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## Scientific Note

# Evidence of sandy beaches as growth grounds for commercial fish in the south-western Atlantic

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**Abstract.** In this study, seasonal fish densities and size structure of *Trachinotus carolinus* and *Trachinotus falcatus* investigated in two Brazilian sandy beaches among September 2001 to August 2002 and whole 2008 evidenced sandy beaches as growth grounds for young-of-the- year individuals.

**Key words:** commercial fish, growth grounds, nursery habitat, sandy beaches, *Trachinotus carolinus*, *Trachinotus falcatus*

**Resumo. Evidência de praias arenosas como áreas de crescimento para peixes comerciais no sudoeste do Atlântico.** Neste artigo, densidades sazonais e estrutura de tamanho de *Trachinotus carolinus* e *Trachinotus falcatus* investigados em duas praias arenosas brasileiras entre setembro de 2001 e agosto de 2002 e em 2008 evidenciaram duas praias como áreas de crescimento para peixes jovens do ano.

**Palavras chave:** peixes comerciais, áreas de crescimento, ambientes berçários, praias arenosas, *Trachinotus carolinus*, *Trachinotus falcatus*

Sandy beaches are one of the most popular marine environments in the Earth due to provision of recreational place to society. Despite of their popularity, the ecological services of sandy beaches are poorly recognized and considered in conservations plans (Schlacher *et al*. 2007). Located in the land-ocean interface, this habitat has distinct environmental features in relation to oceanographic factors, such as fast nutrient cycling, sediment transport and strong physical dynamics (McLachlan & Brown 2006). Due to their intense hydrodynamics, only few species are adapted to live in these habitats (Clark 1997). Coastal ecosystems (e.g. sandy beaches, mangroves and shallow estuarine areas) may be important juvenile habitats contributing to development of many fish species during the early life stages. Beck *et al*. (2001) provided a better understanding of the 'nursery habitat' concept and defined that it is a habitat where the productivity of juveniles per unit area is greater than the average observed to other habitats. According to these authors, even though a given habitat supports high densities of some fish species, it does not mean it contributes majoritarily to adult populations, which would be required to define it as a nursery habitat. Growth grounds, as used in this study, are defined as those habitats where juvenile abundance is large, however, there are no evidences of connectivity with adult populations (Gillanders *et al*. 2003). Therefore, they are potential nurseries that need more ecological understanding to be called as real nursery grounds.

Sandy beaches naturally represent key habitats by providing fish with shelter from predators and food from high densities of mobile invertebrates (Lasiak 1986). Despite several commercial fish species usually inhabit sandy beaches at some period of their life-history, studies focusing on these species have sporadically been reported (but see Adams *et al*. 2006). Instead, most fish studies in sandy beaches have aimed to evaluate patterns of fish communities (e.g. Félix *et al*. 2007). Fishes from the genus *Trachinotus* are usually found in surf zones of sandy beaches during part of their early life and represent important fishery resources in the western Atlantic margin, particularly at North America (Jory *et al*. 1985; Carvalho-Filho 1999; McLachlan & Brown 2006; Vasconcellos *et al*. 2010). Although ecological traits as age, growth, habitat use and recruitment of *Trachinotus* species have already been studied in USA waters (Crabtree *et al*. 2002; Adams & Blewet 2004), studies specifically approaching this genus in the South Atlantic are still scarce, but see Lemos *et al*. (2011).

The aim of this study was evaluate the densities and size structure of *Trachinotus carolinus* and *Trachinotus falcatus* in two sandy beaches from the central coast of Brazil, highlighting those ecological attributes as indicative of growth grounds for these species. The study area comprised two sandy beaches from the central coast of Brazil: Prainha, Arraial do Cabo - RJ (22°57’54”S, 43°01’25”W) and Itaipava docks, Itapemirim - ES (20°53'38"S, 40°46'26"W). Salinity ranges from 35 to 36 at Prainha and from 30 to 31 at Itaipava docks (Gaelzer & Zalmon 2008, Andrades 2011). Prainha and Itaipava docks are relatively sheltered to moderately exposed to wave action according to the season and with medium to fine sand (Gaelzer & Zalmon 2008), however, due to the different morphologic features (e.g. steep beach face) two different beach seine nets were used. Prainha was sampled with a 25 x 2,5 m net, and Itaipava with a 6.5 x 2.5 m. Given that we do not intent compare differences between beaches, the use of two different nets is not a problem. Fish sampling was conducted monthly using a beach seine net in two sandy beaches, being from January to December 2008 at Itaipava docks and September 2001 to August 2002 at Prainha, a total of 12 samples each beach. The hauls were performed parallel to the coast, during diurnal low tides. Sampled fish were identified and their specific densities were expressed as individuals per 100 $m^2$. Fish densities (*T. carolinus* from Prainha and *T. falcatus* from Itaipava docks) were compared between rainy (spring-summer) and dry (autumn-winter) seasons through the non-parametric Mann-Whitney U test (Zar 1999).

Mean fish densities of *Trachinotus carolinus* from Prainha were 1.30 (0.37 SE) and 3.38 (2.48 SE) ind.100 $m^{-2}$ during rainy and dry seasons, respectively. Similar seasonal results were found for *Trachinotus falcatus* at Itaipava docks, where fish density increased from 0.14 (0.09 SE) to 2.32 (1.90 SE) ind.100 $m^{-2}$ from the rainy to the dry season, respectively (Figure 1). However, because of the large variability on the number of fish caught along with the samplings undertaken here, that seasonal differences was not significant at any of two sandy beaches (Mann-Whitney test, n=2250, p>0.05). Fish densities observed in this study were higher than the observed in other areas; e.g. 0.3 to 1.42 ind.100 $m^{-2}$ for *T. falcatus* in Florida, USA (Naughton & Saloman 1978; Adams & Blewet 2004), and 0.68 ind.100 $m^{-2}$ for *T. carolinus* in the Virginia barrier islands (Layman 2000). Nevertheless, comparisons of fish density among different studies should be interpreted with care as they depend greatly on the sampling design adopted in each study. For example, studies carried out specifically during the months in which the carangids occur would naturally return higher fish abundances than those (e.g. this study) where mean abundances were obtained from samplings that have been performed throughout a whole year. Maximum abundances could, however, be compared among these studies.

