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Artisanal fisherfolk's Local Ecological Knowledge on catfish and fishing legislations: a necessary dialog

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Abstract: The presence of catfish of the Ariidae family in the list of endangered species of Rio Grande do Sul (RS), as from 2014, led to forbidding fishing two species of this family. Thus, artisanal fisherfolk lost a significant part of their income, causing conflicts between them and the fishing authorities in RS. This work aims mainly to understand the Local Ecological Knowledge (LEK) of the artisanal fisherfolk of the North Coast of RS regarding the ecology and taxonomy of catfish of the Ariidae family, seeking to relate it to the establishment of the fishing regulations in force in the State. 33 semi-structured interviews were made with artisanal fisherfolk. The interviewees perceive differences among the region ethnospecies; hardly ever are they consulted during the fishing regulations establishment process. Considering the aforementioned aspects, the artisanal fisherfolk LEK on catfish can be an important tool in the participatory management of catfish fishing.

Keywords: Ethnoichthyology; Ariidae; *Genidens*; Catfish; North Coast/RS.

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Introduction

The designation "catfish" refers to a set of marine and brackish water fish (MALABARBA, 2013), some of which are used in human nutrition and thus constitute an important fishing resource. In the State do Rio Grande do Sul, four catfish species of the *Genidens* genus have been recorded: *G. Genidens* (CUVIER, 1829), *G. machadoi* (MIRANDA-RIBEIRO, 1918), *G. planifrons* (HIGUCHI; REIS; ARAÚJO, 1982) and *G. barbus* (LACÉPÈDE, 1803), the latter being the main target species of artisanal fishing in estuarine regions in the State (e.g. REIS et al., 1986a, MACHADO et al., 2012).

In 2014, *G. barbus and G. planifrons* were included in the Red List of Endangered Species of Rio Grande do Sul, organized under the coordination of Fundação Zoobotânica of Rio Grande do Sul (Zoobotanical Foundation - FZB-RS) and State Secretariat for the Environment (SEMA-RS), founded on the criteria and procedures developed by the International Unit for the Conservation of Nature (IUCN). Still in 2014,MMA Decree number 445 was published in the Federal Official Gazette; in its Art. 1, it recognized how "endangered species of fish and aquatic invertebrates of the Brazilian fauna, those present in the National Official List of Endangered Fauna Species" (BRASIL, 2014), which led to the prohibition of fishing the *G. barbus* and *G. planifrons* species.

The species of *Genidens* genus present in RS are morphologically similar and difficult to distinguish, being hard to safely being diagnosed by ichthyologists (MARCENIUK, 2005), artisanal fisherfolk and environmental agencies, which has caused a number of conflicts as regards the management and use of fishing resources. Due to this difficulty in identifying the species, after the enforcement of Decree n° 445, artisanal fisherfolk were prevented from fishing any of the four species of catfish present on the coast of RS, which affected their major means of subsistence, triggering conflicts between fisherfolk and fishing authorities in the State.

Artisanal fisherfolk notoriously have empirical knowledge that has been referenced in the literature as local ecological knowledge, defined as the set of cognitive and cultural practices, practical skills and know-how, orally transmitted in the day-to-day experiences and by the relationship among the members of the communities, on the use of fishing resources and on the environment they live in (BERKES, 1999; DIEGUES, 1999; 2004; ARRUDA; DIEGUES, 2001; SILVANO; BEGOSSI, 2012; SILVANO et al., 2014).

This knowledge has a close relationship with experience (BENJAMIN, 1994), showing to be fundamental to the social reproduction of these individuals and their groups. It is rich in detail, being based on a series of observations of the environment and of the species fished; over time, they allow understanding the way of life and the characteristics of fishing species (BEGOSSI; HANAZAKI; RAMOS, 2004; NUNES; HARTZ; SILVANO, 2011; SILVANO; BEGOSSI, 2012; PERUCCHI; SILVANO et al., 2014; PERUCCHI; COELHO-DE-SOUZA, 2015; LIMA et al., 2016).

The notion of Local Ecological Knowledge (LEK), related to natural resources, has fostered significant advances towards understanding the functioning of the terrestrial and marine ecosystems (BERKES et al., 1998, TOLEDO; BARRERA-BASSOLS, 2010). Thus, the artisanal fisherfolk's contributions are extremely relevant to a better under-

standing of some aspects of fish biology, such as: occurrence and abundance of species in certain areas, reproductive aspects, migration periods and feeding aspects (e.g. BEGOSSI; GARAVELLO, 1990; MARQUES, 1991; SILVANO et al., 2006; SILVANO; BEGOSSI, 2012; RAMIRES et al., 2015), and may also help to propose social-environmental management strategies.

