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SYNOPSIS OF BIOLOGICAL DATA ON THE BROAD-HEADED SLEEPER GOBY, *DORMITATOR LATIFRONS*

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Synopsis of Biological Data on the Broad-Headed Sleeper Goby,

Dormitator latifrons

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INTRODUCTION

Recently, *Dormitator latifrons* has been introduced as a species for aquaculture in Ecuador and Peru. It is considered to be a favourable species for aquaculture for the following reasons:

(1) it is resistant to considerable variations in temperature and salinity,

(2) it enjoys wide market acceptability, and

(3) the meat is of good quality, white and non-oily.

However, very little is known about the biology of *Dormitator latifrons* (see Appendix I). Therefore, this synopsis provides a review of the literature presently available which refers to this species.

The references which have been included were discovered as a result of a computer search on commercially available databases, a manual search of the holdings of the libraries at the International Development Research Centre and the University of British Columbia, and a literature search completed by Dr. Wm. Vanstone.

Special thanks are extended to Dr. Wm. Vanstone for bringing many of the publications mentioned in this synopsis to the author's attention. Comments on the manuscript by Dr. W.H.L. Allsopp are gratefully acknowledged.

Dormitator latifrons

IDENTITY

Nomenclature (taken from Meek and Hildebrand, 1916)

Eleotris latifrons Richardson, Voyage "Sulphur", Fishes, 1837, 57, Pl. 35, figs 4 and 5 (probably from Pacific coast of Central America).

Eleotris maculata (in part) Gunther, Cat. Fish. Brit. Mus., III, 1861, 112 (Guayaquil).

Dormitator micropthalmus Gill, Proc. Ac. Nat. Sci. Phila., 1863, 170 (Panama).

Eleotris maculata (non Bloch) Gunther, Trans. Zool. Soc. London, VI, 1869, 440 (Huamuchal).

Dormitator maculatus (non Bloch) Jordan and Gilbert, Proc. U.S. Nat. Mus., IV, 1881, 232 (Cape St. Lucas); (in part) Jordan and Gilbert, Bull. U.S. Nat. Mus., XVI, 1883, 632; (in part) Jordan and Evermann, Bull. U.S. Nat. Mus., XLVII, 1898, 2196.

Dormitator latifrons Eigenman and Fordice, Proc. Ac. Nat. Sci. Phila., 1885, 72 (Pacific coast of Central America); Regan, Biol. Cent. Amer., Pisces, 1905, 9.

Taxonomy

Order: Perciformes

Suborder: Gobioidea

Family: Eleotridae (Sleeper Gobies)

Dormitator latifrons was listed under the family Gobiidae by Meek and Hildebrand (1916). At the present time it is classified under the Family Eleotridae. However, according to Sterba (1966), the sleeper gobies (Family Eleotridae) are closely related to the marine gobies (Gobiidae) and both are classified under the suborder Gobioidea. The basic difference between these two families can be distinguished by the structure of the ventral fins. The ventral fins are united to form a cup-shaped sucker in the Gobiidea, while in the Eleotridae the ventral fins are always completely separated. This family also has the following characteristics: elongate to very long body, usually cylindrical anteriorly, slightly to strongly compressed posteriorly; two clearly separated dorsal fins, the first usually consists of shorter, flexible spines while the second is composed of soft rays which are often preceded by a single spine; caudal fin rounded; anal fin usually about as long as the second dorsal; ctenoid scales; lateral line usually absent.

Genus: *Dormitator*

This genus has the following distinguishing characteristics: very broad head; lateral eyes; jaws anteriorly of equal length; teeth compressed at apices; gill-rakers numerous, well developed, in 2 series on each arch; intestinal canal long (Meek and Hildebrand, 1916).

