

Notice upon the viviparous fishes inhabiting the Pacific coast of North America, with an enumeration of the species observed / by Charles Girard.

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Notice upon the viviparous Fishes inhabiting the Pacific coast of North America, with an enumeration of the species observed.

By CHARLES GIRARD.

The observations which we have traced upon the genital apparatus of the female, have satisfied us that there exists an ovarian sheath or sack, which, during the early period of pregnancy, is an elongated and subcylindrical tube, containing the ovaries proper, two in number, each of which consisting of two, three, or more vascular membranes, attached by their upper edge to the upper floor or roof of the sheath, forming either one, two, or more pouches (according to the number of these membranes) of the same length as the sheath itself, widely open beneath, though not in a direct communication with one another, since the membranes hang loosely down, resting on the lower floor of the sheath.

The eggs are formed within the texture of the ovarian membranes themselves. We have examined the ovaries of *Ennichthys heermanni*, when the sheath, within which they were contained, was not larger than an ordinary quill. Numerous eggs could be observed in a very immature state, appearing to the naked eye like minute dots. Under the microscope, they exhibited evident traces of the germinal vesicle, surrounded as yet with a very scanty supply of vitelline substance.

The sheath and the ovaries are gradually increasing in bulk, as the eggs themselves first increase in size and the embryos afterwards. The sheath is a muscular membrane chiefly, whilst the ovarian membranes, we have stated, are altogether vascular.

When mature, the eggs either fall into the space between the membranes or ovarian pouches, or else remain attached to the ovaries until the embryos issue out of them. We are inclined to think that they drop into the pouches as eggs. At any rate, we found very young embryos loosely contained in the ovarian pouches, when no trace of the egg membrane could be seen within the tissues of the ovaries in the shape of corpora lutei or graffian vesicles. Whatever be the case, numerous eggs or embryos may be observed within one pouch. The young thus remain together until grown to a considerable size, when, filling up the space in a more compact manner, the ovarian membranes, in their nature very expansive, will extend a fold between each embryo. In this manner every individual young, when removed sideways from the ovary, appears to the operator as if enclosed in a separate cavity, pouch, or follicle, of the ovary, whilst, in reality, the membranes may be stretched out or extended, and the entire progeny loosened from all adherence or connection with them.

The male organs of generation consist of two spermaries, a right and a left, perfectly independent from one another, having each its separate duct, discharging their contents into an elongated cloaca, into which the bladder, likewise, empties its contents. This cloaca communicates with the exterior by a subcircular opening, the edge of which being rather protruding. Such is that apparatus—the same in its general structure as in the other osseous fishes. There is no sheath enclosing the two spermaries, and this fact throws a considerable light upon the morphology of the ovaries: the latter being in fact two in number, but so closely connected together as to simulate a single organ. Thus the general disposition, not the plan of structure, of these organs, is adapted to the mode of reproduction—a single sheath being a more simple adaptation than two, one for each ovary.

How the mechanical act of fecundation takes place we are not prepared to say from direct observations; the eggs themselves must be fecundated within the ovarian sheath; a copulation of some sort is therefore required, and it is not improbable that at this period the eggs have dropped from the ovarian membranes into the pouches, or spaces between these membranes, in which they are freely floating.

The hatching of the embryos takes place at an early period. After leaving the egg shell, they have an abdominal bag containing the remaining yolk, which is to be gradually absorbed during a period when neither the mouth nor the esophagus are formed; the fins have not yet appeared. The visual organs begin with a deposition of an external layer of black pigment, in every respect similar to the same organs in invertebrata. The head is anteriorly rounded, and the cleft of the mouth not yet apparent at the period when the fins begin to develop. The caudal has the start over all other fins; its posterior margin is first lanceolated, then rounded, with a convexity gradually diminishing until it is perfectly straight, when a gradual emargination commences, and from a slight crescent reaches the forked shape which it assumes in the adult. The soft and articulated portion of the dorsal and anal fins, next assume a development reaching extraordinary proportions, which they again gradually lose so soon as free from parental sheltering. The posterior portion of these fins is especially to be noticed, as longer or deeper than the anterior portion (the reverse of what we observe in the adult,) and extending generally beyond the base of the caudal fin, a character, therefore, not exclusively proper to the genus *Rhacoechilus*. The spinous portion of these same fins, on the other hand, develop but slowly and gradually, reaching their full growth at a late period. The ventrals and pectorals are likewise tardy in their appearance. The scales are fully developed before the young leave the ovary.

