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Assessing and Managing the Marine Fish Resources of Sierra Leone, West Africa

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Abstract

A joint Sierra Leone/ICLARM project funded by the Commission of the European Communities is presented, whose task is to assemble the available survey and fisheries data on the marine fish resources of Sierra Leone, analyze them, and based thereon, propose a management regime for these resources.

The computerized databases and other tools developed for this purpose and for monitoring and analyzing the fisheries after the project has ended are presented, and their potential use in neighboring countries is discussed.

Introduction

Sierra Leone is a small country on the West African coast, with a coastline of about 350 km stretching from 7°N to 9°N (Fig. 1). It covers an area of 71,740 km² and its latest population estimate is around 4 million. The shelf off the Sierra Leonean coast is about 100 km wide in the north at the border with Guinea, but narrows to only 13 km in the south, towards Liberia. Total shelf area is around 30,000 km², representing an important fishing ground along the West African coast (Fig. 1).

The fish communities display the high biodiversity that is characteristic of tropical marine fishes. More than 200 pelagic and demersal species have been identified so far in various surveys. Among the pelagics, the most important species are the clupeids (*Ilisha africana, Ethmalosa fimbriata, Sardinella maderensis and S. aurita*), the carangids and the scombrids. The demersal species of shallow waters include sciaenids (especially *Pseudotolithus senegalensis*), catfish (*Arius* spp.), sicklefish (*Drepane africana*) and haemulids (esp. *Pomadasys jubelini*). The deeper part of the shelf is characterized by a "sparid community" (*Pagrus ehrenbergi, Dentex congoensis*) which includes other families such as the Triglidae, the Platycephalidae, etc. There is also a distinct snapper community (*Lutjanus goreensis, L. agennes* and others) over old, deeply submerged reefs (Longhurst and Pauly 1987).

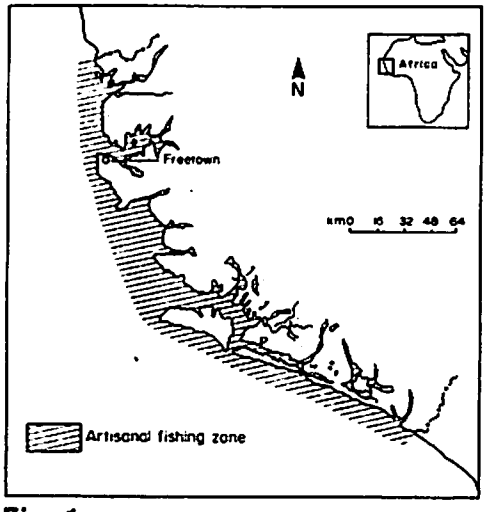


Fig. 1. *Coast of Sierra Leone, showing the area reserved for the artisanal fishery.*

The Fisheries

Fish play an important role in the national food supply of Sierra Leone, accounting for about 75% of total animal protein intake (Kamara 1991). With only the inland fishery poorly developed and aquaculture virtually nonexistent, Sierra Leone relies heavily on the exploitation of its marine resources for animal protein.

The marine fishery sector is divided into an artisanal fishery and a largely foreign-dominated industrial fishery. The former plays a crucial role in providing fish at affordable price to the local markets, while the latter is primarily export-oriented.

The general trend of the available catch data shows a dominant role of the artisanal fishery in the landings up to the mid-1970s when the annual catch reached around 60,000 t, compared to only 10,000-20,000 t landed by the industrial fishery. Thereafter, the situation changed (Fig. 2). The largely uncontrolled activities of a large number of foreign fishing vessels led to a drastic increase of captures by the industrial fleet, which official figures show to have reached almost 180,000 t in 1990. During that period, however, artisanal landings declined steadily. Only recently have these catches reached again an estimated level of 50,000 t per year (Ndomahina and Chaytor 1991).

Besides fisheries for finfish, the Sierra Leonean shelf also supports an important shrimp fishery. In 1990, 128 shrimp trawlers were reported to operate on the Sherbro Shelf, which straddles the territorial waters of Sierra Leone and Liberia. Annual landings reached a maximum of 4,000 t in 1988 and have since declined to around 2,600 t in 1990 (Showers 1991). The most important species is the "pink shrimp" *Penaeus notialis*, which makes up for around 80% of the total landings. Other shrimp species include *P. kerathurus* and *Parapenaeus longirostris*.