Participatory management in artisanal fishing occurs when the management of resources is shared among the government, fisherfolk and other actors related to the process, a strategy that can be considered a solution to the mounting issues of over-exploration of fishing resources (SEN; NIELSEN, 1996; PERUCCHI; KUBO; COELHO-DE-SOUZA, 2012). In the artisanal fishing participatory management, there is the participation of the fisherfolk in the elaboration of management rules (HALLAWASS; SILVANO, 2016), a case in which artisanal fisherfolk account for the discussions and decision-making on the use of arts and fishing areas, species captured, conflicts (SILVA, 2014), as they act in planning, implementation and monitoring of management plans of fishing resources (PAZ; BEGOSSI, 1996; HALLAWASS; SILVANO, 2016).

As regards the management process, problems such as the inexistence of statistic series of temporal data, together with misconceived management, result in great difficulty in elaborating adequate strategies that regulate the artisanal or industrial fishing activity. In this context, the set of information available about the local fishing dynamic, which should include the LEK of fisherfolk (JOHANNES, 1998; LIMA et al., 2016), could be converted into a powerful source of data to be inserted into management actions that, by including the fishing communities, tend to foster dialog and cooperation between fisherfolk and authorities (SILVANO; BEGOSSI, 2012).

Conversely, fishing management methods that fail to take into consideration the local communities and keep administration strategies founded on command and control, on criteria and objectives restricted to a specific rationality (for example, the scientific one), hinder or even prevent the management of fishing activities, generating problems and local conflicts regarding fishing management (MORENO, 2015). Castello (2008) states that, in practice, a differentiated approach is necessary for managing artisanal fishing, which must be developed with attention to the social and ecological reality of the artisanal fisherfolk and which is implemented in an adaptative way.

Therefore, the present study aims to assess the LEK of the artisanal fisherfolk of the North Coast of RS regarding the ecology and taxonomy of the catfish of the Ariidae family, seeking to relate it to the establishment of fishing regulations in force in the State. We thus seek to promote reflections on the contribution of the artisanal fisherfolk's LEK in the construction and improvement of laws that currently regulate the fishing resources in the State.

Materials and methods

Study site

The Rio Tramandaí Basin (BHRT), located on the North Coast of the State of RS, has a 2,700 km^2 area, bordered by the source of the Rivers Maquiné and Três Forquilhas up to the north of the Itapeva Lagoon and south of the Cerquinha Lagoon (RIO GRANDE DO SUL, 2004). The region holds a high biodiversity when its small extension is considered, with approximately 100 freshwater fish species (MALABARBA et al., 2013) and at least 55 estuarine species (ROBLES, 2017).

The lagoon estuarine system of Imbé-Tramandaí (29°59'S; 50°08'W), formed by the Tramandaí and Armazém lagoons, communicates with the Atlantic Ocean by a narrow channel of about 1.5 km in length. In this basin, artisanal fishing is a marked activity for the local communities (COTRIM; COSTA; DIETZ, 2005), catfish fishing (*Genidens* spp.) being the most expressive in the area (MACHADO et al., 2012; MACHADO et al., 2010).

Data collection

The present research was conducted in the fishing communities of the lagoon estuarine region of Imbé-Tramandaí for being the major catfish fishing area in the region (MACHADO et al., 2010; MACHADO et al., 2012). The field activities were conducted in 2015 and 2016 and started by observing the meetings of the Forum of Artisanal Fishing on the North Coast of RS, when the organization of the fishing community emerged, fostering the possibility of interacting with the government authorities, allowing discussions about co-managing the fishing environments (SEIXAS; KALIKOSKI, 2009). It is worth remarking that, in all the meetings and workshops attended, catfish was the theme in the agenda, which evidences the concern of the fisherfolk and the importance of catfish fishing for their communities.

For the data collection, we conducted semi-structured interviews (VIERTLER, 2002), containing questions on the fisherfolk perceptions as regards the abundance of the main commercial species of the North Coast, also observing the knowledge of the interviewees regarding the differentiation of the catfish ethnospecies and about the current fishing regulations. As ethnospecies, we here understand they are species of fish recognized by the fisherfolk, which may not correspond to the Linnaean taxonomic identification of the scientific species (NETO; PACHECO, 2005).

The interviews also involved conducting a free listing of the fish species fished in the region (BORGATTI, 1996b). It is worth pointing out that, in all the interviews, the fisherfolk were communicated about the purpose of the research and invited to sign the Free Informed Consent – FIC. The project was submitted to the Ethics Committee of the Universidade Federal do Rio Grande do Sul, and registered in Plataforma Brasil, under process n° 62996116.0.0000.5347.

