

SOME NOTES OF MULLET (*Mugil liza*, Valenciennes, 1836) FISHING IN BRAZIL: HISTORY AND TRADITION

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ABSTRACT

The present study proposes to describe some peculiarities about the history and tradition of mullet *Mugil liza* Valenciennes (1836) fishing in Brazil. The present work is qualitative, descriptive and, exploratory, highlighting some historical facts relevant to the time range of 1945 to 2014. It was concluded that the mullet fishing *Mugil liza*, Valenciennes, (1836) in Brazil: 1) is based on strong Portuguese and indigenous influences; 2) is based on the tradition of a cooperative effort of art, technique, and subjective abilities; 3) has maintained over the centuries the “Mullet Festival” along coastal regions of southern and southeastern Brazil; and 4) depends on initiatives by official organizations and organized civil society to use sustainable exploitation, guaranteeing the preservation of the species and the marine ecosystem.

Keywords: mullet, *Mugil liza*, history of fishing, socio-economic aspects, fishing in Brazil.

ALGUMAS NOTAS SOBRE A PESCA DA TAINHA (*Mugil liza*, Valenciennes, 1836) NO BRASIL: HISTÓRIA E TRADIÇÃO

RESUMO

O presente estudo se propôs descrever algumas peculiaridades sobre a história e tradição da pesca da tainha *Mugil liza* Valenciennes (1836) no Brasil. Trata-se de um estudo de caráter qualitativo, descritivo e exploratório, destacando alguns fatos históricos dentro do período de 1945 a 2014. Concluiu-se que a pesca da tainha no Brasil 1) sofreu forte influência portuguesa e indígena; 2) estrutura-se pela tradição de um esforço cooperativo da arte, técnica e habilidades subjetivas; 3) mantém ao longo de séculos a “Festa da Tainha” ao longo das regiões costeiras do Sul e Sudeste do Brasil; e 4) depende de iniciativas dos órgãos oficiais e da sociedade civil organizada para manter exploração sustentável, garantindo a preservação das espécies e do ecossistema marinho.

Palavras-chave: tainha, *Mugil liza*, história da pesca, aspectos socioeconômicos, pesca no Brasil.

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ALGUNAS NOTAS SOBRE LA PESCA DE LA TAINHA (*Mugil liza*, Valenciennes, 1836) EN BRASIL: HISTORIA Y TRADICIÓN

RESUMEN

El presente estudio se propuso describir algunas peculiaridades sobre la historia y tradición de la pesca de la tainha, *Mugil liza* Valenciennes (1836) en Brasil. Se trata de un estudio de carácter cualitativo, descriptivo y exploratorio, destacando algunos hechos históricos dentro del periodo de 1945 a 2014. Se concluyó que a pesca de la tainha en Brasil: 1) sufrió fuerte influencia portuguesa e indígena; 2) se estructura por la tradición de un esfuerzo cooperativo del arte, técnica y habilidades subjetivas; 3) mantiene al largo de siglos la “Festa da Tainha” en las regiones costeras del Sur y Sudeste de Brasil y depende de iniciativas de los órganos oficiales y de la sociedad civil organizada para mantener exploración sostenible, garantizando la preservación de las especies y del ecosistema marino.

Palabras clave: tainha, *Mugil liza*, historia de la pesca, aspectos socioeconómicos, la pesca en Brasil.

INTRODUCTION

Mullet fishing is a part of both historical fishing in Brazil and the customs of the indigenous populations along the southern-southeastern coast (1). This activity displays an extensive cultural richness, starting with tasks such as fishing preparation by the production of weapons and expedition equipment and extending to the mobilization of people and artisans (2) creating a dynamic process of customs and traditions transmission along of generations (3). The activity of capturing, specifically, employs different techniques, weapons, and effort (4). After the capture, fish-conservation techniques are also employed which allows the long-distance commercialization of fishing and riverside areas and enables this species to be consumed throughout the year.

An important dietary item, mullet is responsible for driving the economy in various locations along the coast and for integrating communities over generations. This species is the protagonist of one of the most traditional regional celebrations, which also carries its name (2), along with various species of the genus *Mugil*, which belong to family Mugilidae.

Fish of family Mugilidae, popularly known as Le branche mullet and Silver mullet, are among the most abundant species found in coastal marine and estuarine environments, and they form dense schools in southern and southeastern Brazil (5). These species range from Rio de Janeiro to Argentina in the western South Atlantic (6,7). According to the fishing histories, the largest specimens obtained reached up to a meter in length and six kilograms in live weight. These fish often have an average length of 50 centimeters.

Characterized as a diadromous species, mullet juveniles migrate from the open ocean to freshwater, where they remain for a specific amount of time. During the reproductive period, the fish have a preferentially catadromous behavior, i.e., they migrate to the open ocean to spawn (6,8).

Recent studies (9) define *Mugil liza* Valenciennes, (1836) as mullet found along the entire coast of the South American and Caribbean Atlantic Ocean, although these fish were previously known as *M. platanus*, Günther, 1880.

Over time, mullet have remained important in artisan and subsistence fishing and represent a source of income and survival. After the year 2000, with declining volumes of true sardines, mullet became an important species for industrial trawlers (5), and mullet was no longer a secondary species to *Sardinella brasiliensis* (10). The increasing capture of adult individuals in the reproductive phase has significantly jeopardized schools in

southern/southeastern Brazil (11) which necessitates responsible fishing under strict sustainability principles.

