

Exploited resources in the live bait trade on the coastal shore of Paraná, southern Brazil

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Nesse trabalho foram identificados os pontos de venda e as espécies comercializadas como iscas vivas para a pesca recreativa no litoral do Paraná, sul do Brasil. Foram registrados cinco pontos de venda e seis espécies, sendo dois peixes (*Poecilia vivipara* e *Dormitator maculatus*) e quatro crustáceos (*Macrobrachium acanthurus*, *M. olfersii*, *Callichirus major* e *Litopenaeus schmitii*). Entre elas, somente *C. major* e *L. schmitii* foram previamente avaliados quanto a seus usos como iscas vivas. Por outro lado, uma das espécies exploradas, *D. maculatus*, encontra-se na Lista Vermelha de Espécies Ameaçadas do estado do Paraná.

Palavras-chave: Iscas; Peixes; Camarões; Pesca recreativa, Sul do Brasil .

Recursos explorados no comércio de iscas vivas na costa litorânea do Paraná, sul do Brasil

In this study, points of sale and the species commercialized as live bait for recreational fishery on the Paraná coastal shore, southern Brazil, were identified. Five points of sale and six species, of which two were fish (*Poecilia vivipara* and *Dormitator maculatus*) and four were crustaceans (*Macrobrachium acanthurus*, *M. olfersii*, *Callichirus major* and *Litopenaeus schmitii*), were recorded. Among them, only *C. major* and *L. schmitii* were previously evaluated regarding their use as live bait. One of the exploited species, *D. maculatus*, is on the Red List of Threatened Species for the state of Paraná.

Keywords: Bait; Fish; Shrimps; Recreational fishery; Southern Brazil.

1. INTRODUCTION

Recreational fishery is an activity that is increasing rapidly worldwide, generating substantial income for regional and national economies [1, 2]. In several places, traditional fishermen have changed the focus of their income-generating activities, working as fishing guides and/or focusing their effort on catching live bait to support recreational fishing [3, 4].

Although conceptually distinct, recreational and commercial fisheries share many common features, such as the potential to degrade environments, causing modifications in ecosystems, generating waste, and inducing the collapse of stocks [5, 6, 7, 8]. Collection of bait for use in recreational fishing can also cause several environmental problems, such as effects on abundance and size structure of harvested organisms and on associated fauna, promoting habitat modifications due to gear used in bait collection or associated trampling [9, 10, 11, 12, 13]. Additionally, the use of live bait has the potential for introduction of non-native species [12, 13, 14, 15].

In Brazil, previous studies evaluating live bait resources used by recreational fishermen were carried out in the Pantanal region [16, 17, 18, 19], Araguaia river [20], and the coastal region of the state of São Paulo [21, 22]. On the coastal shore of the state of Paraná, fishery is mainly artisanal and shrimp trawling has been the principal activity in the region [23, 24]. However, when trawl fishery is forbidden, the catch and trade of live baits for recreational fisheries become an important economic activity [24]. Besides its local relevance, there is no information about the production or the exploited target species by the live bait trade. So, the aim of this study was to locate points of sale of live baits and, especially, to identify the exploited species in this activity along the Paraná coast, southern Brazil.

2. MATERIALS AND METHODS

Between March and April 2008, the coast of Paraná was traveled during the weekends looking for points of sale (POS) of live baits. When a POS was located, it was georeferenced and a portion of each type of live bait predefined by the sellers was acquired once. The live baits are sold by the dozen and the individuals were randomly selected by the seller. The organisms were anesthetized on ice before being fixed in 5% formalin solution and transported to the laboratory where they were identified with the aid of specific literature [25, 26, 27], as well as with assistance of specialist colleagues.

3. RESULTS AND DISCUSSION

Five points of sale (POS) were identified (Figure 1), which commercialized between one and three types of live bait according to the sellers classification, totaling six different species (Table 1). Greater variety of exploited species was observed in the locality of Barrancos (POS 3 and 4, Table 1).

