

Description of newly settled *Mycteroperca bonaci* (Serranidae: Epinephelini) using genetic identification in the Mesoamerican Reef

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Introduction

The black grouper, *Mycteroperca bonaci*, has ecological and economic importance supporting valuable fisheries along the southeastern Atlantic coast of the United States and in the Mesoamerican Reef (MAR). Adults are large-sized, long-lived and inhabit coral reefs (Jory & Iversen, 1989). This species is the dominant Serranid in southern and central coast of the Mexican Caribbean (Sosa et al, 2009), where it is part of a small-scale fishery. There is scarce information concerning this resource and its spawning aggregations that have been overfished along the Mesoamerican region.

Its larvae are planktonic and juveniles have been captured in mangrove, coral rubble, and seagrass beds close to shore. Marancik et al, 2010, recently described pre-flexion and post-flexion individuals from the Gulf of Mexico, however, information on the early life history and essential habitat use of newly settled and early juveniles (Brulé et al, 2005) is extremely limited.

This information is essential for the appropriate conservation of this key commercial and ecologically species in the region.

Methods

Newly settled individuals were collected (n=15) in the MAR in 2006-2008 using various gear using seine nets, light traps, water column collectors and MOCNESS. Specimens were measured (Standard Length, mm) and preserved in 96% Ethanol. DNA was extracted from muscle tissue and protocols from the Consortium for the Barcode of Life, CBOL (Ratnasingham & Hebert, 2007) were followed using the mitochondrial DNA gene cytochrome oxidase subunit I (COI), and matched with previously sequenced adult *M. bonaci* vouchers in the CBOL database.

Five of the specimens were maintained alive in a 20L aquarium at 26-28°C. They were fed shrimp *ad libitum* daily and were measured (Total Length, mm) every ten days to estimate previously unknown juvenile growth parameters. Specimens were photographed to document morphological and pigment development.

Juvenile specimens (n=4) were illustrated (Figure 4, a-d) by Jack Javech (NOAA SEFSC, Miami, FL) and descriptions were evaluated using morphological characters including morphological and melanistic pigment patterns in the four juvenile specimens.

Sagittae and lapilli otoliths were removed from the illustrated specimens and a drop of immersion oil was added. Increments were counted using an Olympus BH compound microscope mounted with an Evolution MP digital camera equipped with Image Pro Express 4.5 software at 100x and 200x magnification. Daily increments were counted by eye and with live images using both otoliths when possible from core to edge by two independent readers along various axes at least three times. Ageing is ongoing and additional otoliths will be aged.

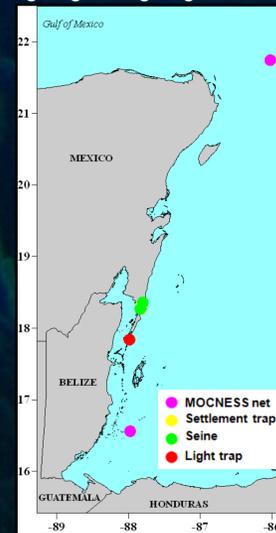


Fig 1 Map of collection sites and gear used to collect *M. bonaci* samples

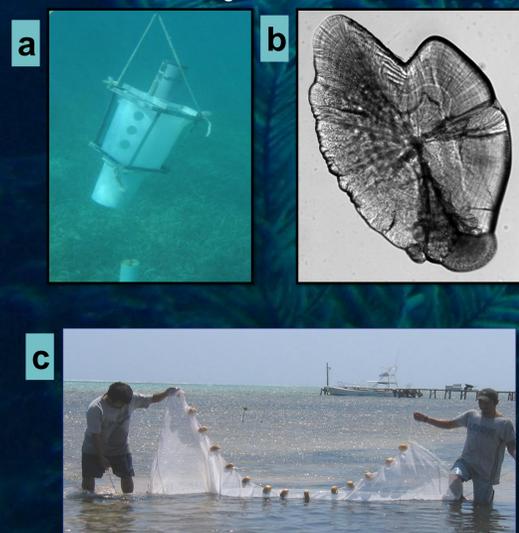


Fig 2: (a) Light Trap (Jones 2007) (b) Sagittal otolith micrograph 100x (c) seine net tow