Because the mullet *Mugil liza* Valenciennes, (1836) is important to Brazilian extractive marine fishing and documented discussions on this theme are lacking, the present study proposes to describe and discuss some of the peculiarities of mullet fishing that stand out in the history of this activity in southern and southeastern Brazil. The study also highlights the activity's socio-economic and artistic importance and how mullet fishing promotes the integration of social groups in mass demonstrations.

Similar to other artisan fishing arts, mullet capture and its cultural and ethnic context have undergone various transformations over time, strongly driven by cultural factors and economic pressures that, over time, jeopardized the maintenance of this activity. Because such practices are based on the interpersonal transmission of knowledge from father to son and among members of a community, the practices tend to transform when they are not lost over time, if there is no effort to document them. This fact justifies the effort to preserve specific information to make available, at another point in time, the data and usable records of both historical preservation of a culture and the planning and ordinance of this system of extractive production. In this context, the present study was designed to describe some of the peculiarities that characterize the art of mullet *Mugil liza*, Valenciennes, (1836) fishing.

Biological aspects

The species *Mugil liza* Valenciennes, (1836) is a teleost fish, belonging to the group of vertebrates, which occur in larger number on the planet and exhibit an efficient body organization and reproduction. It's known that mullets belong to the same family *Mugilidae*, detritivore fish, with wide distribution, occurring in tropical waters and subtropical regions around the world, mainly in the marine estuarine coastal regions (12) and in the lagoons of hypersalines and fresh waters (13). Only the genus *Mugil* occurs in Southeastern Brazil. This genus is represented by seven species (8). The species *Mugil liza* was first described by Valenciennes in 1836, and it is a pelagic species that lives in the water column (8), usually at depths of 20 meters. Some specimens have been found up to 300 meters deep (14). These fish form large schools, especially during their reproductive migration from estuaries to the sea. Juveniles remain in estuaries, which are calm environments that offer shelter and rich food resources, until their gonads mature. Spawning occurs far from the coast, but juveniles require a period of time in waters with similar conditions to those of estuaries (15). Mullet attain sexual maturity when they reach a length of approximately 40 centimeters (8).

Vieira and Scalabrin (16) described the life cycle of the mullet that occurs on the Brazilian coast, which was known as *Mugil platanus* Günther, (1880), but in 2010, (Menezes, Oliveira and Nirchio (9) identified the species *Mugil liza* Valenciennes, (1836) occurring from the Caribbean to Argentina. These authors report that during the reproductive period, *Mugil liza* migrates to open sea to spawn between the coast of Northern Rio Grande do Sul and Northern Santa Catarina, originating large schools. Spawning occurs from the end of fall to the beginning of winter, with peaks in the months of May and June, and can extend until September. Juvenile recruitment in the Lagoa de Patos occurs throughout the year, with peaks of abundance during winter and spring. Juveniles search for coastal waters, penetrating estuaries where they develop until they again migrate to waters far from the coast. Menezes and Figueiredo (6) reported the capture of individuals measuring up to one meter in length and weighing approximately six pounds. Godinho, Serralheiro and Scorvo (17) affirmed that the species *Mugil liza*, *M. platanus* and *M. curema* are the most exploited species along the Brazilian coast.

Fishing gear used to catch mullet

A variety of fishing arts have been used to capture mullet, such as small nets made with lines of tucum (*Bactris setosa*) leaves used by the Tupi indigenous people, inhabitants of the southern Brazilian coast, along with arrows and structures fixed in the sea made of rods and leaves (5). These fixed structures, called fixed enclosures, were previously of the utmost importance to mullet fishing (18).

Currently, we still see various types of fishing arts employed in mullet capture on beaches, estuaries, and shores or in water farther from the coast by fishing vessels of a wide range of drafts and tonnages. According to Diegues (19), after the 1950s, with the advent of synthetic lines in seine nets, the first records of the use of seine nets for mullet appeared, along with the configuration of the trammel, which was used in mullet capture from canoes, rafts, and small rowboats.

According to De Pina and Chaves (4), who investigated mullet fishing in the state of Paraná, the uses of trawler nets and beach cast nets (beach haul or fence) are the most widespread in this region. Fishing with trawler nets occurs throughout the year but is intense during the winter. Beach seine nets are most commonly used during the spring, summer and fall. The authors also mention the use of gillnets, which can be anchored or drifting, also known as trammels (Table 1).

Table 1. Mullet capture in the Guaratuba Bay, state of Paraná, Brazil, by type and season according to Pina and Chaves (4).

	Summer	Autumn	Winter	Spring
Anchorage	-	<i>M. platanus</i> <i>M. curema</i>	-	<i>M. curema</i> <i>Mugil. sp.</i>
Drifting gill nets	-	<i>M. platanus</i>	-	-
Beach throw net	<i>M. platanus</i> <i>M. curema</i>	<i>M. platanus</i>	-	<i>M. platanus</i> <i>M. curema</i>
Cast net 10-11 cm	-	<i>M. platanus</i> <i>M. curema</i>	-	-
Cast net 07-09 cm	-	<i>M. platanus</i>	-	-
Cast net 04-06 cm	<i>M. platanus</i> <i>M. curema</i> <i>Mugil. sp.</i>	<i>M. platanus</i> <i>M. curema</i>	-	<i>M. platanus</i> <i>M. curema</i> <i>Mugil. sp.</i>

Beach cast nets are also cited by Pinheiro et al. (3) as one of the oldest forms of fishing practiced in Brazil, and the principal target species is mullet. These authors investigated the case of mullet fishing on the Paraná coast and describe the art of beach cast nets as the most widespread.

