

# **CHARACTERIZATION OF ARTISANAL FISHING IN FISH-WEIRS, THE NORTH COAST OF PARAIBA, BRAZIL**

Caracterização da pesca artesanal em “Currais” no litoral norte da Paraíba, Brasil.

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## **ABSTRACT**

*Traditional fishing strategies are used by fishing communities around the world, such as fish-weirs, which are fixed traps built along a coastal zone. This study aims to characterize and describe how fish-weirs are managed by fishermen from the coastal state of Paraíba in the Northeast Brazil. Unplanned interviews, “rapport”, “Snow ball”, and direct observation were carried out during monthly visits to five fish-weirs, from November 2012 to March 2013. We quantified fish-weirs production, and identified the most species caught. These traps are made up of compartments and go through steps both, on land and at sea, until they are completely activated. The total fish production was 303 kg. The predominant species were: Mugil curema and Mugil liza, Trichiurus lepturus, Caranx hippos, Selene vomer and Selene setapinnis, and Diapterus auratus and Diapterus rhombeus. We concluded that this type of fishing has been used for decades on the coast of Paraíba, and that the fishermen have their own management and techniques, used with this type of trap.*

**Keywords:** Ethnoichthyology. Fishing Production. Ichthyofauna. Traditional Population.

## **RESUMO**

*Estratégias tradicionais de pesca são utilizadas por comunidades de pescadores em todo o mundo, dentre elas os “currais”, que são armadilhas fixas construídas na zona costeira. O objetivo do presente estudo foi caracterizar e descrever as formas de manejo destes “currais” pelos pescadores do litoral da Paraíba. Foram utilizadas entrevistas livres, “rapport”, “Snow ball” e formulário semiestruturado nas visitas mensais aos cinco “currais” entre os meses de novembro 2012 até março de 2013. Foi quantificada a produção dos currais e identificada as espécies mais capturadas. Os dados mostraram que estas armadilhas são constituídas por compartimentos e passam por fases em terra e mar até serem totalmente ativadas. O total da produção de peixes foi de 303 kg. As espécies predominantes foram: Mugil curema and Mugil liza, Trichiurus lepturus, Caranx hippos, Selene vomer, Selene setapinnis, Diapterus auratus e Diapterus rhombeus. Conclui-se que este tipo de pesca é utilizado há décadas no litoral da Paraíba, demonstrando existir manejo e técnicas próprias com relações de trabalhos inerentes a este tipo de armadilha.*

**Palavras-chaves:** Etnoictiologia. População Tradicional. Ictiofauna. Produção Pesqueira.

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## INTRODUCTION

Over millions of years, the human diet was restricted to plants and land animals; due to climate changes, such as glaciations, populations migrated to coastal areas, limiting their eating habits as from the late Pleistocene (Marean *et al.*, 2007). This growing human interaction with the maritime space, over time, required acquisition of knowledge from communities that inhabited these regions and, through the acquired knowledge, their own cultural practices were developed, accumulated and perpetuated for several millennia (Diegues, 2004). One of these practices is artisanal fishing, which is not homogeneous, demonstrating that the differences and variations of these interactions arise from habitats, ecosystems, variety of fish, and the way of life of these fishermen (Vasconcelos, 2013).

Along the Brazilian coast, there is a wide variety of art and instruments used in the artisanal fishing (Diegues, 2004). During the colonial period, the indians were mainly responsible for leaving a large legacy in terms of fishing techniques, which were incorporated and modified by African slaves and Europeans (Silva, 2001). Similarly, Maneschy (1993) reports that the Indians greatly influenced the knowledge and traditional practices of techniques to capture fish, over time after the colonization by Europeans.

Among the diversity of traps developed by fishing communities, fish-weirs are located along the Brazilian coast, especially in the Northeastern region, and can be found in rivers, estuaries and seas. The use of this fishing technique was first recorded in Brazil in 1858, in the studies of Thomaz Pompeo de Souza Brazil, in Fortaleza, in the state of Ceará (Menezes, 1976). In the North of Brazil, the term for this fishing technique (fish-weirs) has two language variations: the “*cacuri*” (Furtado, 1981; Lima, 2010; Lima and Pacheco, 2012) and “*curral*” (Furtado, 1987; Maneschy, 1993; Tavares, 2005; Santana *et al.*, 2006). In the Northeast of Brazil, this technique is commonly known as “*curral*” (Paiva and Nomura, 1965; Fonteles-Filho and Espínola, 2001; Piorski *et al.* 2009; Mai *et al.*, 2010; Araújo, 2012), and in the Southeast of Brazil it is called “*cercosfixo*” (Radasewsky, 1976; Oliveira and Hanazaki, 2011; IBAMA, 2013).