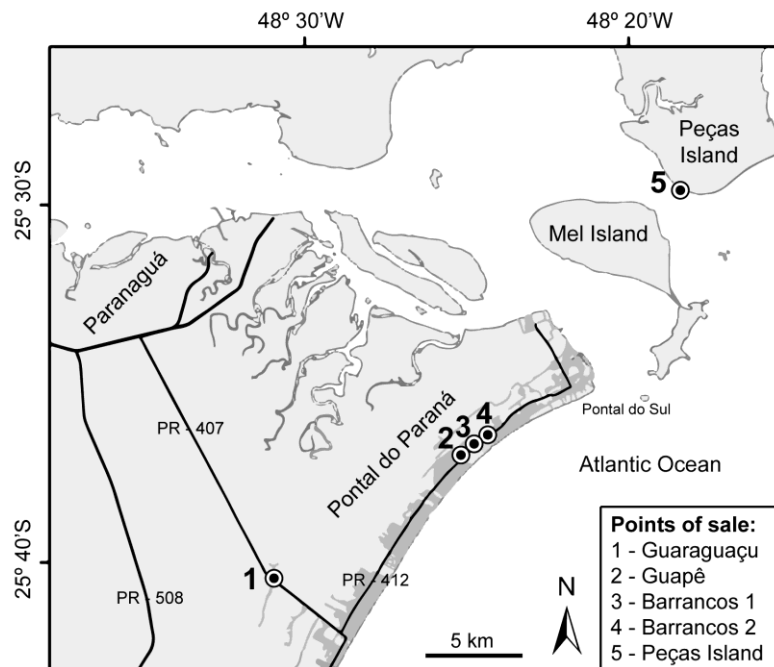


Figure 1: Map of the central coast of the state of Paraná indicating the points of sale of live bait (●) recorded in 2008.

Table 1: List of species commercialized as live bait and their respective seller classification at each point of sale recorded along the coastal shore of Paraná in 2008.

Species	Seller's classification	Points of sale				
		1	2	3	4	5
Crustaceans						
<i>Macrobrachium acanthurus</i> (Wiegmann 1836)	Shrimp	X	X	X	X	
<i>Macrobrachium olfersii</i> (Wiegmann 1836)	Shrimp			X		
<i>Callichirus major</i> (Say 1818)	"Corrupto"			X	X	
<i>Litopenaeus schmitti</i> (Burkenroad 1936)	Shrimp					X
Fishes						
<i>Poecilia vivipara</i> Bloch & Schneider 1801	"Barrigudinho"			X	X	
<i>Domitator maculatus</i> (Bloch 1792)	"Barrigudinho"			X	X	

1: Guaraguaçu, 2: Guapê, 3: Barrancos 1, 4: Barrancos 2, 5: Peças Island

Along the coastal zone of São Paulo, recreational fishermen buy live bait [22], which is sold directly at marinas or close to them [21]. In this region the main species commercialized as live bait are the penaeid shrimps [21, 22]. Unlike that observed for São Paulo, of the five POS identified on the coast of Paraná, only one (*i.e.*, Guaraguaçu) was situated at a marina. The other POS were the homes of live bait catchers, which were advertised by signs along the roads. Of the live bait, the species most commonly commercialized was the cinnamon river shrimp *Macrobrachium acanthurus* (Wiegmann 1836). On the other hand, the bristled river shrimp *Macrobrachium olfersii* (Wiegmann 1836) was represented by only one individual taken in POS 3. Both species are commonly found along rivers of coastal basins together with other caridean species [27, 28] and have already been cited as live bait resources in the Cananéia-Iguape estuarine system [21]. Since the sampling method is not selective, it is likely that other species of caridean shrimps can also be caught and eventually sold as live bait.

Other crustaceans sold as live bait were the ghost-shrimp *Callichirus major* (Say 1818) and the white shrimp *Litopenaeus schmitti* (Burkenroad 1936). The former lives in deep burrows in fine sand and sandy-mud sediments along the east coast of America, from North Carolina (USA) to Santa Catarina (Brazil), where it is caught with "yabby-pump" for its use as bait [29, 30]. This species is locally named "corrupto" and is an economically important resource as a source of live bait for anglers in several coastal localities [30]. Souza and Borzone [31] evaluated the impact of recreational bait fishery on a southern Brazilian sandy beach, and estimated that the annual fishing harvest removes nearly 10% of the total stock of ghost-shrimp.

In turn, the white shrimp *L. schmitti* was commercialized only on the Peças Island. Along the southern and southeastern Brazilian coast, juvenile white shrimp are caught in estuaries and bays and sold as live bait for sport fisheries, particularly when fishing for the snook *Centropomus* sp. [32, 33]. For instance, in the municipality of Cananéia, São Paulo, in certain months, the demand for live bait-shrimp is estimated to range from 270,000 to 300,000 individuals [21, 33].

Besides crustaceans, two fish species, the guppy *Poecilia vivipara* Bloch & Schneider 1801 and the fat sleeper *Dormitator maculatus* (Bloch, 1792), were also sold as live bait. Both fish species are found in streams, channels and small water bodies of the coastal zone [34] and, together with other similar fish, are locally named "barrigudinhos". Fishing and the use of "barrigudinhos" as live bait in the region, have already been mentioned by Chaves and Robert [24], but the authors do not specify which species they belong to. The guppy *P. vivipara* is a very resistant species, which requires a minimum rate of oxygen to maintain its respiratory metabolism [35]. On the other hand, the fat sleeper *D. maculatus* is on the Red List of Threatened Fish Species for the state of Paraná since there is not sufficient data about this species and due to the fast deterioration of its habitat [36].

