

## FISH AGGREGATING KNOWN AS MOITA, AN ARTISANAL FISHING TECHNIQUE PERFORMED IN THE MUNIM RIVER, STATE OF MARANHÃO, BRAZIL\*

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### ABSTRACT

This study offers a description of a fish aggregating technique known as *moita*, which is a traditional fishing method practiced by riverine communities in the state of Maranhão, Brazil. Fishermen place natural materials (branches, twigs and leaves) from the riparian vegetation into the river, which attract different species of fish. After several months, a barrier is created around the *moita*, the branches are removed and the fishes that have colonized the structure are caught with a net.

**Keywords:** habitat use; artificial substrate; species composition; family tradition

## MOITA, UMA TÉCNICA DE PESCA ARTESANAL NO RIO MUNIM, ESTADO DO MARANHÃO, BRASIL

### RESUMO

O presente trabalho descreve a pesca de *moita*, praticada tradicionalmente por comunidades ribeirinhas no estado do Maranhão, Brasil. Os pescadores colocam materiais naturais (troncos, galhos e ramos) da mata ciliar dentro dos rios, atraindo diferentes espécies de peixes. Alguns meses depois, um cercado é construído ao redor da moita, todos os ramos são removidos e os peixes que colonizaram a estrutura são capturados com uma rede de pesca.

**Palavras-chave:** uso de habitat; substrato artificial; composição ictiofaunística; tradição familiar

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## INTRODUCTION

Artisanal fishing is commonly practiced in small communities for commercial and/or subsistence purposes (RAMIRES and BARRELLA, 2003) and involves a range of fishing methods, including the capture of fish using crude equipment made of natural materials, such as wood, vines and another vegetal fibers (PIORSKI *et al.*, 2009). In Brazil, approximately 45% of the annual fish production comes from artisanal fishing, accounting for a total of 1.24 million tons per year (MPA, 2011).

Artisanal fishing is widely employed in riverine communities. Although this type of fishery is the main source of protein for such communities in the state of Maranhão (northeastern Brazil), some practices have a negative impact related to the deployment of destructive gear (ALMEIDA *et al.*, 2006; NUNES *et al.*, 2011). Fixed traps are frequently deployed in the state, with the removal of a large amount of wood from mangroves to secure different types of traps (ALMEIDA *et al.*, 2006; PIORSKI *et al.*, 2009; NUNES *et al.*, 2011).

This paper describes an artisanal fishing practice known locally as *moita* fishing, which is a destructive method that employs riparian vegetation to form a microhabitat of submerged vegetal substrate for the colonization and subsequent capture of fishes. *Moita* is practiced in different communities around the municipality of Chapadinha (Cedro, Poções, Monte Alegre and Riacho Fundo) and the municipality of Porto Franco. This paper presents the description of the installation process and fish catch, and its influence on the fish community and riparian vegetation.

## MATERIAL AND METHODS

The Munim River is located in the northeastern portion of the state of Maranhão (northeastern Brazil), occupying an area of approximately 16,000 km<sup>2</sup>, the main tributaries of which are the Iguará, Mocambo and Preto Rivers (3°44'31''S, 43°21'36''W). The river stretches 275 km from its spring in the

