

Utilization and Protection of the Brackish Water Ecosystem of the Niger Delta for Sustainable Fisheries Development

N.A. Jamabo and A.T. Ibim

Department of Animal Science and Fisheries, Faculty of Agriculture,
University of Port Harcourt, Choba, Rivers State, Nigeria

Abstract: The brackish water ecosystem is an important component of Nigeria's artisanal fisheries resources. The vast rivers, creeks and mangrove swamps serve as important nursery breeding and feeding grounds for shell and fin fish production. However, the unhealthy degradation of the ecosystem by environmental pollution poses a great threat to sustainable fisheries practices. Large-scale utilization and protection of this ecosystem would lead to sustainable income generation and youth empowerment. The incorporation of basic knowledge and information of the coastal ecosystem with existing problems and possible solution should be of fundamental concern to all stakeholders. This paper projected the brackish ecosystem of the Niger Delta coastal ecosystem as a potentially profitable and secure area for investment in fisheries development projects.

Key words: Degradation • Pollution • Environment • Development

INTRODUCTION

The Niger Delta occupies a significant position of importance in the fisheries and aquaculture development of Nigeria. The area is endowed with vast mangrove swamps and forest environment including marine, brackish and freshwater ecosystem [1]. The mangrove, a dynamic ecosystem, is a transitional area between the terrestrial and marine. It offers valuable natural resources and is a potentially important food producing area [2].

The productivity of the ecosystem is dependent on ocean processes like up-welling, the health of the mangrove forests, coral reefs and sea grass beds and the amount and quality of runoff from the rivers. Ocean currents are important features that strongly influence the distribution of marine organisms. Fishing in these waters is an important economic activity.

Fish constitute as much as 80% of the animal protein consumption for Nigerian natives in coastal communities and fishing is a way of life and the primary occupation of the coastal dwellers that depend on it for their livelihood and subsistence. There is a gradual decline of fish landings from 95% in 1980 to 40% in 2003 [3]. Extensive stretches of these rivers, creeks and swamps are not exploited for fisheries because of the effect of pollution on the water quality, macro-invertebrate, flora and fisheries resources. The resultant effect is extreme poverty, food crisis and restiveness of the unemployed youths.

There is presently wide public and scientific concern in understanding the structure and function of brackish water mangrove ecosystems in the Niger Delta region. The impact of pollution and changes in hydrological regimes caused by freshwater diversion projects, have adverse effects not only on subsistence dwellers in and near mangrove habitats, but also rural communities, who depend directly or indirectly on intact coastal resources.

Large-scale utilization and protection of this ecosystem would lead to sustainable income generation and youth empowerment. Information obtained in this project will be useful to researchers in many fields in their efforts to improve techniques for the sustainable utilization of brackish water mangrove ecosystems, benefiting rural communities as well as policy makers. This paper aimed at examining the brackish ecosystem of the Niger Delta coastal ecosystem as a potentially profitable and secure area for investment in fisheries development projects.

The Study Area: The study area is situated within the Bonny River at the western edge of the Niger Delta (Fig. 1). The area lies within latitudes N.4°45'.98" and N.4°49'.88" and longitudes E.7°2'.15" and E.7°4'.76" with a mean annual rainfall of over 2000mm and mean annual temperature of about 29°C [4]. The creeks are tide dominated embayment with little fresh water input and are characterized by extensive mangrove swamps, tidal flats,