In a study by Mourão (20) about fishermen of the southern coast of the São Paulo state, the trawler or beach cast net is cited as the principal fishing art used by these fishermen. Fixed enclosures, made of bamboo rods (*Phyllostachys aurea*), have also been used in this region. Similar to the coast of Paraná, gillnets are also used on the coast of São Paulo, in addition to trawler nets.

In the Lagunar Cananéia-Iguape region, the fixed enclosure (corral) is the principal fishing art used to capture mullet according to Ramos et al. (21).

In the area around Patos Lagoon estuary, located in the state of Rio Grande do Sul, an investigation by Ferreira (22) showed the fishing characteristics and relative abundance of mullet. The author indicated the use of four different types of capture: fixed gillnets, enclosure, drift gillnets, and cast nets.

Fisheries on industrial fishing vessels uses different capture methods, including trawling, paired trawling, gillnets with drifting and weighted nets, and the enclosures built by mullet fishermen. The offloading performed by the São Paulo industrial fleet is described by Seckendorff and Azevedo (5).

Industrial mullet fishing in the state of Santa Catarina includes the use of trawls, paired trawls, gill nets, and enclosures. The industrial activity in this state is effectively all performed by mullet fishermen because there are insignificant numbers of other types of fishermen (11). Mullet are captured in this state by a mullet fishermen fleet that captures stocks of other species in addition to mullet (23).

Fishing mullet and geography

From Rio Grande do Sul to Rio de Janeiro, there are mullet fisheries practiced by fishermen and members of traditional communities and by fishing fleets that operate out of ports along the coast (11).

In the state of Rio Grande do Sul, the Lagoa de Patos estuary is described by Ferreira (22) as a region of intense fishing activity aimed toward mullet.

The Santa Catarina coast is known for harboring diverse traditional fishing communities, which maintain the Portuguese customs which were always intimately connected within the mullet fishing tradition. The Barra da Lagoa community in the Itajaí Valley (2) and in the cities of Imbituba, Florianópolis, Governador Celso Ramos, Bombas, Bombinhas and Balneário Camboriú (11), traditionally practice this capture. The mullet disembarkation in the state of Santa Catarina is cited as the largest of the country (11).

The state of Paraná has a limited coastline, yet there is traditional and intensive fishing for various species, including mullet, especially in the estuary-lagoon complex Paranaguá Bay and the Guaratuba Bay (4), Barra do Saí-Guaçu, Prainha, Caiobá, Ipanema, Shangri-lá, Guapê, Barranco, Pontal do Sul, Maciel, Ilha do Mel and Barra do Ararapira (3).

In the state of São Paulo, from the southern to northern coast, mullet are captured by fishing members of traditional communities and the industrial fishing fleet (5). Cardoso Island and the Paranagua Bay, on the border with Parana State of Brazil. The largest mullet disembarkations performed by the industrial fleet took place in Santos and Guarujá (5,11). Along the northern São Paulo coast, communities perform traditional fishing throughout the entire range (1) to the state of Rio de Janeiro where traditional communities inhabit various lengths of the southern coast near the border with São Paulo and extend to the Lagos region participating in mullet fishing (11).

METHODOLOGY

The present work is an exploratory documentary study (Table 2), which also uses information collected from direct contact with fishing researchers and professionals. The clerical search included records from 1913 to 2010. The search was performed via Scielo and other sites of institutions related to the theme of fishing and fisheries, including the USP [University of São Paulo] Zoology Museum and USP Oceanographic Institute. The field research was based on a qualitative, descriptive, and exploratory methodology, as a theoretical basis, described by Minayo (24). The data collection followed the precepts of a systematic observation described by Marconi and Lakatos (25). Visits were also made to regional festivals celebrating mullet, at which time informal testimonies from the following entities were recorded: fishermen of southern and southeastern Brazil; fishermen unions of

Santa Catarina and Fishing Colony Z-3 Fishermen Association of Guarujá/São Paulo (SP), called Vicente de Carvalho; fishermen of the neighborhoods Engenho and Perequê in Ilhabela/SP; and fisheries consumers in the City Market of the neighborhood of Tucuruvi/SP.

Table 2. Studies dealing with fishing and reference catch mullet and related topics to this activity.