Standard common names:

broad-headed sleeper (Hervey and Hems, 1952)
western sleeper (Axelrod et al, 1962)
sambo (Ministerio de Agricultura y Ganaderia, 1977 - Ecuador; Moss, 1971 - El Salvador)
chamé (Ovchynnyk, 1968 - Ecuador; Mock, 1975 - Mexico)
chalaco (Ovchynnyk, 1968 - Ecuador)
monenque (Mock, 1975 - Mexico; Ancieta and Landa, 1977-Peru)
pujeque (Mock, 1975 - Mexico)
pupo negro (Keiser et al, 1973 - Guatemala)
poroccos (Meek and Hildebrand, 1916 - Panama)

Morphology

Ancieta and Landa (1977) described *Dormitator latifrons* (Salitreras Lagoon, Tumbes, Peru) as having the following external characteristics: short robust body, wide head flattened on top, somewhat oblique mouth, jaw which reaches back as far as the anterior of the orbit, somewhat projected lower mandible, dark brown colour blending to green on top and sides with yellow bands radiating from the eye above the operculum, ventral fins have dark spots on a light background.

This species has also been described (Sterba, 1966) as having flanks paler than its back with longitudinal rows of bright red-brown spots (each scale with a red-brown spot), gill-cover with red-brown vermiform lines behind which is a pale blue slightly iridescent blotch, dorsal and caudal fins with rows of red-brown spots on an almost colourless ground, reddish anal fins and lower edge of the caudal fin. He goes on to state that the young are grey; rows of spots and vermiform lines are indistinct.

Hervey and Hems (1952) recorded that this species had very similar colouration and size to *D. maculatus* but could be distinguished by a larger head.

Specimens collected in Panama ranged in length from 40 to 235mm (Meek and Hildbrand, 1916) and between 165 to 235mm in the Salitreras Lagoon, Tumbes, Peru (Ancieta and Landa, 1977).

DISTRIBUTION

Total Area

Found in brackish, marine and freshwater and sluggish streams (Miller, 1966) from California to Peru (Ancieta and Landa, 1977; Miller, 1966). According to Axelrod et al (1962) and Sterba (1966), the distribution extends along the Pacific coast from California south through Mexico and Central America.

Local Distribution

(1) Mexico - Golfo y Caribe (Yanez-Arancibia, 1977)
- Sonora (Branson et al, 1960)
- Huizache-Caimanero coastal lagoon system (Warburton, 1978, 1979; Amezcua-Linares, 1977)

(2) Ecuador - Rio Vinces (Ovchynnyk, 1967, 1968)

(3) Panama - Rio Abaco (Meek and Hildebrand, 1916)

(4) El Salvador - Laguna de Jocotal, most rivers (Moss, 1971)

(5) Peru - Mouth of the Huarmey River (10^{o}S) - During "El Nino", it moves further south, at least as far as 12^{o}S, penetrating into the mouths of rivers and coastal lagoons where it resides temporarily (Ancieta and Landa, 1977).

Migratory Habit

According to Axelrod et al (1962), this is not a migratory fish. Mock (1975) reported that small migrations take place into newly formed lagoons (data collected near San Blas, Nayarit, Mexico) when they become flooded with brackish water.

Habitat Characteristics and Adaptations

Ancieta and Landa (1977) found that this species is very resistant to variations in salinity and temperature. Under experimental conditions, it was maintained out of water in a humid environment for 120 hours and behaved normally after it was returned to freshwater aquaria.

During the tropical dry season, *Dormitator latifrons* may be trapped at low tide in brackish water pools where spatial, diurnal and seasonal fluctuations in dissolved oxygen concentrations occur. Physiologically, it has adapted to this situation is two ways:

(1) it is a facultative air-breather.

(2) the concentration of hemoglobin in its body changes in oxygen deficient habitats.

(1) Air-breathing and Positive Buoyancy

As reported by Todd (1973), *Dormitator latifrons* is a facultative air-breather A flat, highly vascularized epithelial surface emerges on top of its head in hypoxic water. Todd (1972) determined that aerial oxygen is absorbed through this organ. However, Todd (1973) observed that this respiratory organ did not emerge in fish which were taken directly from the field and put into smooth walled buckets of hypoxic freshwater; all died within several hours.

