Journal of Environmental Science and Engineering A 14 (2025) 43-52
doi:10.17265/2162-5298/2025.01.004

Human Effects on Tabounsou's Coastal Ecosystem and the Matoto-Conakry Case Study of Sustainable Management Practices

Daouda Konate[1], Ahmed Guisse[2], Yamoussa Bangoura[1], Ousmane II Camara[3] and Sekou Ahmed Bangoura[1]

1. Department of Fisheries and Aquaculture, Higher Institute of Veterinary Sciences and Medicine of Dalaba, BP;09 Dalaba +224, Guinea

2. Conakry Rogban è Scientific Research Center, BP: 1516, Conakry +224, Republic of Guinea

3. Boussoura National Center for Fisheries Sciences, BP1515 Conakry +224, Guinea

Abstract: Humans have always engaged with their surroundings and the ecology in which they live. However, during the industrial age, this contact has been more intense and has had a substantial impact on environment and ecosystems. For example, overexploitation of natural resources, mining, pollution, and deforestation are all elements that negatively affect biodiversity and natural resources. Few studies have been conducted to evaluate the damage caused, despite the significant uncontrolled pressure from human activity. However, maintaining its environment is essential to the survival of coastal fishing. Goal: This study's goal was to evaluate how human activity affected Tabounsou's coastal ecology in order to suggest remedial actions for sustainable management. The following was the methodological approach used: executive consultation and archival analysis; stakeholder survey (locals, farmers, salt producers, fishers, and loggers); inventory of species; anthropogenic activity inventory; evaluation of how human activity affects aquatic life in the research region; suggestion and action for sustainable management; Outcome: Executive consultation indicated that the main issues are: construction projects that reduce the estuary's surface area; agricultural practices such as woodcutting and salt farming; the rise in resource exploitation; noncompliance with fisheries laws; and the catching of young fish. Eighty-three percent of fisherman ditch their nets on the coast after using them, but only seventeen percent burn them. With a 75% frequency rate, the same survey indicates that most fisherman fish around the coast. In the Tabounsou area, according to loggers' survey, 68% of the wood cut is Rhizophora, 24% is Avicennia, and 8% is Laguncularia. Three fish stocks, representing nine families and nine species, were identified by the species inventory. At 18% and 15%, respectively, the actors most frequently capture the species *Pseudotolithus elongatus* and *Arius parkii*. According to a poll of 30 farmers, 90% of them apply fertilizer to their soil, while only 10% do not. During the dry season, salt is grown. According to two actors, Bougna Toro Toro produces 100 kg of salt per day, followed by Khoumawadé, which produces 80 kg, and Toumbibougni, which produces 70 kg.

Key words: Coastal environment, mitigation measures, sustainable management.

1. Introduction

Coastal ecosystems constitute for most living beings a favorable living environment for reproduction and growth but also an element of balance between living beings and their environment, which are most often the subject of intense fishing exploitation.

Despite this particular importance, it is strongly threatened by anthropogenic activities, such as: excessive cutting of mangrove trees, salt farming, agriculture, anarchic urbanization, the discharge of garbage of all kinds and the dumping of water worn.

By 2035, the regions of Asia, the Middle East-North Africa and sub-Saharan Africa will have more than 5,000 inhabitants per km of coastline [1].

Among the 54 countries in Africa, 38 are coastal. A large number of the West African population live in coastal towns. The estimate of the African coastal population in 2020 is approximately 103,908 people, or 44,545 for North Africa and 59,363 for sub-Saharan

Corresponding author: Daouda Konate, researcher in marine and costal environment.

Africa. This estimate is expected to increase between 2020 and 2035 from 18% to 42%, respectively. On this same trajectory, an estimated 143 million additional people living near African coasts will contribute to marine pollution, overfishing and loss of natural habitats, thereby exacerbating their exposure to frequent and violent variations in climate change [2].

The Guinean coastal ecosystem is recognized as being among the most dynamic in the sub-region. It is bordered by 300 km of coastline. This ecosystem is subject to environmental changes caused by man such as urban development in the coastal zone and cause of unconcerted actions by the population.

In the coastal zone of Tabounsou, there is the presence of these anthropogenic activities which result in: the modification of the living environment of aquatic organisms, the mutation of fishery resources, the disappearance of fishery resources, climate change, the increase sea level, coastal erosion and marine pollution. Aware of all these issues, it seems interesting to ask these questions: why is the coastal ecosystem of Tabounsou subject to human action? What solutions should we recommend to curb this scourge?