Autor	Year	State/Brazil	Subject
Mussolini G (1)	1945	São Paulo	Mullet enclosures
Mourão F (20)	1971	São Paulo	Fishermen of the southern coast
Radasewsky A (18)	1976	São Paulo	Fixed enclosures
Mussolini G (1)	1980	São Paulo	Anthropology
Ramos E B, Jaques G, Verrone VMA (21)	1980	São Paulo	Fixed enclosures
Diegues ACS (19)	1983	São Paulo	Seamen
Mendonça JT, Katsuragawa M (26)	2001	São Paulo	Artisanal fishing
Mendonça JT, Pires AD, Calasans GC, Xavier SC, Hoff EA, Sena RJ (27)	2004	São Paulo	Fish production of the southern coast
Pina LV, Chaves PT (4)	2005	Paraná	Mullet fishing
Miranda LV, Mendonça JT, Cergole MC (8)	2006	São Paulo	Diagnosis of stock
Rosswongtschowski CLB, Ávila-da-Silva AO, Cergole MC (28)	2006	São Paulo	Principal southeastern-southern fisheries REVIZEE
Ibama (11)	2007	Santa Catarina	Mullet fishing regulation
Ferreira CN (22)	2007	Rio Grande do Sul	Characterization of fishing
Miranda LV, Carneiro MH (10)	2007	São Paulo	Mullet fishing
Seckendorff RW, Azevedo VG (5)	2007	São Paulo	Historical account of mullet fishing
Alves PMF, Arfelli CA, Tomás ARG (29)	2009	São Paulo	Gillnet fishing
Pinheiro L, Lana PC, Andriguetto Filho JM, Hanazaki N (3)	2010	Paraná	Mullet fishing
Conceição ML (2)	2011	Santa Catarina	Mullet fishing and festival

LITERATURE REVIEW

Historical Highlights

As previously presented, reports in the national literature about mullet fishing, focused on fishing art and the socio-cultural importance, are lacking, which justifies the exhaustive use of the author Mussolini (30). In a study from 1980, the richness of information and

accumulated knowledge were given in Mussolini's reports. The work by Mussolini is of great relative importance in the creation of knowledge on Brazilian coastal fishing, especially in the southern and southeastern regions.

Providing a short history, between the XVII and XIX centuries, the only valued fishery for the national economy was that of whaling, which began in 1603 in Bahia and moved towards the south, where it was heavily developed in Santa Catarina. The importance of this industry was focused on "[...] *extracting oil from whales [...]*", according to Mussolini (1, p. 224), but "[...] *real contracts*" or "*armações*" [...] were not established in fishing locations, and thus, fisheries were not considered to exist or maps of fishing production were "[...] *insignificant, only for waste, not making available establishments for this [...]*" (1, p. 224, author's emphasis).

Reaffirming the Portuguese and indigenous influence, they wore the harpoon to the whale fishing. In relation to the mullet fishing on the Sao Paulo coast there are reports that was almost as a sport, commonly known as slingshot (1) [...] trident fitted with a cable of 2.5 to 3 meters in length [...] to announce the station of the mullet, that is, the period of abundant fishing. Mussolini (1, p. 231, author's emphasis) tells that fishermen leave "[...] *at night in their canoes, to which was attached a lantern (torch) – which is why this type of fishing is known as 'torching', and the fishermen says he will go 'torching' – and, with his feet firm on the edges of the canoe, he throws a gaff and sticks a fish. This process is similar to not only harpooning a whale but also the indigenous system of shooting fish from within canoes [...]*."

Mullet exploitation has developed over time within the history of Brazilian fisheries. After whaling, the second most important economic exploration in Brazil began with colonization (1). This fact is, at least in part, associated with Brazil's abundance of natural resources due to its eco biological characteristics. For long periods, Brazil has suffered intense concentrations of individuals, which have made foraging/hunting/fishing important economic activities and food sources.

Mussolini (1) states that it is not possible to discern the Lusitanian and indigenous influences on the processes of fish capture in Brazil, even in fishing gear, such as in the appliance and type of vessel used. Regarding fishing techniques, Mussolini (1, p. 227) comments that "[...] *the principle of gilling the fish [...]* destined to those that, as the mullet, are disposed to jump in defense, which are not easily captured by enveloping nets, is so advertised to the world that we will not attribute the indigenous influence to the practice adopted by Brazil because Portuguese nets also put this practice to use [...]." The practice of corking involves the creation of a fence made of wood sticks that (1, p.227) [...] *you to shed much sum of one certain herbs footsteps, which they call "timbo", with the puttest thy bottle the fish so that comes above the water as dead; where they have to many of them [...]*.

Describing the influence of Portugal and of indigenous people, the author (1, p. 227) that the technique of "tapagem", comment that the corking technique that "[...] *is so condemned by the fishing legislation [...]* consists of a trap, formed by branches, to trap the fish." In their words, "[...] *The Indians used ticum nets [...]* a species of palm (*Bactris setosa*) [...] *to entangle the fish, and the mode of encircling it, hitting it in the water afterwards to shock it so that thus it would be trapped in the net mesh [...]*." This mode of fishing was practiced from the Northeast to the Southeast of Brazil and was called "jolt fishing" and "Trojan fishing" in the cities of Bahia and São Paulo state, respectively.

Santos (31) reports that indigenous people know mullet as "curumã-aiva", or "bad to eat" flavor "tapiearas." The author considered as mullet the fishes that were not sexually mature, i.e., those that had not yet gone to the sea, still inhabitants of estuaries. However, Santos (31) understood "tapiearas" not as still immature individuals but as mullet that after spawning were thinner and smaller with an unpalatable flavor that was uncharacteristic and unexpected for consumption.

In the Amazon, the practice of fish preparation called *moqué*m, a product of indigenous inheritance, is still practiced. Mussolini (1, p. 227) explains that *moqué*m is:

*"[...] the only way [...] to keep the fish fresh when it is not prepared with salt [...] They suspend for a given time over the fire the amount that serves as a meal, beef or fish, and let it cure and smoke until drying; [...] meat prepared in this manner is called moqué*m [...]" (author's notes).