4. CONCLUSION

For the most part, live bait sale occurs directly at the homes of catchers, which are signalled by signs along roads of the coastal shore of Paraná. Of the six species sold as live bait, only the ghost-shrimp, *C. major*, and the white shrimp, *L. schmitti*, have been previously evaluated regarding the effects of their harvest for use as live bait. This fact reinforces the need for additional studies to evaluate the impact of harvesting the other four species for live bait trade on their natural populations. This information will be crucial for the creation of policies for an adequate management of these resources, as well as for the sustainability of this activity in the region.

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1. Cowx IG. Recreational fishing. In: Hart PB; Reynolds JD. (eds) *Handbook of Fish Biology and Fisheries*. Oxford, Blackwell Science, 2002; 367-390.
2. Pitcher TJ, Hollingworth C. *Recreational Fisheries: Ecological, Economic and Social Evaluation*. Oxford, Blackwell Science; 2002.
3. Ramires M, Barrella W. Ecologia da pesca artesanal em populações caiçaras da Estação Ecológica de Juréia-Itatins, São Paulo, Brasil. *Interciencia*. 2003; 28 (4): 208-213.
4. Barcellini VC, Motta FS, Martins AM, Moro PS. Recreational anglers and fishing guides from an estuarine protected area in southeastern Brazil: Socioeconomic characteristics and views on fisheries management. *Ocean & Coastal Management*. 2013; 76: 23-29.
5. Cooke SJ, Cowx IG. The role of recreational fishing in global fish crises. *Bioscience*. 2004; 54: 857-859.
6. Cooke SJ, Cowx IG. Contrasting recreational and commercial fishing: searching for common issues to promote unified conservation of fisheries resources and aquatic environments. *Biological Conservation*. 2006; 128: 93-108.
7. Morales-Nin B, Moranta J, Garcia C, Tugores P, Grau A, Riera F, Cerdà M. The recreational fishery in Mallorca Island (Western Mediterranean): implications for coastal resources management. *ICES Journal Marine Science*. 2005; 62: 727-739.
8. Young MAL, Foale S, Bellwood DR. Impacts of recreational fishing in Australia: historical declines, self-regulation and evidence of an early warning system. *Environmental Conservation*, available on CJO2014. doi:10.1017/S0376892914000046.
9. Cryer M, Whittle GN, Williams R. The impact of bait collection by anglers on marine intertidal invertebrates. *Biological Conservation*. 2007; 42: 83-93.
10. Keough MJ, Quinn GP, King A. Correlations between human collection and intertidal mollusc populations on rocky shores. *Conservation Biology*. 1993; 7: 378-390.
11. Contessa L, Bird FL. The impact of bait-pumping on populations of the ghost shrimp *Trypaea australiensis* Dana (Decapoda: Callinassidae) and the sediment environment. *Journal of Experimental Marine Biology and Ecology*. 2004; 304: 75-97.
12. McPhee DP, Leadbitter D, Skilleter GA. Swallowing the bait: Is recreational fishing ecologically sustainable? *Pacific Conservation Biology*. 2002; 8: 40-51.
13. Lewin W-C, Arlinghaus R, Mehner T. Documented and potential biological impacts of recreational fishing: insights for management and conservation. *Reviews in Fisheries Science*. 2006; 14: 305-367.
14. Welcomme RL. *International introductions of inland aquatic species*. FAO Fisheries Technical Papers. 1988; 294. 318p.
15. Lindgren CJ. Angler awareness of aquatic invasive species in Manitoba. *Journal of Aquatic Plant Management*. 2006; 44: 103-108.
16. Moraes AS, Espinoza LW. Captura e comercialização de iscas vivas em Corumbá, MS. Corumbá, Embrapa Pantanal, 2001. 37p. (Embrapa Pantanal, Boletim de Pesquisa, n. 21)
17. Catella AC. A Pesca no Pantanal Sul: situação atual e perspectivas. Corumbá, Embrapa Pantanal, 2003. 48 p. (Embrapa Pantanal, Documentos, n. 48)
18. Peixoto-Gervásio MS. Uso e conservação de recursos naturais relacionados com a pesca desportiva e a exploração de iscas vivas no Pantanal Mato-Grossense, Brasil. *Ensaio e Ciência*. 2006; 10: 181-194.
19. Marques DKS; Calheiros DF. Diversidade de tuviras comercializadas como iscas vivas pelas comunidades do Porto da Manga e Codrasa, Corumbá, MS. Corumbá, Embrapa Pantanal, 2013. 12p. (Embrapa Pantanal, Boletim de Pesquisa e Desenvolvimento, n. 120).
20. Carvalho AR; Medeiros ER. Levantamento socioeconômico e da composição de espécies entre os turistas que praticam a pesca recreativa no Rio Araguaia, região de Aruanã (GO). *Revista Saúde e Ambiente*. 2005; 6 (2): 23-31.
21. Beccato MAB. A Pesca de iscas vivas na região estuarino-lagunar de Cananéia/SP: análise dos aspectos sociais, econômicos e ambientais como subsídio ao manejo dos recursos e ordenamento da atividade (Tese de Doutorado). São Carlos, Universidade Federal de São Carlos, 2009. 135p.
22. Tsuruda JM, Nascimento RB, Barrella W, Ramires M, Rotundo MM. A pesca e o perfil socioeconômico dos pescadores esportivos na Ponta das Galhetas, Praia das Astúrias, Guarujá (SP). *UNISANTA BioScience*. 2013; 2: 22-34.
23. Chaves PTC, Pichler HA, Robert MC. Biological, technical and socioeconomic aspects of the fishing activity in a Brazilian estuary (Guaratuba Bay). *Journal of Fish Biology*. 2002; 61(Suppl. A): 52-59.
24. Chaves PTC, Robert MC. Embarcações, artes e procedimentos da pesca artesanal no litoral Sul do Estado do Paraná, Brasil. *Revista Atlântica*. 2003; 25: 53-59.

