

Preliminary Findings on Riverine and Reef Habitat Use by Dog Snapper (*Lutjanus jocu*), Abrolhos Bank, Brazil

RODRIGO L. MOURA¹, RONALDO B. FRANCINI-FILHO², EDUARDO M. CHAVES³,
CAROLINA V. MINTE-VERA⁴, and KENYON C. LINDEMAN⁵

¹Conservation International Brazil, Marine Program, Caravelas, BA, 45900-000, Brazil

²Departamento de Biologia, Centro de Ciências Biológicas e da Saúde, Universidade Estadual da Paraíba, Avenida das
Baraúnas 351, Campina Grande, PB, 58109-753, Brazil

³Universidade Estadual de Santa Cruz, Rodovia Ilhéus-Itabuna

⁴Universidade Estadual de Maringá, Núcleo de Pesquisas em Limnologia, Ictiologia e Aqüicultura, Avenida Colombo 5790,
Bloco H-90, Maringá, PR, 87020-900, Brazil

⁵Florida Institute of Technology, Dept. of Marine and Environmental Systems,
150 W. University Blvd., Melbourne, Florida USA 32901

ABSTRACT

Information on Western Atlantic snapper species in the southern hemisphere is limited for many species. This study examined habitat use patterns in newly settled, juvenile and adult stages of the dog snapper, *Lutjanus jocu*, within a larger study of lutjanids across the wide Abrolhos shelf system of east-central Brazil, 18° S. Visual surveys were conducted in rock, forereef, tide pool, and mangrove habitats within widely separate cross-shelf systems (estuarine rivers; inner-shelf reefs, and mid-shelf reefs) to determine larval settlement sites, quantify life stage abundances, and determine distribution. *Lutjanus jocu* was the most abundant snapper, comprising approx. 80% of all individuals recorded of the seven or more lutjanid species in the area. Density was highest in reef habitats on the inner shelf. There was an increase in size of individuals across the shelf. For example, < 7 cm individuals were highly associated with estuarine habitats, whereas older stages (> 40 cm) were recorded only on mid-shelf reefs. Individuals between 10-30 cm were most abundant on inner-shelf reefs. Settlement sites include rock piles and mangrove roots in the Rio Caravelas estuary, and potentially shallow forereef areas on the inner-shelf. Constraints on cross-shelf migration include wide softbottom expanses (several 20 km distances) among disparate reefs across the 200 km shelf and high fishing pressure beginning on sub-adults. Relative plasticity in juvenile habitat use is implied by some early results but answers to fundamental questions of ecological structure will require extended observations and manipulations across this large South Atlantic shelf system.

KEY WORDS: Brazil, lutjanidae, Abrolhos, snappers

Resultados Preliminares sobre Pargo perro (*Lutjanus jocu*) en Hábitats Riverinos y Hábitats Arrecifes, Banco de Abrolhos, Brazil

La información sobre las especies de pargos del Atlántico Occidental en el hemisferio sur es limitada para muchas especies. Este estudio examina los patrones de uso del hábitat durante las etapas de recién asentamiento, juveniles y adultos del pargo perro, *Lutjanus jocu*, dentro de un estudio más amplio de los lutjanids a lo ancho del sistema de plataforma de Abrolhos, en la parte central este de Brazil, 18° S. Se realizaron evaluaciones visuales en hábitats rocosos, en forereefs, en piscinas de mareas y en manglares dentro de sistemas ampliamente separados a lo ancho de la plataforma (rios estuarinos, arrecifes en la parte interna de la plataforma, y arrecifes a mitad de plataforma) para determinar los lugares de asentamiento de las larvas, cuantificar la abundancia en la etapa de vida, y determinar la distribución. *Lutjanus jocu* resultó ser el pargo de mayor abundancia, con aproximadamente 80% de todos los individuos registrados de las siete o más especies de lutjanid en el área. La densidad fue la más alta en los hábitats de arrecifes en la plataforma interior. Hubo un incremento en el tamaño de los individuos a través de la plataforma. Por ejemplo, individuos mayores de 7 cm eran altamente asociados a hábitats estuarinos, mientras que se registraron etapas de vida posteriores (> 40 cm) solamente en arrecifes de mitad de plataforma. Los individuos entre 10 - 30 cm fueron más abundantes en los arrecifes de plataforma interior. Los lugares de asentamiento incluyen pilas de rocas y raíces de mangles en el estuario del Rio Caravelas, y en áreas potencialmente someras del forereefs en la plataforma interna. La migración a través de la plataforma estuvo restringida a amplias expansiones en los fondos blandos (varias distancias de 20 km) entre arrecifes disímiles a través de los 200 km de plataforma y a los comienzos de una alta presión de pesca en los sub-adultos. La plasticidad relativa en los usos de hábitat de los juveniles esta implícita en algunos resultados iniciales pero las respuestas a preguntas fundamentales de estructura ecológica requerirá observaciones y manipulaciones extensas a través de este gran sistema de plataforma del Atlántico Sur.

