
**PRESSURES ON THE FISHING POTENTIAL OF SOUTH BENIN'S WATER BODIES:
POLLUTION AND UNSUSTAINABLE FISHERIES**

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ABSTRACT

In the Benin context where the fishing potential of marine and continental waters has reached its maximum exploitation level, the present work proposes to contribute to the establishment of a sustainable management through the diagnosis of the evils which undermine the fishing Benign. To achieve this, several techniques and tools for data collection and analysis were used. The documentary review and the analysis of a series of fishery data made it possible to know the current situation of the country's fish production. An inventory, characterized by an annual non-growing fishery production, stagnated around 40,000 tons from 1997 to today. At the same time, Benin's demand for fish has continued to increase, as evidenced by the total import of fish from 20,000 tonnes to 160,000 tonnes a year between 1995 and 2015.

Surveys carried out along the Beninese coast and on some continental water bodies in southern Benin (Sô and Ouémé) have revealed malfunctions in fishing and in its management by fishing administration. These dysfunctions have for name, the massive use of gear and practices of fishing-unsustainable and the absence of a follow-up of the application of the regulations of the fishing activities in the Republic of Benin

Keywords: Halieutic potential; fishing practices-unsustainable; fisheries

1. INTRODUCTION

The benefits that human populations derive directly or indirectly from the functions of the marine and coastal ecosystem are enormous. The most obvious of these services is, of course, the provision of dietary protein through fishery products (Adjé, 2014, FAO, 2011). Overall, in 2010, more than 2.6 billion people worldwide earn a living in the fishing industry and more than a billion people derive their animal protein from fish, demonstrating the great dependence of the global population on fishery products (Augier, 2018, Costanza et al., 2017, Moffitt & Cajas-Cano, 2014). In Africa, more than 200 million people provide their animal protein in fish and more than 100 million people fish as their main activity, thus contributing to the food security of

these peoples (FAO, 2016, Kolding, Zwieten, Marttin, & Poulain, 2017). In Benin, of the 10 million people (INSAE, 2013), more than 100,000 people depend on fishing (fishing and related activities) and about 70,000 people practice fishing (mainland and maritime) all year long (DPH, 2016) . With an estimated fish demand of over 120,000 tonnes a year, Benin's population is largely dependent on fish products (DPH, 2015). In spite of this strong dependence of Benin on fishing products, one wonders if in the current state of fishing practices on the water bodies of South Benin, the fishing potential of the country, can continue to meet this demand incessantly To help answer this problem, the present research is to make an inventory of fishing practices-unsustainable, still in use, on the South-Benin water plans. To achieve this objective, the present study assumes that fishing practices-unsustainable are still present on the water bodies of southern Benin and contribute significantly to the degradation of the ecosystem. the main cause of the decline in the country's fish production. Through discreet surveys along the Beninese coast and on some continental water bodies of southern Benin, the results of this expose gear and other fishing-unsustainable practices still used by Beninese fishermen.

2.METHOD AND EQUIPMENT

For a better knowledge of the current situation of the fishing in Benin, it was necessary to widen the field of investigation since the country evolves in a global environment. Thus, the consultation of the books, articles, scientific productions and other documents made on the fishing, took place in the libraries and the documentation centers of the universities and institutions in charge of the fishing in Benin. This review of the literature has synthesized knowledge of fisheries management in general, and the issues facing the sector.

As a first step, this review of the literature was coupled with the analysis of a series of fishery production data from the country, collected from the Department of Fisheries Production of the Ministry of Agriculture, Livestock and Livestock. fishing (DPH / APRM) in Benin. In a second step, secret surveys were carried out along the Beninese coast (fishing camps) and on two arms of Lake Nokoué, namely, Sô and Ouémé. These surveys, which have filmed and documented gear and practices currently in use in the country's marine and inland fisheries, have been secretive in order to avoid a possible violent reaction by fishermen to the use of fishing gear and gear. prohibited by the administration. The Sô River and the Ouémé River are two main tributaries of the largest lake in Benin, Lake Nokoué, the main provider of animal protein of aquatic origin. In addition to these criteria, these two bodies of water extend into the interior of the country.

The equipment used for the collection and processing of data consists of a boat to circulate on the water; a camera for shooting. Lestableurs

Word and Excel have enabled word processors and statistical data. The Zotero software was used for citations and bibliography generation of the document.