For the taxonomic identification of the catfish ethnospecies, we used a visual stimulation technique with color photographs (MEDEIROS et al., 2010), randomly organized, of the species *G. Genidens* (leitão), *G. planifrons* (juru-bebê) and *G. barbus* (cabeçudo), which were shown to the participants at the time of the interview. Moreover, the relationships between the local and scientific knowledge were established after articulations between the local ecological knowledge (emic) with those obtained from the academic literature (ethical), observing the complementarities and contrasts (FELEPPA, 1986).

Data analyses

The data were analyzed according to frequency, ordination and salience by software Visual Anthropac-Freelists 4.0, aiming to verify the degree of importance of the species listed and, mainly, to verify the importance of catfish to those fisherfolk (BORGATTI, 1996a). Note that frequency refers to the number of mentions of each ethnospecies; ordination is equal to the order of citation in relation to the set of species mentioned by each interviewee; and salience is an index that analyzes the frequency and ordination parameters, so that high salience values reflect high frequency and ordination values (BORGATTI, 1996a).

Results and Discussion

Social-economic profile

In total, 31 male and 2 female artisanal fisherfolk were interviewed in Imbé (16), Tramandaí (14) and Capão da Canoa (3) municipalities. The artisanal fisherfolk age range varied from 22 to 79 years of age, the average being equivalent to 53 years. The time of experience in artisanal fishing varied between 10 and 60 years, with an average of 36.4, demonstrating a long time in exerting the activity. Furthermore, the data reveal the low number of young people involved in the fishing activity, as they have been exerting other activities.

Fishing is the sole economic activity for 67% of the interviewees, whereas for 11% of them, fishing is not the only source of income. The remaining 22% are retired. Of the interviewees, 73% fish in lagoons, 15% divide their fishing between lagoons and the sea and 12% fish exclusively in the sea, a result that corroborates Sousa and Abdallah's (2003) findings; they state that artisanal fishing in the RS largely occurs in inland and estuarine waters due to the difficulties faced by the small artisanal vessels in the open sea.

The main device used for catfish fishing is the gillnet of the "feiticeira" type (triple-layered gillnets), with the inner mesh varying from 90 to 160 millimeters, also observed by Machado et al., (2012). Note that the mesh size used by the fisherfolk interviewed abides by the criteria established for the activity in the Rio Tramandaí Basin, in MMA Normative Instruction (IN) n° 17 (BRASIL, 2004).

Local Ecological Knowledge (LEK) of the artisanal fisherfolk of the North Coast of RS

During the free listing, the ethnospecies most frequently mentioned by the fisherfolk was the catfish (*Genidens* spp.), followed by the mullet (*Mugil* spp.) and sole (Bothidae family), as presented in Table 1, a result corroborating with what was found in ethnobiological studies (BARBIERI et al., 2012) and from monitoring fishing in the estuarine-lagoon region of Tramandaí and Imbé (VOOREN; KLIPPLE, 2005; MACHADO et al., 2010; MACHADO et al., 2012).

Table 1 – Ethnospecies pointed out by over 20% of the interviewees in the free listing, with their respective frequency values (%), ordination and salience.

Ethnospecies	Frequency (%)	Ordination	Salience
Catfish	100	2.94	0.738
Mullet	97	2.28	0.813
Sole	84.8	5.18	0.373
Corvina	48.5	3.25	0.328
Silverside	42.4	5.14	0.222
Trahira	33.3	4.27	0.216
Shrimp	33.3	6.82	0.13
Sardine	33.3	5.09	0.169
Crab	30.3	5	0.175
Sea bass	30.3	6.2	0.097
Cará	30.3	5.4	0.16
Jundiá	27.3	5.4	0.16
Papa-terra	21.2	5	0.13

Source: Table elaborated by the authors, 2017.

As observed in Table 1, catfish and mullet have high values of frequency and salience, indicating that both ethnospecies are important to the fisherfolk interviewed. Sole presented high frequency of citation, yet contrasting with ordination and salience, when compared with the values of catfish and of mullet. In the interviews, sole is pointed out as a rare species in the lagoon and may have been recalled due to the high market value of its fillet, as observed in Table 2, which justifies a high frequency of citation in the free listing.

Table 2 – Variation in the sale prices of the fish ethnospecies mentioned by the interviewees (R$/ kg).