In 2010, artisanal fisherman from the cities of Santos/SP, Guarujá/SP and Ilha Bela/SP also reported the capture of mullet with undesirable flavor, which were thrown away even when fresh, large, and healthy. The fishers note that the mullet considered of high consumption quality are those that were captured in the open ocean and were well developed, with a blue back, also known as "new" mullet. According to Santos (31), the "new" mullet, are also called spawned mullet, is that one which is sexually mature after a long journey from the estuary and that has arrived in the open ocean.

Mussolini (1, p. 235) affirms that mullet is important in the context of fishing and relates to traditional practices that characterize the lifestyle of a region. These practices are passed down from generation to generation as a cultural inheritance. The author highlights fishing by "beach cast nets" as an art and ingenuity with a complex process. He describes with delicate beauty this intricate "man-nature" relationship established in the fishing practice, which depends on sensibility, intuition, observation, dexterity, effort, and cooperation. The abundance of mullet in specific periods allied with this true "ritual" might have fundamental characteristics that perpetuate the art details in its history (30).

Ramalho (32) comments in his book about artisanal fishermen from Pernambuco state that the practices exercised by fishermen, resulting from creativity, liberty, and resistance in an effort to live and work the true art, full of its own codes, are dominated by values much different than those of traditional systems of working relationships in other economic sectors, such as agriculture. The fishing activity occurs in a unique space, called by the author as "*[...] aquatic space [...] in which [...] the fisherman has to make decisions regardless of [...] a priori defined external pressures; [...] the peculiarity of the main means of production (the sea) places constant unpredictability and risk (including loss of life)[...]*" Therefore, the production units are governed by a strong sense of cooperation; the efforts are always toward a single objective on the boat, and partnership and familiar work are of the highest value.

Mussolini (1) argues that fishing comprises a set of practices whose work organization transcends familial limits and is converted into communal activity. Mullet is the species that best expresses this particular form of human interaction for productivity, based on extractive marine fishing. In the words of Mussolini "*[...] it is in fishing, around the net, that a series of interactions between the people of a neighborhood are established, uniting them in cooperation and making them truly constitute a local group [...]*".

Based on the peculiar characteristics of mullet fishing in the country, especially in the South and Southeast, conditions have developed that allow the rise of the "mullet festivals", which commemorate the victory of the cooperative fishing effort. Based on the words of Ramalho (32), there is a solid relationship between the abundance of mullet in Brazilian waters and the coastal communities aimed at its capture. Mullet harvest is perpetuated by the transmission of the "art of fishing", i.e., of the set of practices more similar to art than technique, transmitted among family members, friends, and work colleagues, composing true rituals with well-defined actions in the pre-fishing work and in the actual fishing until the catch arrives on land.

The fishing gear most frequently used to capture Lebranche and Silver mullet is gillnets. Gillnets are nets with lead weights that lie on the ground and floats that stay on the surface. According to the characteristics of the region, to avoid breaking and destroying the nets, fishermen fish for Lebranche mullet with nets that have three to four sections in height and a length of up to 14.0 m, and the mesh holes are greater than 10 cm between opposing knots.

The nets used to catch Silver mullet have three to four sections in height and a length of up to 8.5 m, with holes in the mesh of six centimeters between opposing knots (5).

With the fishing completed, it is time to divide the fish, a practice that is nothing more than live tradition in action. First, the “third” that belongs to the owner of the net or nets is removed; the two remaining thirds are divided among all who helped haul the nets or row the boats. Here, there is an intertwined relationship between fishing participants and shares of the fish, Mussolini (1) notes that in this cooperative process, “[...] the canoes that were “*aparar*” deliver [...] one-third of their catch.

Seckendorff and Azevedo (5) in a technical report on Lebranche and Silver mullet fishing in northern São Paulo, highlights the importance of historians such as Staden and Léry, with published dates of 1974 and 1980, respectively, who highlight the importance of these species in feeding Tupi Indians throughout the São Paulo coast to Cabo Frio.

For the artisanal sector, mullet is a resource both for subsistence and income, while for the industrial sector (mid- or large-sized vessels), mullet represents, mainly after the 2000s, a potential alternative resource for sardines, which are highly valued by the consumer market, in a substitution of traditional resources that have shown strong declines, both in capture and yield (5).

On the northern coast of São Paulo, the controlled ships include industrial fishers with gillnets and some mullet fishermen. Regarding artisanal fishing, there are still deficiencies in the control and documentation systems, which implies that information is not available on the true dimension of this practice. In this region, beach cast nets are no longer used due to both the low availability of schools and the difficulty of organizing the large human contingent necessary for fishing, a result of changes in the social organization of communities. According to Giulietti and Assumpção (33), increasing tourism and housing expansion have threatened fishing activities in the same way as overfishing fish stocks. Diegues (19) states that real estate speculation has disrupted the foundation of the social organization of coastal communities along the São Paulo coast, and many coastal indigenous people never held documentation for the lands on which they lived, lands where they practiced itinerant extraction and artisanal fishing (e.g., with canoes and nets) and consequently, the knowledge about these activities, which has been passed down over generations, was lost.

The largest volumes of mullet are captured from March to May from the coast of Rio Grande do Sul to Pará. Gasalla et al. (34) call attention to the improvement of industrial fishing vessels, valuing sophisticated equipment for locating schools, such as echo sounders, sonar and GPS (*global positioning systems*), etc., which restrict the opportunity for captures by artisanal fishers.

