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# The Pelagic Larva of the Midnight Snapper, *Macolor macularis* (Teleostei: Lutjanidae)

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ABSTRACT. A larva of the Indo-West Pacific lutjanid fish *Macolor macularis* Fowler, the Midnight Snapper, is described from a 6.0 mm (standard length) specimen, collected in the western Pacific Ocean (2°58.1'S 158°14.3'E). Although recently settled *M. macularis* have been described, this is the first report of a pelagic larva. The deep-bodied larva is typical of the perciform family Lutjanidae and is characterized by 24 myomeres, laterally compressed head and body, robust, long dorsal and pelvic-fin spines with fine serrations and strong head spination. The larva of *M. macularis* can be distinguished from the similar larvae of *Macolor niger* (Forsskål) by having fin-ray counts of D X, 13 and A III, 10, the greater relative length of the second to third dorsal-fin spine and the lack of any opercular melanophores. Larvae of *Macolor* species are rare, juveniles are not common and adults live to 40–50 years. These facts indicate *Macolor* species have a life history extremely vulnerable to exploitation.

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The two species of the lutjanid genus *Macolor* Bleeker, *M. niger* (Forsskål), the Black-and-white Snapper, and *M. macularis* Fowler, the Midnight Snapper, are, as adults, closely associated with coral reefs and widely distributed in the Indo-Pacific (Anderson & Allen, 2001). In spite of the abundance of adult *Macolor* species on coral reefs, larvae are extremely rare in collections. Knowledge of early life history stages of *Macolor* species is limited to larvae of *Macolor niger* (Leis, 2007) and recently settled individuals of both *M. niger* and *M. macularis* (Kishimoto *et al*., 1987; Leis, 2007). Until now, no larvae of *M. macularis* have been reported or described. Our purpose here is to describe a single 6.0 mm SL larva of *M. macularis* from the southwest Pacific Ocean north of the Solomon Islands that was found in the collections of the Far Seas Fisheries Research Laboratory, Shimizu, recently transferred to the National Museum of Nature and Science, Tokyo.

## Materials and methods

Measurements and abbreviations follow Leis & Carson-Ewart (2004). Lengths are Standard Length (SL). Percentages are of SL. Fig. 1 was prepared with the aid of a camera lucida. Pigment refers to melanophores in preserved specimens. Specimens examined are deposited in Institute of Oceanic Research and Development, Tokai University (IORD) and National Museum of Nature and Science, Tokyo (NSMT).

**Identification**. The specimen was identified as a lutjanid through the characteristics listed by Leis & Rennis (2004) including: 24 myomeres; laterally compressed body and head; very long dorsal-fin spines (particularly the second) and pelvic-fin spines; fin spines that are smooth to very weakly serrate; longest P2 ray at least as long as P2 spine;

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strong head spination without serrations on preopercular spines; head spination includes, supraorbital ridge, and spines on opercle, interopercle, and on inner and outer borders of preopercle; spines also present on bones of the pectoral girdle, including posttemporal, supracleithrum, and dorsal postcleithrum; no supraoccipital crest or spines; no lachrymal spines or serrations.

The larva was identified as belonging to the genus *Macolor* through its fin-ray counts of D X, 13, A III, 10, and its similarity to larvae of *Macolor niger*. Among lutjanine lutjanids, only *Macolor* spp. have this combination of meristic values. Some species of the caesionine lutjanid genera *Caesio* and *Pterocaesio* have fin-ray counts within the range of the larva described here, but, their larvae have been described and can be distinguished by other characters, most especially by their strongly serrate fin spines and more slender body (Reader & Leis, 1996).

The larva (Fig. 1) is generally similar to those of *M. niger*, differing only in fin-ray counts, length of some fin spines, and some details of pigment. It was identified as *Macolor macularis* by the fin-ray counts of D X, 13 (*M. niger* has D X, 14–15), and A III, 10 (*M. niger* only rarely has 10 anal-fin rays, see Table 1 of Leis 2007). Further, at any size, the ratio of the length of the second dorsal spine to that of the third is greater in the present larva and in settled individuals of *M. macularis* than in *M. niger* (Fig. 2).