PALABRAS CLAVES: Brazil, lutjanidae, Abrolhos, pargos

Pargo Chien (*Lutjanus jocu*) Dans des Habitats Riverinos à Traversée Habitats Récifs, Banque d'Abrolhos, Brazil

L'information sur les espèces de pargos de l'Atlantique Occidental dans l'hémisphère sud est limité pour beaucoup d'espèces. Cette étude examine les patrons d'utilisation de l'habitat pendant les étapes récemment de règlement, juvéniles et adultes du chien pargo, *Lutjanus jocu*, dans une étude plus vaste des lutjanids à large ce qui est du système de plate-forme d'Abrolhos, dans la partie centrale ce de Brazil, 18° S. On a effectué des évaluations visuelles dans des habitats rocheux, dans du forereefs, dans piscines de marées et dans mangroves dans des systèmes largement séparés à large ce qui est de la plate-forme (rivières estuarinos, récifs dans

la partie interne de la plate-forme, et récifs au milieu de plate-forme). *Lutjanus jocu* il a résulté il d'être le pargo d'une plus grande abondance, avec approximativement 80% de tous les individus enregistrés le sept ou de davantage d'espèces de lutjanid dans le secteur. Des individus plus grands de 7 cm étaient hautement associés à des habitats estuariens, tandis qu'on a enregistré des étapes de vie postérieures (> 40 cm) seulement dans des récifs de moitié de plate-forme. Les individus entre 10 - 30 cm ont été plus abondants dans les récifs de plate-forme intérieure. Les lieux de règlement incluent des piles roches et racines de mangles dans l'estuaire, et dans les secteurs potentiellement brefs du forereefs dans la plate-forme interne. La migration à travers la plate-forme a été restreinte à de vastes expansions dans les fonds doux et aux débuts d'une haute pression de pêche dans ce qui est sub-adultos. La plasticité relative dans les utilisations d'habitat de ce qui est juvéniles est implicite dans quelques résultats initiaux mais les réponses à des questions fondamentales de structure écologique requerra des observations et des manipulations étendues.

MOTS CLÉS: Brazil, lutjanidae, Abrolhos, pargos

INTRODUCTION AND METHODS

The largest and most bio-diverse reef-estuarine system in the South Atlantic is the Abrolhos Shelf of Brazil (approx. 18 ° latitude south), encompassing a mosaic of reefs, algal and muddy bottoms, mangroves and beaches (Dutra *et al.* 2005). Coastal and fisheries management is centered on Marine Protected Areas (MPAs) under no-take (~ 890 km²) and multiple-use regimes (~ 2,900 km²). Information on biological responses and management effectiveness is growing (e.g. Moura and Francini-Filho 2005, Moura *et al.* 2009, Francini-Filho *et al.* 2008, Francini-Filho and Moura 2008a), but the lack of early life history information of fishery species impedes regional MPA management.

Snappers represent a conspicuous component of reef fish assemblages in Brazil (Moura and Francini-Filho 2005, Francini-Filho and Moura 2008a) and are a primary constituent of artisanal fisheries (Frédou *et al.* 2009 a,b). The lutjanid fauna of the tropical and warm temperate South Atlantic (Brazil) contains at least 15 species, all but one shared between the Caribbean and Brazil (Moura and Lindeman 2007).