In other countries, such as Canada, Australia, New Zealand and Iceland, this type of fishing has been listed under the archeological point of view, pointing out evidences of its genesis, cultural aspects, social identity, and even geographical conditions

that no longer contribute to the existence of these traps (O’Sullivan, 2004). Salisbury (1991) reports that the fish-weirs have been used as a fishing practice since the Middle Ages, in rivers and estuaries. This author also mentions that handling this type of trap depended on fishermen’s knowledge of fish movement and the local landscape.

Scarce (2009), describing the various types of fishing present in European history during the pre-industrial period, reports the presence of fish-weirs in the estuaries of Great Britain and Northern Ireland. This fishing strategy was also described and characterized by Jeffery (2013), in a historical comparative among some regions of the world: South Africa, Penghu, Yap, Palau, Pohnpei, and Australia; however, this strategy was no longer used as fishing techniques by the communities that depended on fishing to survive. In this description, the fish-weirs were built with stones or sticks, during the low tide, in places that they could be totally accessible and visible.

This study aimed to record the ethnography of fishing in fish-weirs, performed by traditional fishermen on the coast of Cabedelo in the state of Paraíba Northeast Brazil. This study was conducted based on the hypothesis that traditional forms of appropriation of space and fishing resources, developed by fish-weirs fishermen (fishermen who employ this kind of fishing), resulted in sustainable management techniques with a high degree of adaptability, enabling the continuity of resources and fishing technique over time.

## MATERIAL AND METHODS

The study area comprises of the municipality of Cabedelo, located on the north coast of Paraíba state (Figure 1), it has approximately 15 km of coast, at the geographic coordinates 6°57’37’’S, 34°49’07’’W, with a total land area of 31.915 km<sup>2</sup> (Miranda *et al.*, 2005). Its population is estimated at 57,944 inhabitants (IBGE, 2010), all of them in urban area since the municipality does not have rural area (Silva *et al.*, 2007).

The municipality of Cabedelo has dry and wet climate, with a dry season of three months and wet season with maximums in June, July, and August (Dutra, 2006). The average temperature ranges from 25°C to 28°C, with an average rainfall of 1,800 mm per year (NEVES and NEVES, 2010). Rainfall is well distributed throughout the year due to the proximity of the sea and the action of the Atlantic Equatorial air mass, the Polar Front, and the Southeast trade winds