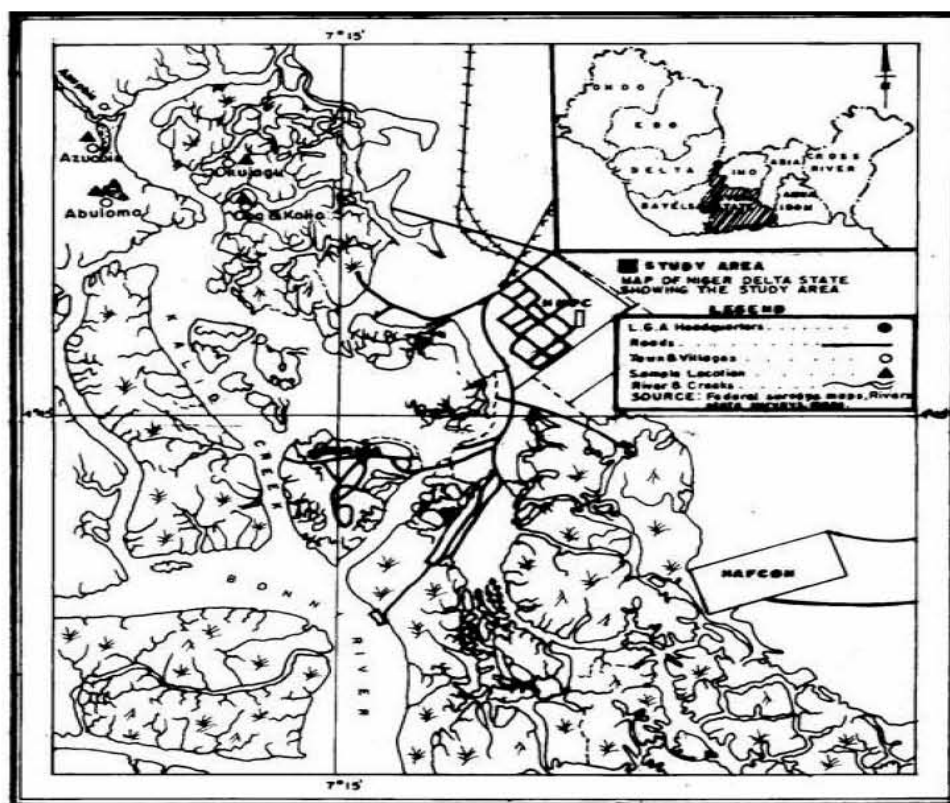


Fig. 1: Map of Niger Delta, Rivers State and the study area



Plate 1: Vegetation type of study area



Plate 2: Brackish water ecosystem.

influenced by semi-diurnal tidal regime. In the Bonny estuary, the salinity fluctuates with the season and tide regime is influenced by the Atlantic Ocean [5]. Tidal range in the area is about 0.80m at neap tides and 2.20m during spring tides [6].

The vegetation consists of thick mangrove forest dominated by the red mangrove *Rhizophora racemosa* and *Rhizophora mangle*. In some areas, the white mangrove *Avicennia africana* is interspersed with *Nypa palm* (Plate 1). The low inter-tidal zone is usually bare of

vegetation, with clay, peat and sand deposit. There are numerous human activities in the study area that include fishing, sand mining, boat traffic, mangrove cutting and dredging. There are also various oil and other non-oil industrial activities in the river system that are potential sources of pollution to the environment.

Importance of the Brackish Water Ecosystem: The brackish water ecosystem is an important component of Nigeria's artisanal fisheries resources (Plate 2).

The area serves as feeding and nursery ground for a range of estuary and coastal water species. The ecosystem and associate biota, are considered to be highly productive and dynamic and are of great importance in the biological and nutrient regeneration processes. Besides, mangrove resources have been exploited for various purposes, all of which support the national economy. The ecosystems are characterized by a richness of organic matter.

The waters in the creeks are usually rich in plankton and inorganic matter, the mangrove vegetation forms major energy source in the marine food chain. Currents are often very strong, especially at spring tides. Fish intensity is very low because of depletion of wild fish populations.

The fishery resource includes fin-fish, shell fish and aquatic organisms (plants and animal). This contains some valuable inshore pelagic species (0 -50m depth) dominated by sardinella, bonga and black horse mackerel. Commercially important demersal species (50m and more depth) include croakers, big-eye grunter, trigger fish, shiny-nose, sharks, mullets and groupers. The pink shrimp, tiger shrimp, oysters, periwinkles cockles, clams, etc. are abundant for commercial harvest also. During low tide, juveniles of these species could be collected in large numbers for stocking in ponds culture.

Brackish water aquaculture has been given an importance to increase the fish production in the Niger Delta; a bulk comes from inshore waters and small-scale fisheries sector. About 1.8 million hectares of brackish water area is available for aquaculture in the form of rivers, estuary and swamps. The role of mangrove swamps in brackish water fish culture besides in erosion control is very significant and has received considerable attention because of the high productivity and shelter they provide.

Major Threats of Degradation to Brackish Water Ecosystem: Pollution is the introduction of unwanted materials into the environment causing imbalance in the ecosystem. Pollution from oil and gas exploration is a potential danger of coastal fisheries [7]. The impact of human activities on fisheries resources may be direct, causing mortality and reduced productivity or may be indirect or sub-lethal in which case the impact may result in habitat alteration or removal and decline in population [8]. The numerous activities that generate pollution include:

- Impact of oil and gas exploration and production.
- Effects of industrial activities and municipal waste.
- Dredging and sand filling activities.
- Agricultural run-off.

Oil and Gas Exploration and Production Affects the Fisheries in Three General Ways: Chronic input of hydrocarbons and associated drilling brines, direct physical damage due to pipelines and onshore construction and indirect physical alteration by erosion of wetlands. The effect of these pollutants in the brackish water can cause poor growth, fish kill, habitat alteration and gradual decline in population of fisheries resources [9]. Effluents from industrial activities are sometimes discharge accidentally into the water bodies and contain toxic substances that are toxic to aquatic life. Heaps of wastes ranging from metal scraps to disused cans and crates of chemicals are usually dumped along river banks, in creeks and at boundaries between two or more industries.