2. Materials and Method

2.1 Material

2.1.1 Monographic Study of the City of Conakry

The city of Conakry developed on the ancient island of Tombo with an area of 450 km^2 and on the Kaloum peninsula which opens to the continent, 36 km long and 5 km wide. It is located between 9°32′53″ north latitude and 13°40′14″ west longitude. Its urban space runs from the southwest to the northeast passing through the Gbassikolo canal and constitutes the state and land potential of the capital (Fig. 2).

2.1.2 Presentation of the Study Area (Matoto)

The commune of Matoto has a wide seafront and covers a large part of mangrove. It is located 17 km from the autonomous port of Conakry, created by ordinance 01/RPG/SGG/90 relating to the organization and operation of municipalities. The commune of Matoto was established on March 15, 1991. It is the largest commune in the capital and includes 38 neighbor hoods and 223 sectors, 7,522 households (2018 census), with a total population of 845,676 inhabitants, including 411,689 men and 443,987 women (2008 census). It covers an area of 36 km^2.

Included in the coastal zone south-east of the capital, it is located between 9 ° and 34 ° north attitude and 13 ° and 37 ° west longitude.

2.1.3 Presentation of the Tabounsou Estuary

The Tabounsou estuary is located southeast of Conakry, between 9°30′ north latitude and 13°30′ west longitude. It extends over the territories of the urban commune of

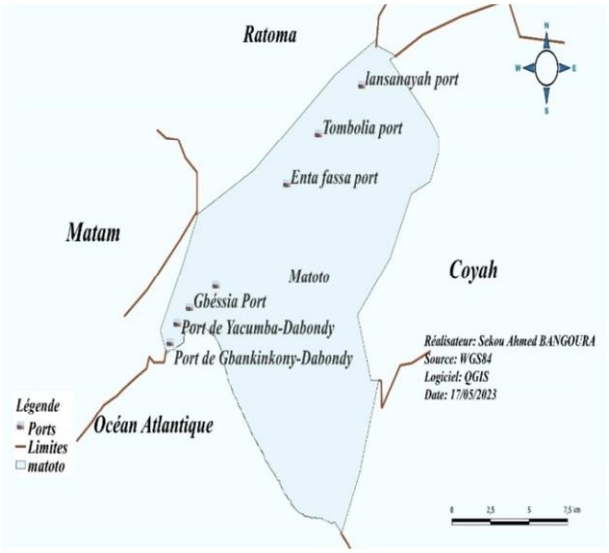

Fig. 1 Map of the city of Conakry.

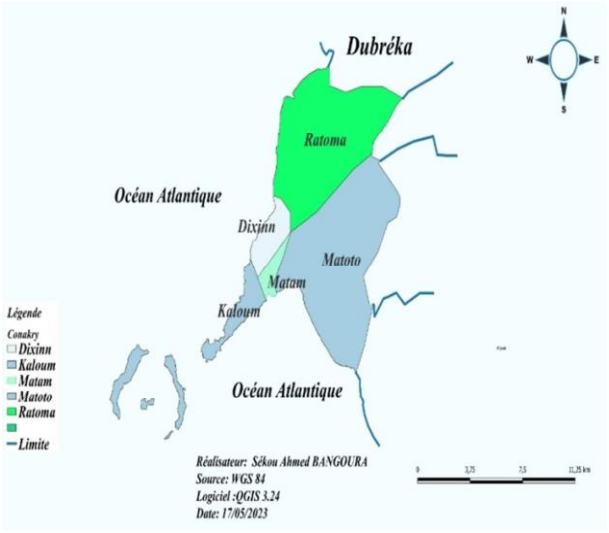

Fig. 2 Map of the investigation area.

Table 1 Materials used.

No.	Designation	Quantity used
1	Survey sheet	90
2	Notepad	1
3	Pen	1
4	Computers	1
5	Camera	1
6	Small boat	1

Matoto which covers an area of 211 km^2 and the rural commune of Manéah which extends over 60.1 km^2 [3] Fig. 1.

It is limited to the north by the urban commune of Coyah, to the northwest by Conakry, to the south by the Atlantic Ocean and to the southeast by the Soumbouya river.

The material used is recorded in Table 1

2.2 Methods

The objective of this study was to assess the impacts of human activities on the coastal ecosystem of Tabounsou and to propose corrective measures for sustainable management.

To achieve this objective the following methodology was followed: Consultation of executives and analysis of archives; Survey of stakeholders (fishermen, lumberjacks, farmers, salt growers, local residents, smokers); Inventory of the main anthropogenic activities; Inventory of the main species of fish landed; Analysis of the impact of human activities on the life of aquatic organisms; Proposal of corrective measures; Data processing.

