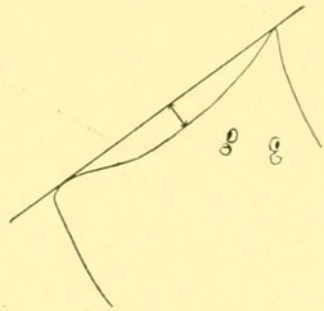


FIG. 1. *Raja rhina*.
Female 32 inches long, to
show outline of front of
disk.

Minute spinules are sparsely scattered over the outer edges of the disk and median line of the back behind the shoulder girdle. Larger stellate spinules are on the anterior edge of the disk, snout, and interorbital space. There are from six to ten enlarged spines around the eye, and sometimes from one to three on the median line between the branchial chambers, but these last are usually absent in large specimens. There are three irregular rows of enlarged spines on the back of the tail, with smaller ones usually scattered between, in the female. In the male the outer row of tail-spines is absent or scattered, there is a patch of very much enlarged spines opposite the eye, and the usual row of sharp spines hooked inward near the angle of the disk. No specimen was observed with more than a single row of these, while large specimens of *Raja binoculata* have two rows and an incomplete third one.

Color dark sienna-brown with irregular black blotches sometimes present. A spot at base of pectoral in the form of an irregular ring always present in the young, and often present in the adult as a ring, or as a diffused blotch, but never larger than the width of the interorbital space. The very young have dark points scattered sparsely over the body.

Specimens from twelve to twenty inches in length differ from these as follows: the interorbital width is contained from 3.5 to 4 in the snout;

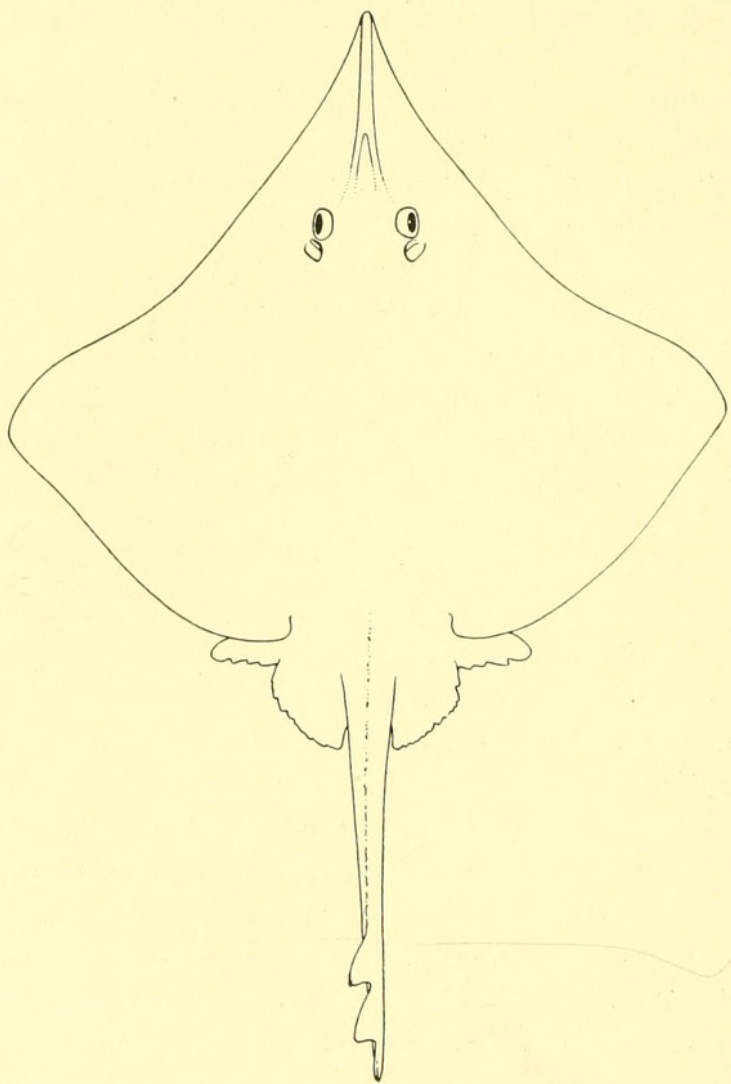


FIG. 2. *Raja rhina*. A female specimen, 32 in. long, from San Francisco.

the interspiracle width from 2.5 to 2.75. The length of the spiracle from its posterior edge to the iris is contained 1.25 in the iris, or to the posterior edge of the eye-ball 2.4 in the eye-ball. The outer ventral lobe from the notch in the posterior edge of the fin is greater than the

interorbital width by from three-fourths to one diameter of the eye. The nearest point from the eye to the edge of the disk is always greater than the interspiracle width. The distance from the median convex area at the side of the front of the disk is not over half of the interorbital space from a straight line drawn from the tip of the snout to the outer pectoral edge. In specimens twenty inches long there are a few spinules on the interorbital, snout, anterior edge of pectoral, and on the median line of the back posteriorly. Specimens twelve inches long and under are, with the exception of the enlarged spines, perfectly smooth.

In the following table measurements are given in hundredths of the length of the disk.

Raja rhina.

Locality.	Puget Sound.	Gulf of California	Puget Sound.		S. California.	Puget Sound.	S. California.	San Francisco.				
			♀	♀		♂	♂	♂	♀	♂	♀	♀
Sex.....	♂	♀	♀	♀	♂	♂	♂	♂	♀	♂	♀	♀
Total length in mm..	250	280	340	422	440	482	525	790	795	810	850	900
Total width in mm..	170	190	234	281	291	337	376	550	552	560	600	620
Length of disk in mm. ¹	135	160	197	238	250	280	320	473	465	463	505	535
Width in hundredths of length of disk..	125	116	120	118	117	120	120	119	119	120	120	118
Between angles of pectorals to posterior edge of disk ²	38	37	41	41	40	40	37	38	37	37	39	37
From between front of eyes to tip of snout	32	33	33	32	32	32	34	32	33	30	33	33
Interorbital width ..	8	7.5	7.5	8	8	9	8	9	8.5	9	9	9
Long diameter of eyeball	7.5	7.5	7	7	7	6	5.5	6	6	6.5	6	6
Eye to nearest point at edge of disk...	16	14	15	15	12	14	12	11	13	11	12	11
Length of outer ventral lobe ³	15	14	15	14	14	15	14	10	12	11	9.5	11
Origin of first dorsal to second dorsal..	12	12	11	13	12	12	11	11	10	11	10	9
Posterior edge of disk to first dorsal	46	50	44	46	50	45	44	42	47	47	45	46
Width of mouth....	16	16	15	17	15	16	15	17	17	17	16	17
From between jaws to tip of snout....	36	37	36	34	37	36	35	32	35	32	36	36

¹From tip of snout to a point on median line opposite tips of pectorals.

²From a point where a line drawn between angles of pectorals crosses median line of back measured back to posterior edge of disk.

³Outer lobe of ventral held straight back and measured from notch in posterior edge of fin.

Specimens just hatched and up to ten inches in length always have only two spines in front of the eye and one behind, a median spine on the back, and a row of spines on the back of the tail. The inter-orbital space is 2.5 in the snout, and the median portion of the anterior edge of the pectoral touches a straight line from the tip of the snout to the outer edge of the pectoral. The young in these respects does not differ from the adult of *Raja inornata*. (The young specimens are from Puget Sound where *Raja inornata* has never been taken.)

3. *Raja binocularata* Girard.

Numerous specimens were taken on set-lines varying in length up to six and one-half feet, and small ones newly hatched and still in the egg-capsule were taken with the dredge. This species reaches a weight of considerably over a hundred pounds.

The snout grows longer with age; the large hooked spines do not grow in proportion with the growth of the body, being smaller in larger individuals, or altogether disappearing; and the body with age grows rougher with spinules.

In the following description the numbers in parenthesis refer to the specimens here listed arranged in reference to size.

Specimen (1) female 77 inches in length, 55.5 inches in width.

Specimen (2) male 60 inches in length, 44 inches in width.

Specimen (3) male 52 inches in length, 38 inches in width.

Specimen (4) female 23 inches in length, 17 inches in width.

Specimen (5) male 16 inches in length, 12 inches in width.

Length of snout from between front of eyes (1) 3.8, (2) 4.33, (3) 4.2, (4) 4.4, (5) 4.6 in width of disk; (1) 2.83, (2 and 3) 3, (4) 3.16, (5) 3.25 in length to inner angle (union with body) of pectoral. Interspiracle width (1, 2, and 4) 1.9, (3 and 5) 1.85 in length of snout. Interorbital width (1) 2.1, (2) 2.5, (3) 2.6, (4 and 5) 3 in length of snout. Length of snout from edge of upper lip (in all) 1.125 in snout from eye. The eye was not measured in (1 and 2). The length of iris is contained (3) 2, (4) 1.5, (5) 1.25 times in distance from its posterior edge to posterior edge of spiracle, or (3) 12, (4) 10, (5) 8.5 times in snout. The length of spiracle (3) 1, (4) 1.33, (5) 1.5 in the length of ball of eye. Transverse width of upper tooth patch (1) 1.9, (2) 1.6, (3) 1.75, (4 and 5) 1.9 in length of snout from upper lip. A line drawn between the outer angles of the pectorals crosses the median line a distance behind the tip of the snout (1, 2, and 4) twice the distance from the tip

of the snout to the middle of the eye or (3 and 5) twice the distance from the tip of the snout to the posterior edge of the eye.

In specimens just hatched, and up to a couple of feet in length, there are two enlarged spines in front of the eye, and one on the orbital margin opposite the posterior edge of the eye. This is very constant; probably three dozen newly hatched young were observed and no variation was found in this respect. These spines are lost in large individuals; no specimen over four feet in length was seen that had them, though in the large ones the spinules of the interorbital space become coarser at the interorbital margins, just as those on the snout become coarser at its tip. But these are not at all like the enlarged hooked orbital spines of the small specimens. In specimens up to two feet in length there is a single row of enlarged spines along the tail, but in large specimens there are three indefinite rows close together. In specimens up to two feet in length there is always a single spine on the median line of the back between the middle of the branchial cavities, which is usually absent in the large ones. The back is everywhere covered with minute prickles in specimens down to sixteen inches in length. Small ones eight to nine inches in length, are smooth, or with prickles only on the median posterior part of the back.

Color dark olive-brown or drab, with a large dusky spot at base of pectoral blending into the body-color. The diameter of the spot is two-thirds of the length of the snout. Light spots as big as the eye are scattered over the body, and form a definite ring around the pectoral spot. Dusky streaks occur on the edge of the pectorals; on the posterior edge following the direction of the rays as short bars, on the anterior edge forming marginal spots, which anteriorly often cross the snout as two bars. Young specimens just hatched have a large, conspicuous, ocellated spot at the base of the pectoral. This has usually a black center encircled by an Indian-red ring, which is in turn encircled by a black ring. Sometimes, however, this spot is solidly coal-black. One egg-capsule was opened, in which there were four young, representing two of each of these color-phases of the spot.

This species is said by Dr. Evermann (Bull. Bur. Fish., XXVI, p. 229) to be specifically identical with *Raja stellulata* and *Raja rhina*. This question is taken up as to *Raja stellulata* under that species. Of the nearly two hundred specimens of the other two species which were caught in Puget Sound no difficulty was experienced in separating them easily and completely, and no important intergrading characters were found.

Raja binocularata may be easily separated from all other rays found on the western coast from San Diego to Puget Sound by the comparatively shallow notch in the posterior edge of the ventrals. From seventy-five to one hundred specimens were observed, and this character was not found to vary materially between individuals just hatched and those over six feet in length. When the outer edge of the ventral

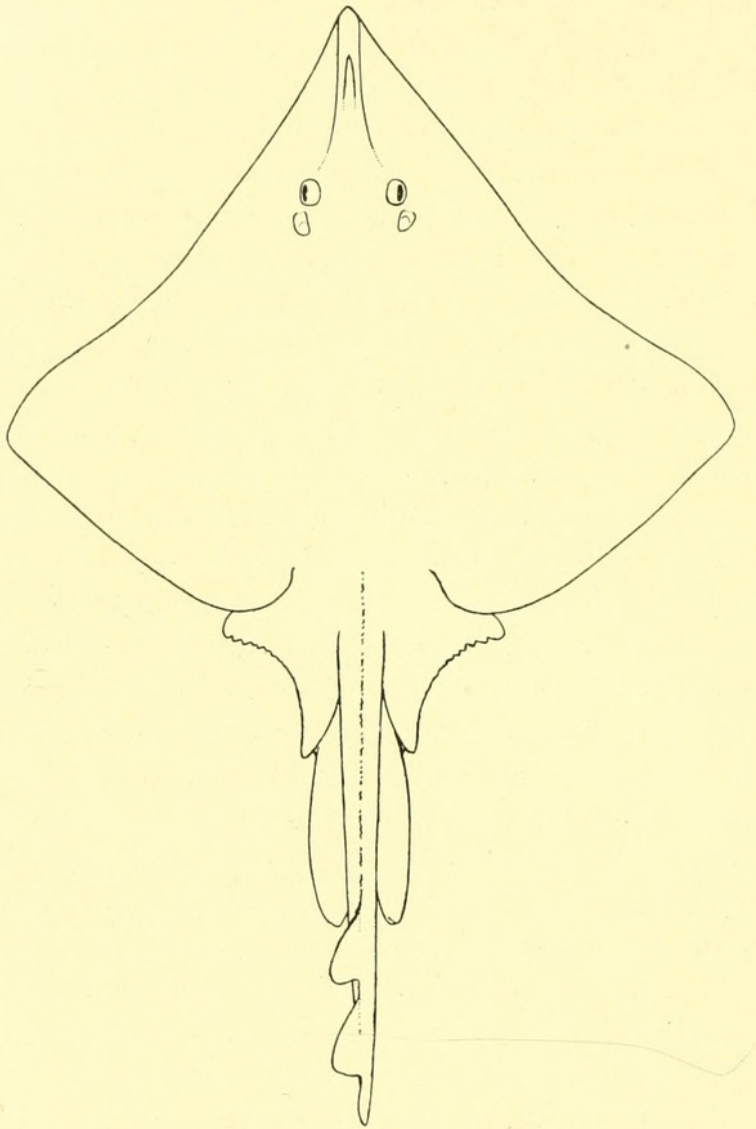


FIG. 3. *Raja binocularata*. Male. 52 in. long. From Puget Sound.

fin is held so that it extends at a right angle with the inner edge, the notch in the posterior edge almost disappears. In treating the ventral of the other species in the same way a deep rounded notch remains.