25. Menezes NA; Figueiredo JL. Manual de peixes marinhos do sudeste do Brasil – Volume V (Teleostei 4). São Paulo, Museu de Zoologia da USP; 1980.
26. Melo GAS. Manual de Identificação dos Crustacea Decapoda do litoral brasileiro: Anomura, Thalassinidea, Palinura e Astacidea. São Paulo, Plêiade/FAPESP; 1999.
27. Melo GAS. Manual de Identificação dos Crustacea Decapoda de Água Doce do Brasil. São Paulo, Loyola/Centro Universitário São Camilo/Museu de Zoologia da Universidade de São Paulo; 2003.
28. Sampaio SR, Nagata JK, Lopes OL, Masunari S. Camarões de águas continentais (Crustacea, Caridea) da Bacia do Atlântico oriental paranaense, com chave de identificação tabular. *Acta Biologica Paranaense*. 2009; 38: 11-34.
29. Souza JRB, Borzone CA, Brey T. Population dynamics and secondary production of *Callichirus major* (Crustacea: Thalassinidea) on a southern Brazilian sandy beach. *Archives of Fishery and Marine Research*. 1998; 46 (2): 151-164.
30. Borzone CA, Souza JRB. A extração de corrupto, *Callichirus major* (DECAPODA: CALLIANASSIDAE), para uso como isca em praias do litoral do Paraná: Características da pesca. *Nerítica*. 1996; 10: 69-79.
31. Souza JRB, Borzone CA. A extração de corrupto, *Callichirus major* (Say) (Crustacea, Thalassinidea), para uso como isca em praias do litoral do Paraná: as populações exploradas. *Revista Brasileira de Zoologia*. 2003; 20 (4): 625-630.
32. Mendonça JT, Katsuragawa M. Caracterização da pesca artesanal no complexo estuarino-lagunar de Cananéia-Iguape, Estado de São Paulo, Brasil (1995-1996). *Acta Scientiarum, Biological Science*. 2001; 23 (2): 535-547.
33. Preto AL, Pissetti TL, Wasieleski Y-Jr W, Poersch LH, Cavalli RO. Production of live bait-shrimp (*Farfantepenaeus paulensis*) in cages at varying stocking densities. *Boletim do Instituto de Pesca*, 2009; 35: 39-45.
34. Froese R, Pauly D. FishBase. [Accessed in: Aug 14, 2013]. Available online at: <http://www.fishbase.org>
35. Mendonça JP, Andreatta JV. Aspectos reprodutivos de *Poecilia vivipara* (Bloch & Schneider) (Poeciliidae) da Lagoa Rodrigo de Freitas, Rio de Janeiro, Brasil. *Revista Brasileira de Zoologia*. 2001; 18 (4): 1041-1047.
36. Abilhoa V, Duboc LF. Peixes - Água Doce. In: Mikich, S.B.; Bérnils, R.S. (Eds) Livro vermelho da fauna ameaçada no Estado do Paraná (2004). [Accessed in: Aug 14, 2013]. Available on line at: <http://www.maternatura.org.br/livro/>