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What drives the cannibalism of *Trichiurus lepturus* (Linnaeus, 1758) in the coastal area of southeastern Brazil (21-22ºS)?

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Abstract
The present study was aimed to investigate the causes that drive the cannibalism of the teleost fish, *Trichiurus lepturus*, in the coastal area of southeastern Brazil (21-22°S) whereas the feeding behaviour was recorded through analyzing of the stomach contents. In this area, the population density of this predator fish is high, but there are many food resources available. Therefore, the highest cannibalism rate couldn't be expected. However, conspecifics intake is nutritionally more advantageous for the predator compared with other prey species, once they provide high protein content and caloric value. In this sense, the quality of food resources drives the cannibalism of this species locally.

Keywords: cannibalism; predator-prey interactions; southeastern Brazil; *Trichiurus lepturus*.

1. Introduction
Cannibalism is the act of a species eating the whole or major part of its own, irrespective of its stage of development. In teleost fish, cannibalism involves either at the egg or at post-hatching stages (larval, juvenile, or adult), comprising more than 10% of the recent fish families and fossil fish [13, 15]. In general, high cannibalism rate in fish is driven by: i) feeding habit, being more common in piscivores species; ii) shoaling behaviour; iii) size disparity among conspecifics, with larger specimens predating small ones; iv) high fish density; and iv) nutritional state, with low food resources encouraging this feeding behaviour [15]. In general, cannibalism is a strategy to energy transfer from smaller to larger specimens, increasing in high population densities. By contrast, this feeding strategy would not be expected when other food resources are sufficient for the predators [1, 4, 11, 15, 16].
Trichiurus lepturus (Linnaeus, 1758) is a teleost fish, known as large head hair tail, with economic importance as fishery resource around the world. The species forms shoals in brackish and marine waters, with aggregated feeding behaviour. There is size disparity among conspecifics, and significant diet shift was recorded during the ontogeny. Juvenile specimens are planktivores, while adult specimens are top predators (mainly piscivores), feeding on the most abundant prey available along its feeding sites [6, 10, 12]. Stomach contents analysis showed cannibalism as an important feeding behaviour for adult specimens [2, 12, 14], but this is not a general rule along its distributional area [4, 5, 16]. Therefore, this study was planned for the first time the causes that drives the cannibalism of *T. lepturus* in the coastal area of southeastern Brazil (21-22ºS) to understand its intraspecific trophic relationship.

2. Material and Methods
There are some scenarios to explain what drives the cannibalism behaviour of *T. lepturus* along its home range. The fish characteristics regarding feeding habits, shoaling behaviour, and size naturally favour cannibalism, but this feeding strategy is not a general rule for this species, as mentioned above. Then, one can say that a combination between population density and food resources drives the cannibalism, such as: i) high population density and many food resources = low cannibalism rate; ii) high population density and few food resources = high cannibalism rate; and iii) low population density and many food resources = low cannibalism rate. A scenario with low population density and few food resources might compromise the maintenance of a given *T. lepturus* population.

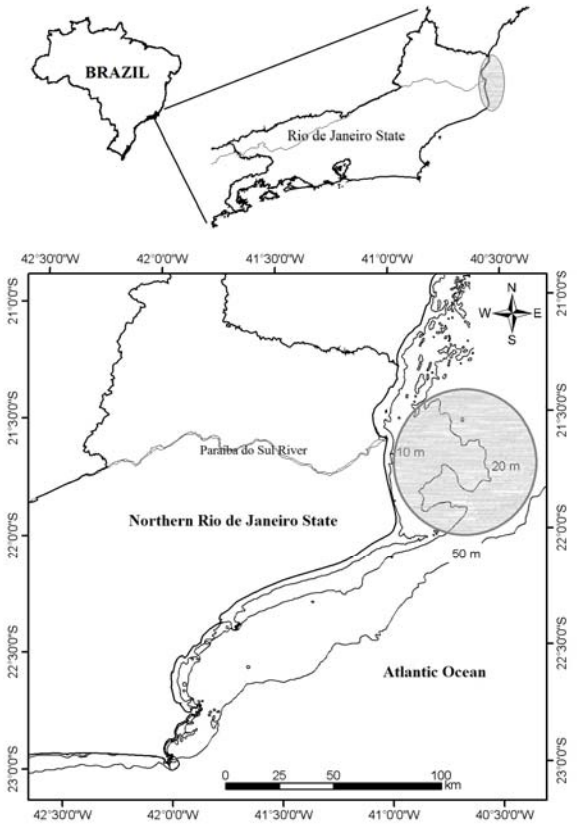

Fig 1: Coastal area of southeastern Brazil where the cannibalism of *Trichiurus lepturus* was recorded (grey circle).

3. Results and Discussion

In southeastern Brazil, the cannibalism was recorded as the main feeding behavior of *T. lepturus* through stomach contents analysis [2, 3] (Fig 1). However, there is still no explanation to its high cannibalism rate. This fish is target of local commercial fisheries [9] and it is the main prey of the coastal dolphin *Sotalia guianensis* (van Bénéden, 1864) [7, 8], indicating its high density locally. Moreover, all prey of *T. lepturus* are abundant year round [2, 3, 10], and the low food resources was not a satisfactory explanation for its cannibal behaviour. The local scenario is high population density and many food resources. Therefore, the high cannibalism rate would not be expected.

In this area, the cannibalism of *T. lepturus* could be explained by the proximate-composition and caloric content provided by conspecifics. Juveniles' conspecifics, preferred prey of adults, have high protein content and caloric value [3]. Thus, their intake is nutritionally more advantageous for the predator compared with other prey, as small engrailed and clupeid fish species. Juveniles' conspecifics provide more protein for rapid growth and more energy to support wide movements along the continental shelf and reproductive demand.

4. Conclusions

In southeastern Brazil, between 21ºS and 22ºS, the quality of food resources drives the cannibalism of *T. lepturus*, indicating a kind of prey selectivity rather than an opportunistic feeding behaviour. The intraspecific trophic relationship is important to maintain the population of this species locally. In this area, the regular assessment of the feeding habits of this species will be important to verify possible changes in its preferred prey, which could be indicative of changes in its population density.

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