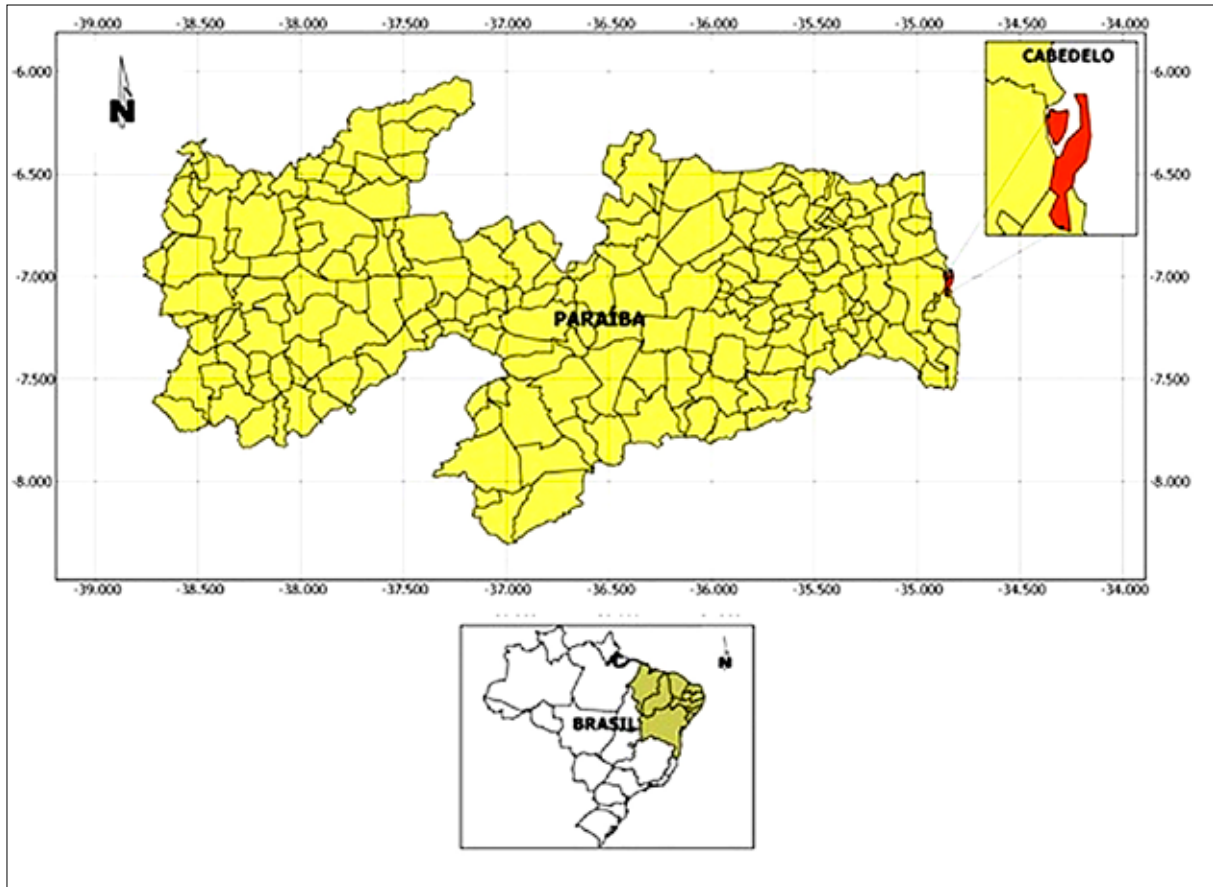


Figure 1 - Location map of the study area in Cabedelo, Paraíba state, Northeast Brazil.

(Guedes, 2002). In the eastern part there are rocky reefs made up of sandstone and conglomerates, forming semi-continuous linear features (Neves and Neves, 2010). The traps are along the rocky reefs in the waterfront of Cabedelo; these reefs are made up of sandstone with strong contribution from the zooxanthellae-coral association, and calcareous algae (Gondim *et al.*, 2011).

This study was conducted from September 2012 to March 2013, using the ethnographic method, which aims to study and analyze the daily activities performed by the members of a community or organization, seeking to discover how they carry out these activities making them visible, rational and reportable (Haguette, 1987). According to Angrosino (2009), the ethnography deals with people in the collective sense of the word; it does not deal with individuals. This author also says that studying culture involves an examination of behaviors, customs, and beliefs, learned and shared in groups. We conducted direct observation and unplanned interviews, and used semi-structured questionnaires, for characterizing the fish-weirs fishermen, and

photographic records were used for a better understanding of the steps and fishing techniques. This study was approved by the Committee of Ethics in Research with Human Beings (CEP) of the Health Science Center (CCS) of the Federal University of Paraíba (Northeast Brazil) registered in protocol 094/13. All participants of the study signed the Free and Transparent Consent.

Unplanned interviews and semi-structured questionnaires were applied to fish-weirs fishermen ( $n = 07$ ), some fish-weirs owners ( $n = 2$ ), and fishermen who use other fishing methods ( $n = 20$ ). The total sample was 29 informants ( $n$  total). To start the research we applied the “rapport” technique to the fishermen of the region, with the specific purpose of gaining the trust of the possible participants in a given community (Albuquerque *et al.*, 2010). Subsequently we adopted the “snowball” technique in which a first specialist from the community is recognized and starts to indicate another specialist and so on (Bailey, 1994).

To quantify the fish production in each of the fish-weirs, we used a portable scale and a measuring

tape of 100 m to measure the compartments of the "fish-weirs". The sampled fish were taken to the Ichthyology Laboratory of the Department of Systematics and Ecology of the Federal University of Paraíba, Campus I, the fish were fixed in 10% formalin and stored in 70% alcohol for later identification.

### Data Analysis

Data was analyzed by using the descriptive ethnographic analysis of the observations and interviews performed in the community studied (Angrosino, 2009). The quantitative analysis was performed by using a descriptive statistical method, per data categories obtained by the ethnoecology, arranged in percentages and in graphics (LAVILLE and DIONE, 1999; AGRESTI, 2012).

## RESULTS

From the unplanned interviews and semi-structured questionnaires, applied to the fish-weirs fishermen ( $n = 7$ ), all relevant information regarding the fishermen's technique and knowledge were collected. The age of fish-weirs fishermen ( $n = 7$ ) varied between 36–59 years old, and the experience time that they have carried out this type of fishing, ranged from 2–15 years. All interviewed fish-weirs fishermen live in the municipality of Cabedelo, and have different levels of education: 72% of them have incomplete primary level, 14% have incomplete secondary level, and 14% have complete secondary level.

Regarding the origin of learning about this fishing technique, the fishermen state that this "práxis" was acquired during the experience with their parents (30%), or with other more experienced fishermen from the region (70%). Many of them perform other parallel activities to fishing (57%), working as a waiter, security guard, and municipal guard. However, only 43% perform fish-weirs activity, since they have an employment bond with owners of these traps.

Each owner has one or more fish-weirs. This "property" belongs only to the people from a social class that has financial position to maintain these fish-weirs. The survey was conducted in five fish-weirs activated during the fishing season in 2012 and 2013; these fish-weirs belong to three owners, but only two of them participated in our study.