**Material examined**. One pelagic larvae NSMT-PL 369, 6.0 mm SL. Collected by plankton net aboard the Japanese research vessel "Shunyo Maru" in the western Pacific (2°58.1'S 158°14.3'E), station 74M, 18:10–18:30 hrs, 6 Nov 1968. Three recently settled *M. macularis* IORD 82–299A, 82–299B, 85–316, 16.8–20.3 mm collected Iriomote Isl, Ryukyu Isls (Leis, 2007) were also used.

## Description

Figs 1, 2, Table 1

*Macolor macularis*, 6.0 mm. Body compressed and deep, slightly decreasing in depth from 46% at 6.0 mm to approximately 40% at 17–20 mm following settlement. Body deeper at P1 base than at anus. Gut broadly triangular, coiled and compact, with virtually no gap between anus and anal fin. Prominent gas bladder immediately dorsal to apex of gut. Caudal peduncle of moderate depth and length. Myomeres for the 6.0 mm specimen were 11+13 = 24.

Head large, compressed and consistent in size ca 39% at flexion and 39–41% at post settlement. Snout length equal to eye diameter at 6.0 mm; snout bluntly triangular becoming rounder and relatively shorter (<eye diameter) following settlement. Mouth large and moderately oblique; tip of maxilla reaching to between the anterior margin of the orbit and the pupil at 6.0 mm. Teeth present on upper and lower jaws, including canine teeth present on upper jaw only. Nasal pit unroofed at 6.0 mm. No scales present at 6.0 mm, but the settled individuals are fully scaled.

Spination on head well developed, and spines smooth. The longest head spine, at angle of preopercle, decreases in relative length from 13% at 6.0 mm to 4–5% in the settled individuals. On the outer border of the preopercle, one spine is located above spine at preopercular angle and four on the lower border. In the settled individuals, (16.8 and 17.3 mm) there are 12 small serrations on the outer border, increasing to ca. 17 at 20.3 mm. On the inner, upper preopercle limb, there is 1 small spine at 6.0 mm, and the inner lower limb has 5 small spines. In the settled specimens, spines were absent on the inner limb of the preopercle. Opercle has a single spine. Subopercular spines are absent in the 6.0 mm specimen, however a single, small spine is present in the settled 16.8 mm specimen. Interopercle with a single spine just dorsal to the preopercular angle at 6.0 mm, no interopercle was observed in the settled specimens. The supraorbital ridge has a single, small spine at 6.0 mm and is overgrown in the settled individuals. Two supracleithral spines present. Two dorsal posttemporal spines present in 6.0 mm larvae, and 3 to 5 in the settled individuals. A small postcleithral spine is present.

The 6.0 mm late flexion-stage larva has 10+8 principal caudal rays. All D, A and P2 fin elements are present. P1 fin has 12 ossified plus 2 incipient rays. Fin spines robust and chevron-shaped in cross-section, except P2 spine which has two leading-edge ridges, and is concavely trapezoidal in cross-section. Weak serrations present on the trailing edges of D spines 1 to 7, but not on the leading edge. Dsp 2 trailing edge serrations cover its entire length, the approximate count of serrations was 40, however the spine is slightly damaged. Serrations are present on the 2 leading edge ridges of P2. Each anal-fin spine differs. Spine 1 has serrations on both trailing and leading edges, although the latter is limited to a very few serrations. Spine 2 has serrations on only the trailing edge, whereas spine 3 lacks serrations entirely. All fin-spine serrations are absent in the settled individuals. The Dsp 2 is longest fin spine, 31% SL in the 6.0 mm larva, and is approximately twice the length of Dsp 3 (Fig. 2).