The rostral cartilages join only at their anterior fourth, while in *Raja*

rhina they are joined along their anterior half. This condition may be easily appreciated through the skin. *Raja rhina* never has a large spot at the base of the pectoral. When a spot is present at this place it is in the form of a small ring. It sometimes has light spots scattered over the body, but never very distinct, and never arranged as a conspicuous ring at the base of the pectoral having a diameter nearly as great as the length of the snout (not evident in the young of less than a foot in length). In *Raja binoculata*, especially in the adult, the anterior outline of the disk is less deeply concave, and the snout is shorter and blunter. The eye is smaller; the skin of the adult is without smooth areas; the median spines on the tail are smaller, at least in the adult; the color is more slaty; the flesh is firmer; and the egg-capsules are many times larger. One never has any difficulty in anticipating from the outside of an egg-capsule what species will be found inside, for the young may be even more readily separated than the adults.

4. *Raja inornata* Jordan and Gilbert.

This common species has never been recorded north of California, but for the sake of completeness it is here included, being the only other species in this genus frequenting the coast south of Alaska.

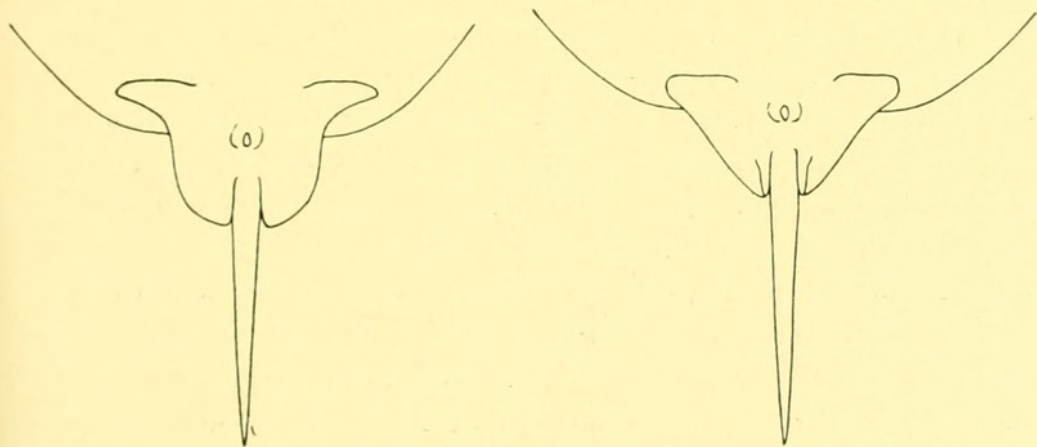


FIG. 4. *Raja inornata*. ♀. 28 in. long. San Francisco.

FIG. 5. *Raja binoculata*. ♂. 27 in. long. To show ventral fins.

The following description is of five female specimens from San Francisco ranging from twenty-five to twenty-eight inches in length.

The snout measured on the median line from between the front of the eyes is contained from 3.5 to 3.6 times in the distance to the inner angle of the pectoral. The interorbital space is from 2.8 to 3

in the snout; the interspiracle width 2 to 2.2. A line drawn between the outer angles of the body crosses the median line of the back twice the length of the snout with the addition of from one to one and a half of the long diameter of the eye from the tip of the snout. The eye, the outer ventral lobe, and the rostral cartilages do not differ materially from those of *Raja rhina* of equal size, as shown by the appended tables. The nearest point of the edge of the disk from the

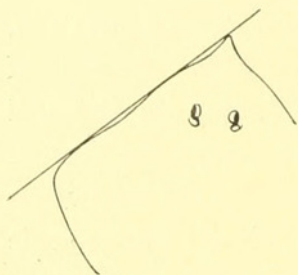


FIG. 6. *Raja inornata*.
♀ 27½ in. long. To
show outline of front of
disk.

anterior edge of the eye is from one-half to one diameter of the eye greater than the interspiracle width. The anterior margin of the disk is concave towards the snout and towards the pectoral angle with a convex median portion. The median portion touches, or comes within a diameter of the pupil of touching, a straight line drawn from the snout to the outer anterior pectoral edge. The outer angle of the pectoral is always well rounded.

Small prickles are sparsely scattered over the outer edges of the pectorals, and along the entire median line of the back. Larger ones are on the interorbital space and snout. The enlarged spines around the eye scarcely differ from those of *Raja rhina*. About a dozen large spines are irregularly placed in a patch between the branchial cavities, and the entire back of the tail is covered with about five irregular rows of spines.

A couple of small specimens, fifteen inches in length, a male and a female, differ as follows: the width of the interorbital space is from 3 to 3.4 in the snout; the interspiracle width 1.83 to 2.33. The length of the spiracle from its posterior edge to the eye-ball is a third of the eye-ball. There are no prickles, except a few on the interorbital space and snout. About five spines occur on the orbital margin, two or three between the branchial cavities, and about three rows on the back of the tail.

The color of this species is not very different from that of *Raja rhina*; it is a clearer, warmer brown, and the pectoral spot is less evident.

This species (except the very young) may be at once known from *Raja rhina*, which it most resembles, by the much less concave anterior outline of the disk, the shorter snout, and the patch of enlarged spines on the back between the branchial cavities. The young are

much more difficult to separate, as the snout in *Raja rhina* is not so long, the edge of the disk not very concave, and the spines undeveloped. The very young of *Raja rhina* differs from that of *Raja inornata* in the greater concavity towards the angle of the pectoral, the less abruptly protruding sharp snout, and the more acute outer

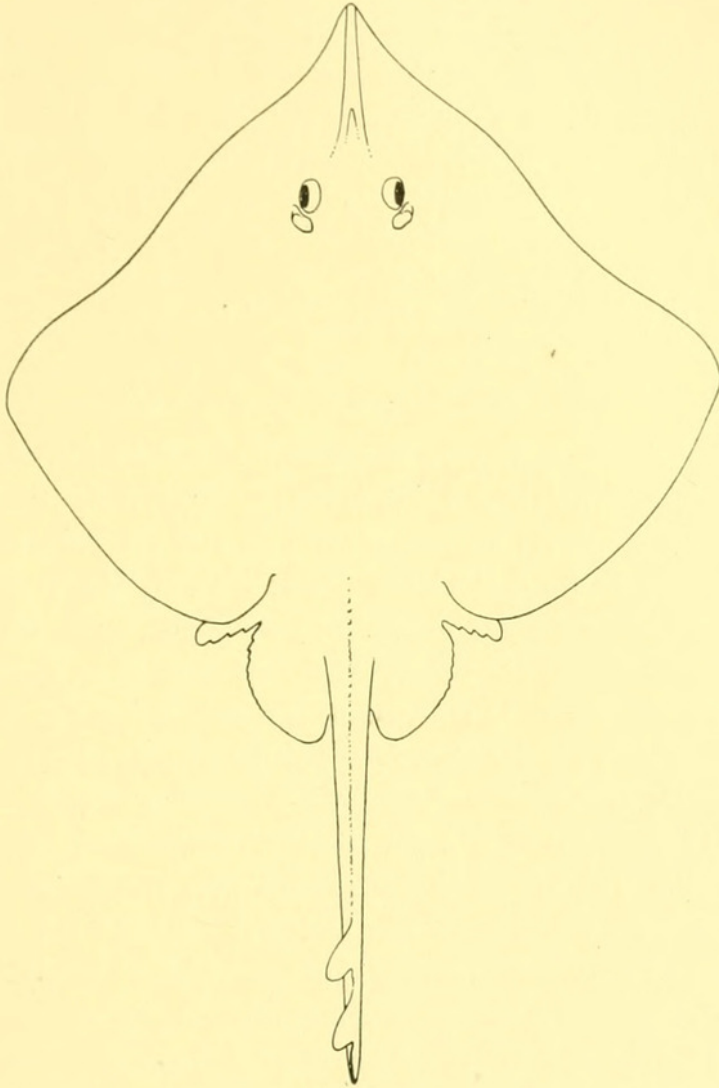


FIG. 7. *Raja inornata*. ♀. 28 in. long. San Francisco.

angles of the disk. The outline in *Raja inornata* is scarcely concave anywhere, except at the tip of the snout. The spines and color are the same in the very young of both species.

In the following table the measurements are made as described in the notes under the table for *Raja rhina*. The specimens are all from the coast of California.

Raja inornata.

Sex.	♂	♀	♀	♀	♀	♀	♀
Total length in mm.....	370	380	635	650	655	690	710
Total width.....	243	255	460	440	445	485	480
Length of disk.....	201	222	367	360	360	403	400
Width in hundredths of length of disk...	123	115	124	123	123	121	122
Between angles of pectorals to posterior edge of disk.....	40	40	42	41	39	41	40
From between front of eyes to tip of snout	26	28	27	27	26	27	27
Interorbital width.....	8	8	9	9	9	9	9.5
Long diameter of eye-ball.....	7	6.5	6	6	6	6	6
Eye to nearest point of edge of disk.....	16	16	15	16	16	16	15
Length of outer ventral lobe.....	12	13	10	11	11	10	9.5
Origin of first dorsal to second dorsal....	12	12	11	11	12	10	11
Posterior edge of disk to first dorsal.....	55	45	48	53	53	48	51
Width of mouth.....	16	15	16	16	16	16	16
From between jaws to tip of snout.....	29	32	30	30	29	30	30

5. *Raja stellulata* Jordan and Gilbert.

A single specimen twenty-one inches in entire length was dredged in thirty fathoms of water. Comparing this with specimens of similar size from the coasts of California, Oregon, and Alaska, the following differences appear: the prickles are sparser and finer; the snout is not nearly so acute; the claspers are slenderer, and very flexible, being quite inflexible in the others; the teeth are not so sharp, and the markings are different. In view of the scanty material at hand, none of the differences are great enough to warrant considering this form a separate species.

Most of the markings remain distinct in alcohol. The color is prevalently dusky light brown with indefinite, very faint slaty spots of varying size scattered over the body, the one at the base of the pectorals being the largest. Small dark spots, some of them arranged around the slaty spots, but not numerous enough to suggest rings, are scattered over the body. The most conspicuous markings are clear naples-yellow spots, ringed with dusky brown, and arranged symmetrically in reference to opposite sides of the upper surface of the disk. The largest is triangular with rounded angles, placed behind the middle of the pectorals, and probably composed of three round spots fused together. A small round spot just inward from this one outward from the eye; one behind the gill-cavity on the shoulder-girdle; one on the middle of the ventral; four or five following the posterior edge of the pectoral; and a few others less definite scattered

at various places, but in the same position on both sides of the body. A yellow cross-bar on caudal. The other specimens from the other localities are plain brown on the body.

In the collection of the University of Washington is a young female skate, four and one-half inches in length, which is referable to this species. The disk is nearly circular, and the snout is represented by a small tubercle in a notch in the front of the disk, but it scarcely extends outward to even with the anterior edge of the disk. The surface of the body is sparsely covered with long fine prickles. There is a very definite row of enlarged spines down the middle of the back and tail. There is a white spot ringed with dusky behind the middle of each pectoral; a pair of very conspicuous white spots on back of tail a little in front of middle of tail nearly meeting medially, and two other pairs much less conspicuous spaced between these and the dorsals.

This specimen agrees very well with the species described by Garman as *Raja kincaidi* (Bull. Mus. Comp. Zoöl., 1908, Vol. LI, No. 9, p. 254). A series of somewhat larger specimens in the Stanford University collection makes it evident that it is the young of *Raja stellulata*.

Dr. Evermann (Bull. Bur. Fish., XXVI, p. 229) concludes that *Raja stellulata*, *Raja binocolata* and *Raja rhina* are all one and the same species. The material at hand certainly does not bear out this supposition. Though *Raja rhina* and *Raja binocolata* are very easily distinct from each other (as here shown under their respective names) *Raja stellulata* stands farther from them than they do from each other.

