

Notes on Spawning of the Fish *Belone stolzmanni* (Belonidae) from Peru¹

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ABSTRACT: *Belone stolzmanni* is a multiple-spawning fish, spawning more than once during a reproductive season. The smallest reproductively active female measured 380 mm standard length (SL); the smallest spermiogenic male measured 353 mm SL. Only one gonad develops in each sex.

Peru has a highly diverse (Chirichigno 1980) but little studied fish fauna. In an effort to add to our knowledge of the reproductive biology of Peruvian fishes, samples of the little-known belonid fish *Belone stolzmanni* were obtained. The range of this fish extends from the Gulf of California (Mexico) to the Islas Chincha (Peru) and the Galápagos Islands (Chirichigno 1980). Nothing is known of its reproductive biology. The purpose of this note is to provide a histological analysis of gonad samples collected during summer.

A TOTAL OF 28 female and 32 male *B. stolzmanni* were obtained from El Mercado Pesquero Artesanal de Chorrillos, Lima, Peru (12°08'S, 77°02'W) during January 1983. Fresh fish were weighed to the nearest gram and measured to the nearest millimeter. Gonads were preserved in 10% formalin and later weighed to the nearest 0.01 g. Gonosomatic indices (GSI = gonad weight/fish weight × 100) were calculated. Ovaries were embedded in paraplast; histological sections were cut at 8 μm and stained with Harris hematoxylin followed by eosin counterstain.

RESULTS AND DISCUSSION

Belone stolzmanni is a medium-sized fish with adult females averaging 613 mm standard length (SL) and 465 g body weight. The eggs of *B. stolzmanni* have filaments attached to them. Histologically these appear as circular to oblong structures which are located between the zona radiata and theca externa. Other belonid fishes also have filaments attached to their eggs (Breder and Rosen 1966).

The following classification scheme, used for a variety of teleost fishes by Goldberg (1981, 1982), was utilized: regressed—primary oocytes (87 μm) predominate; previtellogenic—vacuolated oocytes predominate; vitellogenic—yolk deposition in progress in enlarging follicles; spawning condition—mode of mature oocytes (485 μm) or hydrated eggs (1161 μm) present. No *B. stolzmanni* ovaries were found in the previtellogenic or vitellogenic stage.

Our data indicate that *B. stolzmanni* spawns more than once in a reproductive season, as we noted a mode of hydrated eggs alongside a mode of vitellogenic (accumulating yolk) oocytes. Hydration occurs when the mature oocyte grows to as much as four times its original volume prior to spawning (Wallace and Selman 1981). Further evidence that *B. stolzmanni* is a multiple spawner comes from the presence of postovulatory follicles alongside vitellogenic oocytes. Postovulatory follicles are remnants of the granulosa layer which hypertrophy when the egg ovulates. It was determined (Hunter and Goldberg 1980) that the postovulatory follicle has a brief existence and is indistinguishable from atretic follicles after 48 hr. The smallest reproductively active female (mature eggs present) measured 380 mm SL.

In looking at Table 1, it is evident the spawning season was well under way. There

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TABLE 1

DISTRIBUTION OF BODY SIZES (SL), GONOSOMATIC INDICES \pm SE, AND SPAWNING CYCLE STAGES FOR 28 PERUVIAN *Belone stolzmanni* COLLECTED JANUARY 1983

N	SL (RANGE) (cm)	GSI	REGRESSED	PREVITELLOGENIC	VITELLOGENIC	SPAWNING
7	380-533	12.59 \pm 3.74	29	0	0	71
9	534-687	17.72 \pm 3.45	11	0	0	89
12	688-841	16.65 \pm 2.90	17	0	0	83

were no fish in the previtellogenic or vitellogenic stages, which normally occur early in the spawning season before spawning females enter the population. The small numbers of regressed females in the two larger size classes (Table 1) may have resulted from environmental stresses causing follicles to undergo atresia. The unexpectedly high number of regressed females in the 380-533 size class (Table 1) probably reflects individual size variation at the onset of the first spawning period.

Our entire male sample averaged 463 mm SL and 201 g body weight. All males were mature (spermiogenesis in progress). The smallest male measured 353 mm SL. This is somewhat smaller than the minimum size attained by females for their first spawning. Average GSI for all mature males was 10.32 \pm 1.13.

In both females and males, only one gonad develops. The advantages of this adaptation are not clear. However, as *B. stolzmanni* has a long and extremely narrow body having all oocytes in one structure would help minimize bulging of the body wall when eggs are ripe. A bulging body wall would likely hinder swimming ability. The same would be true (but to a lesser extent) for males in which the testes enlarge during periods of spermiogenesis. Fitch and Lavenberg (1971) similarly reported that only one gonad develops in the belonid fish *Strongylura exilis* from California.

Nikolsky (1963) found prolonged spawning periods to be common in tropical and subtropical fishes. While the duration of the *B. stolzmanni* spawning period has yet to be determined, on the basis of its tropical and sub-

tropical range (Chrichigno 1980) one would suspect it to be prolonged.

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