(1) Consultation of executives and search of archives

In order to obtain information on the anthropization of the coastal ecosystem of Tabounsou, we conducted interviews with executives from the CNSHB (National Center for Fisheries Sciences of Boussoura), CERESCOR (Conakry Robganè Scientific Research Center), of the Ministry of the Environment, the Municipal Directorate of Matoto as well as the port authorities through telephone calls, series of interviews on pre-established survey sheets.

(2) Survey of stakeholders

As a survey method, semi-structured interview and direct observation of facts were used for data collection. At each site, fishermen, loggers, salt farmers, farmers and the local population were supported individually. The interview focused on knowledge of the evolution of activities, work tools and techniques.

(3) Inventory of the main anthropogenic activities

In this part, following a series of questions on a survey sheet, the actors were interviewed with the aim of listing the different activities carried out by the local population throughout the estuary.

(4) Inventory of the main species of fish landed

This part was devoted to the identification of landed species in a direct way. Species that were not directly recognized were identified using a field guide to West African fisheries resources.

(5) Analysis of the impact of human activities on the life of aquatic organisms

The analysis of the impact of human activities on the life of aquatic organisms in the study area is made through surveys, direct observations in the field and obtaining downloaded images on the evolution of the coasts in the previous years in order to highlight their impact on aquatic animals in the study area.

(6) Proposed corrective measures

Taking into account our results and observations on the ground, we proposed a set of measures aimed at improving the shortcomings observed on the ground.

(7) Data processing

Data processing and calculations of different results were possible thanks to the use of several software programs, namely: EXCEL for creating figures, Word for data entry, and QGIS for creating a map of the area of study. After entry, the results obtained were discussed.

3. Results and Discussion

3.1 Consultation of Executives and Search of Archives

The consultation of executives from the CNSHB, CERESCOR and those of the Matoto municipal management revealed that the Guinean continental

shelf is among the richest and most diversified in marine resources in the West African sub-region. In the recent past the Guinean fish stock was considered virgin, today this is not the case, many species are on the red list of species threatened with extinction following the destruction of coastal zones and overfishing. They claim that the actors do not respect the regulations, among other things: the use of fertilizers and herbicides, the meshes of fishing nets, urbanization aggravated by demographic pressure.

The analysis of Fig. 3 shows an evolution in the number of canoes over the years which goes from 218 in 2015 to 1,346 in 2020. This could be explained by the financial profitability generated by fishing, the increase in fishing effort, fishing, the remoteness of fishing zones and the arrival of foreign fishermen at the landing stages. However, these boats are the basis for the destruction of nursery areas for several species. Due to the cost, the majority of fishermen engage in this practice. These ideas are consistent with those of FAO [4] which concludes that fishing and its related activities (processing and marketing, outboard mechanics, construction of canoes, etc.) contribute to food security, the creation of employment and the fight against poverty in fishing communities.

The analysis of this shows an increase in the number of fishermen compared to other actors. The different activities practiced at the port of Yimbaya are: fishing, logging and salt farming.

The observation in Fig. 6 shows an exponential growth in the number of the population of the city of Conakry which increased from 128,002 inhabitants in 2010 to 2,328,338 inhabitants in 2020. This increase in the population immediately favoured a rapid increase in pollution and could have enormous consequences on coastal diversity. This result relates to that of Christophe et al. [5] which states that many of the problems encountered in estuaries and coastal areas are the direct result of human activities resulting from industrial growth and population growth.

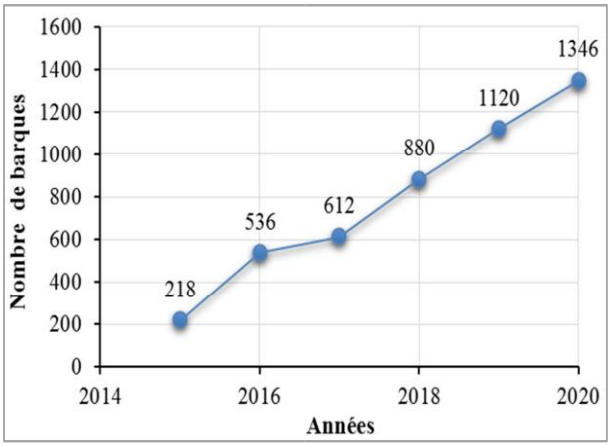

Fig. 3 Evolution of the canoe fleet from 2015 to 2020.

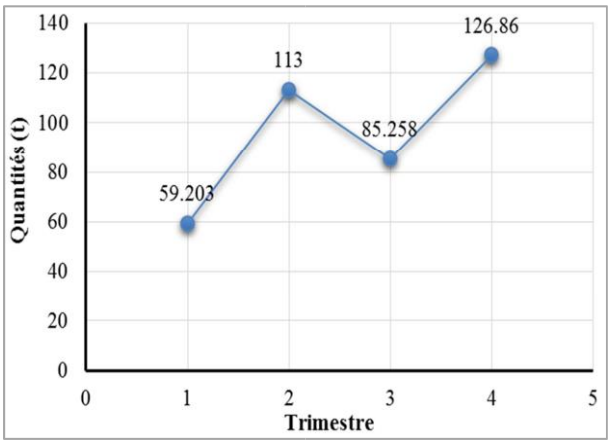

Fig. 4 Fishing catch statistics by quarter of 2019.