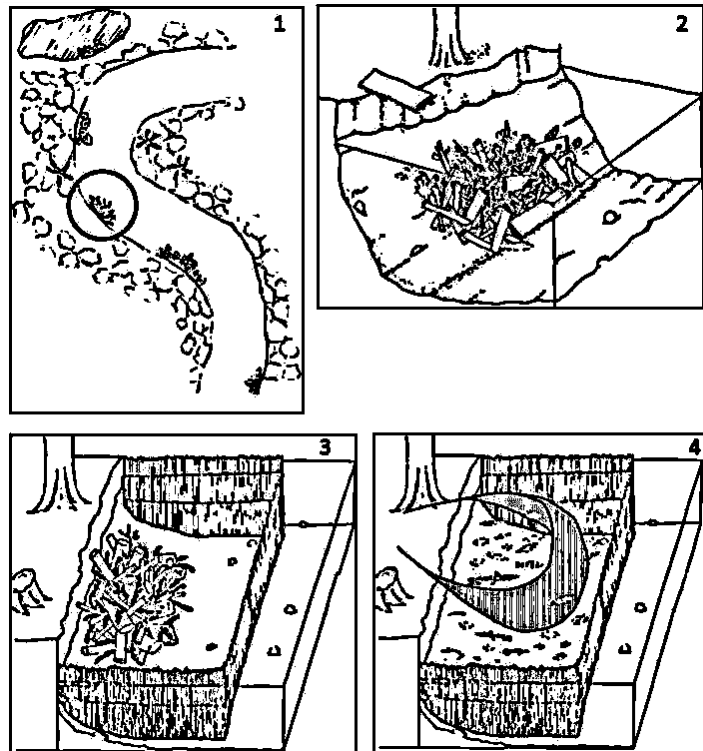
municipality of Aldeias Altas to São José Bay. The surrounding vegetation is mainly composed of medium-sized trees and bushes, such as *Senna alata*, *Inga* sp., *Mimosa caesalpiniaefolia*, *Ipomea* sp., *Astrocaryum* ssp., *Bactris* spp. and *Orbignya* spp..

The description of *moita* fishing was based on observations made during field trips. The entire process of building the *moita* and catching fishes was followed in 2010 and 2011 in the community of Cedro, which is located approximately 15 km from Chapadinha. Species identification was performed using specialized literature (PIORSKI *et al.*, 1998; SANTOS *et al.*, 2004; SOARES, 2005; FROESE and PAULY, 2013).

## RESULTS

The *moita* process begins with the removal of riparian vegetation (~4 m<sup>2</sup>). Fishermen cut trees ranging from 15 to 25 cm in diameter using axes, saws and machetes and place the branches, twigs and leaves in the water. This process continues until vegetation is littered on the bottom of the river. Deployment generally occurs in June or July, when the water level begins to subside due to the onset of the dry season in the region. In October or November, the vegetation is surrounded by a corral (approximate area: 30 to 40 m<sup>2</sup>) made from the stalks of palm leaves to avoid the escape of the fishes. After two to five days, the fishermen remove the *moita* and the fishes are caught with drag nets (mesh: 2 or 3 cm between knots). *Moitas* are commonly installed at curves in the river with a slow current, turbid waters and silt bottom containing pebbles (Figure 1).

Harvesting is a community event known as the "*moita* fest", with the catch generally consumed on the banks of the river (Figure 2). This event also attracts residents from the surrounding villages. Specimens not consumed at the time are divided up among the families of the fishermen for subsistence or commercial purposes. Due to the informal nature of this fishing activity, the fishermen do not have conclusive data on productivity.



**Figure 1.** *Moita* assembly process: 1 - deployment location in river; 2 - *moita* (branches, twigs and leaves) submerged; 3 - positioning of corral constructed with stakes from palm leaves around *moita*; 4 - deployment of net to catch fishes following removal of *moita*. (Designed by: Maurile Sousa Costa)



**Figure 1.** *Moita* fest: A - removal of structure; B, C - fish caught.

Based on observations and reports from members of the riverine community, about 20 species are caught in the *moita*. Species from 12

families and four orders are frequent and the order Characiformes accounts of the largest number (Table 1).

**Table 1.** List of species caught using the *moita* fish aggregating method in the Munim river, state of Maranhão, Brazil. Species marked with an asterisk (\*) are appreciated locally for consumption and have commercial interest.