**Pigment**. The larva is lightly pigmented. The 6.0 mm larva is mostly devoid of external pigment on the body except for three melanophores on the caudal peduncle, 2 are expanded stellate, one at the base of the urostyle and the second below and slightly smaller and posterior to the first. A third, punctuate contracted melanophore is positioned on the ventral midline about midway between the anal and caudal fins. There are three faint and very small contracted punctate melanophores dorsally on the midbrain. Internal pigment forms a large saddle dorsally over the gas bladder to the posterior margin of the gut. The fins of the larva are mostly devoid of pigment except for a series of melanophores on the trailing edge of the chevron groove of Dsp 2, and on the fin membrane between spines II and III. The base of the caudal fin has two melanophores: one on the posterior base of the 5th lower principal ray and a much smaller one on the 3rd upper principal ray. There is no trace of the distinctive post-settlement colour pattern which is illustrated by Kishimoto *et al*. (1987) and Randall (2005).

**Remarks**. Leis (2007) predicted "based on comparison of recently settled individuals, it is reasonable to expect that pelagic larvae of *M. macularis* will be similar to those of *M. niger*, but possibly somewhat deeper-bodied, and with longer elements in the spiny dorsal and pelvic fins. Probably, *M. macularis* larvae have weak serrations on fin spines similar to those of *M. niger*." Larvae of the two *Macolor* species are similar, and have similar head and fin spination (including serrations) and similar pigmentation, including the distinctive lateral caudal peduncle melanophores. However, the 6.0 mm larva of *M. macularis* is not deeper bodied than larvae