Most of the sampled individuals presented total lengths ranging from 20 to 80 mm with pronounced modes in 40 mm for *T. carolinus* and 60 and 80 mm for *T. falcatus* (Figure 2). These sizes correspond to the 0+ cohort, according to Crabtree *et al*. (2002), which evidences the predominant occurrence of young-of-the-year (YOY) *T. falcatus* and *T. carolinus*. The elevated densities of YOY fish during the dry season in this study suggests these juveniles may have settled from the previous spring to summer. Additionally, we found a seasonal incidence of macroalgae in both sampled beaches particularly during the dry season. The occurrence of allochthonous macroalgae in surf zones could contribute for settlement and recruitment for many fish species, by providing food and shelter from predators (Gaelzer & Zalmon 2008). Studies focusing on food habits of *T. carolinus* and *T. falcatus* in Brazilian sandy beaches evidenced that amphipods are their main prey (Helmer *et al*. 1995). Since amphipods are usually associated with macroalgae (Tanaka & Leite 2003; Leite *et al*. 2007), the incidence of macroalgae during the dry season may indirectly provide the necessary energy to the survivorship of *Trachinotus* YOY in surf zones of Brazilian sandy beaches. In fact, non-detached and detached macrophytes have been suggested to increase abundance and richness of fish communities of sandy beaches (Crawley *et al*. 2006). Therefore, we suggest the incidence of macroalgae may also explain the high fish densities observed in this study.

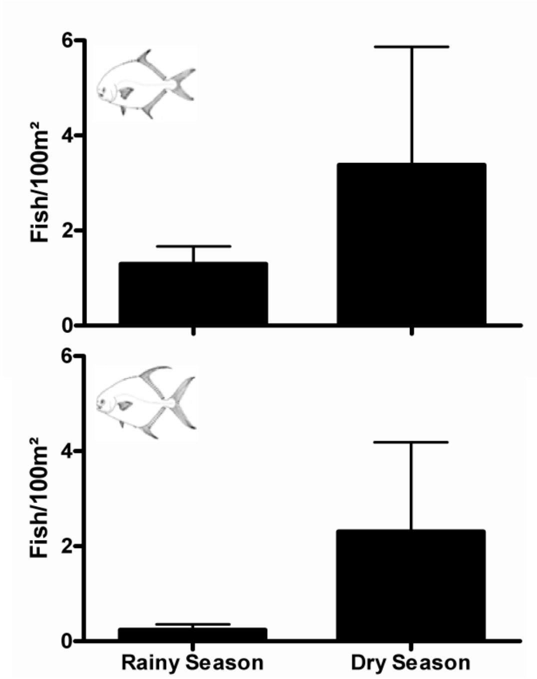


**Figure 1.** Mean (Standard Error) seasonal densities of *Trachinotus carolinus* from Prainha (above) and *Trachinotus falcatus* from Itaipava docks (below). Differences between seasons were not significant at p= 0.05 (Mann-Whitney test, n= 2250).

Fish density is an important ecological trait to determine if a given habitat serves as a nursery ground (Gillanders *et al*. 2003). Beyond fish density, to be considered a putative fish nursery, a given habitat should significantly contribute to the adult recruitment by providing increased larval/juveniles growth rates and survival, which define the "nursery-role hypothesis" (Beck *et al*. 2001). However, characterizing a habitat as a nursery following the principles of the nursery-role hypothesis is clearly complicated and time demanding. Therefore, in this study we made a first step on evaluating the importance of sandy beaches from the central coast of Brazil as juvenile growth grounds and potential nursery areas to commercial fish species. Next studies will focus on fish growth and connectivity with adult populations.

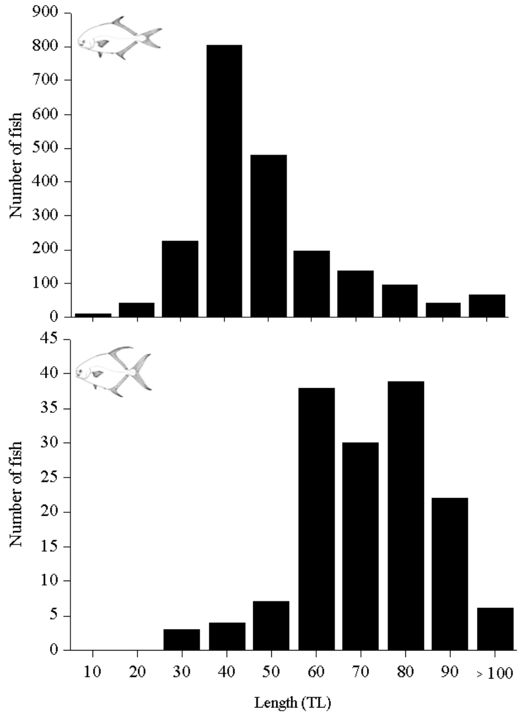


**Figure 2.** Length frequency histograms (Total length, mm) of *Trachinotus carolinus* (above) and *Trachinotus falcatus* (below) from the central coast of Brazil.

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