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An Addition to the Knowledge of the Fish, *Retropinna anisodon* Stokell (Retropinnidae)

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Abstract

Attention is drawn to inadequacies in the specific description of *Retropinna anisodon* Stokell, 1941. The sexual dimorphism of mature adults of this species is mentioned and figured. The development and form of the larva are figured and described.

Introduction

In the course of investigation of the smelt-like fishes of the Rangitata river mouth, Canterbury, it became apparent that *R. anisodon* was unsatisfactorily described. The description (Stokell, 1941, pp. 371–2) appears to have been based on a small sample of male fish taken from the Waiau River, Southland. The observed ranges given are small, and the marked sexual dimorphism, characteristic of the Retropinnidae, is not mentioned except in a reference to another "form" taken from the mouth of the Waimakariri River, Canterbury.

Systematic

In describing *R. anisodon*, Stokell (1941, p. 371) stated, ". . . pectoral, ventral, and anal fins and lower part of body with numerous small nodules." These "nodules", or nuptial tubercles, are found on the scales and fins of mature males but are not on the scales and fins of females. Another major difference between the sexes occurs in the length of the fins—paired fins in particular (Text-fig. 1). Stokell gave, ". . . . pectoral extending .75–.81 of the distance from its base to base of ventral." Measurements of a random sample of 144 mature specimens of *R. anisodon* (74 females and 70 males) revealed a complete discontinuity between the sexes in the observed range of this ratio, which in females extended from 0.44–0.64, and in males from 0.67–0.86 (Table I). A similar discontinuity was observed in the range of the ratio of the length of the ventral fin to the length from its origin to the origin of the anal fin—the observed range in females being 0.37–0.50, and in males 0.53–0.71, compared with Stokell's range of 0.60–0.65.

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TABLE I.—COMPARISON OF RATIOS OF LENGTH OF PECTORAL FIN TO LENGTH FROM ITS ORIGIN TO ORIGIN OF VENTRAL-RATIO EXPRESSED AS A QUOTIENT (× 100).

Sex	Number of Specimens	Range	Mean	Standard deviation
females	74	44-64	55.93±.56	4.83±.33
males	70	67-86	76.93±.63	5.27±.45

TABLE II.—COMPARISON OF RATIOS OF LENGTH OF VENTRAL FIN TO LENGTH FROM ITS ORIGIN TO ORIGIN OF ANAL FIN.

Sex	Number of Specimens	Range	Mean	Standard deviation
females	74	37-50	42.40±.35	4.04±.21
males	70	53-71	60.30±.49	4.14±.35

The differences in the averages of males and females are extremely significant and do not require testing.

In both the ratios given above, Stokell's range lies within that observed for Rangitata males. He described a " form " from the mouth of the Waimakariri River, concerning which he stated (1941, p. 372), ". . . differs from the above species in having . . . shorter paired fins (pectoral .53–.60, ventral .42–.47), a less muscular pectoral base . . ." These ranges lie well within those given above for females of the species.