Genus EMBIOTOCA, Agass.

Head of moderate development; mouth small; upper jaw slightly the longest. Lips thick and fleshy; lower one attached by a frenum to the symphysis of the dentary (chin). Intermaxillaries protractile. Teeth in both jaws, short, conical, blunt, slightly recurved and disposed upon one single row. Pharyngeal teeth pavement-like. Spinous portion of dorsal fin generally lower than the soft; the greatest difference in height between the two being observed upon their contiguity. Five or six branchiostegal rays. Scales of medium development; lateral line well marked, continuous from head to base of caudal, and concurrent with the dorsal outline. No scales upon the fins.

SYN. *Embiotoca*, AGASS. Amer. Journ. of Sc. Second series, xvi. 1853, 386; and xvii. 1854, 366.

1. *EMBIOTOCA JACKSONI*, Agass.—General form subelliptical. Anal broadly rounded upon its external margin; origin of latter fin situated opposite the sixth or seventh articulated ray of the dorsal. Tips of pectorals reaching a vertical line intersecting the base of the third articulated ray of dorsal fin. Eyes rather of small than of medium size. Posterior extremity of maxillary reaching a vertical line, passing in advance of anterior rim of orbit. Frontal region slightly depressed above the eyes. Branchiostegals five in number. About sixty scales in lateral line. Female, uniform dark purplish brown; male, olive brown, with diffused darker blotches.*

SYN. *Embiotoca jacksoni*, AGASS. Amer. Jour. of Sc. Second series, xvi. 1853, 387; and xvii., 1854, 366.—GIRARD, in Proc. Acad. Nat. Sc. Philad. vii. 1854, 151.

Locality.—San Francisco, Cal. Collected by Dr. A. L. Heermann.

2. *EMBIOTOCA CASSIDYI*, Grd.—General form subellipsoid. Frontal region very slightly depressed above the eyes. Anal undulated upon its external margin; its origin being opposite the third articulated ray of the dorsal fin. Tip of pectorals reaching a vertical line that would intersect the base of the last spiny ray of the dorsal. Eyes above the medium size. Posterior extremity of the maxillary not reaching the vertical of the anterior rim of the orbit. Branchiostegals six in number. Fifty-seven scales in the lateral line. Purplish brown, with about twelve transparent bands of a deeper hue.

SYN. *Embiotoca cassidyi*, GRD. in Proc. Acad. Nat. Sc. Philad. vii. 1854, 151.

Locality.—San Diego, Cal. Collection of Lieut. W. P. Trowbridge, U. S. A.

* The coloration of this and of all the following species is described as extant on specimens after a long immersion in alcohol.

3. *EMBIOTOCA WEBBI*, Grd.—General form ellipsoid. Frontal region subconcave; occiput prominent. Anal undulated upon its external margin; its origin being opposite the fifth articulated ray of the dorsal. Tip of pectorals reaching the vertical of the third articulated ray of dorsal fin. Eyes above the medium size. Posterior extremity of maxillary extending to the vertical of anterior rim of orbit. Branchiostegals, five on right side, six on the left. Fifty-four scales in the lateral line. Olive brown, with indistinct purplish blotches.

Locality.—San Diego, Cal. Collection of Lieut. W. P. Trowbridge, U. S. A.