Table 2 Sources and consequences of pollution in the coastal area of Tabounsou.

Sources of pollution	Consequences
Plastic materials	Kill small fish and sea turtles by suffocating them Clutter up the fishing nets Promote fishing for plastics instead of fish
Waste	Containing detergents that scare away fish Contain fecal waste and chemical pollutants causing parasitism and asphyxiation of fish.
Abandoned nets	Fish indefinitely and are non-biodegradable
Population explosion	Overexploitation of natural resources
Industrial discharges	Massive mortality of fishery resources Eutrophication of the environment Diseases and endocrine disruptions of species

3.2 Field Investigation

During this activity, 125 actors were surveyed including 60 fishermen, 30 loggers, 5 salt farmers, 10 farmers and 20 local populations and 20 smokers in the area were interviewed individually for the collection of information on the impacts of anthropogenic activities through sheets investigations.

The results of this survey of these stakeholders are recorded in Figs. 5, 7 and 8.

3.2.1 Among the Local Population

A survey was carried out among the local population with the aim of knowing or collecting some information regarding waste management on the coast after use. The results we achieved are shown in the Fig. 11.

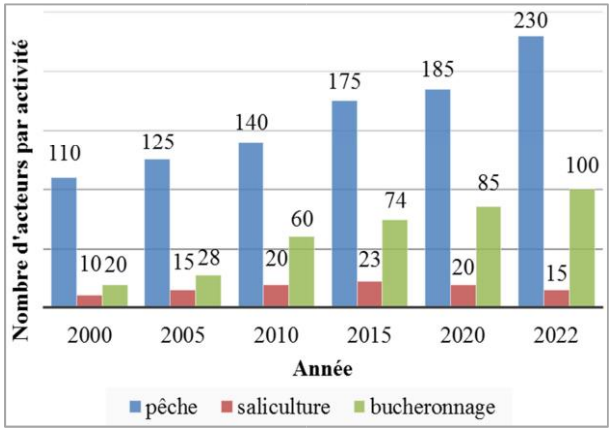

Fig. 5 The evolution of the number of actors per activity.

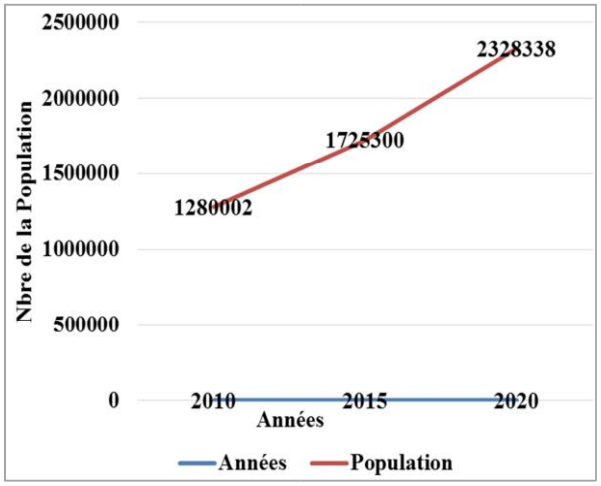

Fig. 6 Evolution of the population of Conakry from 2010 to 2020.

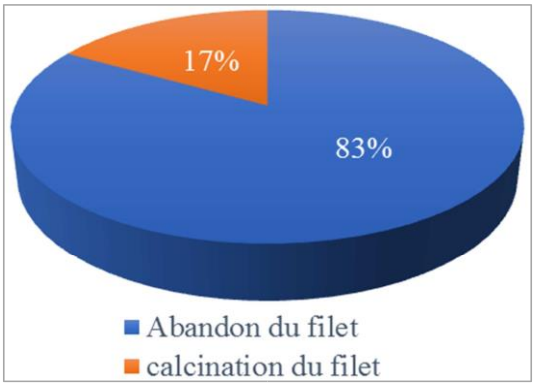

Fig. 7 Management of old nets after use.