Todd (1973) concluded that this species is very resistant to anoxia and if frightened can survive long exposure to low ambient oxygen. He suggested that positive buoyancy is mediated behaviourly, physiologically and possibly fortuitously when fish encounter water of sufficiently increased salinity (Todd, 1972).

(2) Hemoglobin Concentrations

Graham (1976) determined that the mean hemoglobin concentrations of *Dormitator latifrons* under normoxic and hypoxic conditions were 8.1g/100ml blood and 9.8g/100ml blood, respectively.

Todd (1972) found that this species possessed one of the highest reported hemoglobin values of any fish, 15.5% (mean hemoglobin concentration) and this was dependent on the number of erythrocytes present.

BIONOMICS AND LIFE HISTORY

Reproduction

This species was described by Hervey and Hems (1952) as having breeding habits identical with *D. maculatus* (in aquaria). These characteristics are listed below:

(1) it is an oviparous species.

(2) eggs attach to stones which have been cleaned previously by the brood-fish.

(3) eggs incubate in about 30 hours at a temperature of 24 - 25°C. Hervey and Hems (1952) went on to say that this species has seldom been bred in captivity and when it has, it has proven to be very difficult to raise the fry.

Maturity

Axelrod et al (1962) and Ancieta and Landa (1977) determined that it was mature at 102mm and 90mm respectively.

Spawning

Ancieta and Landa (1977) found that fish were spawning in June in waters up to 40°C (Salitreras Lagoon, Tumbes, Peru). In aquaria, Sterba (1966) observed that the fish spawn on stones that have been previously cleaned by the male and female.

Todd (1975) observed adults breeding in the field in 3% seawater.

This species was observed spawning on the underside of planks and among mangrove roots in the Laguneta Rama Blanca, Guatemala in July (Keiser et al, 1973).

Spawn

Ancieta and Landa (1977) observed that the eggs were small and numerous. Sr. Jorge Llands (Instituto del Mar del Peru) reported to Dr. Wm. Vanstone (personal communication) that chame have a fecundity of 7×10^6 eggs.

Todd(1975) recorded that prolarvae hatch from the egg capsule tail first. He observed that the ventral membrane is partially unfolded at birth and usually within 20 minutes the dorsal membrane unfolds.

In aquaria, Sterba (1966) observed that the eggs were laid in rows. The latter author recommended that as soon as the minute young hatch (after 20 - 26 hours at $25^{o}C$) the parents should be removed.

Prolarvae

There is a strong selective pressure for rapid development of eggs in this species because of the sluggish water habit (Hildebrand, 1930). Todd (1975) has described prolarvae development:

(1) the small (approximately 0.8mm total length) tadpole-shaped prolarvae hatch with few visible sensory apparati.

(2) eyes lack retinal pigments long after hatching.

(3) at hatching, prolarvae lack neuromast organs, melanization, fin buds, mouths, gas bladders, functional kidneys, hearts.

(4) auditory vesicles are the most obvious structures of possible sensory function seen at hatching.

(5) a large, fluid-filled "blister"-like structure on the head is also obvious at hatching but it disappears within six hours of hatching at 26.5^{o}C. Two neuromast organs develop in its place, first as flattened, papilla-shaped thickenings of the epidermal epithelium.

(6) within 12-14 hours at 33^{o}C, six more pairs of neuromast organs with sensory hairs appear along the body. Their microstructure includes nine basic supporting fibers.

(7) a visible nervous connection to the central nervous system can be seen in one neuromast organ located in the dorsal fin fold.

(8) the auditory vesicles are flattened laterally and each contains two suspended statocysts.

(9) the primordial iris is clearly visible by 40 hours but there are no retinal pigments until 54 hours. At 85 hours, the cornea, lens, and the retinal pigments are fully developed and eye movements occur.

(10) at 23°C, the heart beat is easily detectable 3 hours after hatching, but erythrocytes do not appear until numerous structural developments have prepared larvae for settling to the bottom.

(11) the kidney becomes functional soon after hatching since fluids are periodically voided through an excretory pore.