The fishermen were asked about the origin of the fish-weirs; 58% of them did not know how to answer, 14% reported that this fishing technique is of

indigenous origin, 14% said it is of Portuguese origin, and 14% stated that it originated from local fishermen. The owners of the fish-weirs ( $n = 2$ ), stated that this technique is of indigenous origin, with no further suggestions.

We also applied forms to fishermen who use other fishing methods ( $n = 20$ ), asking them for their opinion regarding the fish-weirs, in order to identify whether this kind of fishing is better than the other techniques and instruments used by them. These fishermen gave us several statements, and the most significant ones are transcribed below:

*"Fishing from fish-weirs is good because it catches fish easily, and it is fixed."*

(Fisherman E. 60 years old)

*"It's the best fishing because it did not bring "fiação" (small fish)."*

(Fisherman B. 34 years old)

*"It's good fishing; we only lift up the fish-weir and then, we only catch the fish."*

(Fisherman P. 61 years old)

*"It's good fishing because it is the trap that catches the fish, and the fisherman just goes there to get it."* (Fisherman N. 52 years old)

Some of the citations above demonstrate that fishermen who use other fishing methods believe that fish-weirs are easy to be used because it does not require much physical effort after the trap is activated. For them, the fish come into the trap by themselves and the fisherman does not have to make any effort to capture them. Furthermore, all fishermen ( $n = 20$ ), who use other fishing methods, state that the fishing using fish-weirs does not hinder their kind of fishing, because they know the location of each of the fish-weirs very well as these traps are fixed "on the rocks".

The fish-weirs we analyzed have two structural characteristics: "Coração" and "Furtado". The first one is considered the most common in the study area; it has an average of 19.20 m in length, where as the second one has 14 m in length (Figure 2). Each trap consists of parts/compartments: "espia" (where the fish comes into the trap through the watercourse), "sala" (the first and largest place where the fish get stuck), "chiqueiro grande" (place where the fish harvest usually starts), and "chiqueirinho" (smallest compartment where the fish cannot get out). (Figure 2).

The fishermen and fish-weirs owners name the local fish-weirs, both the "Coração" type and "Furtado" type: "mar de Guerra" ("Coração"),

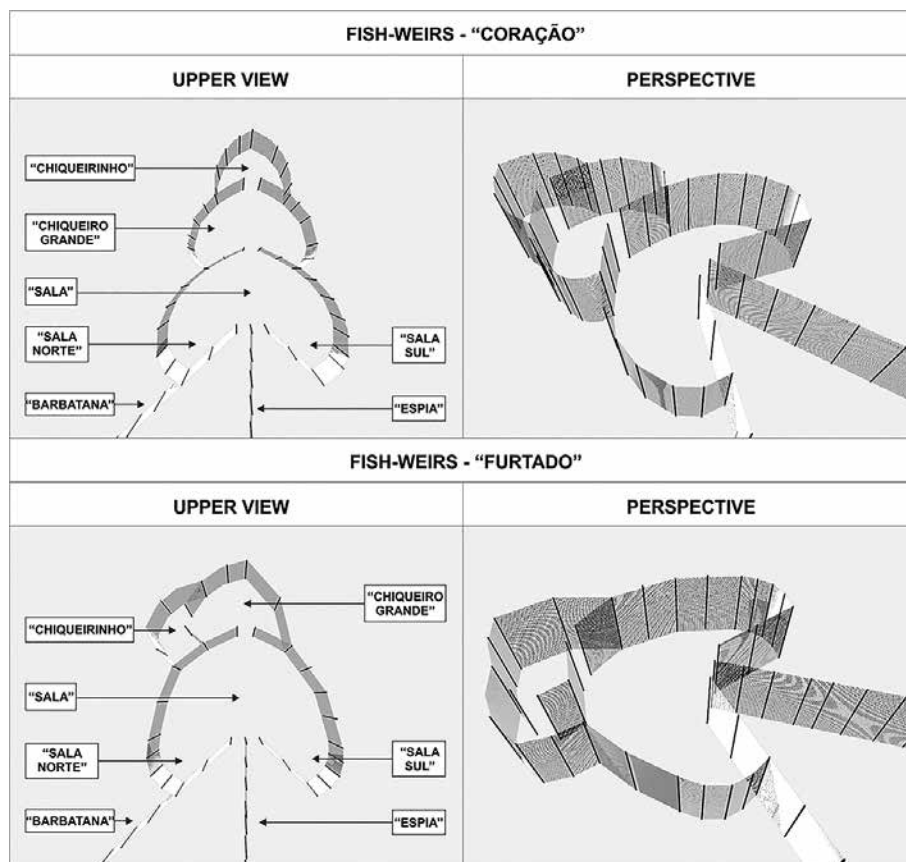


Figure 2 - Types of fish fish-weirs found in Cabedelo, Paraíba state, Northeast Brazil.  
Source: Illustration by Tainá Fagundes (2013).