Diegues (19) reports that small groups of fishermen from communities of the São Paulo and Rio de Janeiro coasts have faced reduced volumes of mullet in cold months which was considered to be the target harvest period for this species. Two decades ago, large schools of mullet were captured on some beaches which required the participation of neighboring communities and the use of connected nets to retain the fish. From reports by Diegues (19) in the 2000s schools were rarely visible, even less frequently and small fishermen take their canoes to the sea to capture them.

Gasalla et al. (34) state that from 1995 to 1999 mullet was the fourth most captured fish species by vessels in the ports of Santos and Guarujá, only surpassed by true sardines, mackerel *Scomber japonicus* (Houttuyn, 1782) and pompano *Chloroscombruschrysurus* (Linnaeus, 1766).

Santos (31) reports that the migration of mullet in the South and Southeast begins in March in Rio Grande do Sul state and ends at the end of June, or July in some years. The first schools appear in March in the state of Santa Catarina, in April in Paraná and northern states, in May in Maranhão, and in April and May in São Paulo and Rio de Janeiro. According to Seckendorff and Azevedo (5), because captures are concentrated during the reproductive

migration, in winter, reduced stocks could occur when fishing is unplanned and/or controlled, which threatens the fishing activity in the mid- to long-term.

According to studies by Lowe-McConnell (35), some species of mullet begin migration in the Patos Lagoon, Rio Grande do Sul, in April/May, arriving at the coast of Santa Catarina in May/June, and spawn between the end of fall and beginning of winter, which includes the months of May and June, especially in areas where the temperature varies from 19°C to 21°C. The largest volumes captured occur at the end of fall and beginning of winter when the fish are “spawned” and the market value hits the highest marks. It is during this period that mullet are the most important artisanal fishery in the Southeast.

In the Patos Lagoon, Rio Grande do Sul, fishing production is highly variable from one year to the next and is extremely dependent on environmental conditions. In the fall, adults leave the estuary, an important development area, and begin their reproductive migration along the coast, toward the north, stimulated by large drops in temperature caused by cold fronts in the region. It is during this migration that most of the fishing occurs. Along the coast of São Paulo, larger quantities are found between May and August (6,7).

Generally from March to May (before the arrival of the cold fronts) the predominant gear used in mullet capture is beach cast nets, principally in Ilha Comprida/SP, and fixed enclosures and estuary gillnets predominate from May to October, e.g., in Cananéia/SP. The principal fishing ventures in Iguape/SP occur from May to September, mainly with beach cast nets and estuary and coastal gillnets. The peak collection occurs in September in Iguape/SP and Ilha Comprida/SP and results from the large captures from beach cast nets. Therefore, estuarine fishing peaks between the months of June and July, while coastal fishing peaks in the months of March to September (10).

Along the coast of São Paulo, mullet fishing is significantly more intense from March to May, due to the abundance of catch. The attractiveness of the species, results from its palatability, cost-benefit, and congregations of people celebrating the harvest period, which results in the traditional “mullet festivals”.

Mullet eggs are also eaten and are called “caviar substitute” by Verissimo (36); according the authors, this product has a sensorial quality better than Russian caviar, equally sophisticated and appreciated by a public with demanding taste. Dias Neto and Dornelles (37) defines industrial coastal fishing as that performed by vessels that are more autonomous than artisanal ones and are able to reach areas further from the coast, with diesel-powered propulsion, wood or steel hulls, and electronic equipment for navigation and detection of schools. These vessels dominate the capture of the principal resources in volume or value for the national production. Mullet capture by the industrial fleet is basically performed by mullet fishermen, mainly in Santos region and the northern coast of São Paulo, and by artisanal methods of beach cast nets, corkings, and fixed enclosures, mainly on the southern coast, which still maintains a strong indigenous influence.

Regarding mullet fishing in Santa Catarina, one of the historical reports of 1918 noted the Canasvieiras beach, in the northern part of the state, little more than two kilometers in length, which was considered in 2010 to be one of the principal beaches destinations of southern Brazil.

On the coast of the state of Santa Catarina, where fishing is part of the history of the state, due in part to the influence of the colonizers and in part to the favorable geographic conditions regarding nutrient-rich maritime currents, mullet fishing has extensive participation.

Mussolini (1) comments that mullet capture is the only one that draws a large number of people during the period of maximum capture (i.e., winter), attracting men that do not practice professional or amateur activities as fishermen during the remainder of the year. Many years of the XX century have had an abundance of the species, uniting men to pull the nets because there were not enough fishermen for the quantity of the fish. Moments of abundance and

festivity moved the entire local coastal community to join forces to produce a successful catch. A historical document, dated in the 1950s, notes the presence of the governor of Santa Catarina, Jorge Lacerda, participating in the *comradeship* to fish for mullet on the Pântano do Sul beach. Mullet fishing by beach cast nets is known as “comradeship” because it attracts locals, tourists, and other fishermen to participate to pull the net full of fish. The collaborating participants are called “comrades”.

In the 2000s, with the reduced catch of the sardine (*Sardinella brasiliensis*, Steindachner, 1879), the industrial fleet of mullet fishermen from southern and southeastern Brazil began to capture species that were previously considered accessory species, which became some of the principal resources, especially for artisanal fishing along the southern coast of São Paulo, mainly during the winter months. Currently, most mullet fishing occurs during the species' reproductive period from the coast of Rio Grande do Sul to the coast of São Paulo, which could have decreased the abundance of this species and jeopardized future fisheries (5).