A specimen of *Raja stellulata* twenty-two inches in length has claspers just a quarter of this length (five and one-half inches), while in a specimen of *Raja rhina* only an inch shorter in length the claspers do not yet reach to the posterior edge of the ventrals, and in *Raja binocolata* of similar size they are still shorter. The pectoral rays of *Raja stellulata* extend anteriorly until they nearly meet near the tip of the snout, being separated by a space not greater than the diameter of the eye. In the other two species the pectoral rays are separated anteriorly by a wide translucent area at least three times the width of the interorbital space. The rostral cartilage of *Raja stellulata* is so delicate that it can scarcely be distinguished without dissection, while in the other two species the cartilage is very strong, being easily felt and seen through the skin. In *Raja stellulata* the body is everywhere covered with prickles in both sexes, and the interorbital space is covered with

coarse spinules which are scarcely enlarged at the orbital rim. The eye is much larger than in the others, and the sides of the disk meet in a more obtuse angle at the snout, forming a sigmoid curve on each

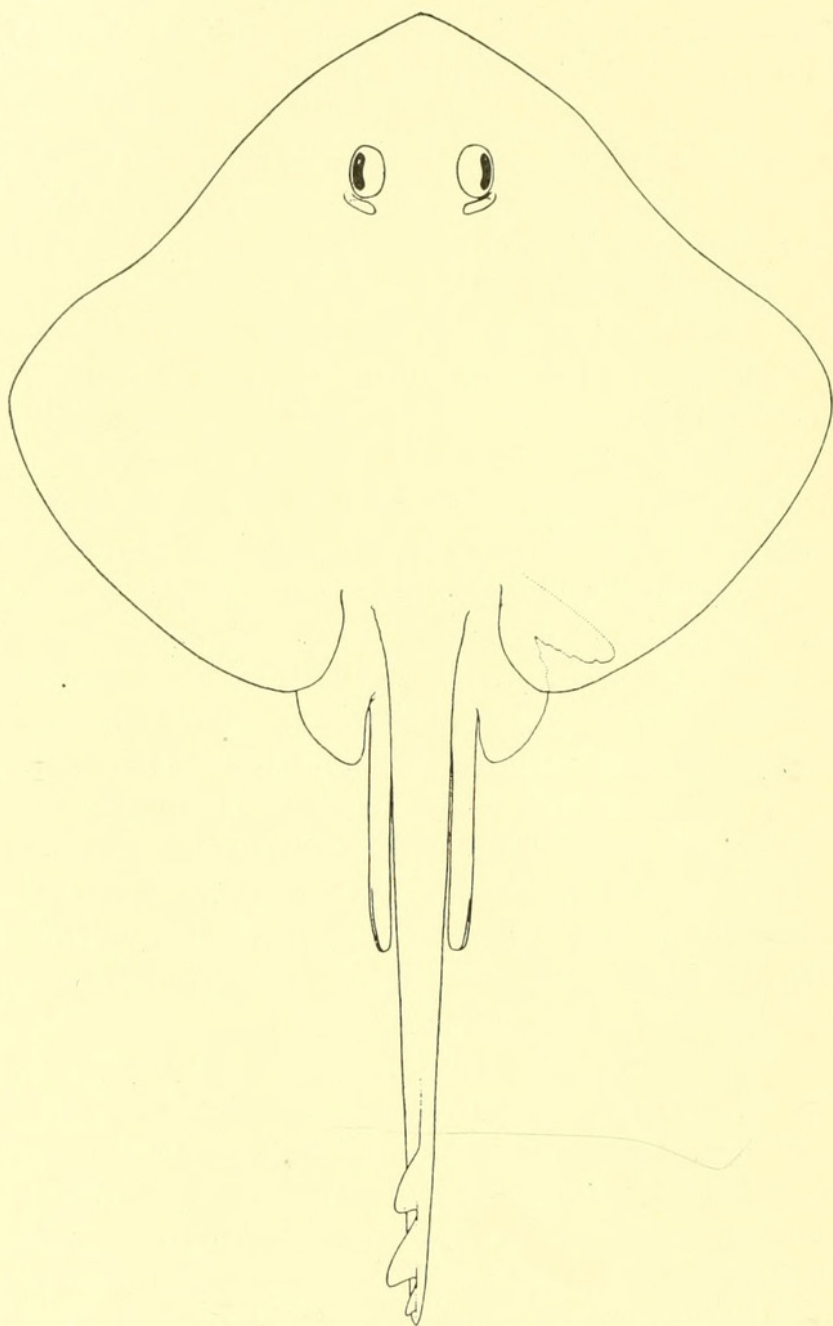


FIG. 8. *Raja stellulata*. ♂. 20 in. long. Puget Sound.

side, convex at the snout, concave towards the pectoral angles. The depth of the notch in the ventral fin is as in *Raja rhina*.

Family CLUPEIDÆ.

6. *Clupea pallasii* Cuvier and Valenciennes

Great schools of the young of this species were seen, but few of the adults were either seen or taken. The young of a couple of inches in length has a dark lateral band, above which the back is lighter in preserved specimens; but those of three inches in length or longer have the entire upper half of the body dark, the change from the light parts below to the dark parts above being rather abrupt.

Family ARGENTINIDÆ.

7. *Hypomesus pretiosus* Girard.

Very young specimens an inch and a half in length are almost perfectly transparent when fresh. Preserved they are white and show a double row of black dots along the ventral side. The statement in current descriptions and keys that the ventrals are under or behind the middle of the dorsal is not correct. It is in all sizes under the front, or a little behind the front of the dorsal, but never nearly so far back as the middle.

Family SYNGNATHIDÆ.

8. *Syngnathus griseolineatus* Ayres.

Not very rare; about a dozen were taken in the seine. The brood-pouches contain eggs and young in all stages of development, and some of the females contain eggs apparently ready to be extruded.

A specimen of this species in the Stanford collections from San Bartolome Bay, Lower California, considerably increases its southern range.

Jordan and Starks in, *Fishes of Puget Sound*, (Proc. Cal. Acad. Sci., Ser. II, Vol. V) ascribe *Syngnathus californiensis* to the Sound. The only ground I can find for such a record are two papers by Jordan and Gilbert (Proc. Nat. Mus., III, pp. 452-458, and IV, pp. 29-70) in which this species is recorded from the Sound, but *Syngnathus griseolineatus* is there treated as a synonym of *Syngnathus californiensis*, hence the species should not be included in that fauna.

Family EMBIOTOCIDÆ.

9. *Cymatogaster aggregatus* Gibbons.

Many male specimens are jet-black over most of the head and body, with the yellow vertical stripes more or less, sometimes completely,

—obliterated. There is always a light area above the anal, and, less constantly, upon the belly. The lighter longitudinal stripes usually show and the lower fins are scarcely involved. Other males are dusky brown with the yellow bars persisting, and still others are no darker than the females. Though the females vary considerably in depth of color, they never nearly approach the black males in this respect.

Family SCORPÆNIDÆ.

10. **Sebastodes melanops** (Girard).

Two specimens of this species were taken exhibiting two extremes of color variation. One is black on the upper parts, and the fins are black, or dusky black on the ventrals and anal, while the side is unevenly covered with irregular spots. The other specimen is light all over; the upper parts dusky, the spinous dorsal dark, but the other fins only slightly tinged with dusky, the ventrals and pectorals being nearly colorless, and the spots on the side only faintly indicated.

11. **Sebastodes introniger** Gilbert.

A single specimen four inches in length was taken with the dredge. It agrees very well with the original description and with some specimens taken near Unalaska. Coronal spines are present; the head is contained 2.75 times in the length; it has thirty-two scales in the lateral line (pores); the second and third anal spines are subequal, and it has all of the characters alleged by Dr. Gilbert to distinguish the species from *Sebastodes melanostomus*, with which it has been confounded.

The specimen from Puget Sound is yellowish in alcohol (bright red in life) with scattered dark spots representing indefinite cross-bars; a black spot on the opercle; dusky lines radiating from the eye; the ventrals tipped with black; the pectorals colorless; the distal half of the anal, caudal, and soft dorsal rays black; and the spinous dorsal narrowly margined with black.

12. **Sebastodes deani** Starks, sp. nov. (Plate XXIX.)

Head 2.6 in the length to the caudal base; depth 3.25. Eye 3 in head. Dorsal XIII, 14; anal III, 7; forty-five pores in lateral line; the lower jaw projects greatly and enters the profile, and has a large, rather sharp, symphysial knob. The teeth are in very narrow bands, in a single series on the side of the lower jaw, but growing wider

anteriorly, and with a well developed knob in front, which closes entirely in front of the premaxillary teeth, and partly in front of the upper lip. The premaxillary teeth are in very narrow bands, but in more than one series at the side. Anteriorly the band curves inwardly very strongly, and forms a deep notch; the curve is greater and the notch is much deeper than in *Sebastodes saxicola*. The vomer and the front of the palatines have a very few fine teeth, much finer and fewer than in *Sebastodes saxicola*; and their presence is rather difficult to detect. The interorbital space is considerably more deeply concave; it is without ridges, and its width, including the scaly rim that projects over the eye, and measured just behind the preocular spine, is contained 2.1 in the postocular part of the head; the bone is only 2.66 in the same space. The ocular ridges, though rather high, rise very gradually from the interorbital space. The ocular and tympanic spines are sharp, but not at all slender, and are very much larger and higher from their base than in *Sebastodes saxicola*. The preocular spines extend outward over the eye much more; the width of the interorbital (bone only) just behind them is two-thirds of the interorbital width across the tips of the spines. No supraocular spine is present. The occipital ridges are very high and sharp, shorter, higher, much more curved as viewed in profile, and the space between them much deeper than in *Sebastodes saxicola*; the ridges end behind in rather sharp, but low spines. The preorbital plate is armed below with two sharp angles, but these are not hooked backwards as sharp spines as is the case in *Sebastodes saxicola*. The suborbital ring is very narrow, not wider than the first dorsal spine, and narrower even than in *Sebastodes saxicola*. The eye is much larger and the postorbital part of the head shorter; the orbit is much longer than the snout, including the projecting mandible, and equal to the distance from its posterior margin to the tip of the upper opercular spine. The preopercular spines are not so slender, and the gill-rakers are slenderer, and anteriorly longer; the longest is contained 2.5 in the postocular part of the head; they number $9 + 25$. The maxillary reaches barely to the middle of the eye.

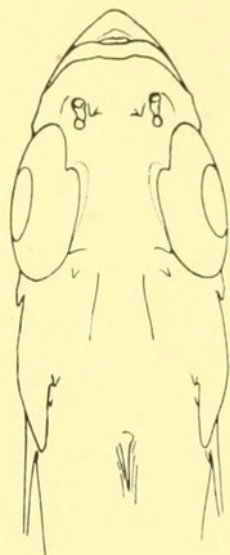


FIG. 9. *Sebastodes deani*. Top of head. To show spines.

The pectoral and ventral reach the same vertical point just behind the vent (in *Sebastodes saxicola* the pectoral reaches well past the ventral); the pectorals are rather narrow and pointed. The second anal spine is stouter and both the second and first are much more strongly curved than in *Sebastodes saxicola*; the second projects well past the much slenderer third, but scarcely reaches to the tips of the soft rays; its length is half that of the head. The spinous dorsal is lower; the fourth and fifth spines are subequal in length, and equal to, or a trifle shorter than, the highest dorsal rays; the lowest spine at the dorsal notch is about half that length. The caudal is very shallowly notched.

The scales are moderately coarsely ctenoid on the body, and with scarcely any accessory scales except on the anterior part of the body and head; ctenoid scales cover the head to the tip of the snout, and cover the opercles and cheek. The preorbital, maxillary, mandible, and breast are closely invested with cycloid scales.

The color is very much darker than in any example of *Sebastodes saxicola* at hand. There is a conspicuous broad dark band on top of the caudal peduncle; another under the soft dorsal extending to below the lateral line and apparently composed of two bars run together; one under the posterior end of the spinous dorsal. Across the anterior part of the body the bars are run together, making the color more or less solid. A very broad dark bar runs back from the eye to the tip of the opercle, and another from the eye to the pectoral base. There is a very inconspicuous narrow bar between the anterior margin of the eyes; another between the posterior margin, and a third between the occipital ridges. The tip of the mandible is dark, and the anterior parts of the maxillary and premaxillary are dusky. The greater part of the dorsals and base of the caudal are dusky. The other fins are colorless, except the pectoral, which is very slightly tinged with dusky. Inside of the mouth and gill-cavities there are dusky blotches, and the peritoneum is black.

The type and only specimen was taken by a shrimp-dredger and secured by the zoölogists of the University of Kansas, to whom I owe the opportunity of describing it. It is 207 mm. in length, and is deposited in the collections of the Carnegie Museum.

I take pleasure in naming this species for Dr. Bashford Dean.

13. *Sebastodes caurinus* (Richardson).

Among the several specimens of this common species is one very dark individual with the fins and most of the body slaty-black; while the lower parts, which in the other specimens are yellow, are broadly washed with reddish-brown.

14. *Sebastodes clavilatus* Starks, sp. nov. (Plate XXX.)

The head is contained 3 times in the length to the caudal base; the depth 3.4 to 3.5 times. The mouth is small, with the lower jaw moderately projecting and slightly entering the dorsal profile; its tip projects a fifth of the diameter of the eye. The symphysial knob is but little developed, and a very low convex portion of the dental surface fits in a notch at the front of the premaxillaries. Anteriorly the front of the premaxillary is on a level with the middle of the eye, or a little below that point, and the maxillary reaches back to under the middle of the eye; the length of the maxillary is 2.25 to 2.4 in the head. The eye is moderate in size and is equal to the length of the snout or a very little longer in the smaller specimen; it is contained 3.5 to 3.6 in the head. The interorbital space is very slightly, but uniformly, convex, and without median ridges; its width is four-fifths of the diameter of the eye. Ocular ridges are not developed, and their region is scaled over. The occipital ridges are moderately developed, rather sharp, but little curved, diverging slightly backward, scaled over, except at the extreme top, and ending behind in a fine sharp spine. Minute, but sharp, preocular, postocular, and tympanic spines are present. Preopercular spines small, the second the largest, the fifth scarcely developed. The gill-rakers are very slender and in length are equal to a half of the diameter of the eye; there are twenty-six or twenty-seven of them on the anterior limb of the first arch.

The scales are everywhere finely ctenoid, and accessory scales are absent. There are from forty-six to forty-eight pores in the lateral line, and an equal number above, counting the oblique series running upward and forward. Scales cover the snout, preorbitals, and suborbitals, maxillary, mandible, and median branchial rays; fine scales are on the bases of all of the fins, and follow the dorsal spines.

The pectoral is rather narrow and pointed; it reaches well past the vent and the tips of the ventrals, but not to the anal. The caudal peduncle is very slender and expands abruptly at the caudal base; its depth is equal to one-fourth of the length of the head. The caudal

is rather deeply notched; the depth of the notch with the outer rays held parallel is equal to half of the diameter of the eye. The second anal spine is a little longer and stouter than the third, but does not reach nearly to the tips of the rays; its length is 2 to 2.1 in the head. There are seven rays in the anal, and fifteen in the dorsal. The dorsal fin is low and rather deeply notched; the lowest spine at the notch is three-fourths of the length of the fourth spine, which is contained 2.66 in the length of the head. The anterior and highest dorsal rays are contained 2.33 in the length of the head. The ventrals reach to the vent.