"*estudante 1*" ("Coração"), "*leitão*" ("Coração"), "*cachimbo doce*" ("Coração"), "*estudante 2*" ("Coração"), "*arraia*" ("Furtado"), "*Alegrete*", "*boa esperança*", and "*Barretinha*" ("Furtado"). These fish-weirs go through five steps of preparation until they are activated: 1) Construction and maintenance of the "esteiras" (mats), 2) Cleaning of the fence posts, 3) Placement of the fence posts, 4) "Cintagem" (Lashing), and 5) "Mat" placement.

These steps, at sea and on land, are necessary before fish harvest. In Cabedelo, the terms used to describe these steps in fish-weirs are: activation and deactivation.

#### a) On land

Before trap construction at sea, artisanal and manual work is carried out during the months before the harvest of the year which is from April to the end of August. During this period the "esteiras" (mats) (large expanse of mesh for fishing with rods tied along its length) are made the repairs are carried out on the ones that were used the previous year and which are still usable (Figure 3).

The "esteiras" (mats) vary in length according to the location where the fish-weirs are going to be placed. For the making of the traps, "esteiras" (mats) with 12-15 rods are used. "esteiras" (mats) with 12 rods are 7.37 m in length, and "esteiras" (mats) with 15 rods are of 9.55 m in length (Figure 3). The height of the rods does not vary much, having on average of 3.59 m, as well as the distance between the rods being 0.67 m which does not vary much either. The diameter of each rods is about 4 cm.

The wood cited as used for construction of fish-weirs were: Chrysobalanaceae (31%), Lecythidaceae (19%), Peraceae (19%), Myrtaceae (19%), and Chrysobalanaceae (12%). According to the informants, these types of wood are resistant to marine erosion and have greater durability, holding the traps during the harvest period. In addition to these species being used in the make of the "esteiras" (mats), they are also used as fence posts and rods. Fence posts are wooden trunks with a diameter of approximately 15 cm and an average height of 4 m, used as support columns for fixing the "esteiras" (mats) during activation of the fish-weirs. The process of placing a fence post is completely manual,

only a pointed iron rod is used to pierce the reef substrate, needing two fishermen for this procedure. They pierce the substrate making movements backwards and forwards until the rod penetrates to a certain depth. Then, the iron rod is removed and the fence post is placed, buried around 0.5 m. During the period of deactivation, only the fence posts are visible at low tide.

### b) At sea

Activation consists of four steps: 1) Cleaning and preparing of the fence posts that were in the deactivated fish-weirs. 2) Placing of new fence posts which is completely manual to replace those that had been damaged; then the rods and "esteiras" (mats) are taken to the fish-weirs that will be activated. 3) "Cintagem" (lashing), which consists of

tying the rods between the fence posts forming horizontal rolos, the first one close to the top of the fence post, and the second one close to its base, with a distance of 1.30 m from each other. These rods are tied to each other with silk thread, forming a base and support for the "esteiras" (mats) which will then be placed. This step of activation is generally carried out at low tide, so the fishermen must work fast, taking advantage of this period. 4) The placement of the "esteiras" (mats), which is the last step, generally requires six men, and two "Caicos" (local boats)

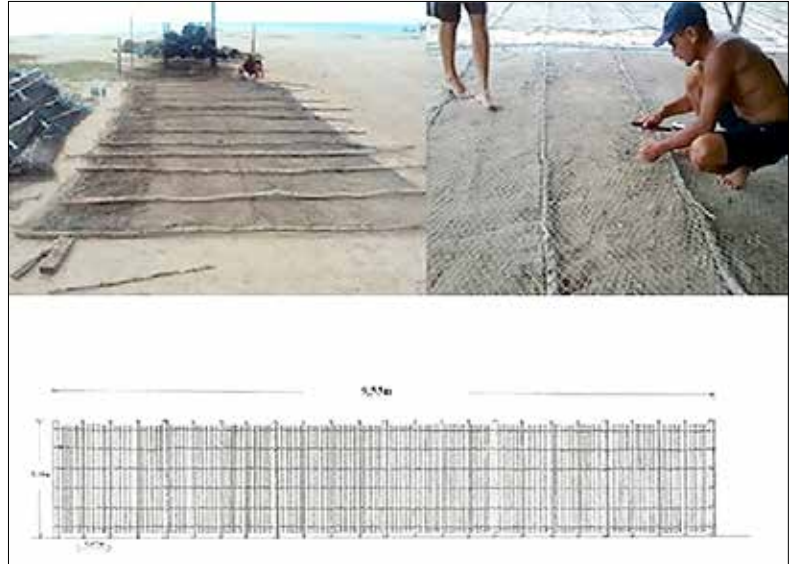


Figure 3 - Making "esteiras" (mats) on land in Cabedelo, Paraíba in the state of Northeast Brazil.  
Source: G.C.C.N. Char. of Art. Fish. in fish-weirs, the North. Coast. Pb, Br. Illustration of "mat" adapted from Furtado (1987, p.196).

which are used to transport the "esteiras" (mats). The ideal weather conditions for the fishermen performing this step are low turbidity in the water, little wind, and low tide, because these factors influence the speed at which the job will be done. (Figure 4).