Scientific Name	Local name
<b>Order Characiformes</b>	
<b>Family Curimatidae</b>	
<i>Curimatella</i> sp.*	Tripudinho
<b>Family Phochilodontidae</b>	
<i>Prochilodus lacustris</i> * Steindachner, 1907	Cumimatá/Purimatá
<b>Family Anostomidae</b>	
<i>Leporinus piau</i> * Fowler, 1941	Piau de coco
<i>Schizodon dissimilis</i> * (Garman, 1890)	Piau de vara
<b>Family Erythrinidae</b>	
<i>Hoplias malabaricus</i> * (Bloch, 1794)	Traíra
<b>Family Characidae</b>	
<i>Poptella</i> sp*	Pacu
<i>Pygocentrus nattereri</i> * Kner, 1858	Piranha-vermelha
<i>Serrasalmus marginatus</i> * Valenciennes, 1837	Pirambeba
<i>Triportheus signatus</i> * (Garman, 1890)	Sardinha
<i>Tetragonopterus</i> sp.*	Pataca-do-olhão
<b>Order Siluriformes</b>	
<b>Family Doradidae</b>	
<i>Hassar affinis</i> (Steindachner, 1881)	Mandi-boca-de-flor
<b>Family Pimelodidae</b>	
<i>Pseudoplatystoma fasciatum</i> * (Linnaeus, 1766)	Surubim
<i>Sorubim lima</i> * (Bloch & Schneider, 1801)	Surubim-bico-de-pato
<b>Family Loricariidae</b>	
<i>Rineloricaria steindachneri</i> (Regan, 1904)	Viola/Cachimbo
<b>Order Gymnotiformes</b>	
<b>Family Sternopygidae</b>	
<i>Sternopygus macrurus</i> (Bloch & Schneider, 1801)	Sarapó
<b>Family Rhamphichthyidae</b>	
<i>Rhamphichthys atlanticus</i> Triques, 1999	Sarapó
<b>Order Synbranchiformes</b>	
<b>Family Synbranchidae</b>	
<i>Synbranchus marmoratus</i> Bloch, 1795	Muçum
<b>Order Perciformes</b>	
<b>Family Cichlidae</b>	
<i>Aequidens tetramerus</i> (Heckel, 1840)	Cará
<i>Crenicichla menezesi</i> Ploeg, 1991	Lopi/Sabão
<i>Satanoperca jurupari</i> (Heckel, 1840)	Cará-bicudo

## DISCUSSION

The efficiency of the fish aggregating method described herein seems to be associated with the diversity of microhabitats created by the pile of vegetation in the river. These microhabitats attract a variety of fish seeking sites for refuge, feeding and/or breeding. Thus, the function of the *moita* is

comparable to that of an artificial marine reef, which enhances the richness, diversity and density of a large number of aquatic organisms (BADALAMENTI *et al.*, 2002; CONCEIÇÃO and NASCIMENTO, 2009).

According to NAKAMURA *et al.* (2004) and MORTATI (2004), the conservation of aquatic

vegetation, as occurs with the deployment of a *moita*, is of considerable importance to colonization by a large number of species. The use of this type of habitat is closely related to the structural characteristics of the environment. Moreover, the heterogeneity of microhabitats formed by the presence of vegetation is a determinant of diversity (NAKAMURA *et al.*, 2004) as well as the structuring and behavior of the community influenced by this type of fish aggregating method.

The use of vegetal feedstock to attract species of fish is common in many fishing communities in Brazil (NASCIMENTO and SASSI, 2007; NOGUEIRA and SASSI, 2007). However, there has been an evident reduction in this type of fish aggregating activity due to the loss of the fishing traditions over the generations (SANTOS and SAMPAIO, 2013). Some types of fish aggregating that use vegetal components have been reported on the coast of the state of Alagoas, but the size of specimens caught has not been attractive to fishermen, which has led to a reduction in this practice (SANTOS and SAMPAIO, 2013). Other types of fish aggregating methods conducted in other regions of Brazil resemble the practice conducted in the state of Maranhão. However, the corral constructed around the *moita* prior to catching the fishes does not occur in other fisheries, such as *marambaia*, *caiçara* and *pitimboia* (see NOGUEIRA and SASSI, 2007; SANTOS and SAMPAIO, 2013).