Ethnospecies	As caught	Cleaned	Fillet
Catfish	4-6	16-20	18-20
Mullet	5-6	7-15	12-20
Sole	5-6	6-12	20-30
Corvina	3-4	7-10	7-10

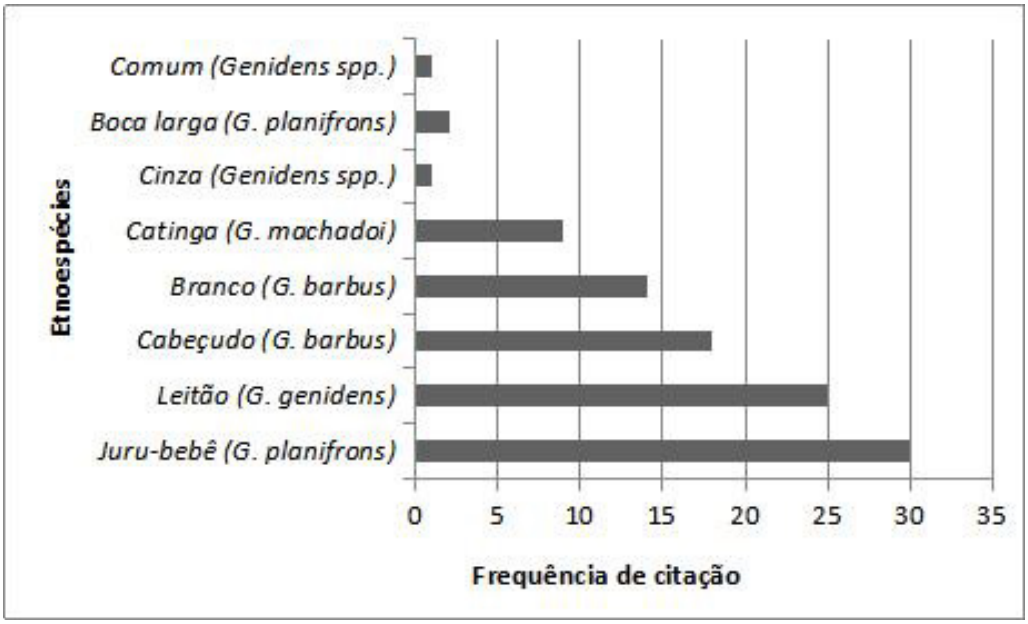
Source: Table elaborated by the authors, 2017.

The way of processing and the sale price of fish varied considerably, as presented in Table 2. The results indicate that catfish has an expressive value when the different processing ways are considered, although the sole fillet presents the highest sale price, in comparison to all the species and sale formats. In this case, the value of the clean fish is observed, as it requires far less processing as compared to the fillet preparation, with high yield, since the head and the bones are accounted. The fisherfolk highlighted that catfish fishing is a profitable activity and that they rapidly achieve significant quantities.

According to the fisherfolk, the catfish ethnospecies of the North Coast are: juru- bebê, boca larga, leitão, cabeçudo, branco and catinga. It is worth observing that G. *machadoi* was identified and registered only after 2007 in the Tramandaí Lagoon (MACHADO et al., 2012). This fact is associated to the great similarity of the species with G. *barbus* (MARCENIUK, 2005) and shows lack of studies directed to ichthyology and fishing biology in the RTB region.

The juru-bebê (*G. planifrons*) ethnospecies was the most mentioned by the fisherfolk, when asked about the number of catfish species they knew, showing that this is the ethnospecies interviewees remembered the most (Figure 1). During the interviews, it was made evident that there is more than one common name for some catfish ethnospecies, as is the case of catfish juru-bebê also known as boca larga/ boca grande (wide mouth/large mouth). We thus observed that there are at least two common names for G. *planiforns* (Figure 1). In Rio Grande, G. *planifrons* is also known as bagre-de-natal and bagre-boca-larga, G. *barbus*, as bagre and G. *Genidens* as bagre-guri (VILLAMIL, 1985). This diversity of common names, or synonymity (MOURÃO, 2000), was also observed by Seixas; Begossi (2001); Clauzet; Ramires; Begossi (2007). These works show how the so-called common names can vary between regions and even in a single region, as occurs with the catfish ethnospecies on the North Coast of RS.

Figure 1 - Frequency of citation of the ethnospecies mentioned by the fisherfolk interviewed.



Source: Graph elaborated by the authors, 2017.

Sixty-four percent of the interviewees stated that the lagoon inlet is the place with the highest probability of catching catfish, which justifies the allocation of initial boundaries at that place, a compulsory passage for catfish in the reproductive season (BARBIERI et al., 2012).