Description and illustrations

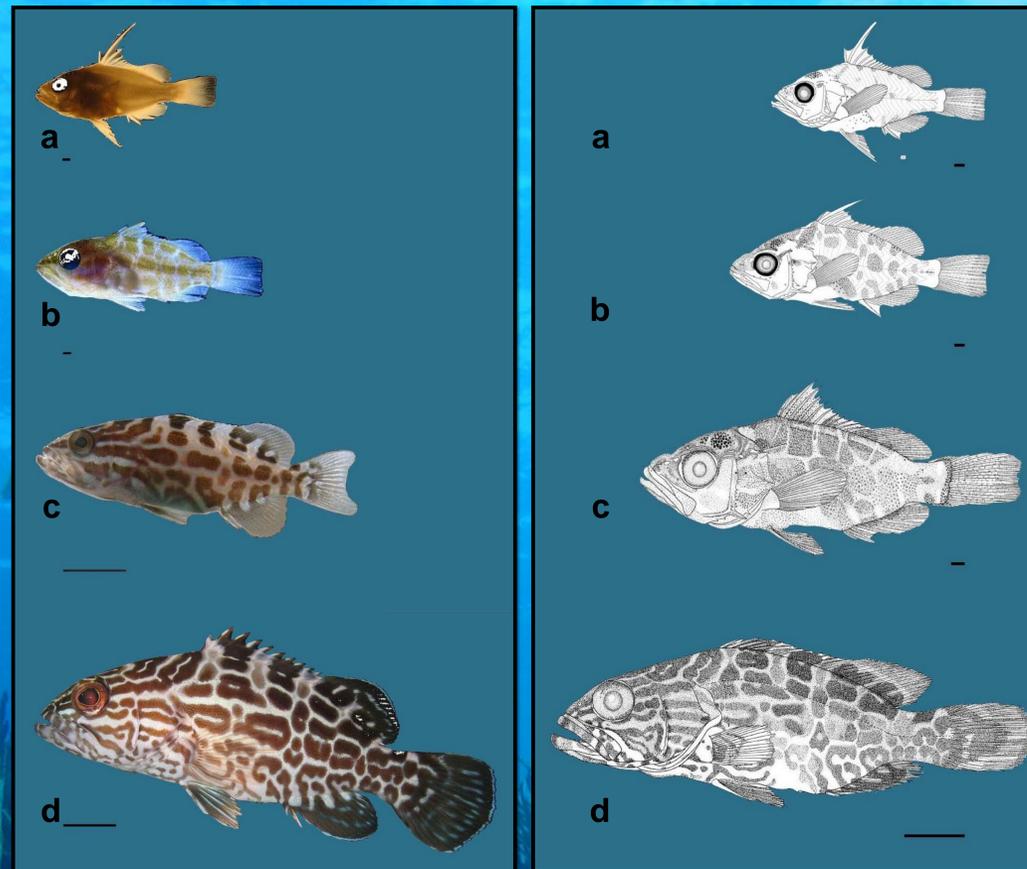


Fig 3: Digital micrographs and photographs of juvenile *M. bonaci* (a-d) SL 15 mm, SL 19 mm, SL 45 mm, SL 74 mm. Small scale bar indicates 1 mm, larger scale is 1 cm.

Fig 4: Illustrations of juvenile *M. bonaci* (a) SL 15 mm (b) SL 19 mm (c) SL 19.5 mm, (d) SL 74 mm. Small scale bar indicates 1 mm, larger scale is 1 cm.

Results & Description

Molecular identification of *M. bonaci* along with sequence results, sampling locations and digital images are available on BOLD (see <http://www.barcodinglife.org>).

Four genetically confirmed *M. bonaci* specimens that were increasing in size were illustrated and pigmentation and morphological patterns are described: Head pigment is apparent in the smallest specimen, (15 mm SL, Fig. 4a) and in three concentrated spots that intensify in Fig. 4b (19 mm SL), and in each subsequent specimen along the lateral, dorsal and ventral line along the base of the D1, D2 and anal fin. For fig 4c (19.5 mm SL), this pigment continues on the D1, D2, A, P2 and caudal fin membranes. In addition, in Fig. 4c, pigment develops at the base of the caudal fin on the edge of the caudal peduncle. The rostral and preopercular pigment in Fig. 4a develops into an eye bar by Fig. 4b, but becomes widespread by Fig. 4c. In Fig. 4a, there is no pigment in the tip of lower jaw, but develops by Fig. 4b and continues to develop. In Fig. 4d, the previous blotches of pigment have become widespread and appear continuous on the body.

In Fig 4a, the first four spines in D1 are serrated, with the second D1 having simple, straight and relatively small spinelets. The spinelets become smaller and narrower in Fig. 4b, and by Fig. 4c they are hardly present. In Fig. 4d the spine is smooth. The second D1 becomes shorter in Fig. 4b and continues to be reduced in size for each larger specimen. In Fig. 4a, the P2 spine is strongly serrated with narrow and curved spinelets that become smaller in Fig. 4b and more widely spaced. In Fig. 4c, the P2 spine is now shorter and thinner but smaller spinelets remain. In Fig. 4d, P2 spine is reduced further and like the other spines, is completely smooth. In Fig. 4a, the second anal spine is less serrated and more irregular that and in Fig. 4b, the serration decreases. In Fig. 4c, the second anal spine is also shorter with barely visible spinelets.

Results (cont.)

The supracleithral, opercular, and preopercular spines become smaller from figures 4a-c and the largest preopercular spine is large and serrated at an angle that decreases from figures 4a to 4b. In Fig. 4d, the preopercular margin is also smooth, with only one small opercular spine visible.

The increments of sagittal otoliths were easier to distinguish than lapilli otoliths, therefore sagittal otoliths were chosen for ageing. The fish (n=4) ranged in size from 15 - 19.5 mm SL. Daily increments ranged from 18-30 with mean increments 23±1.77 and the coefficient of variation (CV) was 7.83%.

Discussion

M. bonaci is listed as a near threatened species (ICUN, 2010) and has historically been targeted during its vulnerable spawning aggregations (Sosa et al., 2009; Jory & Iversen, 1989). Mesoamerican ageing data can aid to fill in knowledge gaps in stock assessment, age & growth rates to improve current ageing curves. Though this resource is recognized as valuable, the early life history is poorly understood. A comprehensive understanding of the life cycle of the species can improve management practices in the region by utilizing newly available genetic techniques along with improved morphological identification of larvae and juvenile *M. bonaci* from the Caribbean.

Future Research

Additional samples are being collected, identified and will be genetically compared with adult vouchers. These *M. bonaci* samples will be included in this study and remaining otoliths will be aged

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