The offshore part of the Sierra Leonean EEZ is believed to have a good potential for a fishery aiming at tunas and other large pelagics. Though vessels are operating in this area, monitoring of their activities is at present beyond the possibilities of the Sierra Leonean authorities. Detailed data are available only from the Russian tuna

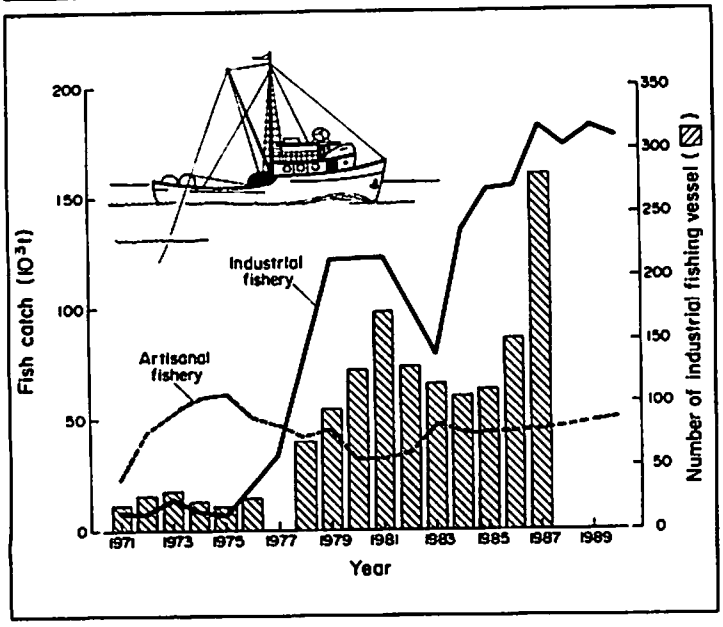


Fig. 2. *Number of registered fishing vessels and estimated total annual landings of the industrial and artisanal fishery on Sierra Leone for the years 1971-1990 (Source: Payne and Coutin 1988; Ndomahina and Chaytor 1991).*

fleet which realized, with seven vessels, a total catch of 8,000 t.

Artisanal Fishery

A recent survey carried out along the Sierra Leonean coast by the Institute of Marine Biology and Oceanography (IMBO) estimated a total of around 6,400 artisanal fishing crafts. The majority of these boats are small wooden canoes (either dug-out or planked), manned by up to five fishers. Their main fishing gear are gill nets, hook and line, and beach seines. Motorized crafts are not common, with paddles and sails still being the dominant means of propulsion. With the exception of one fishing village in the vicinity of Freetown, the capital, most fishers live in isolated communities with often no road access and generally poor socioeconomic conditions.

A rather specialized type of boat in the artisanal fishery is the so called "Ghana boat", which was introduced to Sierra Leone in the late 1950s, when a large number of Ghanaian fishers came to Sierra Leone. Though these were later repatriated, their boats and mode of operation were adopted by local fishers.

The "Ghana boat" is a large planked canoe, around 15 m in length, usually with a crew of 17 fishers. Aft, a 25 or 40-hp outboard engine is mounted sidelong on a wooden frame. Primary fishing target are small pelagics such as *Ethmalosa fimbriata* ("Bonga") and *Sardinella maderensis* ("Herring"). The gear is basically a very long and deep gill net, operated as if it were a purse seine.

At present, Ghana boats number about 200 units, making up only 3% of all artisanal fishing vessels. Their catches (almost exclusively *E. fimbriata* and *S. maderensis*), however, contribute 60-70% of the total landings of the artisanal fishery.

Small planked canoe used in the Sierra Leone hook and line fishery.

Industrial Fishery

During the 1980s a yearly average of 170 fishing vessels were licensed to fish in Sierra Leonean waters. Of these, only 40 were owned by local fishing companies. Licensed vessels comprised fish trawlers, purse seiners and shrimp trawlers, and to a much smaller extent tuna boats, longliners and motherships. In addition to the actually licensed vessels, an unknown, though probably substantial number of fish and shrimp trawlers were fishing illegally in Sierra Leonean waters, taking advantage of the difficulty of the local authorities to control activities effectively in their territorial waters.

The lack of effective control was a reason for Sierra Leone to initiate in 1991 a rather unique experiment, whereby the task of issuing fisheries licenses and enforcing the fishery regulations were left into the hands of a foreign-based company. This led to a drastic reduction in fishing effort as only around 50 vessels applied for a license under the new regime and poaching was effectively reduced due to the constant presence of a patrol vessel on the fishing grounds. The experiment also included the enforcement of the ban on industrial fishing vessels from the five-mile inshore area reserved for the artisanal fishery (Fig. 1). However, not all hoped-for benefits expected from this experiment materialized and the agreement is presently under revision.