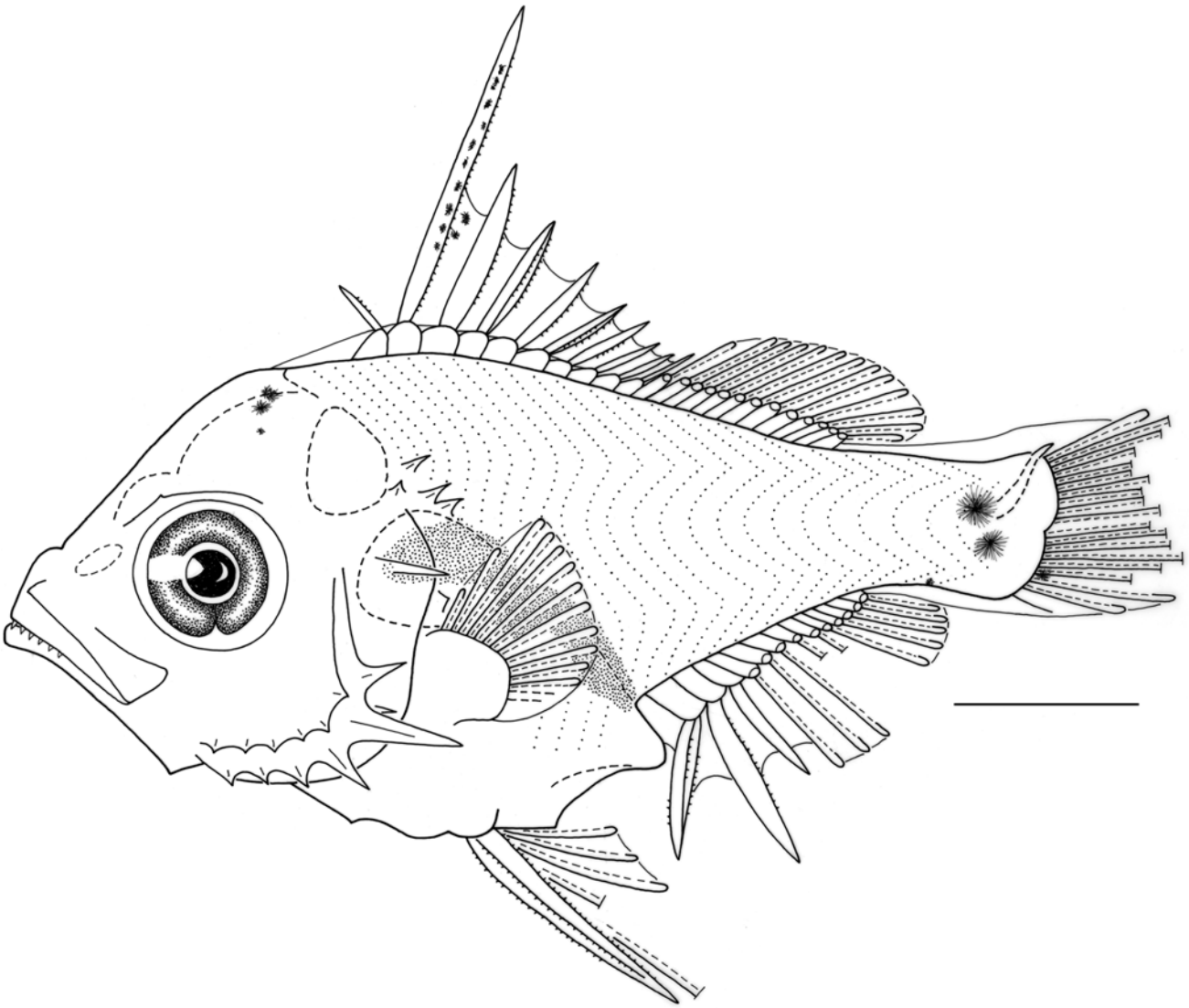

Fig. 1. Larva of *Macolor macularis*, 6 mm SL (NSMT-PL 369) from the southwest Pacific Ocean near the Solomon Islands. Scale bar = 1 mm.

of *M. niger* (BD = 46% vs 47–50% SL, respectively), and although the dorsal spines of *M. macularis* are longer than those of *M. niger* following settlement (Dsp 2 = 38% SL vs 17% SL, respectively) they are not in the larvae (Dsp 2 = 31% SL vs 33–35% SL, respectively). Nor are the pelvic spines of the 6.0 mm *M. macularis* longer than those of *M. niger* (P2 sp = 26% SL, vs 25–31% SL, respectively). One difference in fin spines is the ratio of dorsal-fin spines 2 and 3. At any size, this ratio is greater in *M. macularis* than in *M. niger* (Fig. 1). Interestingly, the differences between the two species in spine length and body depth found following settlement must develop late in the pelagic larval phase. The only notable differences in pigment are the absence in *M. macularis* of melanophores on the opercle near the base of the opercular spine that are present in larvae of *M. niger*, and the series of melanophores in the chevron of dorsal-fin spine 2 in *M. macularis*, which is lacking in *M. niger*.

The rarity of larvae of *Macolor* species in collections is puzzling. Thus far, a total of only three pelagic larvae, and four settlement-stage larvae have been reported, yet the adults are abundant in outer reef habitats. The three reported larvae were found well offshore, not close to reefs or in lagoons.

**Table 1**. Morphometrics (mm) of the *Macolor macularis* larva. Abbreviations are: PreAL, preanal length; *PreDL*, predorsal-fin length; *HL*, head length; *ED*, eye diameter; *SnL*, snout length; *BD(P)*, body depth at P1 base; *BD(A)*, body depth at anus; *PedL*, caudal peduncle length; *Dsp*, dorsal-fin spine; *P2sp*, pelvic-fin spine.

| SL | PreAL | PreDL | HL | ED | SnL | BD(P) | BD(A) | PedL | Dsp 2 | Dsp 3 | P2sp |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6.0 | 3.7 | 2.4 | 2.5 | 0.7 | 0.7 | 2.8 | 2.1 | 1.1 | 1.6 | 1.0 | 1.6 |