This brief report is intended to emphasize the importance of the participants involved in fishing mullet and involved in advertising actions to the maintenance of a rational and sustainable fishery that guarantees not only the preservation of the species but also the live art of mullet fishing, the commemorative festivals, and the fishing culture.

Summarizing the findings of this study, mullet fishing (*Mugil liza*, Valenciennes, 1836) in Brazil 1) is based on strong Portuguese and indigenous influences; 2) is based on the tradition of a cooperative effort of art, technique, and subjective abilities; 3) has maintained over the centuries the “mullet festival” along coastal regions of southern and southeastern Brazil; and 4) depends on initiatives by official organizations and organized civil society to use sustainable exploitation, guaranteeing the preservation of the species and the marine ecosystem.

FINAL CONSIDERATIONS

Regardless of who captures the mullet, whether it is the artisanal fisherman or the industrial fleet, this activity always occurs near the coast, often in regions of lagoons and estuaries, regions that are susceptible to anthropic actions, which in many cases lead to negative impacts. Under this premise, society's view of environmental questions inherent to the preservation of coastal ecosystems is fundamental to maintaining the species and preserving the practices cited throughout this study because the capture of this species is influenced by a series of social, economic, and environmental factors. Parallel to environmental preservation is the maintenance of ecosystems and the preservation of immaterial patrimony figures as a social demand with the same level of importance. This patrimony, which is the fiber for a complex network of knowledge and centennial traditions dating to the Amerindians, has resisted various ethnic and cultural influences and the advent and modernization of innumerable fishing techniques.

Mullet stocks have decreased, according to reports of catch per unit effort. The size of the individuals captured follows the decrease in catch, as does the realization of this activity by traditional methods.

Because the capture volume of this stock is concentrated in a specific part of the year, we can affirm that the activity of catching this species plays a fundamental role in providing food and creating work for traditional populations in a specific part of the year, which composes an annual calendar that has been followed across generations. This calendar overlaps mullet fishing with agricultural activities and the capture of other species; thus, mullet fishing is extremely important for the continuation and connection of all the annual activities.

The cultural and ethnic factors are extremely extensive in the theme treated here. This fishing activity is intertwined with the history and customs of coastal communities of southern and southeastern Brazil. Additionally, mullet fishing carries a cultural richness that shows the relationships between human beings, the ocean, art, and survival.

REFERENCES

1. Mussolini G. Ensaios de antropologia indígena e caiçara. Rio de Janeiro: Paz e Terra; 1980.
2. Conceição ML. A pesca e a festa da tainha na formação da açorianidade. Rev Santa Catarina Hist. 2012;5:69-75.
3. Pinheiro L, da Cunha Lana P, Andriguetto Filho JM, Hanazaki N. Pesca de pequena escala e a gestão patrimonial: o caso da pesca da tainha no litoral paranaense. Desenvolv Meio Ambient. 2010;21:143-55.
4. De Pina JV, Chaves PDT. A pesca de tainha e parati na Baía de Guaratuba, Paraná, Brasil. Acta Biol Par. 2005;34:103-13.
5. Seckendorff RW, Azevedo VG. Abordagem histórica da pesca da tainha *Mugil platanus* e do parati *Mugil curema* (Perciformes: Mugilidae) no litoral norte do Estado de São Paulo. Ser Relat Tec. 2007;28:1-8.
6. Menezes NA, Figueiredo JL. Manual de peixes marinhos do sudeste do Brasil: Teleostei (4). São Paulo: Museu de Zoologia da Universidade de São Paulo; 1985.
7. Miranda LV, Mendonça JT, Cergole MC. Diagnóstico do estoque e orientações para o ordenamento da pesca de *Mugil platanus* (Günther, 1880). In: Rossiwongtschowski CLB, Ávila-da-Silva AO, Cergole MC. Análise das principais pescarias comerciais da região sudeste-sul do Brasil: dinâmica populacional das espécies em exploração–II. São Paulo: Instituto Oceanográfico – USP; 2006. (Série Documentos REVIZEE–Score Sul).
8. Menezes NA. Guia prático para conhecimento e identificação das tainhas e paratis (Pisces, Mugilidae) do litoral brasileiro. Rev Bras Zool. 1983;2:1-12.
9. Menezes NA, Oliveira C, Nirchio M. An old taxonomic dilemma: the identity of the western south Atlantic lebranche mullet (Teleostei: Perciformes: Mugilidae). Zootaxa. 2010;2519:59-68.
10. Miranda LV, Carneiro MH. A pesca da tainha *Mugil platanus* (Perciformes: Mugilidae) desembarcada no Estado de São Paulo subsídio ao ordenamento. Ser Relat Tec. 2010;30:1-13.
11. Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis. I Relatório da reunião técnica para o ordenamento da pesca da tainha (*Mugil platanus*, *M. liza*) na região sudeste/sul do Brasil. Itajaí: IBAMA; 2007.
12. Fischer W. FAO species identification sheets for fishery purposes. Western Central Atlantic. Rome: FAO; 1978. (Fishing area 31).