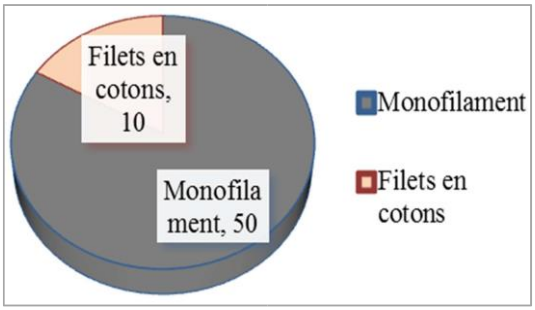

Fig. 8 Rate of use of fishing nets.

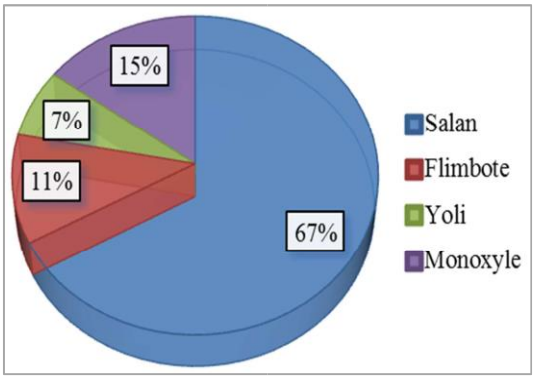

Fig. 9 Different boats encountered in the area.

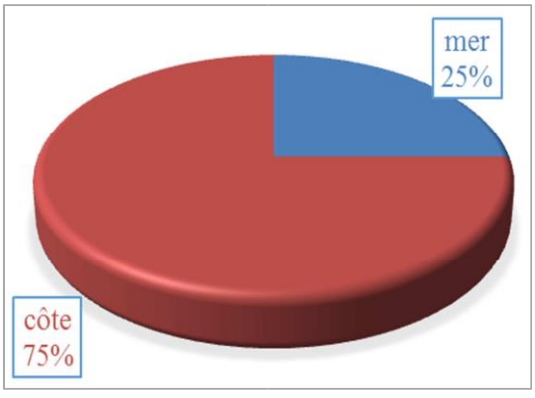

Fig. 10 Attendance rate by fishing zone.

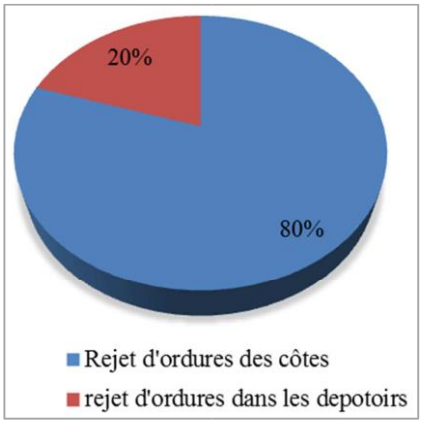

Fig. 11 Rate of garbage discharges along the coasts.

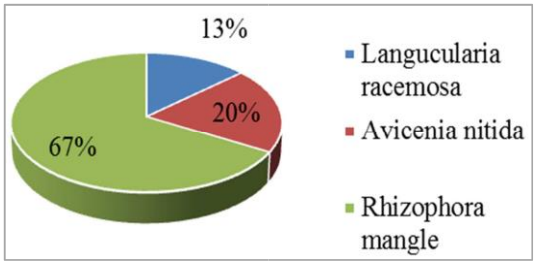

Fig. 12 Distribution of wood by exploitation rate.

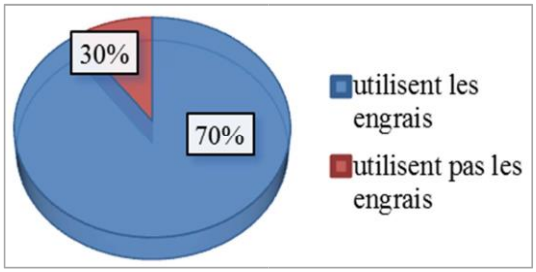

Fig. 13 Fertilizer use rate.

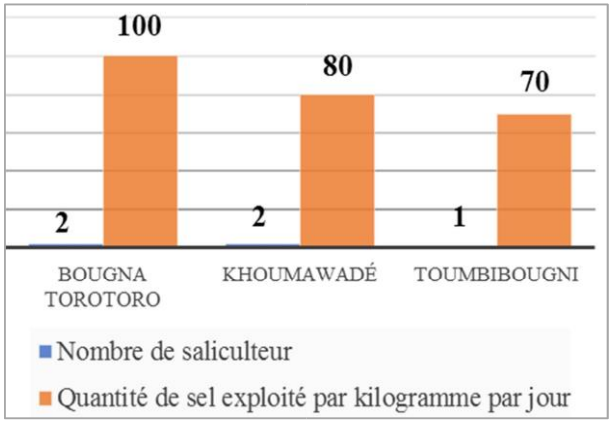

Fig. 14 Quantity of salt exploited per day and per zone.