3.RESULTS

I- State of the fisheries in Benin

3.1. Inland fisheries

From 1995 to 2011, the continental fishery has a declining trend with production ranging from 35,000 to 30,000 tonnes a year. From 2011 to 2012, the shape of the curve is almost vertical, marking the sharp drop in catches that went from 30,000 to 20,000 tons per year. From 2012 to 2015, the pace remained constant with an annual production of 20,000 tons. At the same time, the fishing effort, represented by the number of fishermen, remained stable, at first, at 57,000 between 1995 and 2006, then a decline of more than 50% (57,000 to 30,000) from 2006 to 2007 before to see a slight increase between 2007 and 2015 (30,000 to 40,000).

Figure 1, above, shows the evolution of catches in inland fisheries from 1995 to 2015, the numbers of canoes and fishermen.

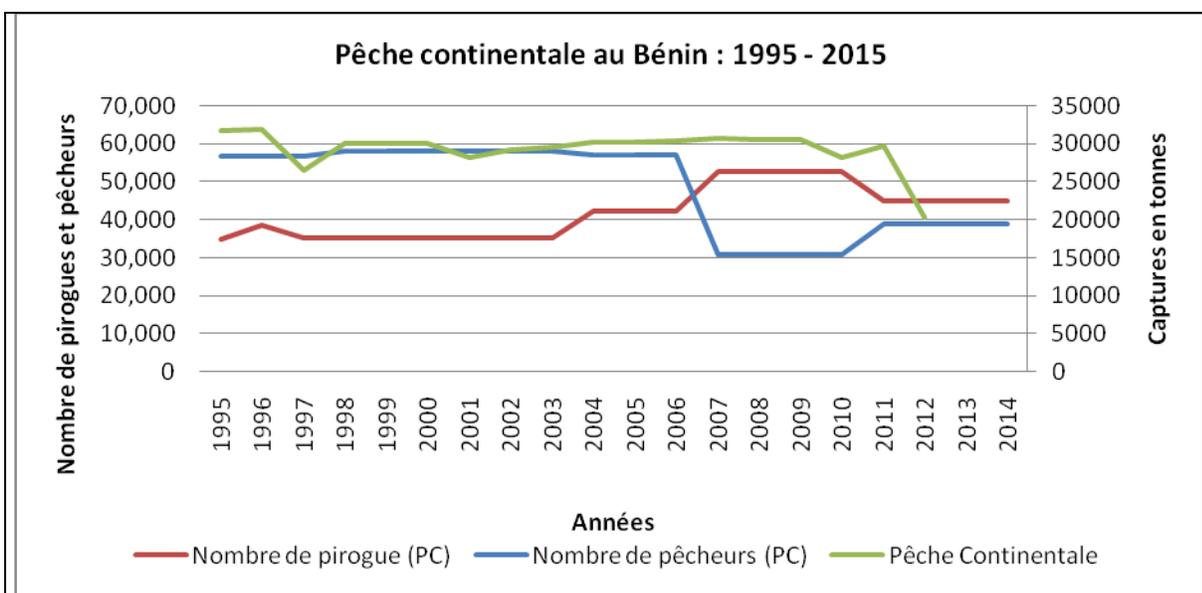


Figure n°1 : Capture pêche continentale au Bénin **Source** : données,(DPH, 2015)

The curve of the number of pirogues shows the evolution of the mainland fishing fleet from 1995 to 2015. It is marked by a general growing trend, from 35,000 boats in 1995 to 45,000 in 2015.

3.2. Marine fisheries

In the marine fishery, artisanal fishermen are distinguished with an increase in numbers between 1995 and 2015; from 3,500 to 4,500 and industrial fishermen called trawlers. The number of employees increased from 15 in 1996 to 24 in 2008 and to less than 10 in 2015. The number of jobs created by industrial sea fishing is around 200 people (DPH, 2015). From 2015 to 2012, the

landings of industrial sea fishing did not exceed 1,000 tons per year, while the artisanal marine fishery landed an annual average of 10,000 tons. From 2012 to 2015, catches in both fisheries increased by more than 200%, as evidenced by the appearance of the two curves (Figure 2).