Fisheries Projects

There are three major fisheries projects in the country, dealing with the technological aspects of increasing production in the artisanal fishery, with improving fish processing methodology, and with community development (a fourth, small project in the south deals with the fishery

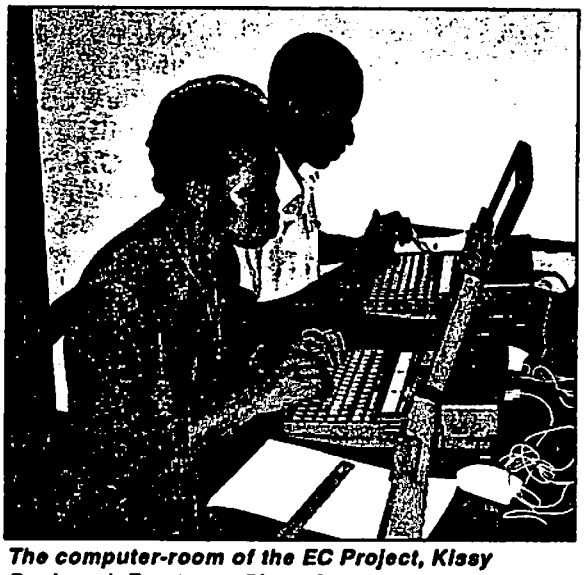
component of a regional rural development project). These projects are financed by the Commission of the European Communities (CEC), the Food and Agriculture Organization of the United Nations (FAO), and the German Agency for Technical Cooperation (GTZ), respectively. Together, they cover almost the entire coastline, but they are geographically separated and there is only limited cooperation and communication between them.

Fisheries Research

In Sierra Leone, institutional fisheries research started with the Fisheries Research Unit (FRU), which in 1951 was expanded to the West African Fisheries Research Institute (WAFRI). Up to Sierra Leone's independence in 1961, this institute coordinated fisheries research in all former British colonies in West Africa. Notable outputs under this arrangement are the contributions of Longhurst (1960, 1964). After independence, the Zoological Department of the Fourah Bay College (FBC), University of Sierra Leone, was in charge of marine research until in 1966 the Institute of Marine Biology and Oceanography (IMBO) was founded as a separate unit of the university.

The first exploratory fishery surveys were carried out in the 1950s, followed by the comprehensive Guinean Trawling Survey 1963-64, which covered the whole of the West African shelf with standardized transects at 40-miles intervals (Williams 1968; Payne and Coutin 1988). Among the various other surveys undertaken during the last 20 years, the most important ones were the surveys conducted by the R/V "Dr. Fridtjof Nansen" in 1981 (FAO 1984) and 1986 (Strømme and Saetersdal, n.d.) and research cruises jointly organized by Sierra Leone and the (then) USSR. The latter surveys started in 1976 as part of a general fisheries agreement between the two countries and were carried out at least once a year until 1990. Besides generating a considerable amount of data on the biology and abundance of the fishes off Sierra Leone, these cruises also provided a much needed opportunity for many of IMBO's students to gain practical experience in collecting and analyzing fisheries survey data. With the reorganization of the licensing system in 1991 the agreement between Sierra Leone and the former USSR came to an end.

Regular assessment of the resources off Sierra Leone is also done in the context of the Fishery Commission for the Eastern Central Atlantic (CECAF), a regional fisheries of FAO supported until recently by a regional project with a technical secretariat in Dakar, Senegal (FAO 1979; 1985).



The computer-room of the EC Project, Kissy Dockyard, Freetown, Sierra Leone.

IMBO/ICLARM Research Cooperation

By promulgating "The Fisheries Management and Development Act, 1988" the Government of Sierra Leone set the frame for a comprehensive policy towards fishery management and resource allocation and conservation. The Act envisages the preparation of management and development plans based on proper resource assessment and a policy in favor of sustainable exploitation and conservation of the marine fisheries resources.

In line with this, and with the active support of the Directorate General for Development of the CEC, the Government of Sierra Leone initiated a joint two-year IMBO/ICLARM project, starting in April 1991. Its objectives are (i) to gather, analyze and interpret existing data relevant to the fisheries development in Sierra Leone; (ii) to provide training and facilities for computerized data management, analysis and presentation; and (iii) to make recommendations for the future development and management of the fisheries resources off Sierra Leone, thereby paving the way for the successful implementation of future development projects.