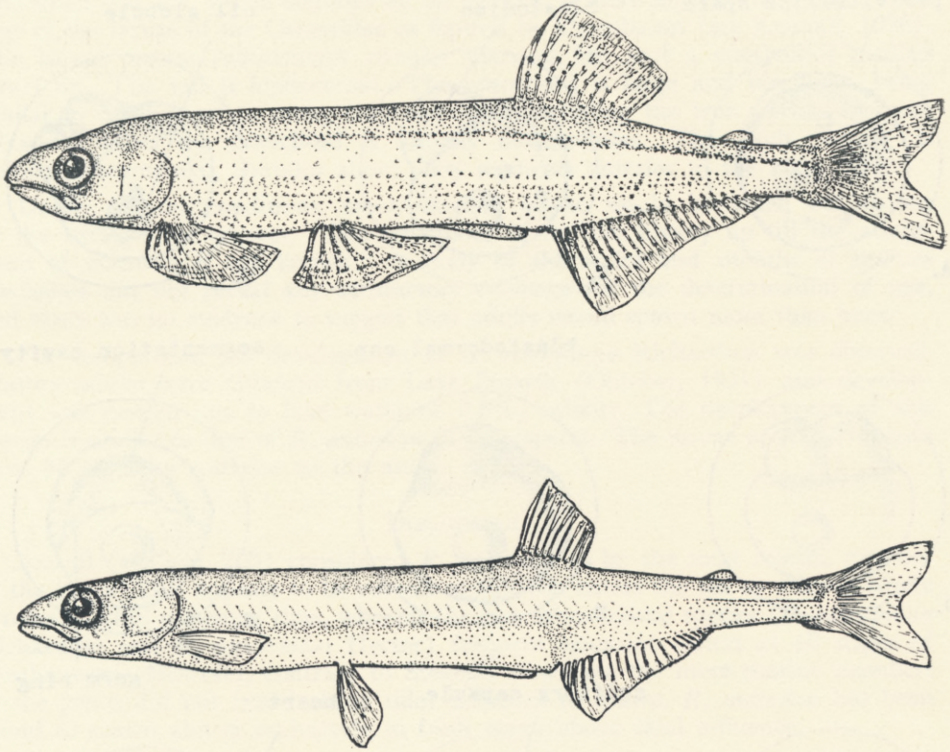
Besides the presence of tubercles in males and the differences between the sexes in the relative sizes of the paired fins, other differences were noted. Males are light brown in colour dorsally and a pale straw colour ventrally, whereas females are steely-blue dorsally and silvery-white ventrally. Both sexes have lateral silvery bands. The musculature of the dorsal region and the body wall is much stronger in males than in females, the abdominal cavity of which is correspondingly larger than that of males.

The sexual dimorphism of *R. anisodon* is similar to that which occurs in many species of true smelts of the Northern Hemisphere (Hart and McHugh, 1944).

LIFE HISTORY

The spawning season of *R. anisodon* was observed to extend from September to April. Large migrations began in November and continued sporadically throughout December, January and February. Spawning begins immediately the shoals reach the stretches of river entering the lagoon. Favourite sites are silt-bottomed reaches of subsidiary streams where the current is slight. Large numbers of spent or partly spent fish were netted in the spawning grounds while eggs and newly-hatched larvae were also collected by net after disturbing the silt bed of the stream.

Freshly-stripped eggs of *R. anisodon* immediately absorb water with the subsequent formation of a perivitelline space and the assumption of a spherical form. The eggs measure from 0.7 to 0.8 mm in diameter and are translucent, although the yolk mass, which contains numerous oil globules, is tinted a pale straw colour. The eggs are demersal and have strongly adhesive outer membranes.