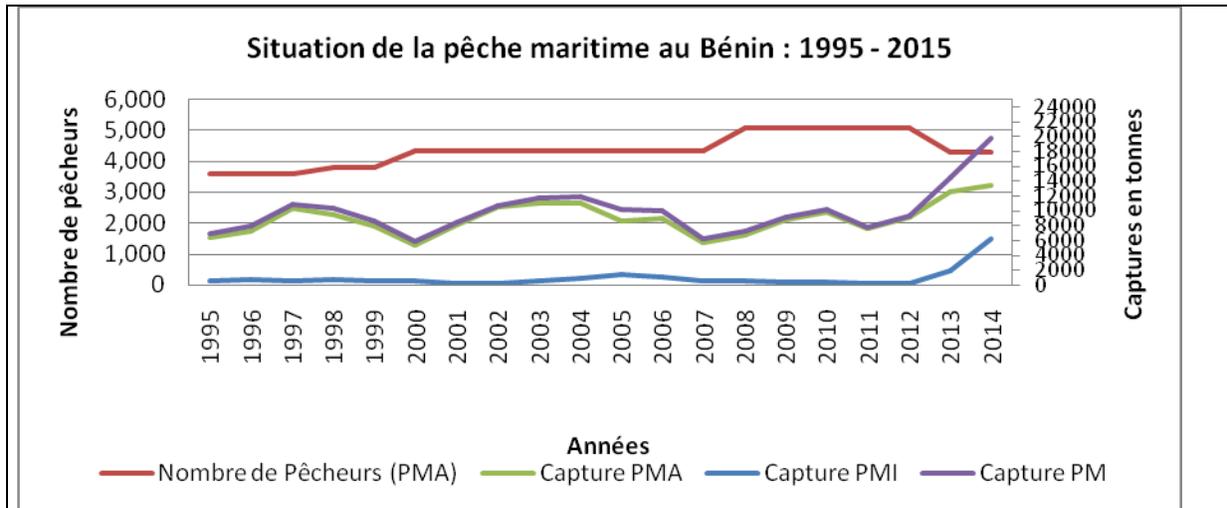


Figure 2 : Situation de la pêche maritime au Bénin Source : données (DPH, 2015)

The production of industrial sea fishing increased from 177.4 tons in 2012 to 8,502.8 tons in 2015 despite the decrease of the fleet to more than 50%. At the same time, small-scale maritime fishing produced more than 16,000 tonnes in 2015 compared with 9,363 tonnes in 2012 (Figure 2). The withdrawal of several trawlers is due to the low catches recorded by fishing vessels operating in Benin's marine waters.

The frozen fish import curve shows a steady increase from 1995 to 2015 (Figure 3). This fishery import chain in Benin started in the 1990s with the initial import of a small quantity of frozen fish. One-to-three, fish imports increased from 40,000 tonnes in 2004 to 160,000 tonnes in 2015. Figure 3 below shows the evolution of Beninese fisheries production in comparison with the evolution of imports. frozen fish in Benin.