### Fish Harvest

From September to March, the harvest is carried out in the activated fish-weirs every day, at least once a day. The fish stay alive inside the trap until the fishermen arrive. The harvest is carried out at low tide, using a type of net called "mangote" (Figure 5), which is 3-4 m, with 25x25 mm of mesh made of nylon. The "mangote" is dragged into the water, the fishermen call this process of "lance", and it is repeated as often as necessary, as long as there are fish in the fish-weirs compartment.

### Expense and maintenance of fish-weirs

The owners of these fish-weirs said that they maintain these traps, in spite of the high value of activation and maintenance, for leisure purposes, tradition, and hobby. One of them acquired the trap from his family, which has been passed down from generation



Figure 4 - Activation steps of the fish-weirs in Cabedelo, Paraíba state, Northeast Brazil. Photo by: G.C.C.N. Char. of Art. in fish-weirs, the North. Coast Pb, Br.

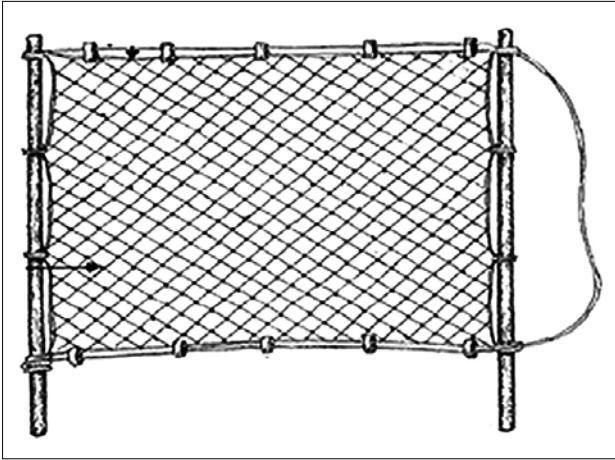


Figure 5 – “Mangote” used at harvest collecting fish from the fish-weirs in Cabedelo, Paraíba state, Northeast Brazil.  
Source: Furtado (1987, p.187).

to generation, and the other one bought the trap from another owner who had no financial resources to maintain it. According to the owners R\$ 20,000.00 was spent to activate, and R\$ 7,000.00 to maintain the fish-weirs. The prices of the material are: fence posts = R\$ 10.00 to R\$ 15.00 per unit, rods = R\$ 2.00 each, rods to “cintar” (lash) (fixing the rods in a horizontal position between) R\$ = 3.00 to R\$ 5.00 each.

The net (a roll with appropriate mesh for fishing) used in “esteiras” (mats) a large fishing net with rods attached along its entire length costs, according to the owners, about R\$ 2,200.00. They generally buy three nets, totaling R\$ 6,000.00. This

net which as previously stated has appropriate mesh for fishing measures approximately 50 m in length and 2 m wide. For this reason, fishermen do not have financial conditions to be owners of fish-weirs.

To get to the traps, fishermen go on boats called “caico”, this kind of boat is 6 m in length, and has a motor of 15 hp, called “motor de rabeta” (motor with a fixed rod with a propeller on the end). These vessels are small, needing only two fishermen for the harvest of fish in the fish-weirs.

### Production in fish-weirs:

We conducted 21 data collections of fish production in four of the five activated fish-weirs these were carried out during the “sizígia” tide (when the high tides are very high and the low tides are very low). The total harvest in 2012/2013 was 303 kg (Table I), classified by the fishermen as “bad”. The unchecked (fish-weirs) were the traps in which there were no collections related to our study.

In November 2012 we observed that there is virtually no data from the fish-weirs “estudante 2”, “cachimbo doce”, “leitão” and “arraia”. The fish-weirs “Barretinha” produced 76 kg, which was the largest production. This fact occurred because of a shoal of *Diapterus rhombeus* that got into the trap, in a single-day of collection. In December only the production of the fish-weirs “leitão” and “Barretinha” was considered due to the previously reported difficulties. In January 2013, “leitão” was the most

Table I - Total monthly production (kg) in the fish-weirs in Cabedelo, Paraíba state, Northeast Brazil: 2012/2013. (n): numbers collections. Source: research data, 2012-2013.