4. *EMBIOTOCA LINEATA*, Grd.—Body subelliptically elongated. Anal fin elongated, with external margin nearly straight, diminishing gradually in height posteriorly; its origin being opposite to the sixth articulated ray of the dorsal. Tip of pectorals reaching a vertical line intersecting the base of last but one dorsal spine. Eyes of medium size. Posterior extremity of maxillary even with the vertical of anterior rim of orbit. Frontal region slightly depressed above the eyes. Branchiostegals five in number. Sixty-two scales in lateral line. Ground color of upper regions dark olive or reddish brown; reddish yellow beneath. Sides of abdomen with light longitudinal stripes intersecting the point of union of the rows of scales. Anal fin deep purple, with a yellowish vitta at its base.

SYN. *Embiotoca lineata*, GRD. in Proc. Acad. Nat. Sc. Philad. vii. 1854, 134 and 151.

Locality.—Bay of San Francisco, Cal. Collected by Dr. A. L. Heermann.

5. *EMBIOTOCA ORNATA*, Grd.—General form subelliptical. Posterior extremity of maxillary extending to a vertical line, which would pass behind the posterior nostrils. Eyes of medium size. External margin of anal nearly straight; its origin being opposite the fifth articulated ray of dorsal. Tips of pectorals falling under the vertical of the tenth dorsal spine. Branchiostegals five in number. About sixty-four scales in the lateral line. Color dark brown above; flanks and abdomen yellowish golden, with purple stripes along the line of union between the rows of scales. Scales on thoracic region provided with a central purple spot.

SYN. *Embiotoca lineata*, GRD. in Proc. Acad. Nat. Sc. Philad. vii. 1854, 151.

Locality.—San Diego, Cal. Collection of Lieut. W. P. Trowbridge, U. S. A.

6. *EMBIOTOCA PERSPICABILIS*, Grd.—Body subelliptically elongated. Frontal region gently declive. Eyes of medium size. Posterior extremity of maxillary not quite reaching the anterior rim of the orbit. Anal fin long; its anterior undivided rays longer than the rest, and its origin situated opposite the twelfth articulated ray of dorsal. Tips of pectorals reaching the vertical line intersecting the base of last dorsal spine. Five branchiostegal rays. Sixty-three scales in lateral line. Deep purplish brown above, lighter beneath. Flanks with light narrow longitudinal stripes intersecting the point of union of rows of scales. Dorsal, caudal anal and ventral fins reddish purple; pectorals yellowish.

Locality.—Fort Steilacoom, Puget Sound. Collected by Dr. Geo. Suckley, U. S. A.

Genus DAMALICHTHYS, Girard.

Head well developed. Eyes large. Mouth of medium size; upper jaw protruding considerably over the lower one. Teeth few in number, short and subconical, disposed upon one row only. Lips of moderate thickness; lower one firmly attached to the symphysis of the jaw. Opercular apparatus very much developed and covered with large scales. Anterior portion of soft dorsal very high. Peduncle of tail slender; caudal fin deeply forked. Anal elongated; its anterior portion the deepest. Ventrals and pectorals proportionally large.

7. *DAMALICHTHYS VACCA*, Grd.—Male provided with a subpyriform sac upon the anterior third of anal. Branchiostegals five in number. Ground color greyish olive. Scales with a golden and silvery metallic reflect. Fins unicolor.

Locality.—Fort Steilacoom, Puget Sound. Collected by Dr. Geo. Suckley, U. S. A.

Genus PHANERODON, Girard.

Head rather small. Mouth small; jaws equal. Lips thin; lower one attached by a very narrow frenum to the symphysis of its jaw. Intermaxillaries very protractile. Teeth large and subconical, disposed upon a single row on both jaws. Spinous portion of dorsal fin as high as the soft. Anterior articulated rays of anal undivided and preceded by three spinous rays, shorter than the articulated ones. Scales well developed. Lateral line concurrent with the dorsal outline. Scales on the base of caudal rays. Dorsal groove extending from middle of spinous portion of dorsal fin to last third of soft portion. Sheath formed by two rows of scales anteriorly, and one only posteriorly.

SYN. *Phanerodon*, GRD. Proc. Acad. Nat. Sc. Philad. vii. 1854, 153.