The cabeçudo catfish (G. *barbus*) was the ethnospecies most observed in the fishing sites by the fisherfolk (75%), as is also verified by Machado et al. (2012), Barbieri et al. (2012) and Machado et al., (2016). We next found the leitão catfish (17%) and juru-bebê (8%). As regards the latter datum mentioned, it is essential to remark that the Red List of Endangered Species of RS shows the G. *planifrons* (juru-bebê) species as Critically Endangered (CR) (FZB-RS, 2014). Out of the 33 interviewees, nine did not want or did not know how to provide information about the catfish frequency; two reported that the juru- bebê is returning to the lagoon and that, in case it is caught, they usually return it to the water.

When asked about the differences of each ethnospecies, some characteristics were more frequent than others, as for example, "small size and yellow flesh", mentioned by 26.3% of the fisherfolk and "different roof of the mouth" (10.5%), these being pointed out as important features for distinguishing the leitão catfish from the others. The "wide mouth" (27.5%) and "thin mouth" (11.8%) characteristics were the most used for the juru-bebê ethnospecies, whereas "greater size" (22.2%) and "weighing at least 40kg" (11.1%) were the most mentioned for the cabeçudo catfish.

Box 1 presents the characteristics used by artisanal fisherfolk for describing the ethnospecies and the scientific literature description, emphasizing the richness of detail used by the fisherfolk when recognizing the ethnospecies. In the box, we seek to draw a parallel between scientific knowledge, widely disseminated, and the local ecological knowledge, little disseminated in official means, without the intention of seeking a validation, but rather emphasizing complementarities and contrasts. Yet it is important to say that the fisherfolk have the habit of comparing the characteristics of the catfish ethnospecies they know at the moment of description.

Box 1 - Characteristics used by the artisanal fisherfolk and by scientists for identifying the ethnospecies/ species of fish.

Ethnoespecies (scientific name)	Description - fisherfolk	Description - scientific
Leitão (*G. genidens*)	Dark, small, at most 1 kg, different roof of the mouth, yellow flesh, small mouth, rounded head.	Dark gray back (FISCHER; PEREIRA; VIEIRA, 2011), 35 cm (FISCHER; PEREIRA; VIEIRA, 2011), accessory, non-fixed tooth plate on the palate region, connected to very salient fleshy projections (MARCENIUK, 2005).
Cabeçudo (*G. barbus*)	Bigger (up to 40 kg), gray, robust carapace, mouth with a horseshow on the roof of the mouth, big head, flat head, fat flesh.	Large-sized species (max. 1.20 cm/30 kg) (FISCHER; PEREIRA; VIEIRA, 2011), grey or dark blue back (FISCHER; PEREIRA; VIEIRA, 2011), robust body, rounded snout (FISCHER; PEREIRA; VIEIRA, 2011), tooth plate in the palate region forming a horseshoe-like set (MARCENIUK, 2005).
Juru-bebê (*G. planifrons*)	Triangular/flat head, wide mouth, thin mouth, lean flesh, white flesh, long head.	Large head and dorso-ventrally flattened. (FISCHER; PEREIRA; VIEIRA, 2011) and large and inferior mouth (FISCHER; PEREIRA; VIEIRA, 2011).

Source: Box elaborated by the authors, 2017

The data present in Box 1 indicate that some characteristics reported in the differentiation of catfish, are shared by both groups of actors. However, some data mentioned

by the interviewees were not found in scientific papers, as for example:

> "*Leitão has a small rounded head and yellow flesh*". P.22
>
> "*Cabeçudo has a long head, bigger than the other catfish*". P.17
>
> "*Juru-bebê has a wider mouth and the lip gets suddenly thinner*". P.2

In this sense, research efforts directed towards understanding local ecological knowledge in relation to academic knowledge would be important to narrow the gap between fisherfolk and academia.

Note that, still regarding species identification, out of the 33 fisherfolk, 27 participated in the interviews with photographs, of which 22.2% recognized all the catfish ethnospecies presented in the check list, 37% recognized two, 18.5% only one ethnospecies and 22.2% did not recognize any of the ethnospecies.