Basic fishery and biological information is available from Brazil's long coastline (Rezende and Ferreira 2004) with high reef fish endemism levels (Moura 2003). Most studies have been on the important fishery species, southern red snapper (*Lutjanus purpureus*) (Rezende *et al.* 2003). However, information on the life cycles and habitat associations of other snappers remains very limited. A preliminary investigation of the Abrolhos shelf revealed substantial numbers of dog snapper across a wide array of habitats. Preliminary findings are provided on size and abundance of dog snapper across this shelf system.

Visual surveys were conducted in different habitats across three cross-shelf strata (estuary, inner-shelf reefs, mid-shelf reefs) in order to:

- i) Determine the main habitats used by newly settled, juvenile and adult individuals, and
- ii) Evaluate spatial variability in fish density and size among three distinct cross-shelf regions (estuarine rivers, inner-shelf reefs, and mid-shelf reefs).

Sampling focused on common shallow habitats using SCUBA and snorkeling within three cross-shelf strata:

- i) Nearshore areas within the larger Caravelas-Nova Viçosa estuary (in a recently-created multi-use

MPA),

- ii) Inner-shelf Areas, particularly fore-reef habitats of two reefs (Sebastião Gomes and Pedra de Leste Reefs) and shallow tide pools, both unprotected from fishing and approximately 15 km offshore, and
- iii) Mid-shelf Areas, particularly shallow back-reef and fore-reef rocky habitats in the Abrolhos Archipelago, within the no-take National Marine Park, about 60 km offshore .

Habitats sampled within the estuarine cross-shelf stratum include unconsolidated mud, downed trees, and sparse rocks adjacent to mangrove roots. On the inner-shelf reefs, approx. 15 km offshore, we sampled tidal pools of 1 - 40 m² (Sebastião Gomes Reef only) and fore-reef habitats (Sebastião Gomes and Coroa Vermelha Reefs). On the mid-shelf reefs, we sampled < 4 m depths off the rocky shores of the islands, bordered by fringing reefs with depths to 20 m.

Three to six sites were sampled within each of the three cross-shelf strata. Samples were obtained in four sampling periods between February 2008 and February 2009 based on weather conditions and quarter moon tides. Visual surveys (20 x 2 m transects) were used to quantify size class abundances and distributions. Three replicates were obtained per site per period.

PRELIMINARY RESULTS AND DISCUSSION

Lutjanus jocu was the most abundant snapper, representing ~ 80% of all recorded snappers with *O. chrysurus* also locally abundant. There was a cross shelf increase in fish size suggesting cross-shelf migration can occur. Dog snapper individuals < 7 cm were almost exclusively associated with the estuary, whereas large bodied fishes (> 40 cm) were recorded only in mid-shelf reefs. Individuals ranging 10-30 cm were most abundant on inner-shelf habitats. Significant between-strata differences were detected by ANOSIM (R = 0.21, p = 0.01), with a clear distinction of the cross shelf gradient in the two-dimensional ordination space. Differences in size structure were also detected by the Komogorov-Smirnov test (p < 0.05 between all pairs of cross-shelf strata). Temporal sampling was not refined enough to exclude the possibility of substantial larval recruitment to the inner-shelf reef area.

Dog snapper density varied when considering different sites within each cross shelf strata. The smallest size class (< 2 cm) was recorded exclusively at estuary site 1 (*Rhizophora*/downed trees habitat), whereas site 3 (rocky habitat) had the highest total density, with high amounts of 7 - 20 cm TL fishes. At the inner-shelf strata, fish density was highest in the tidepools of Sebastião Gomes, with most individuals ranging from 10 - 30 cm. Density of the 10 - 20 cm size class in these tide pools reached over 500 fish/1000 m² at the inner shelf SG 3 site. No individuals were recorded at shallow reef habitats of Pedra de Leste. At the mid-shelf rocky reefs (Abrolhos Archipelago), no individuals were recorded at Siriba. No significant differences in fish density were recorded between the other two sites (Mato Verde and Faro). The latter two offshore sites were the only areas where individuals greater than 40 cm were recorded.