8. PHANERODON FURCATUS, Grd.—General form elongated, rather tapering posteriorly, and very much compressed. Cleft of mouth not extending to the anterior rim of the orbit. Eyes large and circular. Branchiostegals five in number. Caudal slender and deeply forked. About sixty-three scales in lateral line. Yellowish brown above; lighter on the sides; whitish under the throat. Fins yellowish. Margin of dorsal and caudal greyish. A diffused marginal spot upon the anterior portion of anal.

SYN. *Phanerodon forcatus*, GRD. Proc. Acad. Nat. Sc. Philad. vii. 1824. 153.

Locality.—Bay of San Francisco, Cal. Collection of Lieut. Trowbridge, U. S. A.

Genus ABEONA, Girard.

Head of medium size; mouth very small; jaws equal. Lips rather thin; lower one attached by a frenum to the symphysis of the jaw. Intermaxillaries protractile. Teeth stoutish, conical, disposed upon one single row on both jaws. Branchiostegals five in number. Spinous portion of dorsal fin higher than the soft; line of separation between both of these slightly depressed. Articulated rays of anal all divided; spiny rays three in number, well developed; base of that fin rather short. Scales of moderate size. Lateral line concurrent with the dorsal outline. No scales upon the fins. Dorsal groove extending nearly to the whole base of the fin. Sheath formed by two rows of scales.

9. ABEONA TROWBRIDGII, Grd.—General form subelliptical. Head subconical; snout abbreviated; mouth small; posterior extremity of maxillary not reaching the vertical of anterior rim of orbit. Eyes large and circular. Branchiostegals five in number. Forty-one scales in lateral line. Olive or reddish brown above; silvery on the sides and abdomen. Flanks blotched. Fins yellowish, except anal, which is purplish, with its anterior portion spotted.

SYN. *Holconotus trowbridgii*, GRD. Proc. Acad. Nat. Sc. Philad. vii. 1854, 152.

Locality.—Not precisely known; San Francisco, Monterey, or San Diego, Cal.

Genus HOLCONOTUS, Agass.

Head well developed. Mouth small; jaws equal; lower one projecting slightly when mouth opens. Lips thin; lower one free all around. Intermaxillaries protractile to a considerable extent. Teeth small, slender, subconical, slightly curved, disposed upon a double row on the upper jaw and one only on the lower. Spinous portion of dorsal fin higher than the soft. Anterior articulated rays of anal mostly all divided, and preceded by three spines shorter than the other rays. Scales rather large. Lateral line concurrent with the dorsal outline. No scales on the fins. Dorsal groove extending from opposite middle of spinous portion of dorsal fin to beyond the middle of soft portion of same fin. Sheath formed of but one apparent row of scales, tapering posteriorly.

SYN. *Holconotus*, AGASS. Amer. Journ. of Sc. Second series, xvii. 1854, 367.

10. HOLCONOTUS RHODOTERUS, Agass.—General form elongated, neither elliptical nor fusiform. Frontal region subconcave. Head subconical; mouth small;

posterior extremity of maxillary not quite reaching the vertical of rim anterior of orbit. Eyes rather large and circular. Branchiostegals five in number. About forty-four scales in lateral line. Bluish grey or olive above, silvery or yellow upon the sides, with rose-colored spots disposed in longitudinal series.

SYN. *Holconotus rhodotus*, AGASS. Amer. Journ. of Sc. Second series, xvii. 1854, 368.—GRD. Proc. Acad. Nat. Sc. Philad. vii. 1854, 141 and 152.

Localities.—From California to Oregon. Collections of Lieut. R. S. Williamson, Lieut. W. P. Trowbridge and Gov. I. I. Stevens.

Genus ENNICHTHYS, Girard.

Head of medium size. Mouth large and oblique; lower jaw projecting beyond the upper. Lips thin, lower one free all around. Intermaxillaries slightly protractile. Teeth small, slender and conical, disposed upon a double series on both jaws. Spinous portion of dorsal fin higher than the soft. Anterior articulated rays of anal divided like the rest, and preceded by three small spines, lower than the articulated rays. Scales of moderate development. Lateral line concurrent with the dorsal outline. Scales upon the base of caudal and anal fins. Dorsal groove rather short. Sheath formed anteriorly by three rows of scales, tapering posteriorly.