Fish-weirs										
Months	“leitão”	n	“cachimbo doce”	n	“estudante 2”	n	“arraia”	n	“Barretinha”	n
NOVEMBER	5 kg	1	unchecked	-	3,5 kg	2	3,5 kg	2	76 kg	1
DECEMBER	4 kg	1	unchecked	-	2 kg	1	unchecked	-	18 kg	2
JANUARY	90,7 kg	3	unchecked	-	unchecked	-	unchecked	-	unchecked	-
FEBRUARY	3 kg	1	unchecked	-	19 kg	2	10 kg	2	unchecked	-
MARCH	14 kg	2	unchecked	-	2 kg	1	7 kg	1	unchecked	-

prominent of the fish-weirs, reaching 90 kg of production in three harvests which were influenced by the frequency of *Trichiurus lepturus*. In February 2013, in the fish-weirs “estudante 2” and “arraia”, we again recorded the production, since in previous months the owners were on vacation, taking visitors to the fish-weirs, and this fact made the collection impossible because the vessel was full. The fish-weirs “Barretinha” and “cachimbo doce” remained without data because the fisherman gave up the research. The presence of other fish, such as *Mugil curema* and *Mugil liza*, *Caranx hippos* and *Selene vomer* and *Selene setapinnis*, was recorded during fish harvest in the fish-weirs, but it was sporadically or with low incidence.

The total fish production is intended for the owners of fish-weirs. Sometimes this production is shared with the fishermen, depending on the amount of fish that is captured. The sharing is always unequal because the fisherman does not survive directly on the sale of the production, but on the employment bond with the owner of the trap.

## DISCUSSION

In literature researched by us, we did not find the exact origin of this fishing technique. There is doubt about its origin, which may be Portuguese or indigenous. Maneschy (1993), describes in his study that the origin of the fish-weirs at various points along the coast of Brazil has indigenous elements, and he still makes ethnography of this kind of fishing in the state of Pará. Still regarding this doubt concerning the origin this trap, Ribeiro (2003) mentions that in the state of Ceará, information from the local press states that this type of fishing has existed since 1869 and was brought by Portuguese immigrants. On the other hand, this same author, referring to the state of Alagoas, mentions that the fish-weirs were created by the indians. In a final clarification, Ribeiro (2003) concluded that the origin of the fish-weirs is not indigenous, but that, the strategy used was learned by them, when he compared similar traps described in the seventeenth century, which consisted in the use of stone, wood or branches erected at the mouth of rivers to take advantage of the tide flow, and catch the fish that got stuck in these traps, at low tide.

Piorski *et al.* (2009) shows once again the information that in 1869, the Portuguese who settled in Acaraú and Camocim, in Ceará state, developed the fish-weirs due to the ideal natural conditions in that region. Silva (2001) describes that in 1694, the

first fish-weirs were built, by three Portuguese military soldiers, on the coast of Pernambuco state. Mura (2010) also describes this type of fishing in an anthropological survey about the occupation of the southern coast of Paraíba by Tabajaras Indians, who called this kind of fishing “gre”, which had the same management and structure as the current fish-weirs, and which favoured fishing in the rivers and seas for these indians. There is no accurate origin of these large traps; however, they can be found in some places along the coast of Brazil (Araújo, 2012).

In fact, what is universally accepted among authors is that fishing in fish-weirs is secular, very artisanal, and still holds some specific techniques. In the nineteenth and twentieth century over the years these techniques were improved and currently, silk threads, wire and plastic screens are used. Formerly these traps were made only with fence posts and rods, the “mats” are a more recent acquisition in these traps (Silva, 2001).

In Marudá in the state of Pará, the steps for constructing fish-weirs are known as: “tiração da madeira” (wood removal), “aparelhamento das talas” (preparation of splints), “tecelagem das esteiras” (weaving of mats), “marcação” (marking), “muruação” (fence post placement), “cintagem” (lashing), “cobrição” (covering) and “atilhamento” (filling) (Furtado, 1987). Also in Pará, in the municipality of São Caetano de Odivelas, Maneschy (1993) also examined the steps of fishing in fish-weirs, and there was no change regarding these terminologies used in the construction steps. In Maranhão the step of “marcação” (marking), (is described an out line is made on the beach, where the fish-weirs will be built according to the current), “estacamento” (fence posts fixing), and placement of “esteiras” (mats) (Piorski *et al.*, 2009). Araújo (2012) analyzed aspects of social order related to the construction steps of fish-weirs in Bitupitá, Ceará state, where the fishermen who will build the trap are named marker, ship-owner and lifter, and those who perform the harvest are called “encarregado” (handler), “vaqueiro” (cowboy) or “mata-vaqueiro” (cowboy killer).