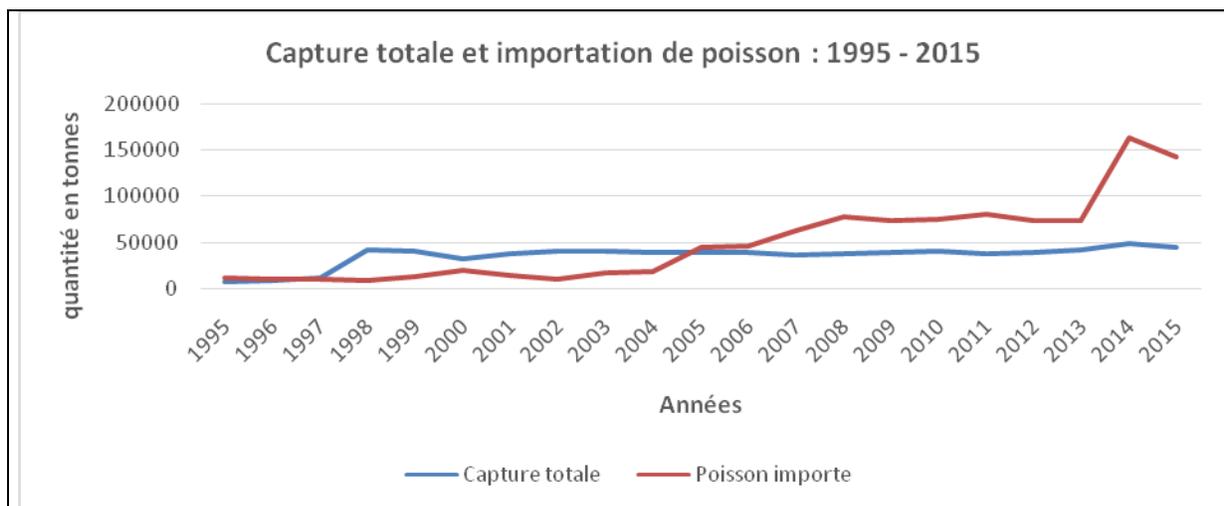


Figure n°3 : Importation des produits halieutiques au Bénin de 1995 – 2015

Source : données de la DPH, 2015

3.3. Fishing gear and practices-unsustainable in Benin

3.3.1. Fishing gear-non-durable

Secret surveys conducted on the Beninese coast, on the Sô and Ouémé have revealed the presence, still inadequate gear for sustainable fishing in Benin. Among these gear, is the trawl-ox (Plate No. 1), a gear exclusively used in industrial marine fishing (trawlers and fishing vessels). It is equipped with a central pocket and pulled by two trawlers. Its non-selective nature is unfavorable to the sustainable exploitation of fishery resources. Gill nets (Plate 1), are also fishing gear, widely used by artisanal, marine and continental fishermen. Gear made or made in nets such as gill nets include all drift nets and bottom nets. Gill nets represent more than 73%, followed by seine nets at 27% (Akitikpa, Aliou, Noumonvi, Gangbazo, & Gnikpo, 2016). In addition to gillnets, sardinella nets (sardinellasp), Tohounga nets (vernacular) and Sovi nets (vernacular) are also found.

Another type of fishing gear - unsustainable, used along the Beninese coast is the beach seine (Plate # 1). She is a gear that can reach over 1000m long with a central pocket. Long used in marine fishing, they became prohibited because of the deformation of their meshes (non selective mesh) and their place of exercise, near the coast, place of development and growth of juveniles.

Plate 1 presents images of marine fishing gear such as the trawl-boat (picture a), the gillnets (picture b) and the beach seine (picture c).



Photo a) : Chalut-bœuf saisi par la DPH



Photo b) : Filet maillant (plage grand-Popo)



Photo c) Senne de plage

Planche n°1 : Engins prohibés pour la pêche

Source : Adjé, 2017

In the continental fishery, acadja, is a widespread practice on Lake Nokoué and its tributaries Sô and Ouémé. It consists of delimiting a space on the water using the woods planted, and branches. The delimited area is then encircled with very fine mesh nets (Plate 2). Acadja, which is a spawning ground and a trap, is left fallow for months; 6 to 12 months. During this time, the fishery resources are concentrated in the acadja they take for a refuge since the owner transforms the delimited space into his private property, thus prohibited from fishing. The exploitation of acadja is done by imprisonment of all the resources which are there. The gillnets in Plate 1 are similar to gillnets in sea fishing (Plate 1). The differences between the two types of gear reside in the dimensions, the meshes (plate n ° 2). At sea the size of nets is very large 500 to 1000 meters

or more while the continental water bodies, these nets range from 100 to 500 meters. The meshes vary according to the targeted species.

Plate 2, below, exposes acadja (photo c) and the mesh (photo d) of gillnets (drifting or rotating), filmed during the surveys, 2017.



Photo c) : Acadja sur le lac Nokoué

Photo d) : Filet à mailles très réduites

Planche n°2 : Engins prohibés dans la pêche au Bénin

Source : Adjé, 2017

3.3.2. Fishing practices-unsustainable

Apart from fishing gear identified as unsuitable for sustainable fishing, other human actions encountered contribute to a large extent. The shores of Lake Nokoué and its channel are littered with garbage and garbage of all kinds (Plate 3). The tributaries of Lake Nokoué, Sôet Ouémé are subject to pollution by petroleum products from Nigeria. The results of this study show that large quantities of petroleum products (gasoline and gas oil) flow regularly into the water during the course of smuggling trade between Nigeria and Benin. Plate no. 3 shows a number of barrels, containers (photo e) whose contents are spilled in water before reaching its second land destination (place of sale in Benin).