The life colors of this species were not taken, but the general color was light red. The color pattern resembles that of *Sebastodes proriger* and *Sebastodes elongatus* in having the lateral line running in a continuous light streak, and a light longitudinal stripe along the side just above the pectoral. There are three dark stripes backward and downward across the cheek, and a conspicuous narrow dark streak along the middle of the maxillary. Dark blotches on the back suggest beginnings of cross-bars; there is one on top of the caudal peduncle, one near each end of the soft dorsal, one under the posterior end of the spinous dorsal, and others under the spinous dorsal more or less obscure and running together. The opercle bears a large dark spot; the tip of the mandible is dark; the outer edge of the membrane between the dorsal spines is dark, and there is a dusky shade across the caudal. The pectoral has a very light dusky tinge above, and the ventrals and anal are colorless. The peritoneum is jet-black.

This species differs from *Sebastodes proriger* particularly in the much larger scales. As compared with the description of that species the maxillary is shorter, the eye smaller, the spinous dorsal lower, and the second anal spine shorter.

Here described from two specimens, 14 and 15 cm. in entire length, dredged in deep water near the San Juan Islands, Washington. The larger one is the type and is deposited in the collections of the Carnegie Museum at Pittsburgh. The co-type is in the collections of Stanford University.

15. ***Sebastodes emphæus*** Starks, sp. nov. (Plate XXXI.)

The head is contained from 3 to 3.1 times in the length to the caudal base; the depth from 3.125 to 3.33. The mouth is small; the lower jaw somewhat projecting; usually not so much as in *Se-*

bastodes clavilatus, though between large individuals little difference can be appreciated in this character, as well as in the character of the symphysial knob, or the notch in the front of the premaxillaries. The maxillary reaches back to under the middle of the eye, or in the largest specimens a little past the middle; its length is from 2.25 to 2.33 in the head. The eye is as long as the snout, including the projecting mandible; its diameter is contained from 3.25 to 3.50 in the head. The interorbital width is three-fourths of the diameter of the eye. It is less uniformly convex than in *Sebastodes clavilatus* owing to the orbital ridge being a little more prominent, so that there is a slight depression between the raised orbital rim and the convex middle portion of the interorbital space. With this exception, and with the exception that the occipital ridges are a little closer together, the cranial ridges and spines are alike in the two species, as well as the preopercular spines. The slender gill-rakers are half the length of the eye, or a little longer, and number from twenty-six to twenty-eight on the lower limb of the arch.

The scales are a little larger than in *Sebastodes clavilatus*, particularly above the lateral line, but are otherwise similar and cover the same areas. They number from forty-one to forty-five in the lateral line or in the oblique series above the line. The pectoral is not so narrow and pointed, and does not reach so far back. The caudal peduncle is wider and not so abruptly expanded at the caudal fin; its depth is contained from 3.4 to 3.6 in the length of the head; the notch in the caudal is not more than half as deep. The second anal spine is considerably longer and stouter than the third, and much stouter than in *Sebastodes clavilatus*. It sometimes reaches almost to the tips of the soft rays, but usually is somewhat shorter; its length varies from 1.6 to 1.8 in the head. The anal fin is a little farther forward than in *Sebastodes clavilatus*. There are seven anal rays, and fifteen dorsal rays. The lowest spine at the dorsal notch is from one-half to three-fifths of the length of the fourth spine, which is 2.4 to 2.5 in the head or usually equal in length to the anterior dorsal rays, but sometimes a little shorter. In females with the abdomen swollen with eggs the ventrals do not nearly reach to the vent, but they do reach to it in the males.

The color of specimens taken in life is coppery-red with indefinite, broken, greenish-brown cross-bars or blotches. Greenish bands run back from the eye. Spinous dorsal dark green, with bright red towards tips of spines; the outer half of the soft dorsal bright red, the base

of the fin almost black. Pectorals, ventrals, and anal a clear brilliant light red. In alcohol there is a dark blotch on top of the caudal peduncle, a couple of dark bars under the soft dorsal, usually united into one, except at the base of the fin, and continued on the base of the dorsal; three more or less united bands under the spinous dorsal; the bands continuous across line without the interruption of a light streak as in *Sebastodes clavilatus*; the bands under the spinous dorsal are continued on the fin to the edge of the membrane, but usually leave a narrow light edge. With the exception of this narrow light edge the entire membrane of the spinous dorsal is sometimes dusky greenish. Two broad streaks run backward from the eye, the lower one continued to the base of the pectoral; a shorter narrow one just above the maxillary; maxillary sometimes with a narrow band longitudinally. The entire color is much darker than in *Sebastodes clavilatus*.

The chief differences between this species and *Sebastodes clavilatus* may be here repeated. The body is deeper, and with a deeper caudal peduncle, the caudal is less deeply notched; the scales are larger, the anal spine stouter, the color darker, and the lateral line does not run as an uninterrupted streak.

This species was the commonest *Sebastodes* brought up in the dredge from deep water. The longest specimen is 16 cm. in length and the smallest considered in this description is 13 cm., though many smaller ones were saved. The type is one of the largest specimens and is deposited in the Carnegie Museum with some of the cotypes. Other cotypes are preserved and are deposited in the collections of Stanford University and in the American Museum of Natural History in New York.

Family HEXAGRAMMIDÆ.

16. *Hexagrammos decagrammus* (Pallas).

The scales on the suborbital stay together with the occipital pair of flaps, which serves to distinguish the adult of this species, can not always be relied upon for the young up to two and one-half inches in length, as in the young the scales on the stay are often difficult to detect, and the occipital flaps are sometimes aborted. The long fourth lateral line serves at once to separate the species from *Hexagrammos stelleri*, and the concave caudal from *Hexagrammos superciliosus*.

17. *Hexagrammos stelleri* Tilesius.

This species was not nearly so commonly taken as *Hexagrammos decagrammus*. The species may at once be known by its short unforked fourth lateral line, which never reaches the tip of the ventral, and usually but little past its base.

18. *Oxylebius pictus* Gill.

This species was frequently seen swimming about the piles of old wharves in Friday Harbor, or sometimes clinging in a peculiar manner with its ventral surface against a pile, its body often straight up or down. Only one specimen was secured

Family COTTIDÆ.

19. *Jordania zonocephala* Starks.

Two specimens were collected with a dip-net under an old pier in Friday Harbor; others were seen swimming about the piles apparently finding food among the barnacles.

The typical specimens have XVIII, 16 (not XVII, 15) rays in the dorsal, and twenty-three or twenty-four (not twenty-two) rays in the anal. The specimens from Friday Harbor have the dorsal XVII, 17 and XVIII, 16, and twenty-three rays in the anal.

The colors in life are: body olive-green with reddish spots growing redder towards the tail; lower part of sides with reddish-brown markings; indefinite cross-bars on the back; olive-brown bars on the head margined with clear light green, one downward from the eye, one forward from the eye to the snout, one across the preopercle; a light green band following the edge of the opercle; lips red, caudal clear orange-red with very inconspicuous cross-bars; anal orange-red without markings; ventrals a little more yellow; pectoral greenish, growing red towards tips of rays, and crossed by dark bands; spinous dorsal dark olive-brown with light cross-bars across the spines; soft dorsal with rather fine light and dark cross bars.

20. *Radulinus asprellus* Gilbert.

This species was commonly taken in the dredge. Two mistakes may here be pointed out occurring in the description and key of this species published by Jordan and Evermann (U. S. Nat. Mus. Bull., 47, p. 1919). Instead of "the pectoral reaching to or nearly to the vent," the description should read "to the vent," as in the original

description. The pectoral reaches well past the front of the anal. In the key to the genus the character of the interorbital space for the two species has been transposed. The key should show the interorbital space *scaled over* for *Radulinus boleoides* and *naked* for *Radulinus asprellus*.

21. **Radulinus boleoides** Gilbert.

Two male specimens were taken in the dredge in deep water; the only ones known since the single typical specimen was taken off the Island of Santa Catalina, southern California. They measure respectively 135 and 140 mm. in length. They differ only from the description of the type as specimens twice as long as the type might be expected to, though there is some variation shown in the number of fin-rays and lateral plates.

The head is 3.87 in the length to the caudal base; the depth 7. The eye is 3.75 to 4 in the head; the snout 3; the maxillary 2.75. The dorsal numbers X-21; the anal 22; the pectoral 20. There are forty plates in the lateral series in both specimens. The upper preopercular spine is broad, and not very sharp; the lower one very broad, or in the larger specimen only forming a slight angle; the two rounded processes below are scarcely indicated. The supraorbital rim is slightly raised, so that the interorbital space is concave. The filaments on the eye and occipital region are very minute in one specimen, and difficult to find, but they are present in both. The pectoral reaches to the base of the fourth or fifth anal ray.

The differences between this species and *Radulinus asprellus* may be here repeated with some additions. The head of *Radulinus boleoides* is more completely scaled. Instead of a narrow v-shaped band about one scale wide at the posterior part of the eyes there is a band two or three scales wide. The interorbital space is scaled over, and the scales follow the anterior margin of the eyes. There is a transverse band of scales across the occipital region. The opercles and cheeks are more completely scaled. The lateral series of scales are rounder in outline, not so evidently keeled and angulated behind, and narrower in vertical width. The eye in particular is much smaller; the nasal spines are smaller and slenderer. *Radulinus boleoides* has minute supraorbital and occipital filaments. The dorsal spines are much higher, the tips of the longest spines when depressed reach to the fourth or fifth dorsal ray, while in the male of *Radulinus asprellus* they reach scarcely past the front of the soft dorsal.

22. *Triglops macellus* Bean.

Five specimens of this species were collected from deep water. Three of them have the dorsal XI-29, and the anal 29; the other two have the dorsal XI-28, and the anal 28. All of them have six lower pectoral rays produced (*five* in the type) and nine other pectoral rays, except in one, which has ten as in the type. The lower jaw is included, and the bony interorbital space is a fifth of the diameter of the eye (*a third* in the type). There is a very conspicuous round black spot on each side of the tip of the snout just above the edge of the maxillary. The specimens otherwise agree very well with the original description.

23. *Triglops beani* Gilbert.

Rather abundant in deep water, where several specimens were taken. The largest was 180 mm. in length. The peculiar cross-folds on the breast are usually, but not always, present; and all intermediate conditions are represented among the specimens collected, ranging from five or six folds to none whatever.

24. *Chitonotus pugetensis* (Steindachner).

Apparently rather rare in Puget Sound. A few specimens were taken in the dredge.

In life the colors are slaty-black on the anterior part of the back and the top of the head, while posteriorly the back is greenish. The upper part of the body is crossed by brown bands. The side below the middle of the body is white with irregular spots of clear coppery red. The pectoral is yellow crossed by reddish-brown bands. The ventrals, anal, and under parts of the body are milk-white.

25. *Stelgidonotus latifrons* Gilbert and Thompson.

A second specimen of this recently described species (U. S. Nat. Mus. Proc., XXVIII, 1905, p. 977, Friday Harbor, Washington) was taken. It is not known whether it was seined, dredged, or taken in a tidal pool; neither does it appear in the original description how the type was taken.

It is somewhat longer than the type, being 35 mm. in length, the type was 24 mm. long, and is a male with the anterior anal rays produced and a very minute or scarcely developed anal papilla. It has the dorsal rays IX-18, the anal 14, and the pectoral 14, or one less soft ray in the dorsal and anal and one more in the pectoral than in

the type. There is a well developed, simple, supraorbital tentacle above the posterior part of the eye, one at the occiput, and two equally spaced between these on each side of the head. There are two on the preopercular margin, one on each nasal spine, and a very minute one on the end of the maxillary. It is more completely invested with spinules than was the type; the naked area along the base of the anal is scarcely to be appreciated, the breast is covered, except a small area in front of the ventral base, and just behind the branchiostegal membrane, the head and postaxial area are naked. The lateral plates are even less conspicuous than is shown in the drawing of the type, and each anterior one bears a simple filament. The specimen at hand agrees otherwise with the original description.

26. *Icelinus borealis* Gilbert.

This was the commonest fish brought up in the dredge. The largest specimens are four inches in length, considerably larger than the typical ones. Of the three spines which are usually present in the typical specimens below the forked preopercular spine, the upper one is absent in these specimens, except in the very small ones.

27. *Astrolytes fenestralis* (Jordan and Gilbert).

This common species was taken with the seine in abundance.

The soft rays of the dorsal in fourteen specimens number seventeen, in three specimens sixteen, and in two specimens eighteen. In the anal fourteen specimens have thirteen rays, four specimens have twelve, and one has fourteen. The dorsal band of scales has from thirty-two to thirty-five in the series, and the pores of the lateral line number from thirty-five to thirty-seven. In two or three specimens the lowermost prong of the preopercular spine has failed to develop, or is very small, thus making the spine trifid.

28. *Axyrias harringtoni* Starks.

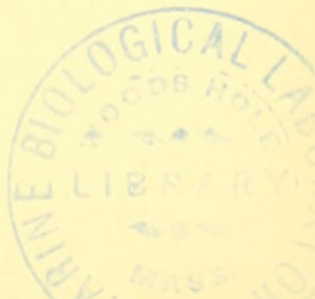
This species was found to be rather abundant in shallow water where several specimens were taken with the seine in company with *Astrolytes* and *Artedius*. The largest was four inches in length.

The following additions may be made to the original description. The dorsal has seventeen soft rays and the anal thirteen in the type (not sixteen and twelve), in each case the last ray being slenderer than the others. This is the usual number of dorsal rays in the

specimens at hand, varying occasionally to eighteen. One specimen has ten dorsal spines, or one in excess of the usual number. The space between the bases of the first two spines is much less than that between the other spines, and the tips of the spines are very soft and fine-pointed. The dorsal band of scales varies from forty-seven to fifty-four and is nine or ten scales wide anteriorly, counting obliquely. The lateral band is thirty-six or thirty-seven, rarely thirty-eight. The cirri are unevenly distributed along the lateral line, when present being either paired or single, but entirely absent on the majority of scales. As in the type, the preopercular spine is very narrowly forked, and in some cases the lower fork is only slightly developed. The lower jaw is slightly included, especially in the larger examples.