(12) nine hours after hatching the heart averaged 77 beats/minute, after 72 hours- 132 beats/minute, and after 120 hours- 203 beats/minute.

(13) after 72 hours at 33°C 10 erythrocytes were observed in each prolarvae, and numerous erythrocytes after 96 hours.

Todd (1975) recorded the swimming behaviour of the prolarvae immediately after the eggs hatched (incubated in the lab - normal prolarvae hatch withing 7 hours of fertilization). He observed the following:

(1) Initially, the prolarvae were negatively buoyant and either sank to the bottom or swam up.

(2) Movement was immediately reversed when the front of the head of the prolarvae contacted the bottom, the water surface or other discontinuities.

(3) Vertical movement was maintained in all cases.

(4) Completed eye development coincided with the ability to maintain a horizontal, dorso-ventral position on the bottom.

(5) This geotaxis possibly functions as an efficient and behaviourally simple method for habitat selection in a rigorous environment.

Predators

Dormitator latifrons was found to be a prey item of the neotropical Boat-billed Heron, *Cochlearius cochlearius* which had been collected in lagoons near San Blas, Nayarit, Mexico (Mock, 1975). This fish was very vulnerable to the wading herons as the lagoon level dropped during the dry periods.

Food

It is a bottom feeder. Stomach contents contain plant remains (*Spirogyra, Osillatoria*), insect larvae (Chironomidae), and desmids (Ancieta and Landa, 1977). According to Axelrod et al (1962), it will eat "just about anything" and will attack other fish when hungry. It is a greedy eater and in aquaria (Axelrod el al, 1962) it is important to provide enough food for its ravenous appetite.

In aquaria, fry have been raised on infusoria and later on small rotifers and screened daphnids (Hervey and Hems, 1975; Sterba, 1966).

Growth Rate

Warburton (1979) estimated that the growth rate was 1.08 - 1.52cm/month (data collected over a 5 month period).

Warburton (1979) also estimated from the data he collected in the Huizache lagoon, Mexico that this species has at least 4 cohorts/year with mean modal lengths of up to 19cm.

Abundance and Density

In terms of mean biomass and density of all the fish collected in the Huizache-Caimanero lagoon systems in Mexico (Warburton, 1979), it was ranked 14th and 9th respectively. However, it was found in this lagoon system only during the dry season (September - March).

Effects of Pesticides

DDT has been used extensively on the cotton fields in Guatemala. In the Sipacate region of Guatemala, the average total DDT residue in *Dormitator latifrons* was low (0,4p.p.m.) and in an estuary bordered by a cotton plantation (Laguneta Rama Blanca) it was high (7.7p.p.m.)

In a 5 week period in the summer of 1970, the average DDT levels in this species increased from 6.3p.p.m. to 9p.p.m. and toxaphene levels increased approximately 4X. The fish died and this species was not observed again in this lagoon during the study. However, it was observed in the coastal collections from Buena Vista to Champerico made before and after this species had disappeared from the Laguneta Rama Blanca (Keiser et al, 1973).

Pond Fish Culture

Dormitator latifrons has been cultured in small-scale aquaculture systems in certain parts of coastal Ecuador (particularly in the valley of the Chone River) (Inter-American Development Bank, 1977). The fish are trapped at high water using bamboo barriers placed at the mouths of small lagoons. The fish are transferred to pens and raised without artificial feed. The fish are harvested when the water level falls or the pens dry up. No production figures are available to date.

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APPENDIX I

The format outlined in the FAO publication, *Preparation of Synopses on the Biology of Species of Living Aquatic Organism*, was used in developing this synopsis. Following this outline it became apparent that there is a paucity of information on *Dormitator latifrons*. Information gaps include:

(1) cytomorphology studies
(2) serology studies
(3) differential distribution studies of the spawn, larvae, juveniles and adults
(4) detailed reproductive studies (sexuality, maturity, gonads, fecundity)
(5) detailed nutrition and growth studies
(6) behaviour studies
(7) population structure studies
(8) detailed fish culture studies.