Some artisanal fisherfolk state not to know which ethnospecies are currently prohibited from being fished. In fact, the common names of the species present in the Red List of Endangered Species of RS are not widely disseminated and they are not often the same as those used by the artisanal fisherfolk of the RS North Coast. Only one fisherman identified juru-bebê (*G. planifrons*) as being a species forbidden to be fished. In another isolated case, the fisherman mentioned the ethnospecies followed by the corresponding scientific name, a fact probably attributable to his interactions with researchers:

"*Leitão/petiço/menino* is *G. Genidens*, *juru-bebê/boca grande/boca larga* is *G. planifrons*, *cabeçudo* is *G. barbus* and *catinga* is *G. machadoi*". P.8

Only two artisanal fisherfolk ignore the existing types of catfish. The other interviewees state to have learned to differentiate the types of catfish influenced by older fisherfolk; others say this happened overtime, through the experience acquired in the fishing activity:

> "*With the prohibition, I started to observe the differences in catfish more often*". P.21
>
> "*Before, we used to fish with our parents, learning from the elder ones*". P.30

In their speeches, most of the artisanal fisherfolk, recognize that differentiating the ethnospecies is a type of knowledge hared among grandparents, parents, children and grandchildren, besides being often shared between fishermen and fisherwomen, also resulting from observation and daily care with the catfish. Therefore, this knowledge may have been passed on from fisherfolk generation to generation (PAZ; BEGOSSI, 1996; MATOS, 2001; RAMALHO, 2007; TOLEDO; BARRERA-BASSOLS, 2010; NUNES; HARTZ; SILVANO, 2011).

The fact that most interviewees (85.1%) count on the help of spouses, children, brothers and sisters may be an important factor for maintaining this knowledge and the activity in the context studied. Ingold (2010), however, counterposes the supposition that culture is the legacy a population receives from their antecessors innately and concludes that knowledge transmission occurs when the descendants reach and (also) excel the knowledge of their antecessors, which occurs by educating their attention. In the case studied, the artisanal fisherfolk state they have learned to deal with their environment through reiterated practical involvement, observing and copying the behaviors around them.

Cavalli-Sforza et al., (1982) state that there is a knowledge transmission process that occurs among relatives (and may be horizontal or vertical), as state 46.6% of the fisherfolk interviewed, or among non-relatives of different generations (oblique), as recognize 20% of the fisherfolk. In the interviews, 33.3% of the fisherfolk state they have learned by themselves overtime and, consequently, with the experience acquired.

The fisherfolk differentiate gravid females from the rest by observing the abdominal region - "belly" – of the female, which is also reported by Mourão and Nordi (2003). However, in the research, some of the fisherfolk interviewed report that the male is the one that takes care of the eggs/fingerlings, sheltering them in its mouth along the incubation period, which is pointed out as a female attribution in the work by Mourão and Nordi (2003). Hence, the fisherfolk interviewed state:

"*Sometimes, before the closed season, it is possible to catch male catfish with eggs in their mouths; I sometimes close the catfish mouth and return it to the lagoon*". P.18

This type of parental care by oral incubation by male catfish of the *Genidens* genus is acknowledged in the scientific literature, the incubation period lasting about three months (REIS, 1986; ARAÚJO, 1988; GARCIA et al., 2006; HOSTIM-SILVA et al., 2009).

Regulations and the artisanal fisherfolk of the North Coast of RS

Some fisherfolk stated that Patram (Environmental Patrol - Military Brigade), the fishing inspection authority in the State, imposes regulatory sanctions for the species *G. Genidens and G. machadoi*, as if they were not liberated for fishing, although they are not in the List of Endangered Species of RS. Moreover, according to local information, inspectors cannot recognize the catfish species and cannot thus differentiate them, a situation that raises a number of conflicts. Perucchi et al., (2012) report a similar situation, showing that this is an old complaint on the part of the artisanal fisherfolk. Note that the current penalty for each specimen of fish captured, when present in the Red List of Endangered Species, has a penalty of R$ 5 thousand Brazilian reais (IBAMA, meeting at the State Legislature).

When asked about their participation in establishing fishing regulations, 87.8% of the fisherfolk affirmed never to have been consulted for this process, as reported as follows:

> "*As far as I know, a study on other countries (USA) was made by the FZB and Chico Mendes Foundation, researches with old data... we need a national study of each region (national researches). My idea is that we*

> *need monitoring fishing with the fisherfolk in the region, a fishery ordination plan for this region, knowing what there is and how much there is*". P.2

> "*IN17 was established by interactions with the fisherfolk all over the Rio Tramandaí Basin, listening to the fishing protagonists. Many say few fisherfolk participated, but this is not true. Of course it has to be revised, but in the other decrees, we were not consulted, not even regarding the prohibition on catfish*". P.5

> "*The regulations* are *shown by the president of the community, we have no participation or even have access to the elaboration of regulations. Everything happens without consulting the fisherfolk*". P.15

MMA Normative Instruction (IN) n° 17, of October 17 2004, which establishes technical criteria and use standards for the fishing activity in the Rio Tramandaí Basin, in the State of Rio Grande do Sul (BRASIL, 2004), was pointed out by the fisherfolk and by EMATER-RS officers as an example of measure built based on the fishing community interest. However, the interviewees report that, along their institutionalization process, IN 17 underwent alterations, so that its final version does not correspond to what was agreed at the moment of the consultation.