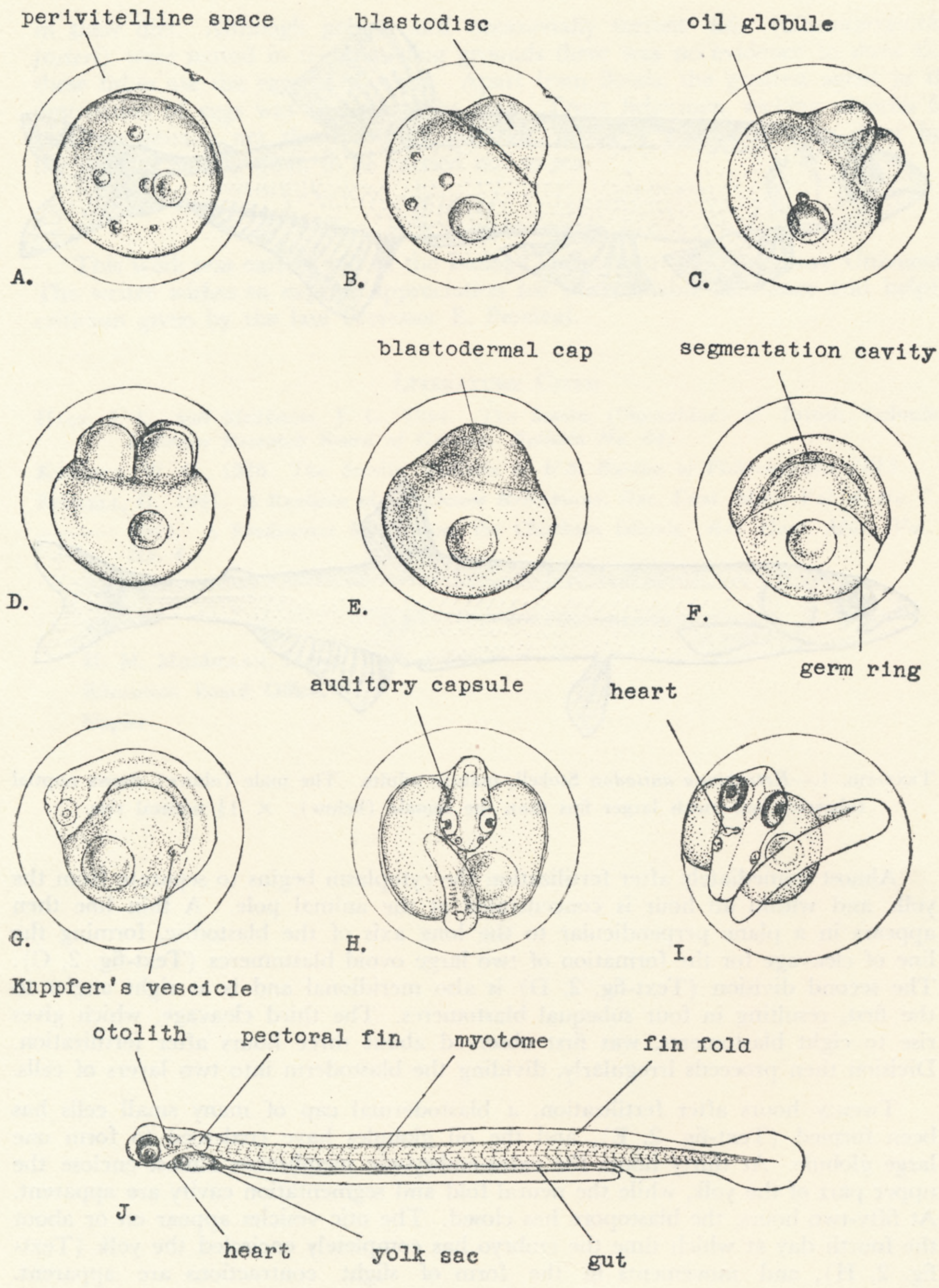


TEXT-FIG. 1.—*Retropinna anisodon* Stokell, mature adults. The male (above) shows nuptial tubercles and much larger fins than the female (below). × 1½ natural size.

Almost immediately after fertilization the cytoplasm begins to separate from the yolk, and within an hour is concentrated at the animal pole. A thin line then appears in a plane perpendicular to the long axis of the blastodisc, forming the line of cleavage for the formation of two large ovoid blastomeres (Text-fig. 2, C). The second division (Text-fig. 2, D) is also meridional and is at right angles to the first, resulting in four subequal blastomeres. The third cleavage, which gives rise to eight blastomeres, was first observed about three hours after fertilization. Division then proceeds irregularly, dividing the blastoderm into two layers of cells.

Twenty hours after fertilization, a blastodermal cap of many small cells has been formed (Text-fig. 2, E), and the oil globules have coalesced to form one large globule. At thirty hours the extra-embryonic membranes almost enclose the upper part of the yolk, while the neural fold and segmentation cavity are apparent. At fifty-two hours, the blastopore has closed. The otic vesicles appear on or about the fourth day at which time the embryo has completely encircled the yolk (Text-fig. 2, H), and movements in the form of slight contractions are apparent. Throughout several seasons' observation it was found that development time varied from eight to twenty-one days. The water temperature during development ranged from 15 to 21 degrees C.

The newly-hatched larvae are 4.5 to 4.8 mm in length (Text-fig. 2, J). They are transparent with large eyes pigmented greenish-brown and black. The dorsal profile of the head is rounded with the rudimentary jaws sub-terminal in position.