13. Cervigón F, Cipriani R, Fischer W, Garibaldi L, Hendrickx M, Lemus AJ, et al. Guía de campo de las especies comerciales marinas y de aguas salobres de la costa septentrional de Sur América [Internet]. Roma: FAO; 1992 [cited 2016 Feb 04]. Available from: <http://www.fao.org/docrep/010/t0544s/t0544s00.HTM>.
14. Harrison IJ. Mulletts. In: Ke C. The living marine resources of the western central Atlantic. Rome: FAO; 2002. v.2, p.1071-81.
15. Bizerril CRSF, Costa PAS. Peixes marinhos do estado do Rio de Janeiro. Rio de Janeiro: FEMAR; 2001.
16. Vieira JP, Scalabrin C. Migração reprodutiva da “tainha”(*Mugil platanus* Gunther, 1980) no sul do Brasil. *Atlantica*. 1991;13:131-41.
17. Godinho HM, Serralheiro PCDS, Scorvo Filho JD. Revisão e discussão de trabalhos sobre as espécies do gênero *Mugil* (Teleostei, Perciformes, mugilidae) da costa brasileira (Lat. 3°S – 33°S). *Bol Inst Pesca* [Internet]. 1988 [cited 2016 Feb 4];15:67-80. Available from: ftp://ftp.sp.gov.br/ftppeca/15_1_67-80.pdf.
18. Radasewsky A. Considerações sobre a captura de peixes por um cerco-fixo em Cananéia, São Paulo, Brasil. *Bol Inst Oceanogr*. 1976;25:1-28.
19. Diegues ACSA. Pescadores, camponeses e trabalhadores do mar. São Paulo: Editora Ática; 1983.
20. Mourão F. Pescadores do litoral sul do Estado de São Paulo [Internet]. São Paulo: FFLCHUSP; 1971 [cited 2016 Feb 4]. Available from: <http://nupaub.fflch.usp.br/sites/nupaub.fflch.usp.br/files/color/anexomourao.pdf>.
21. Ramos EB, Jaques G, Verrone VMA. Áreas da região lagunar Cananéia-Iguape suscetíveis de exploração pesqueira segundo diversos tipos de tecnologia. I-Pesca com cerco fixo. *Bol Inst Oceanogr*. 1980;29:329-35.
22. Ferreira CN. Caracterização da pesca e abundância relativa da tainha (*Mugil platanus*) (Günther, 1880) no Estuário da Lagoa dos Patos. Rio Grande: Fundação Universidade Federal do Rio Grande; 2007.
23. Andrade HA. Estrutura do setor industrial pesqueiro no estado de Santa Catarina. *Notas Tec FACIMAR*. 2010;2:17-27.
24. Minayo MCDS. Pesquisa social: teoria, método e criatividade. Rio de Janeiro: Vozes; 2004.
25. Marconi MA, Lakatos EM. Fundamentos de metodologia científica. In: Marconi MDA, Lakatos EM. Fundamentos de metodologia científica. 7a ed. São Paulo: Atlas; 2010.
26. Mendonça JT, Katsuragawa M. Caracterização da pesca artesanal no complexo estuarino-lagunar de Cananéia-Iguape, Estado de São Paulo, Brasil (1995-1996). *Acta Sci Biol Sci*. 2001;23:535-47.

27. Mendonça JT, Pires AD, Calasans GC, Xavier SC, Hoff EA, de Sena RJ. Produção pesqueira marinha do litoral sul do estado de São Paulo no período de 1995 a 2002. Ser Relat Tec. 2004;18:1-75.
28. Rossi-Wongtschowski CLB, Avila-Da-Silva AO, Cergole MC. Análise das principais pescarias comerciais da região sudeste-sul do Brasil: dinâmica populacional das espécies em exploração–II [Internet]. São Paulo: Instituto Oceanográfico – USP; 2006 [cited 2016 Feb 3]. v.2. Available from: <http://www.fishbase.org/references/FBRefSummary.php?ID=83857&database=FB>.
29. Alves PMF, Arfelli CA, Tomás ARG. Caracterização da pesca de emalhe do litoral do Estado de São Paulo, Brasil. Bol Inst Pesca. 2009;35:17-27.
30. Mussolini G. O cerco da tainha na Ilha de São Sebastião. Rev Sociol. 1954;7:135-47.
31. Santos E. Zoologia brasílica: nossos peixes marinhos. Belo Horizonte: Itatiaia; 1982.
32. Ramalho CWN. "Ah, esse povo do mar!": um estudo sobre trabalho e pertencimento na pesca artesanal pernambucana. São Paulo: Polis; 2006.
33. Giulietti N, Assumpção R. Indústria pesqueira no Brasil. Agric São Paulo [Internet]. 1995 [cited 2016 Feb 4];42:95-127. Available from: <ftp://ftp.sp.gov.br/ftpica/asp6-0295.pdf>.
34. Gasalla MA, Servo GJM, Tomás ARG. Dinâmica da frota de traineiras da região de Santos. In: Cergole MC, Rossi-Wongtschowski CLB. Análise das principais pescarias comerciais da região Sudeste-Sul do Brasil: dinâmica populacional das espécies em exploração. São Paulo: Evoluir; 2005. p.227-49.
35. Lowe-McConnell RH. Estudos ecológicos de comunidades de peixes tropicais. São Paulo: Edusp; 1999. (Coleção base).
36. Veríssimo J. Pesca na Amazonia. Belém: Universidade Federal do Pará; 1970.
37. Dias Neto J, Dornelles LDC. Diagnóstico da pesca marítima do Brasil. Brasília: IBAMA; 1996. (Série estudos da pesca).

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