Most species of fish caught in the *moita* are benthic (35%) or bentopelagic (45%). This suggests that the *moita* is a place of refuge, feeding and/or growth. The *moita* seems to be a good attractor of fishes. Species such as *S. macrurus*, *R. atlanticus* and *S. marmoratus* illustrate the use of this microhabitat as refuge (SANTOS *et al.*, 2004), while the piranhas *P. nattereri* and *S. margintus* use the *moita* as a substrate for spawning eggs (SAZIMA and POMBAL-JR, 1988; SAZIMA and MACHADO, 1990; HADDAD-JR and SAZIMA, 2010).

Although the placement of branches increases the availability of microhabitats for fishes, it also represents a threat to the conservation of riparian vegetation, which is the main negative impact of this fish aggregating method. Although not

quantified, a number of open clearings were sighted along the banks of the river, with evidence of the cutting of trees for the construction of *moitas*. The removal of vegetation can lead to erosion of the banks and increased sedimentation due to the buildup of silt and sand. Moreover, the cutting of plants considered food sources for the tropical fish community can compromise the physical integrity of the affected stretch of the river (SABATER *et al.*, 2001; MORTATI, 2004).

## CONCLUSION

The traditional *moita* fish aggregating method is non-selective and attracts a number of benthic and benthopelagic species, which are subsequently caught by fisherman from the surrounding villages in the state of Maranhão, Brazil. The environmental impact of this type of fishing practice includes the clearing of riparian vegetation and erosion.

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## REFERENCES

- ALMEIDA, Z.S. de; CASTRO, A.C.L.; PAZ, A.C.; RIBEIRO, D.; BARBOSA, N.; RAMOS, T. 2006 Diagnóstico da pesca artesanal no litoral do estado do Maranhão. In: ISAAC, V.J.; MARTINS, S.A.; HAIMOVICI, M.; ANDRIGUETTO, J.M. *A pesca marinha e estuarina do Brasil no início do século XXI: recursos, tecnologias, aspectos socioeconômicos e institucionais* Belém: Editora Universitária UFPA. p. 41-65.
- BADALAMENTI, F.; CHEMELLO, R.; D'ANNA, G.; HENRIQUEZ RAMOS, P.; RIGGIO, S. 2002 Are artificial reefs comparable to neighboring natural rocky areas? A mollusc case study in the