As regards the current fishing regulations (prohibitions), the fisherfolk state that:

> "*We, fisherfolk, catch at most 500 kg; the industries capture tons. Inspection should be different for large vessels. The law is strict on us, but the big ones keep fishing. IBAMA does not inspect the big ones, the very inspectors say it is easier to inspect us.*" P.11

> "*Unfair. It is not this that will keep the species. What will keep the fish* is *the net mesh control and the quota system for fishing; the inspection is not directed to the environment. We need regular patrols, with people that know the thing; we have to environmentally educate people. There are things inspection has to change; it is done by know-nothings*". P.9

In this sense, it is necessary to pursue more effective measures than prohibitions, since these show to be quite unsatisfactory in cases in which inspection is not adequate. Sousa and Abdallah (2003) propose that alternatives to prohibiting fishing are investigated, a context in which they stress the importance of public policies, provided they consider the participation of artisanal fisherfolk. Azevedo (2012) states that the management of fishing resources in Brazil is still very deficient, especially as regards monitoring and data collection on the artisanal fishing production. It is the State responsibility to establish public policies counting on the participation of all those involved, ensuring the protection of the marine and coastal biodiversity, making fundamental for this the support to research and scientific development.

When asked about the function of the closed season (*piracema*), the fisherfolk

showed to be aware of the importance of prohibiting fishing:

> "*Piracema* is the fish *spawning* season". P.2

> "*It exists for preserving the species. I agree with the closed season, provided there are studies with the fishers (theoretical and practical studies); for example, fish reproduction is altered by human beings, water temperature and pH, rainfall, we need more studies*". P.5

However, when asked if they would fish during the catfish spawning season, in case it were not forbidden, ten interviewees stated they would, justifying as follows:

> "*Yes, to support my family*". P.7

> "*Formerly, there was no closed season, but there was control. The fisherfolk community organized some rules, fish were only captured when there was the possibility of selling them (net fishing seasonal era). The control of the volume fished was made by the very fisherfolk and the community inspected the size of the fish caught, small fish were not allowed*". P.27

The excerpts exposed above demonstrate the interdependence between the fisherfolk and the resources they use and point out a conflict as to the local knowledge on the species, their ecology and on law abidance, evidencing the complexity of this theme in the municipality in question.

As regards the establishment of regulations, twelve fisherfolk affirmed not to know how this process is conducted, which may be associated to a possible fear of talking about the subject. Only four fishermen stated they had participated in regulation establishment processes, by means of some kind of previous consultation, as is the case of establishing IN 17, previously mentioned, which is to be revised, according to the interviewees. Some fisherfolk highlighted the importance of surveys made by consulting the community. It is worth pointing out that, in 2012, the request for revising the regulations, especially that of IN 17, was already made by the region fisherfolk (PERUCCHI et al., 2012).

Still currently, the few public policies directed to artisanal fishing fail to include all artisanal fisherfolk and are not enough to strengthen fishing or artisanal fishing communities as a whole (VASCONCELLOS; DIEGUES; SALES, 2007). Moreno (2015) highlights that the public policies have an elitist character; moreover, they are mostly directed to the fishing product and not to the fisherfolk. Vasconcellos, Diegues and Sales (2007) point out that the assessment of fishing resources in Brazil, when ever performed, is directed to the species of economic importance to industrial fishing, as is the case of sardine, red snapper, lobster, shrimp and tuna. For those authors and Moreno (2015), this lack of political attention has as major consequences the scarcity of investments on research and monitoring of artisanal fishing, causing the inexistence of recent data on fishing, especially the artisanal one.

Artisanal fishing is complex for using different types of art and for capturing the most

different species. Hence, the fishing stocks used by this fishing modality need specific methods for assessing data, which would require using different sources of information, be they quantitative, qualitative or LEK (VASCONCELLOS; DIEGUES; SALES, 2007; MORENO, 2015; DIEGUES et al., 1999).

Another important fact related to the lack of information on this activity is associated with the lack of priorities for the fishing sector by the State and Federal governments. This is demonstrated by the constant alterations, establishment and elimination of secretariats and ministries, which prevents the country from doing its duty of protecting artisanal fishing, its communities and fishing traditions.