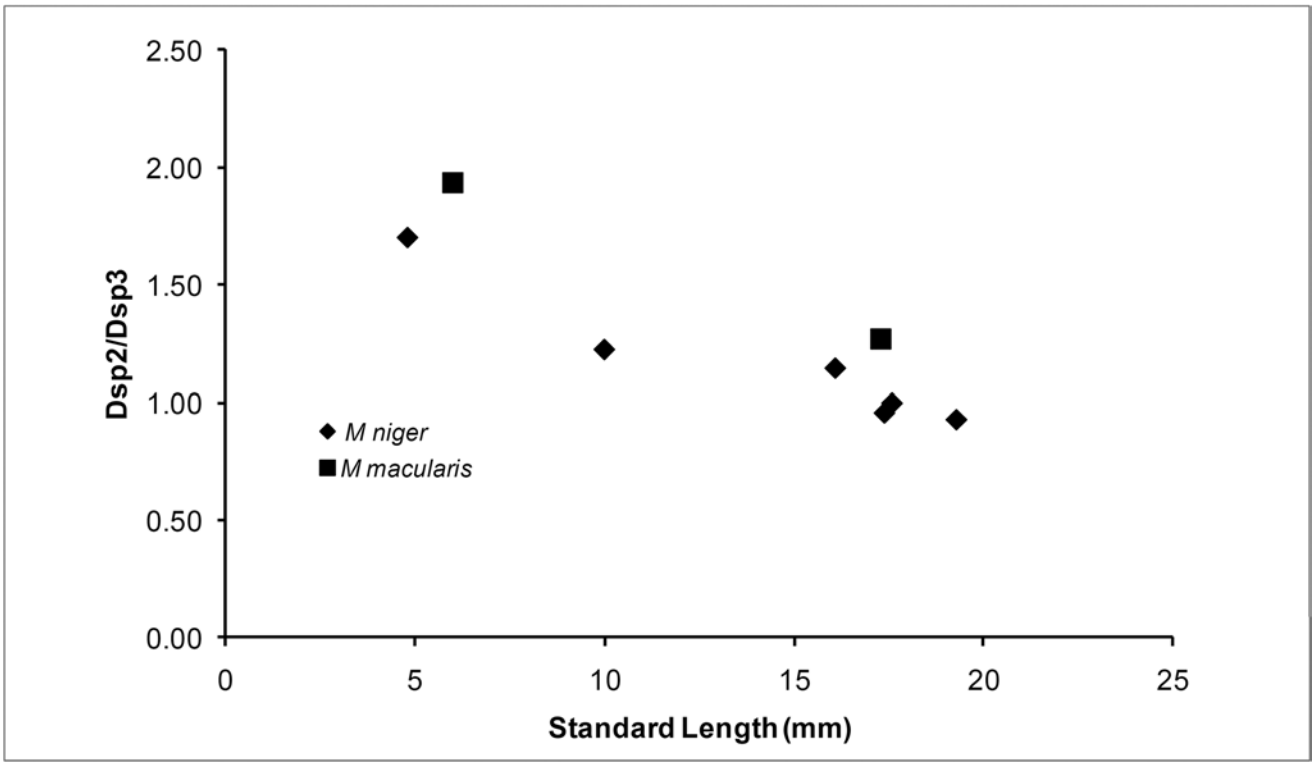


Fig. 2. Relationship between standard length and ratio of length of dorsal-fin spine 2 to that of dorsal-fin spine 3 in larvae and settled individuals of *Macolor macularis* and *M. niger*. Spine length ratio for only one settled *M. macularis* from Leis (2007) is plotted because the other specimens did not have intact second dorsal-fin spines.

In spite of the apparent abundance of adults, the distinctive juveniles are not similarly abundant in reef habitats (pers. obs., JML; J.H. Choat, pers. comm.). One likely explanation is that adults have a long life span, yet post-spawning survival and recruitment may seldom be successful. In fact, *Macolor* species reach ages of 40–50 years on the Great Barrier Reef (J.H. Choat, pers. comm.), supporting this possible explanation. If this is correct, then the species of *Macolor* would be particularly vulnerable to exploitation, and should be managed extremely carefully.

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