Other practices such as the intensive sampling of construction sand are also developing on the Ouémé River (photo f, plate n ° 3). This practice has led in some places, shifts banks (Photo g, Plate No. 3).



Photo d) Ordures et déchets sur la berge du chenal de Cotonou



Photo e) : Fûts d'essence déversés dans l'eau (rivière Sô)



Photo f) : Dragages de sable sur l'Ouémé



Photo g) : Glissements de berges

Planche n°3 : pratiques de pêche-non-durable Source : Adjé, 2017

4.. DISCUSSION

4.1. State of play of fisheries in Benin

For inland fisheries, total annual production fell by more than a third between 1995 and 2015, from 30,000 to 20,000 tonnes (Figure 1). This decline in catches recorded in the statistics, demonstrates the full exploitation or over-exploitation of the halieutic resources of continental water bodies in southern Benin. With regard to the fishing practices observed and registered with the main actors of the fisheries sector in Benin, it appears that the country's fishing potential has

reached its maximum production. A situation that is not without consequences on the socio-economic activities of these actors. Indeed, between 2006 and 2015, there was a departure of more than 20,000 inland fishermen and a withdrawal of more than 10,000 canoes between 2010 and 2015.

In sea fishing, total catches (artisanal and industrial) have increased in recent years from one to two: from 9,363 tons in 2012 to 25,000 tons in 2015. At the same time, the number of artisanal marine fishermen has decreased about 1,000. The increase in catches in marine fisheries is a desirable situation in the management of renewable natural resources. However, the increase in fishing catches does not always augur a healthy state of fish stocks for savvy managers. A similar situation has already appeared in North America in the fishing of certain groundfish species such as cod (*Gadus morhua*), American plaice (*Hippoglossoides platessoides*) and redfish (*Sebastes* spp.), whose catches have reached 800,000 tonnes a year. by the end of the 1980s. Stocks of these resources collapsed successively: in 1992 they were the cod stock, and in 1994, those of the magpie and redfish (Chadwick, 2018, Chouinard, 1992; Harris 1990, DFO 2005). The moratorium on cod fishing from 1992 to the present is still in effect (Higgins 2009). These experiences indicate that technological innovation in the fishery has led to increased catches of groundfish in the North Atlantic in the 1980s (Parsons 1995). These technologies have invaded the world and can be compared to fishing-unsustainable practices developed by Beninese fishermen, as the resource becomes scarce. It is therefore prudent to rigorously monitor marine and even continental fish stocks by structures responsible for fisheries research at sea and in coastal water bodies.

Malaise in the inland fishery could exacerbate poverty in fishing communities and lead to huge currency losses for the country, with an increase in fish imports in Benin. According to the DPH, the demand for fish from Benin's population has risen to more than 120,000 tons in recent years (DPH, 2015), while total fish production in the country is only declining. The gap, is provided each year by the import (important part) and aquaculture whose sector struggles to develop in Benin (IRHOB, 2016a, PROVAC, 2011). This situation of declining domestic production has increased fish imports, an activity that is gradually ruining the local fishing economy and exacerbating poverty among the fishing population.

4.2. Fishing practices-unsustainable

For fisheries and aquatic ecosystems conservation measures in the Republic of Benin, Article 73 of the Framework Law on Fisheries and Aquaculture (APRM, 2014) prohibits the use, in the exercise of the inland or maritime fishing, gear or fishing methods that are incompatible with the sustainable management of the country's fish stocks. Among these devices and methods prohibited by the law, many are still present and used on Benin's water bodies: the trawl-beef deformed, a fishing gear pulled by two vessels, targets all species (shrimp, fish) and on its course, it scrapes the bottom of the sea and destroys the habitats. The gill nets and the seines of beach, are fishing gear, forbidden by name because of their very narrow meshes and the presence of their conical or central pockets.