Conclusions

Artisanal fisherfolk are dependent on the marine and freshwater resources to keep food and nutritional safety, and health, but mainly for subsistence. However, a number of these resources are endangered due to overfishing, degradation, loss of natural habitats, pollution and climate change.

The results of this research indicate that the artisanal fisherfolk interviewed present vast LEK of catfish, considering aspects of its biology and ecology. We highlight that this knowledge also includes characteristics of the ethnotaxonomy of the species of catfish present in the Rio Tramandaí Basin, as well as on equipment, techniques and fishing sites. The information provided in this study presents potential to be incorporated in the participatory management strategy of catfish fishing, which can be fundamental in cases of fishery organization proposals on the North Coast of RS, thus allowing to establish public policies dialogically built with artisanal fisherfolk and fishing authorities in the State.

The data surveyed demonstrate the fisherfolk's interest in participating in processes to establish regulations for the fishing activity, besides demonstrating that there is recognition of the importance of this participation so that development is increasingly more sustainable in the fishing activity on the North Coast of RS. This thus evidences the need of promoting a greater involvement of the fisherfolk in the process of elaborating fishing regulations, once this class constitutes the target public of the legislations.

Also indispensable would be the establishment of fishing technical assistance, involving both states and municipalities, valuing fisherfolk and their families, aiming at social inclusion and at quality of life. Additionally, we call attention to the need of developing researches that fill the scarcity of data on the artisanal fishing activity in the country, as well as on fishery and biological data on catfish.

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Revista AMBIENTE & SOCIEDADE

SciELO

Conhecimento Ecológico Local de pescadores artesanais sobre bagres e legislações pesqueiras: um diálogo necessário

Sammer Maravilha Chagas Gilio-Dias
Rodrigo Machado
Tatiana Mota Miranda
Rumi Regina Kubo

São Paulo. Vol. 23, 2020
Artigo Original

Resumo: A presença de bagres da família Ariidae na lista de espécies ameaçadas do Rio Grande do Sul (RS), a partir de 2014, levou à proibição da pesca de duas espécies desta família, assim, os(as) pescadores(as) artesanais ficaram sem uma parte significativa da sua renda, gerando conflitos entre estes e os gestores da pesca no RS. O objetivo principal deste trabalho é compreender o Conhecimento Ecológico Local (CEL) dos(das) pescadores(as) artesanais do Litoral Norte do RS sobre a ecologia e taxonomia dos bagres da família Ariidae, buscando relacioná-lo à criação das leis pesqueiras vigentes no Estado. Foram realizadas 33 entrevistas semi-estruturadas com pescadores(as) artesanais. Os entrevistados reconhecem diferenças entre as etnoespécies da região; e raramente são consultados durante o processo de criação das leis pesqueiras. Considerando os aspectos mencionados percebe-se que o CEL dos pescadores(as) artesanais sobre os bagres pode ser uma importante ferramenta na gestão participativa da pesca do bagre.

Palavras-chave: Etnoictiologia; Ariidae; *Genidens*; Bagre; Litoral Norte/RS.

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SciELO

Conocimiento ecológico local de los pescadores artesanales sobre el bagre y la legislación pesquera: un diálogo necesario

Sammer Maravilha Chagas Gilio-Dias
Rodrigo Machado
Tatiana Mota Miranda
Rumi Regina Kubo

São Paulo. Vol. 23, 2020

Artículo original

Resumen: La presencia de bagres de la familia Ariidae en la lista de especies amenazadas en Rio Grande do Sul (RS/Brasil), a partir de 2014, llevó a la prohibición de la pesca de dos especies de esta familia, teniendo como consecuencia la pérdida de una parte significativa de los ingresos por parte de los pescadores artesanales, y generando conflictos entre ellos y los gestores de la pesca en RS. El objetivo principal de este trabajo es comprender el Conocimiento Ecológico Local (CEL) de los pescadores artesanales de la Costa Norte de RS acerca de la ecología y taxonomía del bagre de la familia Ariidae, buscando relacionarlo con la creación de las leyes de pesca vigentes en el Estado. Se realizaron 33 entrevistas semiestructuradas con pescadores artesanales. Los entrevistados reconocen las diferencias entre las etnoespecies de la región; y raramente se les consultan durante el proceso de creación de leyes de pesca. Considerando los aspectos mencionados, es claro que el CEL de pescadores artesanales de bagre puede ser una herramienta importante en el manejo participativo de la pesca del bagre.

***Palabras-clave*:** Etnoictiología; Ariidae; *Genidens*; Bagre; Costa Norte / RS.

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