Among these specimens is a male (with the anal papilla enlarged) differing so much from the others that it is here referred to this species with some hesitation. A second male from Nanaimo, B. C., entirely agrees with this specimen. The number of scales and fin-rays, the general color, the shape of the bands of scales and teeth, the position of the cirri, the character of the preopercular spine are all as in the female specimens (the specimens in which the anal papilla is not enlarged). The body however is more robust, especially in the specimens from San Juan Island (the Nanaimo specimen is shrunken in alcohol). In the females the small, simple, pointed cirrus over the front of the eye, which is not longer than the diameter of the pupil, is replaced in the male specimens by a cirrus as long as the diameter of the eye, and with its edges along its distal half broken up into a plume of many subdivisions. A multifid cirrus over the posterior part of the eye does not differ greatly from that of the female except that it is somewhat enlarged and thickened. In the male the membrane between the anal rays is not so deeply incised, and instead of being concave it is convex. The anal and ventrals are white and spotless in the female. In the male they are dusky, and the anal is beautifully marked with fine lines forming a lace-work of small hexagons. Towards the marginal half of the fin a small light spot appears at each angle of the pattern, and soon the lines disappear, leaving only the spots. The lower part of the head is uniformly dusky, whereas in the female it is dusky marked with white spots and lines.

The genus *Axyrias* is most closely related to *Astrolytes*, and should perhaps be considered the same, especially as the lower process of the preopercular spine in some cases fails to develop in the latter genus,



making it bifid as in the former. In *Astrolytes*, however, when the spine is bifid, it is the lower process which has failed to divide, and the upper process is widely forked from the lower, and strongly hooked upward and inward. Other differences are the much finer scales in *Axyrias*; the flat multifid cirrus over the posterior part of the eye, which in *Astrolytes* is smaller and simple; the presence of a cirrus over the anterior part of the eye; and particularly in the ctenoid scales of the lateral line, which are represented by small imbedded plates in *Astrolytes*.

29. **Artedius lateralis** (Girard).

This species is not found nearly so abundantly as *Astrolytes* or *Axyrias* among the San Juan Islands, being probably more southern in its distribution, as it is common in Monterey Bay. These specimens are not so conspicuously marked with a broad light band across the top of the head and body, which forms so striking a marking on the majority of specimens on the California coast. They do not exhibit much variation in the number of rays or scales. The dorsal has sixteen or seventeen rays, the anal twelve or thirteen; there are from twenty-six to twenty-nine series of scales in the dorsal band, and the pores of the lateral line number thirty-four or thirty-five.

30. **Hemilepidotus hemilepidotus** (Tilesius).

Several specimens were taken in shallow water. They all show the spotted under parts which help to distinguish this species from *Hemilepidotus jordani*. Of the eight specimens counted six have the usual number of fin-rays; dorsal III, VIII, 19; anal 15. The other two have twenty dorsal rays, one of them has seven spines in the second division of the dorsal, and sixteen rays in the anal.

Attention may here be called to an evident misprint in the description of *Hemilepidotus jordani* published by Jordan and Evermann (Bull. 47, U. S. Nat. Mus., p. 1934), in which the eye is stated to be three in the head. Specimens of a foot in length have the eye 4.5 in the head, and the original description states it to be four.

31. **Myoxocephalus polyacanthocephalus** Pallas.

Very common in shallow water. There is considerable variation in the width and concavity of the interorbital space apparent among specimens from Puget Sound.

33. *Scorpaenichthys marmoratus* (Ayres).

A larval specimen 15 mm. in length and a couple of very large ones were seined, but the latter were not saved. The small one is compressed and has three well developed preopercular spines; the interorbital space is much wider than in the adult; and the fleshy flaps on the head are very short.

34. *Blennicottus globiceps* (Girard).

A single specimen seven and a half inches in length, the largest ever recorded, was collected by the zoölogists from the University of Kansas at Kanaka Bay, San Juan Island, in a tidal pool. A series of specimens from four to six inches in length from Neah Bay are at hand. The larger ones have a very conspicuous bony ridge running back from each eye. The supraorbital ridge is higher, and the lateral line flaps bear more cirri on their posterior edges than in the small ones. In the small ones the ridges running back from the eyes are only indicated, but there is a perfect gradation in this as well as in the other characters. Specimens from the California coast have not been taken of greater length than about four inches. Specimens from Pigeon Point, California, have the head a little more thickly covered with cirri than in the northern specimens, but no other differences are apparent.

35. *Oxycottus embryum* (Jordan and Starks).

Four specimens were taken in tidal pools and seined. It is apparently rare throughout its known range from Point Lobos, California, to Karluk, Alaska. The species may be easily distinguished from *Oxycottus acuticeps* by the four pairs of tentacles on the top of the head between the eyes and the occiput, the very minute nasal tentacle, and the absence of a tentacle on the eye. On the other species there are only three pairs of tentacles on the head, the nasal tentacle is long, reaching nearly to above the middle of the eye, and the eye-ball just above the pupil bears a simple tentacle. In *Oxycottus embryum* the body is much stouter, especially at the caudal peduncle; the anal papilla smaller; the spinous dorsal rounder, and not so high in front; and the anal rays are fewer. There are multifid flaps on the anterior part of the lateral line in *Oxycottus embryum* each with from two to four points (except in the young where they are simple tentacles), and not developed as far back as the front of the anal, while in *Oxy-*

cottus acuticeps the flaps are simple at all ages, or sometimes the first one or two are doubled, and they extend backwards past the front of the anal.

36. **Oligocottus maculosus** (Girard).

Some large specimens of this fish which is very common in tidal pools were taken in the pools at Kanaka Bay, San Juan Island. The species may be readily known from *Oligocottus rubellio* and *Dilarchus snyderi*, which replaces it on the California Coast south of Monterey Bay (its range and that of the latter form overlap from Pigeon Point north to Crescent City) by the absence of cirri at the base of the dorsal fin, or anywhere above the lateral line, and by the absence of a definite dark spot on the front of the spinous dorsal. From *Oligocottus rubellio* it is further known by the smaller head and eye, being in this respect closer to *Dilarchus snyderi*. It has a much blunter snout and lower nasal spines than *Dilarchus snyderi*, from the male of which it is at once distinguished by the generic character of the connected first anal rays.

37. **Dasycottus setiger** Bean.

Taken abundantly in deep water; the largest specimen being eight inches in length. The occipital spines are not so high as in Alaskan specimens, with which these have been compared, and the transverse distance between most of the spines is less.

The life-colors are as follows: grayish flesh ground-color with chocolate-brown cross-bands, spots, and lines; pectoral lead-color, below edge with white; caudal with a light margin.

38. **Nautichthys oculofasciatus** (Girard).

This species apparently adapts itself to various depths, as it was taken from deep water (30 or 40 fathoms) in the dredge, and from shallow water in the seine. It is rather a sluggish fish, and no difficulty was experienced in catching in a dip-net a couple of specimens which were swimming in a foot of water.

The colors in life are orange-brown, the flesh translucent; the pectoral and cheek a little deeper in color than the rest of the head or body; some yellow about the snout and under side of the head; membrane of spinous dorsal light yellow, varying to green; the first spines olive-brown, crossed with light green; soft dorsal light brick-red, crossed with olive-brown; olive-brown spots on pectoral rays; ventrals yellow; anal like soft dorsal, but a little lighter; caudal with a wide

dark bar behind, and a narrow, broken bar at base; an olive-brown bar extending through the eye across the cheek; some inconspicuous light brown cross-bars on the body.

39. *Psychrolutes paradoxus* Günther.

A few specimens were taken in the seine, but it was not found at all abundantly as was the case at Port Ludlow, Washington, in 1896.

40. *Gilbertidia sigalutes* (Jordan and Starks).

A specimen 55 mm. in length was dredged. It is in a much better state of preservation than the type, or the specimen reported upon by Dr. Gilbert (Proc. U. S. Nat. Mus., XXXVIII, p. 981). The specimen at hand differs from Dr. Gilbert's specimen (with which it is directly compared) in being much wider, deeper, and with a wider interorbital space, owing wholly to the fact that the latter specimen is greatly shrunken. The skin is lax as in Liparids, and it is covered closely with small papillæ. The anterior nostril is in a short tube. The dorsal spines are invisible under the loose skin except at their tips, which extend beyond the skin, appearing as soft tubercles. About half of the length of the ventrals is hidden by the skin.

Family RHAMPHOCOTTIDÆ.

41. *Rhamphocottus richardsoni* Günther.

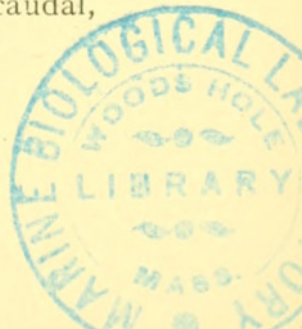
This species was taken rather abundantly by the dredge. It is known among the shrimp dredgers of Puget Sound as the "horse-fish."

Family AGONIDÆ.

42. *Hypsagonus quadricornis* (Cuvier and Valenciennes).

Taken in abundance at thirty or forty fathoms. These and others from off Washington, collected by the "Albatross," have the rostral barbel considerably longer and thicker than in some specimens from Behring Sea, with which they have been compared.

In alcohol there is considerable variation in the markings. Some specimens are slaty-black under the spinous dorsal, the color sometimes extending over the belly. In other specimens this region is almost white, and in these the spinous dorsal is also involved. Behind this broad area are several narrow bands variable in width and thickness, but more constant in position. There is a dark spot at the base of the caudal, and a dark band follows the posterior outline of the caudal,



but the border of the caudal is white. In life the color is senna-brown or dull opaque yellow, with the darker markings brown. One specimen had the spinous dorsal a very bright carmine, the color continued down on the back to the middle of the side. Another had the base of the spinous dorsal and the entire body below it a bright ochre-yellow.

Many of the specimens are thickly covered with a thick growth of hydroids.

43. **Pallasina aix** Starks.

A few specimens were collected. Though this species should possibly stand as *Pallasina barbata* it seems better to consider it as distinct until better evidence to the contrary is presented than I am able to furnish with the material at hand. It has a larger eye than in any of the available specimens from Alaska. This is particularly so in the single large example (five inches long) in which the eye is five-hundredths of the length, while in specimens of equal size from Alaska it is three and one-half hundredths. The length of the mandibular barbel is not variable in Puget Sound examples. As has been pointed out before, specimens with either two or three preventral median plates occur both among the typical *Pallasina barbata* and *Pallasina aix*, but among the latter two is the usual number, and three the exception, while among the others two is the exception. In the cotypes of *Pallasina aix* and the specimens of the present collection from Puget Sound sixty-four have two plates, six have three plates, and two have one plate.

44. **Xeneretmus latifrons** (Gilbert).

Specimens differing in no essential way from the description of the type, or from specimens collected from off Monterey by the "Albatross," were taken rather abundantly in the dredge at a depth of about forty fathoms.

45. **Xeneretmus infraspinatus** Gilbert.

A couple of dozen specimens of both sexes of this species were taken by the dredge in deep water in company with *X. alaskanus*, which exceeded it in abundance about three to one. The largest of these is about four and one-half inches in length.

This species is much more robust than *X. pentacanthus*, as was pointed out in the original description (Proc. Cal. Acad. Sci., Ser. III, Vol. III, p. 262). The width of the head is from 5.75 to 6.5 in the entire length to the base of the caudal, while in *X. pentacanthus*

it is from 8 to 9.5.⁴ The condition of the preentral plates, which may usually be depended upon to separate these two species, is not absolutely dependable, as occasionally *X. pentacanthus* has only one pair, as in *X. infraspinatus*, instead of two, its normal number.

X. infraspinatus resembles *X. alaskanus* much more closely, but may at once be known by the well developed spines on the lower lateral body ridge. These are sharp, stand well away from the body, and do not decrease in size to the base of the caudal fin. In *X. alaskanus* these spines are reduced to very small needle-like points lying close to the body, and on the caudal peduncle are scarcely distinguishable by the naked eye, though they may be readily felt by the finger.

The body of these specimens is scarcely slenderer than that of *X. alaskanus*, nor are the spines and ridges on the side of the head weaker. The postocular spines are usually smaller, and the postocular and nuchal depressions wider and deeper. The anal opening though very often farther back than it ever is in *X. alaskanus*, is, on the other hand, frequently as far forward as in that species. This variation is not sexual.

The small point extending forward on the rostral plate noticed by Dr. Gilbert (Proc. U. S. Nat. Mus., XXVIII, p. 982) is often absent especially in large specimens. In the same paper a *lapsus calami* may be here corrected. In stating the width of the interorbital as being equal to three-fourths of the diameter of the orbit, the intention was to give three-fourths of the diameter of the pupil. In the specimens at hand this dimension varies from three-fourths to the full diameter of the pupil. The variation is that of the pupil rather than that of the interorbital.

46. *Averruncus emmelane* Jordan and Starks.

This was found to be the commonest agonoid fish among the islands. Specimens were taken in abundance in the trawl at from fifteen to forty fathoms.

Of the sixteen specimens examined, ten have nine dorsal spines, and six have eight; twelve have eight dorsal rays, and four have seven; eleven have eleven anal rays, and five have twelve. The pores of

⁴The greater variation in *X. pentacanthus* goes with the greater discrepancy in size of the specimens measured in that species. They were from three and a half to seven inches long, the larger ones the slenderer. In *X. infraspinatus* the specimens were from three to four and one-half inches.

the lateral line number from thirty-eight to forty, the count for the typical specimen being incorrect (thirty-five). The color of the ventrals abruptly coal-black at the base, where they sharply contrast with the white breast, and abruptly white at the tips was found to be a very constant character.