Densities were higher at inner-shelf habitats, and a clear cross-shelf increase in fish size suggests ontogenetic shifts in habitat use, though patterns are complex. Individuals < 7 cm were associated with both estuarine (mangrove and rock habitats) and inner shelf reefal areas (shallow fore-reefs and tide pools). Larger fishes (> 40 cm) were recorded only on mid-shelf reefs, although a few individuals between 30-40 cm were consistently recorded in the estuary. Individuals between 10 - 30 cm were broadly distributed, but consistently more abundant on inner-shelf reefs.

To better understand population movements, multi-year studies are needed that incorporate tagging and/or stable isotope examination (the latter is underway at Abrolhos on dog snapper and other species). However, the available information on cross-shelf ontogenetic migrations of *L. jocu* in Brazil highlights the need to increase precautionary management steps through the inclusion of shallow coastal habitats in protected areas to protect migration corridors of fishery species from habitat destruction.

LITERATURE CITED

- Francini-Filho, R.B. and R.L. Moura. 2008a. Dynamics of fish assemblages on coral reefs subjected to different management regimes in the Abrolhos Bank, eastern Brazil. *Aquatic Conservation: Marine and Freshwater Ecosystems* **18**:1166 - 1179.
- Francini-Filho, R.B. and R.L. Moura. 2008b. Evidence for spillover of reef fishes from a no-take marine reserve: An evaluation using the before-after control-impact (BACI) approach. *Fisheries Research* **93**: 346-356.
- Francini-Filho R.B., R.L. Moura R.L., C.M. Ferreira, and E.O.C. Coni. 2008. Live coral predation by parrotfishes (Perciformes: Scaridae) in the Abrolhos Bank, eastern Brazil, with comments on the classification of species into functional groups. *Neotropical Ichthyology* **6**(2):191 - 200.
- Frédou, T., B.P. Ferreira, and Y. Letourneur. 2009a. Assessing the stocks of the primary snappers caught in Northeastern Brazilian reef systems. 1: Traditional modelling approaches. *Fisheries Research* **99**:90-96.
- Frédou, T., B.P. Ferreira, and Y. Letourneur. 2009b. Assessing the stocks of the primary snappers caught in Northeastern Brazilian reef systems. 2 - A multi-fleet age-structured approach. *Fisheries Research* **99**:97-105.
- Moura, R.L. 2003. Brazilian reefs as priority areas for biodiversity conservation. *Proceedings of the International Coral Reef Symposium* **9**(2):917-920.
- Moura, R.L. and R.B. Francini-Filho. 2005. Reef and shore fishes of the Abrolhos Bank. Pages 40-55 in: G.F. Dutra, G.R. Allen, T. Werner, and S.E. McKenna (Eds.) *A Rapid Biodiversity Assessment of the Abrolhos Bank, Bahia, Brazil*. RAP Bulletin of Biological Assessment 38.
- Moura, R.L. and K.C. Lindeman. 2007. A new species of snapper (Perciformes: Lutjanidae) from Brazil and the southern distributional status of *Lutjanus griseus* and *L. apodus*. *Zootaxa* **1422**:31-43.
- Moura, R.L., C.V. Minte-Vera, I.B. Curado, R.B. Francini-Filho, H.C.L. Rodrigues, G.F. Dutra, D.C. Alves, and F.J.B. Souto. 2009. Challenges and prospects of fisheries co-management under a Marine Extractive Reserve Framework in Northeastern Brazil. *Coastal Management* **37**:617-632.
- Rezende, S.M. and B.P. Ferreira. 2004. Age, growth and mortality of dog snapper *Lutjanus jocu* (Bloch & Schneider 1801) in the northeast coast of Brasil. *Brazilian Journal of Oceanography* **52**(2):107-121.
- Rezende, S.M., B.P. Ferreira, and T. Fredou. 2003. A Pesca de lutjanídeos no Nordeste do Brasil: Histórico das Pescarias, características das espécies e relevância para o manejo. *Boletim Técnico Científico do CEPENE* **11**(1):56-63.