It appears from Fig. 11 that 80% of the population throws away garbage along the coast, followed by 20% in bins. This would be due to the lack of installation of garbage bins in the landing stages, at the cost of which the local population is heading towards the coasts without knowing the serious dangers that result from this act. Consequently, the coastal ecosystem is severely disrupted, even disrupted by pollution due to the drastic dumping of garbage along the coasts. This could cause a decline in stocks of fishery resources, destruction of the marine environment and disruption of the food chain. These results corroborate with those of Christian [6] who concludes that during these two decades in Cameroon, coastal urbanization has strongly contributed to environmental degradation, which will cause pollution of the marine environment and lead to eutrophication of the environment.

3.2.2 With the Loggers

It appears in Fig.12, that 68% of the wood cut is rhizophoras, 24% of the wood cut is Avic énnia and 8% is Laguncularia in the Tabounsou area. This pressure on Rhizophora would be due to its importance in providing services for construction and the long combustion time as energy wood for smoking fish, preparation at home and in bakeries. This activity leads to the reduction of habitats, the variation of abiotic factors in the environment of aquatic animals, the migration of some aquatic animals, the reduction of fish stocks and the reduction of the microclimate of the environment. These results are in the same logic as those found by Lemmen et al. [9] who say despite the ban on cutting mangrove trees, African populations actually exploit 77% of mangrove wood (Rhizophora). This would be due to a lack of financial resources, it has very high calorific value, cooking, the production of charcoal and energy wood for the processing of fish and molluscs, which leads to changes in the level of plant cover, climate and the existence of populations.

Fig. 9 shows the different types of boats encountered in the study area and which serve as a means of transporting magrove wood and for fishing, while Fig. 10 shows us the frequentation of fishing areas

3.2.3 With Farmers

Fig. 12 denotes that during our inverstigations, 10 farmers were surveyed, 70% of whom use fertilizers as

soil fertilizer compared to only 30% who do not use fertilizer in agriculture. Forget that these fertilizers can have a serious impact on marine and coastal resources like poisoning of organisms, accumulation in trophic chains and trophic dysfunction (eutrophication). These chemicals are responsible for polluting the living environment of these species which lead to the migration of certain species from the environment, asphyxiation of the aquatic environment, toxicity in living beings. Farmers clear mangrove forests to obtain arable land. The fertilizers used by these farmers are very stable chemical compounds such as ethyl chloropirit. according to Fig. 13 Their effects on ecosystems are harmful, it can accumulate and pollute the aquatic environment. What is detrimental to fisheries resources promotes eutrophication. This assertion is supported by FAO [7] which highlights that 87% of the coastal population uses toxic chemicals in agriculture, leading to harmful impacts on the biological diversity of mangroves and the living conditions of local residents. This was confirmed by MMGE/UNDP/GEF [8], who concluded that pesticides have a much broader spectrum of toxicity on coastal ecosystems.These chemical substances act on all biodiversity and on food chain.

3.2.4 With Salt Farmers

Based on an established survey sheet, the questionnaires asked to the various salt producers on the quantity of salt exploited per day and the condition of the operating premises and the quantity of salt obtained made it possible to obtain results, which are mentioned in Fig. 14.

Fish preservation is not the only objective sought in fish smoking. Some traditional dishes are prepared with smoked fish giving them a particular flavor and taste. Also, smokers are concerned about obtaining a good quality product and giving a color and a good smell to the smoked fish. They have thus developed preferences for certain species of wood for their calorific properties and their ability to influence the organoleptic properties of smoked fish. The most soughtafter wood species are red mangroves (*Rhizophoras mangle*) and white mangroves (*Avicénnias germinans* and *Laguncularia racemosas*). According to Lemmen et al. [9], the coloring of smoked fish varies depending on the types of wood used.

It appears from this Fig. 12 that among the 20 smokers surveyed, 17 use Rhizophoras for smoking fish, a rate of 85%, and 3 use Avicénniasa rate of 15%. This preference of smokers for the red mangrove (*Rhizophoras mangle*) would be due to its burning quality and the coloring it gives to the fish. These ideas are confirmed by Kathyresan and Bingham [10] who assert that the Rhizophoras species is preferred for its calorific value and its ability to burn slowly, without prior drying.

3.3 Inventory of the Main Anthropogenic Activities

In this section we have inventoried the different anthropogenic activities carried out in the area, the results of which are recorded in the following Table 3.