On inland fisheries, several research projects have addressed the problem of the use of gear and fisheries-unsustainable practices in Su-Benin. For Principaud (1995), the practice of acadja, a branched park, is unique in Africa and originates in Benin, precisely at SôTchanhoué in the Commune of Sô-Ava. It appeared in the 1900s and spread over all water bodies of southern Benin, during the century, with the gradual decline in the fishing production of these bodies of water. Today, this practice has invaded the entire Lake Nokoué and has led over time, filling and eutrophication of this body of water (Mama, 2010). In addition to the filling of the lake bottoms, the exploitation of acadja entails the destruction of the habitat of aquatic resources. The researches of Attingli, Ahouansou, Vissin, Zinsou, & Laleye, (2017), focused on the influence of certain gear and inland fishing practices including Acadia and gillnets, in the lower valley of Ouémé. It has emerged that these fisheries are seriously affecting the health status of fisheries resources and their habitats in this part of the country. Acadjaet fine mesh nets are prohibited practices and are specifically named in the Framework Act; despite this, they are widespread in the Ouémé valley and cover the surface of Lake Nokoué enormously. In fact, gillnets were used favorably in fisheries without affecting the fishery resources and their ecosystem. Unfortunately, over time, these machines have experienced deformation. Meshes, formerly very selective, are made very narrow and do not let anything escape the resource. In sea fishing, gill nets and beach seines are very popular among fishermen on the Beninese coast. These machines are decried because they are not so selective. They pick up everything in their path, the small fish and fry that follow their growth cycle in shallow places (the coast and banks) are trapped by these devices. The purse seine or driftnet behaves like the beach seine, very harmful on the fish fauna (Attingli et al., 2017) and have negative impacts on the biological diversity of fish species.

Pollution of the environment, that of continental and marine waters by garbage and waste of all kinds is prohibited by the Framework Law on the Environment in the Republic of Benin (MEHU, 1999) in Articles 28 and 39. Unfortunately populations living near water bodies in southern Benin use the banks of these water bodies as garbage dumps and garbage dumps. Its banks are constantly filled for the construction of dwellings. In addition to this pollution, the discharge of hydrocarbons into water bodies is the cause of the destruction of fish habitats, undermining the majority of ecological services expected from the country's aquatic ecosystems. Sampling of marine sand was banned by the Ministry of the Environment; that of water bodies should be taken to limit the wild harvest found by this research. Failing to take action, a regulation of the activity will define the conditions of this levy which will limit shorelines.

5.CONCLUSION

The fishing potential of the marine and continental waters of Benin has for a long time supported the country's national economy through various socio-economic activities developed around fishing. Unfortunately, since the last three decades (1990 - 2018), these fisheries resources, so exploited, struggle to meet the growing demand of the populations. While the fish demand of the Beninese population increased from 70,000 tons in 2000 to 120,000 tons per year in 2010 (DPH, 2015), the total annual catch of sea and inland fisheries has capped at 40,000 tons since the

1990s nowadays. The number of fishermen has also dropped considerably, from 60,000 in 1995 to 30,000 in 2007, which is more than 50% of departure.

The state of the Benin fisheries and its conditions of exercise, have revealed several causes of anthropogenic origin. As a first step, the gradual decline in the fishery production of the country's water bodies has resulted in fishermen ingenuity in the means and techniques of fishing; new machines and techniques have emerged. Fishing gear such as nets, accepted yesterday in the fishery, have gradually been transformed or modified to catch more fish. Machinery and devastating practices of fish resources and their habitats have invaded a Beninese environment where regulations and conservation measures are largely lacking. In the second time, unhealthy behaviors exacerbated the fishing pressure on a struggling fishing potential. Indeed, most of Benin's waterbodies are borrowed for the smuggling of petroleum products from Nigeria. The banks are used for garbage storage of all kinds. The rivers are dredged for the extraction of fluvial sand, used in constructions. The results of this show showed that barrels of gasoline and gas-oil have emptied their contents into the water during their transit to the points of sale (Benin). In places on the Ouémé River, intensive extraction of river sand has led to shorelines. The banks of the Cotonou Channel are filled daily by waste produced by local populations.

This state of affairs has, for a long time, compromised the capacity of South Benin's marine and coastal ecosystems to support the goods and services enjoyed by the people of Benin. Overfishing and pollution have upset the ecological balance in the southern part of the country. , formerly of high fish productivity. As commercial species are being depleted, they have been replaced by others and so on until the last species. This situation calls on the leaders in charge of the management of the country's fishery resources, at various levels, to apply the texts already taken and to develop others to measure that the actors of the sector of the fishing develop practices not favorable to the sustainable management of the halieutic resources of the country. Today, more than ever before, our water bodies are under pressure of all kinds.

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