Among these specimens are some small ones, which more or less completely bridge the gap between this species and *Xystes axinophrys*, making it evident that the latter form is the young of this species. The type of *X. axinophrys* is one and three-quarters of an inch long. In addition there are at hand two specimens from Port Ludlow, and one from the San Juan Islands of the same size as the type and agreeing with it in all particulars. A specimen a little under three inches long and several a little larger, from the last locality, show some decided intermediate characters, though more strongly those of *A. emmelane* than of *X. axinophrys*.

In the young (type of *X. axinophrys*) the supraocular spine is very much enlarged, and stands outward over the eye as a high crest. All of the ridges of the head are broken up into spines, and the body spines are larger and sharper than in the adult. The ventral ridges, which are spineless in the adult and lost on the caudal peduncle, are in the young armed with as large spines as the other ridges, and continue as two distinct ridges to the base of the caudal. The dorsal ridges, though not entirely uniting in the adult, are more distinctly separate in the young. In the young the soft dorsal and anal are much higher posteriorly, the rays not decreasing much in length backwards, and are not so broadly adnate to the body. The cirri on the under side of the head are only indicated by well developed fleshy tubercles, but in the exact places and number that they are in the adult. The number of fin-rays, body-spines, and lateral line pores are the same. (The type of *X. axinophrys* has eleven anal rays, not ten.) The color of the young is like that of the adult.

All of these changes are along the lines of those known to occur in other agonoid fishes.

Family LIPARIDÆ.

47. *Liparis callyodon* (Pallas).

Two specimens 2.5 and 3.5 inches in length, and a few small ones a couple of inches in length were collected in the dredge. The species has a much firmer body and tougher skin than *L. dennyi*, as the speci-

mens were preserved perfectly in the same solutions which failed to preserve specimens of the latter species.

As there is some discrepancy between these specimens and the description published by Jordan and Evermann (U. S. Nat. Mus., Bull. 47, p. 2110) the following description is submitted:

The depth of the body under the anterior dorsal lobe is from 4.2 to 4.33 in the length to the caudal base. The length of the head is from 3.50 to 3.66. The maxillary extends to under the anterior margin of the eye; its length is contained three times (or very slightly less) in the head. There are seven or eight series of teeth on each side of the upper jaw counting the series which become parallel with the jaw at the side. Counting the series which run in the opposite direction, or more or less transversely to the jaw, there are fourteen or fifteen. The nostril is in a broad tube; anterior to it is a large pore, and posterior to it over the front margin of the eye is a larger one. The disk is contained 2.8 in the length of the head, or 1.33 of its own distance from the tip of the jaw. The length of the gill-opening is one-fourth of the length of the head; it extends only very slightly in front of the pectoral, not more than to the base of the second ray from the top. The anal opening is the diameter of the disk behind the disk, and an equal distance from the front of the anal. The longest ray in the lower pectoral base is half the length of the head. The longest pectoral rays are equal to the length of the caudal, and are contained 1.66 in the length of the head. The dorsal and anal scarcely join the caudal, or, if at all, only at the extreme base, and there is a decided notch between. The dorsal rays number forty, of which five are of the anterior lobe, the anal thirty-one, and the pectoral thirty-six. An anterior lobe is separated from the rest of the dorsal fin by a deep notch.

This species may be known from all other liparids of the west coast having a large anterior dorsal lobe, with the exception of *L. mucosus*, by the very small gill-opening. *L. mucosus* may be at once recognized by the very large ventral disk; the diameter of which is two-thirds the length of the head.

48. *Liparis cyclopus* Günther.

Three small specimens were dredged. The anterior dorsal rays slightly indicate an anterior dorsal lobe, making this one of the intermediate forms between the genera *Liparis* and *Neoliparis*.

49. *Liparis dennyi* Jordan and Starks.

This species is the most abundant liparid about the San Juan Islands. Many specimens were taken in the dredge. The skin is very thin and tender, and they were more difficult than any other species to preserve in either alcohol or formalin. *L. dennyi* may be known from all others of its genus on our coast except *L. fucensis* by the very wide gill-opening, extending down to about the tenth pectoral ray from the top. From *L. fucensis* it may be distinguished by the broader attachment of the dorsal and anal to the caudal, and by the more robust body.

50. *Liparis pulchellus* Ayres.

A dozen small specimens were taken in the dredge. The dorsal and anal are more broadly joined to the caudal than in any other west coast species. They join the caudal without a notch and together form a continuous fin around the tail. The caudal appears pointed in preserved material, when it is not spread.

Family BATHYMASTERIDÆ.

51. *Ronquilus jordani* (Gilbert).

This species is not very rare, and a number of specimens were taken in deep water. Among them there is an astonishing variation in color, which, however, does not vary with surroundings as stated by Jordan and Evermann (Bull. 47, U. S. Nat. Mus., p. 2289), as both extremes of variation frequently occurred in the same haul of the dredge. Some specimens have the anal and ventrals, and the lower half of the pectorals jet-black. The gradation from this to entire absence of color on these fins is perfect. The specimens with dark lower fins have the dorsal and anal rays (the other fin-rays do not vary materially) much longer than in those with light lower fins. These would appear to be sexual differences, were it not for the fact that there is nearly as complete a gradation between the long- and short-rayed forms, as there is between those having light and those having dark fins. A slight break will, however, be noticed, above which the dorsal rays run from fourteen to eighteen hundredths of length, and below from ten to twelve. There is no break in color at this place.* There is considerable variation in the shade of the body-color, but this is apparently not correlated with the other characters, except that there are no very dark-bodied individuals with perfectly colorless lower fins, though light-bodied specimens may have black fins.

The following table is arranged in reference to the depth of color on the lower fins, ranging downward from black to colorless.

Length in mm. to Base of Caudal.	Shade of Lower Fins.	Longest Dorsal Ray in 100ths of Length.	Longest Anal Ray.	Shade of Body.
138	jet black	18	12	dark
95	jet black	15	11	dark
107	jet black	15	11	rather dark
115	dark slate	14	11	dark
135	slate	16	11	very dark
131	slate	15	10	very light
105	slate	15	10	dark
111	light slate	14	9	dark
123	dusky	11	10	light
132	slightly dusky	10	8	dark
100	slightly dusky	12	9	dark
122	very slightly dusky	11	8	light
103	colorless	10	8	rather light
120	colorless	11	8	very light

In life the body is greenish-grey with short reticulated lines of canary-yellow extending longitudinally; a bright yellow line around lower part of eye, and another across cheek; some specimens have the dorsal and pectoral yellow, with the lower rays of the latter abruptly dark slate-color; the ventrals and anal similarly colored, but the latter shading into a clear electric blue toward the base of the rays; in others these lower fins are light yellow. The caudal is always yellow.

Family BLENNIIDÆ.

52. *Pholis ornatus* (Girard).

This is the commonest blenny in the region, and was taken in the seine, in tidal pools, and even in the dredge in fifteen or twenty fathoms of water. The number of dorsal spines does not vary greatly. In the eighteen specimens which were carefully examined, ten had seventy-six, six had seventy-seven, and two had seventy-eight spines.

53. *Apodichthys flavidus* Girard.

Taken in abundance in the seine, but not found in tidal pools. The red and bright green forms occur together in exactly the same surroundings, and no specimens were taken which were intermediate in color.

A large male, fourteen inches in length, differs from females of equal size in being slenderer, and in having a longer head and maxillary.

The maxillary is contained 2.33 in the head, while in the females it is almost 3. Of two males a couple of inches smaller, one is intermediate in these characters, and the other does not at all differ from the females. These are possibly characters appearing with age after the limit of size is reached.

54. **Xiphistes chirus** (Jordan and Gilbert).

This species was not at all common about the islands; *Xiphidion mucosum* being much commoner, which in turn was not nearly so common as *Xiphidion rupestre*.

While collecting in 1895 in the southern end of the Sound and at Cape Flattery this species was found abundantly at the former locality, and one specimen (the type of *Xiphistes ulvæ*) was taken at the Cape, while the other two were taken only about the Cape. All three of the species were taken the following year at Port Ludlow, but the relative abundance of each does not appear. Further information on the distribution of these fishes in the sound would be of interest. It is not a deeper water species (at least about the islands) than the others as alleged in the original and in current descriptions, being found wherever *Xiphidion mucosum* occurs.

A re-examination of the type of *Xiphistes ulvæ* proves almost beyond doubt that the species is untenable. The branches of the upper lateral line are not longer than may be found in individuals of *Xiphistes chirus*. It has, however, three anal spines, but as all other characters are identical with those of *Xiphistes chirus* it is doubtless abnormal in this character. Color, the only other alleged difference, is so variable in these fishes that little dependence can be placed upon it.

55. **Lumpenus anguillaris** (Pallas).

Many specimens were seined from shallow water. The young have elliptical spots arranged in longitudinal rows, about equal in color, size, and spacing, over the sides and back. In the adult the spots in the row along the lateral line become more elongated and distinct, while below them the spots disappear, and above them they are more or less broken up into clouded reticulations.

The statement in current descriptions of the genus *Lumpenus* that the lateral line is indistinct, or obsolete, does not adequately state the facts, at least for this species. The lateral line is represented by slightly enlarged scales, not inconspicuous in individuals of mod-

erate sizes especially anteriorly, though less evident in larger ones. There are, however, no pores along the lateral line.

Family ZOARCIDÆ.

56. *Lyconectes aleutensis* Gilbert.

A single specimen, eight inches in length, representing this rare species, was taken in the dredge.

57. *Lycodopsis pacificus* (Collet).

Commonly taken from deep water in the dredge. In current descriptions a faint lateral line is described as running along the side of the body. It is only in exceptional cases that with the aid of a microscope a few very minute pores may be found running back for about a half an inch behind the opercle. In most cases even this much can not be found, so to say that the lateral line is even faintly indicated is misleading.

Usually there is a small black spot on the anterior end of the dorsal at the tips of the rays, and the dorsal is nearly always, but not invariably, margined with dusky or black.

58. *Lycodes brevipes* Bean.

This species was taken in the dredge nearly, but not quite, as commonly as *Lycodopsis pacificus*.

There is considerable variation in the bars on the back. These may end abruptly just above the middle of the side, or they may fade out gradually below, occasionally being faintly indicated posteriorly as far down as the anal base. Usually the bars are conspicuous, but occasionally they may be almost altogether absent. They may, or may not, be immediately surrounded by color darker than the body-color, and their number, which is usually eleven or twelve, may be increased to fourteen. The dorsal may, or may not, be bordered by dusky or black.

59. *Lycodes palearis* Gilbert.

Two small and two large specimens were taken in the dredge; the largest ten inches in length. The species has hitherto been recorded only from Bering Sea.

In small specimens where the cross-bars are evident, the species may be readily distinguished by the fact that the second bar on the back is entirely in front of the dorsal, and by the black spot on the front of



the dorsal. In *Lycodes brevipes* the second bar is well behind the front of the dorsal. In large individuals the color-markings disappear, but specimens of any size may be known from *Lycodes brevipes* by the longer ventrals, which are as long as, or longer than, the vertical diameter of the eye, while in the latter species they are considerably shorter than the eye, and by the more conspicuous mandibular folds. With the original description (in which most of the above differences, as well as others were noted) the small specimens agree, as do also the large ones with exceptions which may be accounted for by size.

In the specimen ten inches in length the head is contained 4.5 times in the entire length; the depth 8.5. The pectoral is 1.8 in the head (it is thus not materially different from *Lycodes digitatus* Gill and Townsend).

In one of the small specimens intermediate and less definite bars occur between the bars across the body and fins, which do not reach to the dorsal outline.

Family GADIDÆ.

60. *Microgadus proximus* (Girard).

Several small specimens were collected on the beaches with the seine, but it was not found in nearly such abundance as *Theragra fucensis*. The following differences between this species and *Microgadus tomcod* of the Atlantic Coast may be published here from notes made by Willis H. Rich, a student at Stanford University. In *Microgadus proximus* the fins, especially the first dorsal, are more falcate, while in *Microgadus tomcod* they are somewhat rounded. The number of rays in the second anal varies from twenty to twenty-three, while in *Microgadus tomcod* they number from sixteen to nineteen. The teeth of the outer row, especially along the side of the lower jaw, are a little larger. The gill-rakers are larger and not so blunt; their total number is from twenty-four to twenty-nine, while in *Microgadus tomcod* they number from sixteen to twenty-two. The color is lighter and not so much broken up into spots. The following tables show the range of variation of gill-rakers and second anal rays.

Microgadus tomcod.

Number of gill-rakers.....16	17	18	19	20	21	22
Number of specimens..... 1	2	8	6	10	3	1
Rays of second anal.....16	17	18	19			
Number of specimens..... 3	8	15	5			

Microgadus proximus.

Number of gill-rakers.....	24	25	26	27	28	29
Number of specimens.....	8	20	15	10	3	3
Rays of second anal.....	20	21	22	23		
Number of specimens.....	8	24	20	7		

61. *Theragra fucensis* (Jordan and Gilbert).

The young of from three to seven inches in length were taken in abundance in shallow water. It is only in the adult that the subopercular bones become swollen and dense, and so distinguish the genus *Theragra* from *Pollachius*.

Family PLEURONECTIDÆ.

62. *Lyopsetta exilis* (Jordan and Gilbert).

A large specimen, nine inches in total length, and a few small ones, about five inches long, were taken in deep water in the dredge. These are with much hesitation referred to this species. Comparing the large one with specimens from Oregon and southern California the body is found to be much deeper, the head smaller, and the fin-rays all a little shorter. These differences do not show, however, in the smaller specimens. In all of them the eye is smaller, the dorsal begins a little nearer to the snout, the distance from the interorbital to the upper profile directly above the middle of the pupil is a little less, the interorbital is lower, and does not extend back in such a high sharp ridge, the mouth is a little smaller, and the ventrals are a little nearer to the tip of the chin.

In the large specimen from Puget Sound the length to the caudal base is 190 mm. The head is 25.5 hundredths of this length; the depth 35; the long diameter of the lower eye 6.5; the distance of the dorsal from the snout 7.5; the interorbital to the profile at middle of pupil 6; the maxillary 9.5; the longest dorsal and anal rays 11.5; and the distance of the ventrals from the tip of the chin 24.