The analysis of this Table 3 shows that the Tabounsou estuary is subject to strong anthropogenic pressure, this could be due to increasing demography. It should be noted that the most common anthropogenic activities in the area are fishing and logging. Intensive fishing can lead to a reduction in the stock of aquatic resources, the disappearance of numerous marine species such as manatees, crocodiles, sawfish, job losses for small fishing structures, the upheaval of ecosystems and the loss of livelihoods for poor communities. This would be due to lack of control by government policies, neglect by man of the long-term consequences of human activities on the environment,

Table 3 List of anthropogenic activities recorded in the Tabounsou estuary.

Anthropogenic activities	Actors	Numbers	Magnitude in the area
Fishing	Fishermen	60	Big
Logging	Lumberjacks	30	Big
Agriculture	Farmers	10	Average
Salt farming	Salt farmers	5	Weak

lack of information and sufficient awareness of the population on the importance of ecosystem. Our hypotheses agree with those of Cissé et al. [11], asserting that population growth generates human activities which in turn influence the coastal environment in different ways.

As for the results of Blasco [12], who concludes that the growth of urban canters on a global scale is also the factor increasing the demand for marine products.

3.4 Inventory of the Main Species of Fish Caught

During this activity, we identified the main species fish caught in the Tabounsou area which are listed in Table 4 below.

3.5 Analysis of the impact of human activities on the life of aquatic organisms

Analysis of the impact of human activities on the life of aquatic organisms in the coastal zone of Tbounsou provided the results recorded in Table 5.

Table 4 Main species of fish caught in the Tabounsou area.

Stocks	Families	Species	French name/FAO	Vernacular name soussou
Benthic	Cynoglossidae	Cyneglosus spp.	Sole tongue	Fagba
Pelagic	Clupeidea Mugilidae	*Ethmalosa fimbriata* Liza falcipinis	African Ethmalosis Big fin mullet	Bonga Seki
Stocks	Families	Species	French name/FAO	Vernacular name soussou
	Clarireedia	*Chrysichthys nigrodigitatus*	Bragid catfish	Khokhounyi
	Sciaenidea	Pseudotolithus spp.	Humped otolith	Boboe
Demersal	Ariidae	Arius spp.	Machoiron	Konkoe
	Polynemidea	Polydactylus spp.	Big captains	Sori
	Sphyraenidea	Sphyraena spp.	Barracuda	Kouta

Table 5 Analyses of anthropogenic activities.

No.	Anthropogenic activities	Impacts on the ecosystem
1	Fishing	(1) decrease in fish stocks (2) the disappearance of fish species (3) the destruction of fish eggs (4) the migration of fish to other areas (5) the low oyster harvest
2	Logging	(1) the disappearance of microclimates (2) the disappearance of the gallery forest on both sides of the river beds (3) the variation of abiotic factors in the environment (T °, pH, light) (4) the reduction of fish stocks (5) the scarcity of fishing resources (6) the disappearance of some animal species from the environment
3	Salt farming	(1) soil impoverishment (2) waste of mangrove wood for cooking (3) migration of many species of fish, crustaceans, oysters, seabirds
4	Garbage discharges	(1) habitat poisoning, migration of species, exposure of resources to parasitic contamination (2) marine pollution (3) eutrophication of the environment
6	Urbanization	loss of plant cover, disappearance of the microclimate, risk of flooding, erosion, destruction of breeding areas, loss of agricultural areas, etc.
7	Oyster harvest	(1) survival of threatened mangrove forests (2) survival of threatened spats, destruction of mangrove forests (3) destruction of spat (4) survival of threatened fishery and biological resources
8	Agriculture	(1) destruction of mangrove areas in inlets and estuaries (2) migration of certain species of fish (3) destruction of spawning areas (4) environmental intoxication due to the use of herbicides, insecticides and NPK (Nitrogen, Phosphorus, Potassium) chemicals

Table 6 Proposed corrective measures.

No.	Findings	Proposed corrective measures
1	Mangrove degradation	Raise awareness among the population about the importance of the mangrove Organize reforestation campaigns for this species in coastal areas then put in place laws for sustainable management
2	Massive introduction of capture techniques with the use of prohibited tools	Strengthen and popularize regulatory texts; Regulate fishing gear; Respect the rules of biological rest; Strengthen the capacities of stakeholders on fishing techniques; Develop and equip the landing stages.
3	Pollution of the coastal zone by the discharge of waste	Raise public awareness of the impact of waste on aquatic species; Place trash bins within the coastal zone; Establish laws on waste disposal in the coastal zone.

The analysis of this table shows that there is strong pressure on aquatic biodiversity which is due to the various anthropogenic activities identified in the Tabounsou estuary. This could be explained by the fact that these activities are the main ones carried out by local communities, especially fishing which has more harmful impacts on these resources (fauna and flora). Anarchic fishing destroys essential habitats, renewable resources and disrupts the environment. These ideas are consistent with that of Garcia [13], who asserts that fishing is the main factor threatening biodiversity and concludes that more than 400 local populations of marine fish have disappeared due to overexploitation of species.