Santana (2006) describes 13 wood species used in trap construction in the municipality São Caetano de Odivelas, in Pará state. Also in Pará, for constructing the fish-weirs, the fishermen do all the work from purchasing and cutting the wood that will be used, which is transported according to the tide flow. Landing should happen at low tide; otherwise it may become impossible to perform (Furtado, 1987). Knowledge from the *caixaras*



(people who live from fishing on the coast of São Paulo state) concerning the best plant species to build “*cerco-fixos*” in the region of the Parque Estadual Ilha do Cardoso, in São Paulo state, showed the richness of local species, contributing to management plans and conservation of this park (Oliveira and Hanazaki, 2011).

The term “harvest” differs from the act of fishing. According to Maldonado (1986), fishing is carried out in the presence of fisherman and his tools, interacting with fish in its habitat. Whereas the harvest is the removal of marine resources from fixed instruments such as creels, trawls, and fish-weirs. The method used to harvest fish-weirs in Cabedelo, is very similar to the method used in other regions of Brazil, where type of this fishing is carried out (Furtado, 1987; Manescky, 1993; Piorski *et al.* 2009; Salles, 2011). Fish-weirs, in spite of its appearance seems to be connected to the pisciculture; it is not a “net tank in the sea” where fish is placed to fatten. These traps offer no artificial attraction to capture fish, such as bait. Capture depends on the active movement of the fish into the interior of the trap, the main factors that enable this process are: trap location, and arrangement of its compartments in relation to tidal currents (Tavares *et al.*, 2005). According to Furtado (1987), “fish-weirs” should be always harvested or fish may die by struggling inside the compartment, in an attempt to escape from the trap.

Since the last century, the survey of fish production in fish-weirs in Brazil has been performed. The statistical control of these traps began to be studied from the 60s, in the state of Ceará (Paiva and Nomura, 1965). Other scientific studies about the production in “fish-weirs” have emerged over time, since the adoption of the statistics of fishing production in these traps in Brazil (Collyer and Aguiar, 1972; Fonteles-Filho and Espínola, 200; Tavares, 2005; Mai 2010). In addition to the production, biological aspects, and incidental captures of some marine species in the fish-weirs are also found in literature (Menezes, 1966; Menezes, 1976; Silva *et al.* 2010).

From annual statistical reports of sea and estuarine fishing, in northeast Brazil, we may see that fishing in fish-weirs performed in the state of Paraíba was only inserted in this statistical survey as from the year 2001. These reports did not clarify the method employed to obtain the data, but aimed to contribute to the definition of political/administrative measures to promote the sustainable exploitation of fishery resources (IBAMA, 1999).

According to this report in 2001 the fish production in fish-weirs in Paraíba, was 20.5 tons of fish, which corresponds to 1.0% of the total production in relation to other fishing tackle. In 2004, fish production was 4.4 tons, considered the lowest production rate, equivalent to 0.2% compared to other fishing tackle, in the same year. Production in fish-weirs indicates that this type of fishing is on the verge of extinction as it is one of the oldest and traditional way of fishing due to the competition of industrial fishing (Linsker, 2000).

## CONCLUSION

We evidenced the fish-weirs as fishing traps used for decades along the north coast of Paraíba state, using ethnography to identify its structure, activation, operation, maintenance, and fish harvest processes. In addition, we showed issues regarding the working relationship between the specialists and fish-weir owners, due to the fact that this type of trap does not belong to the artisanal fishing communities, access to information in the region about these fish-weirs is very difficult.

This fishing technique despite being secular and still handed down through generations, is influenced by the rapid urbanization of the municipality of Cabedelo. Moreover, it is a fishing art that requires a high financial investment; so the fish-weirs do not belong to the local fishermen, which leads to some social conflicts of ethics and trust.

This social gap shows no dissatisfaction among fishermen who often do not have any alternative, although most of the people from the municipality work on board, that is, they are regularly working on fishing boats or merchant ships, during a few months of the year along the coast of Brazil.

The regions where the fish-weirs are installed are directly affected by human action, when observed that this fishing technique has fishing intervals between harvests respecting to the size of the species of fish that are capture accidentally in addition to the type of structure composed of natural timber which favours the sea fauna and flora associated to this activity, enriching the local food chain, this technique may be classified as a sustainable fishing art.

Regarding the production, fishing in fish-weirs is not economically profitable for fish-weirs owners, since the fish sold in the community and to local market, does not earn enough money to cover the expenses of these traps. The owners stated that fish production is not the main motivation to

maintain the fish-weirs, they maintain them for tradition and leisure. Local fishermen do not see conflict with other existing fishing arrangements in Cabedelo as existed in the captaincy of Pernambuco in the seventeenth and eighteenth centuries.

Concerning its origin, there is a hybrid between the indigenous and Portuguese fishing techniques, due the fact there were changes, innovations and adaptations in the traps, promoted by the Portuguese, who colonized Brazil. These fish-weirs also revealed the culture and management methods developed by fishermen often marginalized by an individualistic and capitalist society, leading to the lose of their simplicity and “innocence”.

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