A specimen from Oregon of exactly the same length has the head 28 hundredths of the length; the depth 30; the eye 7.5; the dorsal from the snout 9; the interorbital from the profile 6.5; the maxillary 11; the longest dorsal and anal rays 13; and the ventrals from the chin 26. The pores in the lateral line vary from sixty-one to sixty-nine in all of the specimens.

The following tables show the variation in fin-rays.

SPECIMENS FROM PUGET SOUND.

Number of dorsal rays.....	77	78	79
Number of specimens.....	1	3	3
Number of anal rays.....	60	61	62
Number of specimens.....	3	3	1

SPECIMENS FROM CALIFORNIA AND OREGON.

Number of dorsal rays.....	80	81	82
Number of specimens.....	4	2	2
Number of anal rays.....	60	61	62
Number of specimens.....	2	3	3

63. *Citharichthys stigmæus* Jordan and Gilbert.

Four specimens were taken with the dredge, the largest five and one-half inches long. The dorsal rays vary in number from 80 to 87, the anal from 65 to 70, and the scales, counting the series above the lateral line, from 56 to 61. The depth of the body in these specimens is a little greater than in specimens from California and Oregon.

This record advances the range of the species from the southern Californian coast to Puget Sound. Specimens taken by the "Albatross" from off the coast of Oregon ("Albatross," Station 3055), are in the collections of Stanford University.

64. *Isopsetta isolepis* (Lockington).

A few specimens four or five inches in length were taken. The small dark spots are definitely placed. There is one opposite the tip of the pectoral above the lateral line, one at the base of the caudal on the lateral line, and one midway between these on the lateral line. There are four equidistant spots following the base of the anal, and six following the base of the dorsal. A less conspicuous spot is below the lateral line just behind the abdominal cavity.

65. *Parophrys vetulus* Girard.

This was the most abundant flounder of the region. The young was seldom absent from the contents of the seine. The small ones are spotted very much as in *Isopsetta isolepis*.

66. *Lepidopsetta bilineata* (Ayres).

Specimens of this common species, from four or five to thirteen inches in length, were taken in abundance. The species is in need of careful study with more material than is at hand. The sides of

the specimens from Puget Sound are very rough in all the sizes here represented, but in the smaller ones the scales are simply spined on their posterior edges. In specimens six inches long a few scales on the anterior part of the body and head become covered with spinules on their upper surface. As the fish grows larger these spine-covered scales extend over nearly the entire body. In the largest specimen there is only a small space towards the ventral and dorsal edges of the body where the scales are simply ctenoid and not covered with spinules.

Jordan and Goss in their review of the flounders and soles (Rept. U. S. Fish Comm., 1886, p. 286) make the following statement. "Specimens from Puget Sound and northward are rougher than southern specimens and constitute a slight geographical variety, for which the name *Lepidopsetta bilineata umbrosa* may be used."

We have only a single specimen obtained south of Puget Sound, a large example, sixteen inches in length, from San Francisco. This is so very different from northern specimens that it appears scarcely possible to refer it to the same species. However to pass definitely on this question will necessitate the study of a number of individuals. According to the laws which seem to govern the development of the ctenoid scales in the form from Puget Sound, the form from San Francisco Bay should grow rougher with size, but the scales of the body are all perfectly devoid of spinules either on the surface or posterior edge, except a very few (probably not exceeding half a dozen) scattered, slightly ctenoid scales. On the upper part of the head and on the cheek the scales are rough, with spinules on their surface. On the opercle and subopercle most of the scales are cycloid. The color is lighter and more broken up into light spots than in specimens from Puget Sound, and the maxillary of the blind side is longer.

Specimens from the north of Puget Sound likewise require study. Some taken just south of the Alaskan Peninsula ("Albatross," Station 3215) have the eye larger than in any of the others (from the various localities here mentioned). The upper eye is 6.5 hundredths of the length, while in the others it is from 5 to 5.5 hundredths. Specimens from Chignik Bay, Alaska, have the pectorals shorter than in any others. The pectoral of the eyed side is from 11 to 12 hundredths of the length, and on the blind side from 8 to 9 hundredths. In the others it is on the eyed side from 13 to 15 hundredths, and on the blind side from 10 to 11 hundredths. Specimens from Nikalski, Bering Islands, have

the snout more projecting than in others, and the color brown covered with fine light flecks.

All of the specimens from north of Puget Sound have the sub- and interopercles naked, while in the specimens from Puget Sound these bones are covered with smooth round scales.

67. ***Microstomus pacificus*** (Lockington).

Several specimens were taken in deep water. Specimens six or seven inches in length from off the southern Californian coast, collected by the "Albatross," are slenderer than specimens from Puget Sound of equal size, though this difference does not exist between larger specimens.

The markings vary from clouded indistinct dark brown spots to distinct rings and half-rings of dark brown, or nearly black, scattered over the body, with smaller dark round spots scattered between them and on the fins. Often there is a dark ring on the lateral line near the tip of the pectoral, another at the base of the caudal, and a third slightly nearer to the posterior spot than to the anterior. These are often duplicated above or below the lateral line. A row of less evident rings follows the base of the dorsal and anal.

68. ***Glyptocephalus zachirus*** Lockington.

This well marked species was found in abundance in deep water. There is much variation in the length of the pectoral of the eyed side between specimens of corresponding size, but it always increases in length with age. In specimens over four inches in length it is always longer, or as long as the head. In specimens smaller than this it may be longer or shorter than the head. In specimens seven or eight inches in length it varies from a quarter of the length of the head longer than the head to nearly twice the length of the head.

LIST OF FISHES KNOWN TO OCCUR IN PUGET SOUND.

Those marked * are species referred to in the preceding notes, or else seen and examined by the writer, but not otherwise noted.

PETROMYZONIDÆ.

1. *Entosphenus tridentatus* (Gairdner).
2. *Lampetra cibaria* (Girard).

HEXANCHIDÆ.

3. *Notorhynchus maculatus* Ayres.
4. *Hexanchus griseus* (Gmelin).

GALEIDÆ.

5. *Prionace glauca* (Linnæus).

SCYLLIORHINIDÆ.

6. *Catulus brunneus* Gilbert.

DALATIIDÆ.

7. *Somniosus microcephalus* (Bloch).

SQUALIDÆ.

8. *Squalus sucklii* (Girard).*

RAJIDÆ.

9. *Raja rhina* Jordan and Gilbert.*
10. *Raja binoculata* (Girard).*
11. *Raja stellulata* Jordan and Gilbert.*

CHIMÆRIDÆ.

12. *Hydrolagus colliæi* (Lay and Bennett).*

ACIPENSERIDÆ.

13. *Acipenser transmontanus* Richardson.
14. *Acipenser medirostris* Ayres.

NEMICHTHYIDÆ.

15. *Nemichthys avocetta* Jordan and Gilbert.

CLUPEIDÆ.

16. *Clupea pallasi* Cuvier and Valenciennes.*
17. *Clupanodon cæruleus* (Girard).
[*Alosa sapidissima* (Wilson). Introduced from Atlantic.]

ENGRAULIDÆ.

18. *Engraulis mordax* Girard.

SALMONIDÆ.

19. *Onchorhynchus tshawytscha* (Walbaum).
20. *Oncorhynchus kisutch* (Walbaum).

- 21. *Oncorhynchus keta* (Walbaum).*
- 22. *Oncorhynchus gorbusha* (Walbaum).
- 23. *Oncorhynchus nerka* (Walbaum).
- 24. *Salmo mykiss* Walbaum.
- 25. *Salmo gairdneri* Richardson.*
- 26. *Salvelinus malma* (Walbaum).

ARGENTINIDÆ.

- 27. *Hypomesus pretiosus* (Girard).*
- 28. *Thaleichthys pacificus* (Richardson).
- 29. *Osmerus thaleichthys* Ayres.

MYCTOPHIDÆ.

- 30. *Tarletonbeania crenularia* (Jordan and Gilbert).
- 31. *Myctophum californiense* Eigenmann and Eigenmann.

PLAGYODONTIDÆ.

- 32. *Plagyodus ferox* (Lowe).

PARALEPIDÆ.

- 33. *Arctozenus coruscans* (Jordan and Gilbert).

AMMODYTIDÆ.

- 34. *Ammodytes personatus* Girard.*

AULORHYNCHIDÆ.

- 35. *Aulorhynchus flavidus* Gill.*

GASTEROSTEIDÆ.

- 36. *Gasterosteus catraphractus* Pallas.*

SYNGNATHIDÆ.

- 37. *Syngnathus griseolineatus* Ayres.*

SPHYRNIDÆ.

- 38. *Sphyræna argentea* Girard.

STROMATEIDÆ.

- 39. *Rhombus simillimus* (Ayres).

SCOMBRIDÆ.

- 40. *Sarda chilensis* Cuvier and Valenciennes.
- 41. *Scomber japonicus* Houttuyn.

ZAPRORIDÆ.

42. *Zaprora silenus* Jordan.

BRAMIDÆ.

43. *Brama raii* Bloch.

EMBIOTOCIDÆ.

44. *Damalichthys argyrosomus* (Girard).*
 45. *Tæniotoca lateralis* (Agassiz).*
 46. *Embiotoca jacksoni* Agassiz.
 47. *Brachyistius frenatus* Gill.
 48. *Amphistichus argenteus* Agassiz.
 49. *Phanerodon furcatus* Girard.*
 50. *Cymatogaster aggregatus* Gibbons.*

SCIÆNIDÆ.

51. *Cynoscion nobilis* (Ayres).

SCORPÆNIDÆ.

52. *Sebastodes melanops* (Girard).*
 53. *Sebastodes mystes* (Jordan and Gilbert).
 54. *Sebastodes pinniger* (Gill).
 55. *Sebastodes ruberrimus* Cramer.
 56. *Sebastodes introniger* Gilbert.*
 57. *Sebastodes deani* Starks, new species.*
 58. *Sebastodes caurinus* (Richardson).*
 59. *Sebastodes clavilatus* Starks, new species.*
 60. *Sebastodes emphæus* Starks new species.*
 61. *Sebastodes auriculatus dalli* (Eigenmann and Beeson).
 62. *Sebastodes maliger* (Jordan and Gilbert).
 63. *Sebastodes nebulosus* (Ayres).
 64. *Sebastodes nigrocinctus* (Ayres).

HEXAGRAMMIDÆ.

65. *Hexagrammos decagrammus* (Pallas).*
 66. *Hexagrammos superciliosus* (Pallas).
 67. *Hexagrammos stelleri* (Tilesius).*
 68. *Ophiodon elongatus* Girard.*
 69. *Oxylebius pictus* Gill.*
 70. *Zaniolepis latipinnis* Girard.
 71. *Anoplopoma fimbria* (Pallas).

COTTIDÆ.

72. *Jordania zonope* Starks.*
73. *Radulinus asprellus* Gilbert.*
74. *Radulinus boleoides* Gilbert.*
75. *Triglops macellus* Bean.*
76. *Triglops beani* Gilbert.*
77. *Chitonotus pugetensis* (Steindachner).*
78. *Stelgidonotus latifrons* Gilbert and Thompson.*
79. *Ruscarius manyi* Jordan and Starks.
80. *Icelinus borealis* Gilbert.*
81. *Tarandichthys filamentosus* (Gilbert).
82. *Astrolytes fenestralis* (Jordan and Gilbert).*
83. *Axyrias harringtoni* Starks.*
84. *Artedius lateralis* Girard.*
85. *Hemilepidotus hemilepidotus* (Tilesius).*
86. *Myoxocephalus polyacanthocephalus* (Pallas).*
87. *Enophrys bison* (Girard).*
88. *Leptocottus armatus* Girard.*
89. *Scorpenichthys marmoratus* (Girard).*
90. *Blennicottus globiceps* (Girard).*
91. *Oxycottus embryum* (Jordan and Starks).*
92. *Oligocottus maculosus* Girard.*
93. *Dasycottus setiger* Bean.*
94. *Malacocottus kincaidi* Gilbert.
95. *Nautichthys oculo-fasciatus* (Girard).*
96. *Blepsias cirrhosus* (Pallas).*
97. *Ascelichthys rhodorus* Jordan and Gilbert.
98. *Psychrolutes paradoxus* Günther.*
99. *Gilbertedia sigalutes* (Jordan and Starks).*

RHAMPHOCOTTIDÆ.

100. *Rhamphocottus richardsoni* Günther.*

AGONIDÆ.

101. *Aspidophoroides inermis* Günther.*
102. *Bothragonus swani* (Steindachner).
103. *Hypsagonus quadricornis* (Cuvier and Valenciennes).*
104. *Pallasina aix* Starks.*
105. *Podothecus acipenserinus* (Pallas).*

- 106. *Averruncus emmelane* Jordan and Starks.*
- 107. *Xeneretmus latifrons* (Gilbert).*
- 108. *Bathyagonus nigripinnis* Gilbert.
- 109. *Xeneretmus triacanthus* (Gilbert).
- 110. *Xeneretmus alaskanus* (Gilbert).*
- 111. *Xeneretmus infraspinatus* Gilbert.*
- 112. *Odontapryxis trispinosus* Lockington.*

CYCLOPTERIDÆ.

- 113. *Lethotremus vinolentus* Jordan and Starks.
- 114. *Eumicrotremus orbis* (Günther).*

LIPARIDIDÆ.

- 115. *Liparis greeni* Jordan and Starks.
- 116. *Liparis floræ* Jordan and Starks.
- 117. *Liparis callyodon* (Pallas).*
- 118. *Liparis cyclopus* Günther.*
- 119. *Liparis dennyi* Jordan and Starks.*
- 120. *Liparis fucensis* Gilbert.
- 121. *Liparis pulchellus* Ayres.*

BATHYMASTERIDÆ.

- 122. *Ronquilus jordani* (Gilbert).*

GobiIDÆ.