3.6 Proposal for Corrective Measures

Several measures have been proposed for remediation purposes and are recorded in table 6.

4. Conclusion

At the end of our work, we note that the Tabounsou estuary is an extremely rich and productive coastal ecosystem from a biological point of view. It plays an essential role in the renewal of fishery resources on the Guinean continental shelf. Many species of fish in the juvenile stage were encountered. This environment is fragile and subject to strong anthropogenic pressures in particular: rice farming, salt farming, woodcutting, urbanization and fishing. Exploitation is carried out in an anarchic manner, at a speed exceeding the capacity for regeneration of resources. The impacts of this pressure are perceptible on this ecosystem. The cutting of mangrove wood is done inadequately. The wood species encountered are Rhizophora mangle, *Avicennia nitida* and *Laguncularia racemosa* and the most exploited is the first, the mangrove thins under the action of loggers to give way to a herbaceous cover. Most of the fishermen surveyed own their boats and they often fish in the coasts on a regular basis and use non-selective gear, with a large reduction in mesh size, inappropriate techniques and often fish in the channels of the sea and the estuary without worrying about the long-term consequences of their actions.

Salt farming is a seasonal activity. Leaching is the only method used for salt extraction although it is devastating.

Despite some results obtained in this study, there are some limitations. That is why, we hope that this scientific research work will be continued by other researchers in order to make their contribution to the sustainable management of coastal ecosystems.

In view of our results and observations in the field, we recommend:

In the State:

To raise awareness among fishermen, loggers and salt farmers about the importance of coastal zones in order to identify and limit their destruction and pollution.

To raise awareness among fishermen about harmful fishing practices (use of monofilaments) for sustainable management of fishery resources.

To develop a popular education and training program for stakeholders.

To regulate fishing in estuaries or coasts to minimize the impact of prohibited gear on fishery resources.

To ensure regular monitoring of mangrove protection.

To reforest the mangroves in the coasts.

To reduce salt extraction for good conservation of the coastal zone.

To prohibit the use of barrier nets at the level of channels.

To industry players:

To respect the legislated mesh standard and prohibit the use of barrier nets at the channel level;

To use biodegradable nets;

To opt for the solar or chemical salt preparation technique;

To minimize salt extraction for good conservation of the coastal zone;

To replace chemical fertilizers with organic ones and reduce the use of the latter to avoid eutrophication.

To reforest the mangrove.

To limit excessive cutting of wood.

Conflicts of Interest

The authors declare no conflict of interest.

References

[1] CCLME. 2014. Summary of Income-Generating Activities and Communication. California: CCLME.

[2] WACA. 2016. "Evaluation of the Coastal Zones of West Africa South of Senegal 2016." https://www.wacaprogram.org/fr/knowledge/evaluation-deszones-cotieres-dafrique-de-louest-sud-du-senegal-2016.

[3] Bah, M., et al. 2014. National Monograph on Biological Diversity. Conakry: UNEP/Guinea.

[4] FAO. 2001. "Basic Definitions for Forest Resource Assessment in 2000." http://www.fao.org/docrep/meeting/003/X9835f/X9835f01.htm.

[5] Christophe, B., et al. 2010. "Summary and Recommendations in Environmental Science."

[6] Christian, L. 2011. "The Fundamentals of the Student's Basic Library in Aquatic Ecosystem Science."

[7] FAO. 2009. "World Food and Agriculture Situation." https://www.fao.org/publications/card/fr/c/e5355d88-e919-52cc-9756-e27f55c8fdc7/.

[8] MMGE/UNDP/GEF. 2002. "National Strategy for the Conservation of Biological Diversity and Sustainable use of Its Resources in Guinea."

[9] Lemmen, C., et al. 2008. "Climate-Change Impact and Adaptation: A Costal Geoscience Perspective in Abstraction." In Proceedings of the 2008 Colloquium Annuao Feneral Meeting of Atlantic Geology, p. 24.

[10] Kathyresan, B. L., and Bingham, K. 2001. "Biology of Mangrove and Mangrove Ecosystems." Advances in Marine Biology 40: 81-251.

[11] Cissé, M., et al. 2002. Alteration and Destruction of the Guinean Banks.

[12] Blasco, F. 1998. "Mangrove Ecosystems: Functioning, Utility, Evolution." In Environmental Science, pp. 225-30. http://archimer.ifremer.fr/doc/00246/35749/34257.pdf.

[13] Garcia, J. E. 2003. "Biodiversity Science and Governance nursery." In Proceedings of the Report of the Debates and Proposed Priority Actions, January 24-28, 2003, Paris, France.