TEXT-FIG. 2.—*Retropinna anisodon.* A—Egg shortly after fertilization; 0.7 mm. B—Blastodisc; 1 hour. C—Two cells. D—Four cells. E—Completed blastodermal cap. 20 hours. F—Segmentation cavity and germ ring at equatorial position. 30 hours. G—Shortly after closure of blastopore. 2½ days. H—Tail encircling yolk sac. I—Embryo shortly before hatching. J—Larva just after hatching. 4.8 mm.

The small yolk sac, which contains an oil globule, is more anterior in position than that of the larvae of the Osmeridae as figured by Ehrenbaum (see Kendall, 1926). The larvae possess rudimentary circular pectoral fins and a continuous median larval fin. The tail is lophocercal. The notochord is large and bicellular, being similar in this respect to many clupeoid fishes, including the true smelts—in more advanced fishes the notochord is usually multicellular. The body, which is uniformly segmented, contains about forty segments anterior to the anus.

Under natural conditions, newly-hatched larvae would be taken out to sea by the strong river current. The remainder of the life history up till the attainment of maturity is not known. A study of the scales and otoliths of mature specimens did not reveal any satisfactory evidence for the determination of age, and there was no evidence to suggest that adults would spawn more than once.

For comparison, the development of *R. retropinna* Richardson was observed. Mature adults were obtained from Lake Forsyth (October, 1951) and development was carried out in lake water of 2.8‰ salinity. The development of this species is similar to that of *R. anisodon* in all respects. The larvae of *R. retropinna* have 36 segments anterior to the anus.

Discussion

Stokell (1949, p. 205) considered *R. anisodon* to be the most marine member of the genus. This appears to be correct as this fish enters the sea as a larva where it remains until spawning time, whereas the two other coastal species (*R. retropinna* Richardson and *R. osmeroides* Hector) frequent estuarine waters at all stages of development. However, contrary to Stokell's view that the more marine members of the genus did not travel above tidal influence to spawn, *R. anisodon* has been found to spawn almost exclusively in fresh water above tidal influence.

The process of development, and the larval form of *R. anisodon,* resemble closely those of members of the Osmeridae (Kendall, 1926). The eggs of true smelts have an attachment membrane which is reflected after extrusion—a feature not present in the eggs of the Retropinnidae, and the newly-hatched larvae of the true smelts have a more posteriorly placed yolk sac. In common with the osmerid fishes (and to a large extent the galaxiids), *R. anisodon* has salmonoid spawning habits; the development period is short; the larvae are simple, pelagic in habit, and have a relatively longer alimentary canal than the larvae of most fishes.

Because of the long spawning season and the enormous size of the shoals, *R. anisodon* plays a most important part in the ecology of the river mouth region of the Rangitata River. Colonies of black-billed gulls (*Larus bulleri*) and white-fronted terns (*Sterna striata striata*) share nesting sites, of some acres in extent, on the landward side of the shingle bar separating the lagoon from the sea, or on shingle islands near the mouth of the lagoon. Black-backed gulls (*Larus dominicanus*) nest on islands some distance up the river where some natural cover is available. Silveries (*R. anisodon*) form the bulk of the food of these nesting birds and during a migration of silveries the river mouth is a scene of great activity. The progress of shoals of silveries towards the mouth is clearly indicated by the white-fronted terns hovering and diving for fish. While the terns are feeding their young they may be seen flying back and forth carrying silveries from the sea to the nesting grounds, or to the beach where the fledglings wait. Schools of kahawai (*Arripis trutta*) feed on the shoals and follow them into the river mouth where they are also preyed upon by black-billed gulls, and to a lesser extent by black-backed gulls, which line the water's edge. The shoals pass quickly through the lagoon into the stretches of river entering it, where they are attacked by flocks of gulls. Flounders, eels, and yellow-eyed mullet (*Agonostomus forsteri*) were found to include silveries in their diet. Although gobies, and occasionally torrent fish (*Cheimarrichthys fosteri*) were netted in the spawning grounds there was no evidence to show that these fishes ate the eggs of silveries. Apart from floods, the greatest agent in the destruction of eggs was thought to be man. Trout fishermen, seeking silveries for bait, continually net the spawning grounds, probably trampling eggs deep into the mud or freeing them to be carried out to sea.

Acknowledgment

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