- 123. *Gobius nicholsi* Bean.
- 124. *Lepidogobius lepidus* (Girard).
- 125. *Gillichthys mirabilis* Cooper.
- 126. *Quietula y-cauda* (Jenkins and Evermann).
- 127. *Clevelandia ios* (Jordan and Gilbert).

BATRACHIDÆ.

- 128. *Porichthys notatus* Girard.*

GOBIESOCIDÆ.

- 129. *Caularchus mæandricus* (Girard).*

BLENNIIDÆ.

- 130. *Bryostemma decoratum* Jordan and Snyder.
- 131. *Bryostemma nugator* Jordan and Williams.
- 132. *Pholis ornatus* (Girard).*

- 133. *Apodichthys flavidus* Girard.*
- 134. *Xererpes fucorum* (Jordan and Gilbert).
- 135. *Anoplarchus atropurpureus* (Kittlitz).*
- 136. *Xiphistes chirus* (Jordan and Gilbert).*
- 137. *Xiphidion rupestre* (Jordan and Gilbert).*
- 138. *Xiphidion mucosum* Girard.*
- 139. *Plectobranthus evides* Gilbert.
- 140. *Lumpenus anguillaris* (Pallas).*
- 141. *Delolepis virgatus* Bean.
- 142. *Lyconectes aleutensis* Gilbert.*

ANARRHICHADIDÆ.

- 143. *Anarrhichthys ocellatus* (Ayres).

ZOARCIDÆ.

- 144. *Lycodopsis pacificus* (Collet).*
- 145. *Lycodes brevipes* Bean.*
- 146. *Lycodes palearis* Gilbert.*

SCYTALINIDÆ.

- 147. *Scytalina cerdale* Jordan and Gilbert.

GADIDÆ.

- 148. *Microgadus proximus* (Girard).*
- 149. *Gadus macrocephalus* Tilesius.
- 150. *Brosmophycis marginatus* (Ayres).
- 151. *Theragra fucensis* (Jordan and Gilbert).*

MERLUCCIDÆ.

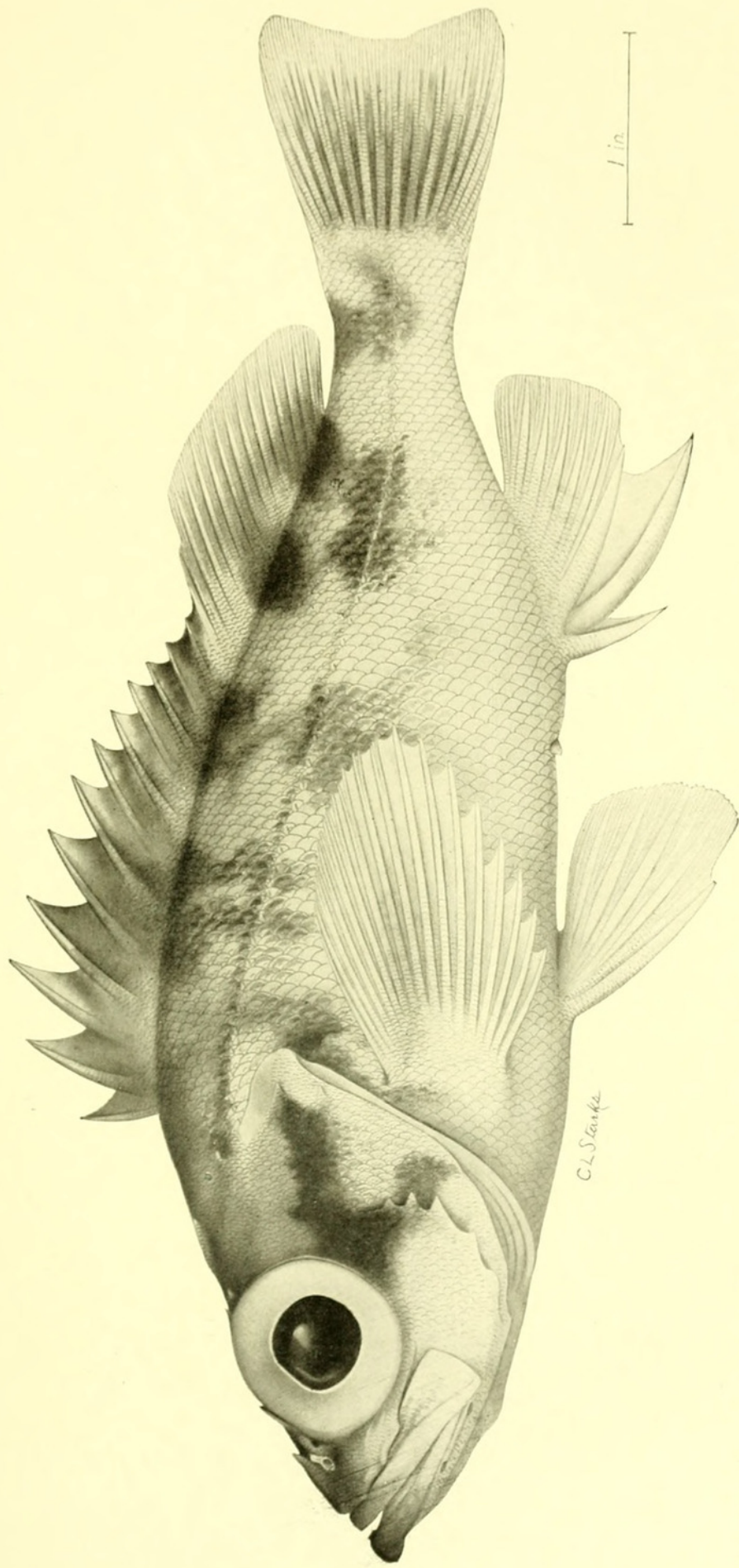
- 152. *Merluccius productus* Ayres.*

TRACHYPTERIDÆ.

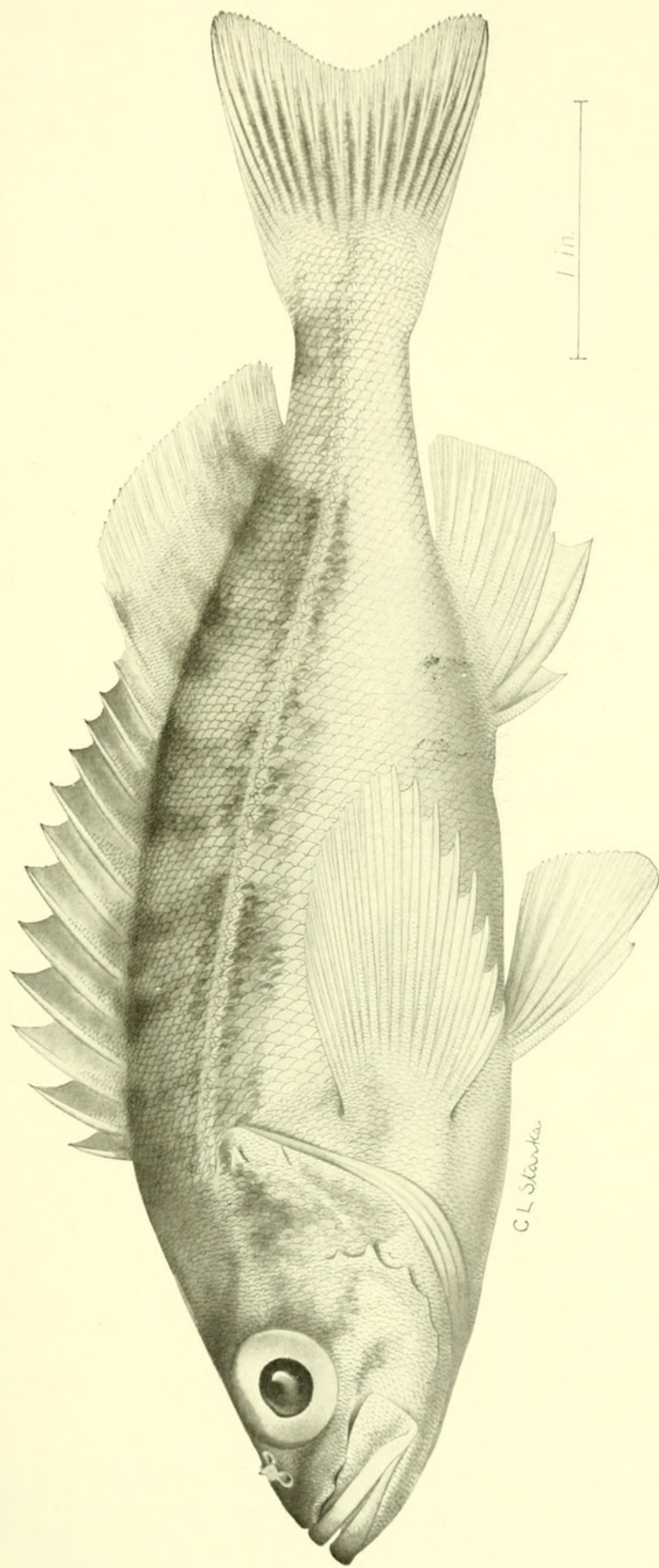
- 153. *Trachypterus rex-salmonorum* Jordan and Gilbert.

PLEURONECTIDÆ.

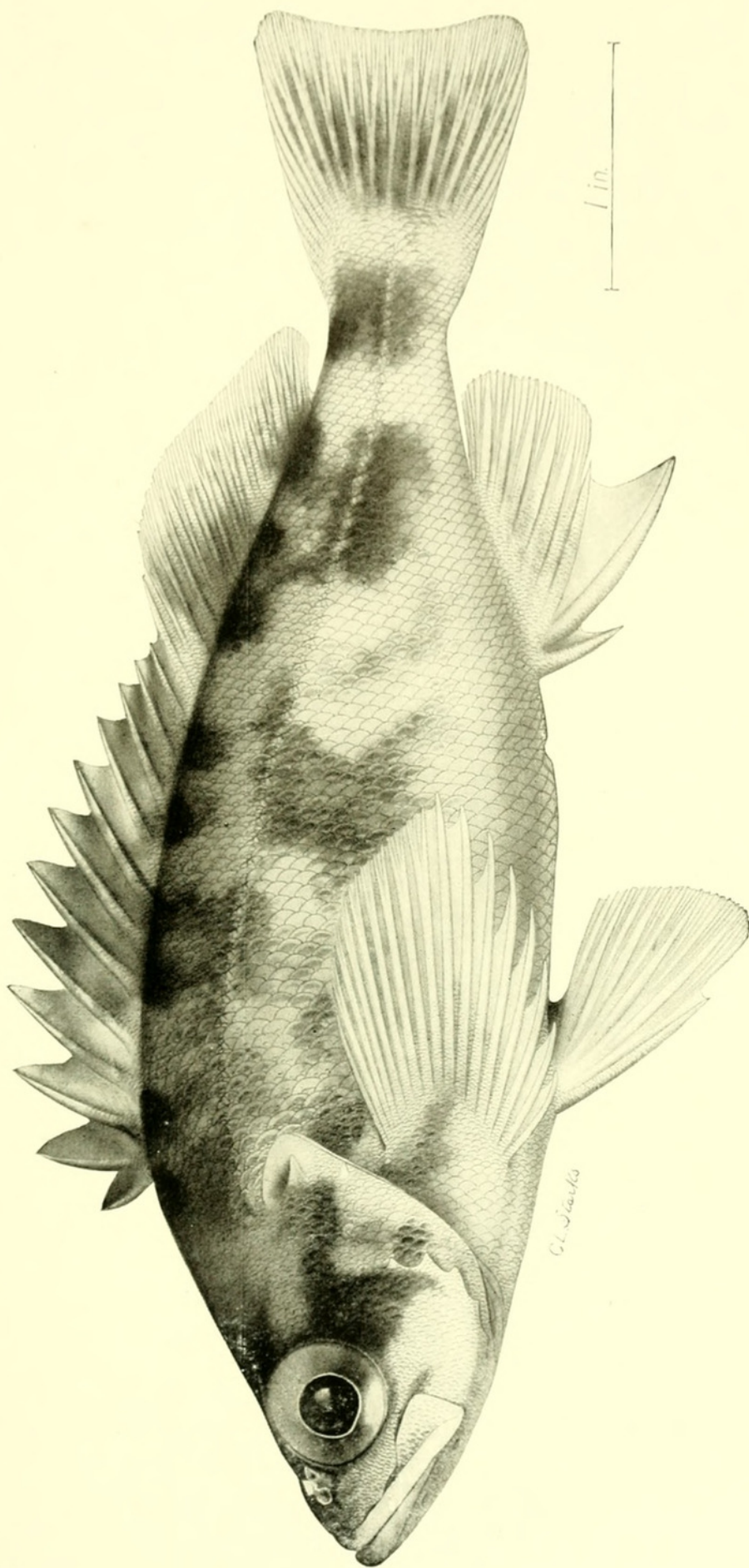
- 154. *Hippoglossus hippoglossus* (Linnæus).
- 155. *Eopsetta jordani* (Lockington).
- 156. *Hippoglossoides elassodon* Jordan and Gilbert.*
- 157. *Lyopsetta exilis* (Jordan and Gilbert).*
- 158. *Psettichthys melanostictus* Girard.*
- 159. *Citharichthys sordidus* (Girard).



Sebastodes deanii Starks. Type.



Sebastodes claviger Starks, Type.



Sebastodes emphicus Starks. Type.

- 160. *Citharichthys stigmæus* Jordan and Gilbert.*
- 161. *Isopsetta isolepis* (Lockington).*
- 162. *Inopsetta ischyra* (Jordan and Gilbert).
- 163. *Parophrys vetulus* Girard.*
- 164. *Lepidopsetta bilineata* (Ayres).*
- 165. *Platichthys stellatus* (Pallas).*
- 166. *Microstomus pacificus* (Lockington).*
- 167. *Glyptocephalus zachirus* Lockington.*
- 168. *Pleuronichthys nephelus* Starks and Thompson, MS.*



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