Pollution from municipal waste which consists of household refuse made up of decayed foodstuff, animal remains, office waste, empty bottles and cans, expired drugs and human waste constitute a major input into the pollution of the coastal ecosystem. Organic waste load from non-industrial and industrial sources is a contributor to degradation of the ecosystem. Dump-sites receive sludge, acid wastes; dredge spoils and construction debris, which have adverse effect on the aquatic fauna and flora. Pulp mill effluent cover shellfish beds and provide media for bacterial pathogens, which could be poisonous, allergic or irritating [10].

Dredging and sand filling operations are prime components of physical alteration of the ecosystem. Dredging activities remove suitable substrate, alters flow patterns, re-suspends sediment particles and contribute to water quality degradation. Sand filling activities involved in the reclamation of wetlands for industrial or residential development are detrimental to living resources because of the elimination of prime habitats (tidal flats, marshes and shallow submerged lands). Physical alteration and modification of coastal habitats including coastal erosion is a potential source of danger for coastal fisheries. Coral reefs attract fish, provide food from attached organisms and offer shelter [10]. Over fishing in coral reef habitats causes reef degradation and adversely affects productivity and biodiversity.

With the increasing trend towards intensification of agricultural practices and the transfer of land from rural to urban use, agriculture and related land use sources have been sighted today as having a greater potential for contamination of the coastal environment through the run-off from land. Various agricultural sources include animal waste, fertilizers and pesticides cause leaching of nitrogen and phosphorus to the coastal waters.

Decomposition of organic waste releases nutrient chemicals which could cause algae blooms, make the water to be turbid and produces unpleasant odour and off-flavor in fish.

In conclusion, the brackish water wetlands are generally open systems with continental (rivers) and marine (Atlantic Ocean) influences. The wealth of this ecosystem contributes significantly to the diversity of fish and other aquatic life. However, the sustainability of this ecosystem for fisheries and aquaculture development has become a matter of intense concern to all stakeholders. Considering the significance of mangroves in brackish water fish culture, it is felt essential to study the ecological and economic role and the methods of proper management for sustainable development.

Recommendation:

- Proper management and better utilization of the mangrove ecosystem.
- Guidelines and policies that promote an environmentally friendly industry should be promulgated and enforced in all its ramifications.
- Establishment of marine protected areas for the wetlands.
- Reclamation of mangrove forests for mariculture ponds on large scale.
- Fisheries enhancement should be encouraged in small enclosed areas along the brackish mangrove swamps.

REFERENCES

1. Scott, J.S., 1966. Reports on the fisheries of the Niger Delta. Niger Delta development Board, Port Harcourt, Nigeria, pp: 160.
2. Jamabo, N.A. and A.T. Ibim, 2006. Impact of the effect of pollution on the coastal fisheries of Rivers State, Nigeria. In Inyang, H.D., Menezes, G.B; Braden, C.L. and Fodeke, B. (Editors). International conference on infrastructure development and the environment (ICIDEN-Abuja 2006) Abuja, Nigeria. Sept., pp: 10-15.
3. F.A.O., 2004. The state of world fisheries and aquaculture. Rome. Italy.
4. NMS., 1998. Nigeria Meteorological Services report, pp: 1-10.
5. Dangana, L.B., 1985. Hydrogeomorphological controls of the mangrove environment. In: The mangrove ecosystem of the Niger Delta. Proceedings of a workshop. University of Port Harcourt., pp: 357.
6. NEDECO., 1961. The waters of the Niger Delta: Reports of an investigation by NEDECO (Netherlands engineering consultants). The Hague.
7. Okpokwasili, G.C. and K.O. Odokuma, 1990. Effect of salinity on biodegradation of Oil spill dispersants. *Waste Manage*, 10: 41-146.
8. F.A.O., 1977. Economic impact of the effects of pollution on the coastal fisheries of the Atlantic and Gulf of Mexico regions of the United States of America. F.A.O. Rome, pp: 79.
9. Sasakova, N., M. Vargova, J. Kottferova and M. Skalika, 2006. Environmental pollution and health risk related to metal in the solid fraction and effluent from waste water treatment. *Bulletin for Environ. Contamination and Toxicol.*, 76: 671-676.
10. Gusey, W.F. and Z.D. Maturgo, 1974. Petroleum production and fish and wildlife resources. Gulf of Mexico. Houston, Texas, Shell Oil Company, Environmental Affairs, pp: 187.