- Gulf of Castellammare (NW Sicily). *ICES Journal of Marine Science*, 59: S127-S131.
- CONCEIÇÃO, R.N. de L. and NASCIMENTO, M.C. do. 2009 Recifes artificiais instalados em Guamaré, Rio Grande do Norte: programa de apoio à pesca artesanal. *Arquivos de Ciências do Mar*, 42(1): 106-111.
- FROESE, R. and PAULY, D. (Editors). 2013 *FishBase*. [on file]. URL: <[www.fishbase.org](http://www.fishbase.org)> Access on: 20 Nov. 2013).
- HADDAD-JR, V. and SAZIMA, I. 2010 Piranha attacks in dammed streams used for human recreation in the State of São Paulo, Brazil. *Revista Brasileira da Sociedade de Medicina Tropical*, 43(5): 596-598.
- MORTATI, A.F. 2004 *Colonização por peixes no folhicho submerso: implicações das mudanças na cobertura florestal sobre a dinâmica da ictiofauna de igarapés na Amazônia Central*. Manaus. 67p. (Dissertação de Mestrado. Universidade Federal do Amazonas, UFAM). Available at: <[http://www.igarapes.bio.br/index.php?option=com\\_docman&task=cat\\_view&gid=18&limit=50&limitstart=0&order=hits&dir=DESC&Itemid=48](http://www.igarapes.bio.br/index.php?option=com_docman&task=cat_view&gid=18&limit=50&limitstart=0&order=hits&dir=DESC&Itemid=48)>
- MPA - MINISTÉRIO DA PESCA E AQUICULTURA. 2011 Pesca Artesanal. Available at: <<http://www.mpa.gov.br/index.php/pescampa/artesanal>> Access on: 24 Jan. 2013.
- NAKAMURA, K.; LASSO, C.A.; VISPO, C.; ORTAZ, M. 2004 Observaciones subacuáticas: una herramienta efectiva para la obtención de datos ecológicos y etológicos en comunidades ícticas continentales. *Memoria de la Fundación La Salle de Ciencias Naturales*, 157: 83-110.
- NASCIMENTO, M.S.V. and SASSI, R. 2007 Análise da atividade pesqueira e das condições socioeconômicas dos pescadores artesanais de Cajueiro da Praia, Estado do Piauí, Brasil. *Gaia Scientia*, 1(2): 141-154.
- NOGUEIRA, E.M.S. and SASSI, R. 2007 A arte das caiçaras e o conhecimento dos caiçareiros de Alagoas. In: MOURA, F.B.P. (org.) *Conhecimento tradicional e estratégias de sobrevivência de populações brasileiras*, EDUFAL, Alagoas. p.91-103.
- NUNES, J.L.S.; PIORSKI, N.M.; SILVEIRA, P.C.A.; ALMEIDA, Z.S. de 2011 Fisheries resources of RAMSAR sites of the State of Maranhão (Brazil). In: BILIBIO, C.; HENSEL, O.; SELBACH, J.F. (org.) *Sustainable water management in the tropics and subtropics-and case studies in Brazil*. Jaguarão: Fundação Universidade Federal do Pampa, Unikassel, PGCult/UFMA, v. I, p. 893-912.
- PIORSKI, N.M.; CASTRO, A.C.L. de; PEREIRA, L.G.; MUNIZ, M.E.L. 1998 Ictiofauna do trecho inferior do rio Itapecuru, Nordeste do Brasil. *Boletim do Laboratório de Hidrobiologia*, 11: 15-24.
- PIORSKI, N.M.; SERPA, S.S.; NUNES, J.L.S. 2009 Análise comparativa da pesca de curral da Ilha do Maranhão, Maranhão—Brasil. *Arquivos de Ciências do Mar*, 42: 65-71.
- RAMIRES, M. and BARRELLA, W. 2003 Ecologia da pesca artesanal em populações caiçaras da estação ecológica de Juréia-Itatins, São Paulo, Brasil. *Interciências*, 28(4): 208-213.
- SABATER, S.; BERNAL, S.; BUTTURINI, A.; NIN, E.; SABATER, F. 2001 Wood and leaf input in a Mediterranean stream: the influence of riparian vegetation. *Archiv für Hydrobiologie*, 153(1): 91-102.
- SANTOS, G.M.; MÉRONA, B.; JURAS, A.A.; JÉGU, M. 2004 *Peixes do médio rio Tocantins*. Brasília: Eletronorte. 216p.
- SANTOS, E.C dos and SAMPAIO, C.L.S. 2013 A pesca artesanal na comunidade de Fernão Velho, Maceió (Alagoas, Brasil): de Tradicional a Marginal. *Revista da Gestão Costeira Integrada*, 13(4): 513-524.
- SAZIMA, I. and POMBAL JR, J.P. 1988 Mutilação de nadadeiras em acarás, *Geophagus brasiliensis*, por piranhas, *Serrasalmus spilopleura*. *Revista Brasileira de Biologia*, 48: 477-483.
- SAZIMA, I. and MACHADO, F.A. 1990 Underwater observations of piranhas in western Brazil. *Environmental of Fish Biology*, 28: 17-31.
- SOARES, E.C. 2005 *Peixes do Mearim*. São Luís: Editora Instituto Geia. 150p.