11. ENNICHTHYS MEGALOPS, Grd.—General appearance gibbous. Dorsal sheath very short. Mouth large and oblique. Eyes very large, circular. Four rows of scales on preopercle. Branchiostegals six. Eighty-five scales in lateral line. Ash or greyish brown above. Sides and abdomen dull yellow or white; a diffused spot upon anterior third of anal. Other fins yellowish; tips of pectorals blackish or deep purple.

SYN. *Holoconotus megalops*, GRD. Proc. Acad. Nat. Sc. Philad. vii. 1854, 152.

Locality.—San Francisco, Cal. Collection of Lieut. W. P. Trowbridge, U. S. A.

12. ENNICHTHYS HEERMANNI, Grd.—General form subelliptical; snout subconical; mouth moderate; posterior extremity of maxillary, even with a vertical line, intersecting the centre of the pupil. Eyes of medium size. Branchiostegals six. About sixty-two scales in lateral line. Back olivaceous; sides and abdomen silver and golden; flanks with indistinct transverse bars or bands. Fins unicolor, yellowish and greyish.

SYN. *Amphistichus heermanni*, GRD. Proc. Acad. Nat. Sc. Philad. vii. 1854, 135.

Locality.—San Francisco, Cal. Collected by Dr. A. L. Heermann.

Genus AMPHISTICHUS, Agass.

Head rather large. Mouth large; jaws equal. Lips thin, lower one attached by a frenum to the symphysis of the lower jaw. Intermaxillaries slightly protractile. Teeth stoutish, recurved, conical and disposed upon a double row on both jaws. Spinous portion of dorsal fin generally lower than the soft, and sometimes equal to it in height. Anterior articulated rays of anal divided like the rest and preceded by three spines, the second and third of which being nearly as deep as the first articulated ray. Scales of moderate development. Lateral line concurrent with the dorsal outline. One row of scales along the base of anal. The dorsal groove extends from middle of spinous portion of dorsal fin to about the middle of soft portion of same fin. Sheath formed by two rows of scales anteriorly, tapering into one posteriorly.

SYN. *Amphistichus*, Agass. Amer. Journ. of Sc. Second series, xvii. 1854, 367.

13. AMPHISTICHUS ARGENTEUS, Agass.—General form subelliptical, more convex above than below. Snout anteriorly rounded. Posterior extremity of maxillary reaching a vertical line passing behind the pupil. Anterior anal spines rather large. Sixty-eight scales in lateral line. Branchiostegals, six. Bluish grey above, sides silvery, with indistinct olivaceous transverse bands. Vertical fins and ventrals olivaceous; pectorals yellowish.

SYN. *Amphistichus argenteus*, Agass. Amer. Journ. of Sc. Second series, xvii. 1854, 367.—GRD. Proc. Acad. Nat. Sc. Philad. vii. 1854, 141 and 153.

Locality.—San Francisco, Cal. Collected by Dr. A. L. Heermann.

14. AMPHISTICHUS SIMILIS, Grd.—General form regularly subelliptical. Snout subconical. Posterior extremity of maxillary reaching a vertical line passing in advance of the pupil. Spinous portion of dorsal as high as the soft. Anterior anal spines rather small. Branchiostegals, five. Bluish grey above; sides silvery. Dorsal and caudal greyish yellow; anal, ventrals and pectorals dull yellowish.

Syn. *Amphistichus similis*, GRD. Proc. Acad. Nat. Sc. Philad. vii. 1854, 135.

Locality.—Bay of San Francisco, Cal. Collected by Dr. A. L. Heermann; also in Collection of Lieut. W. P. Trowbridge.

Full descriptions, accompanied with figures of all the species above enumerated, are ready for the press, and will shortly be published by Congress.