The staffing of the project consists of the author, outposted in Freetown, Sierra Leone, his IMBO counterpart, Mr. P.A.T. Showers, students, and personnel seconded from the Fisheries Department with support from the EC-funded fisheries project. The computer equipment purchased comprises of five laptop computers, printers and other peripherals, as well as the necessary software. Given the irregular electricity supply, the equipment was complemented by high-capacity batteries, rechargeable through solar panels.

One of the major tasks of this project is the computerization and analysis of the data from a series of joint Sierra Leone/USSR research cruises. Unlike so many other "joint ventures" in science between countries of the northern hemisphere and developing countries, the original data from these surveys were supplied to Sierra Leone. The bulk of these data is still available, though a few files have been lost in the last 16 years. Efforts are presently made to obtain copies of whatever is missing from the successor organization of AtlantNIRO in Kaliningrad, Russia.

In Sierra Leone, as in many other places, a substantial amount of data has been collected in the past on the

biology and ecology of fish, which subsequently was buried in some internal reports or, even worse, has never been written at all. A means of making this potentially valuable information available to the researchers in Sierra Leone and for the international scientific community is FISHBASE (Froese 1990; Pauly and Froese 1991). This is a global database on fish resources, which is being developed by ICLARM in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and with the

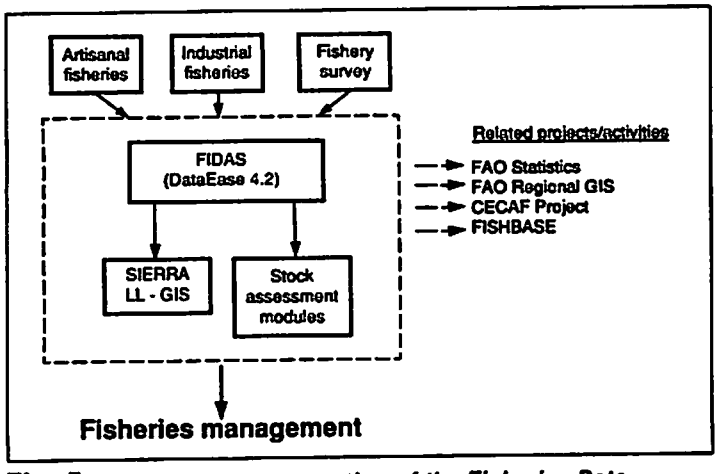


Fig. 5. ***Schematic representation of the Fisheries Data Acquisition System (FIDAS) and its linkages with other software and/or activities relevant to fisheries management in Sierra Leone.***

support of the Commission of the European Communities. Another major task of this project, therefore, will be to encourage research personnel in Sierra Leone to access old files and to assist in summarizing and analyzing of unpublished data, using appropriate outlets, then to include this information into FISHBASE.

Other tasks comprise the transfer into an appropriate database of the enormous amount of data generated by two frame surveys of the artisanal fisheries, carried out by IMBO in 1990 with more than a thousand questionnaires filled in, and the computerization of the daily catch statistics collected by enumerators of the above-mentioned EC fisheries project.

Ultimately, the experience gained from dealing with data originating from the artisanal fishery, the industrial fishery and fishery surveys will be used to design a comprehensive Fishery Data Acquisition System (FIDAS) for the institutions involved in fisheries research and management in Sierra Leone (Fig. 3). Such a system must be cost-effective, tailored to the needs of the client, but still versatile enough to easily adapt to the requirements of fisheries resource management in other countries.

Essentially, FIDAS will consist of a relational database that receives geographically referenced information from the fisheries; the information may only consist of catch and effort data, but could also be expanded to include, e.g., biological or economic data, dependent on what data collection scheme can reliably be implemented in the country.

FIDAS will have built-in interfaces that allow data transfer to other major information systems such as the FAO fishery statistics unit or FISHBASE. An important component on the national level will be FIDAS' ability to create data sets for use with "SIERRA", a country-specific "Low-Level Geographic Information System" (LL-GIS) developed at ICLARM (Fig. 4). Such LL-GIS is perceived as a valuable tool in resource management. Numeric data are visualized in a way that allow identification of trends and interactions emerging from fisheries data even by those otherwise unfamiliar with advanced tools for statistical analysis or true (high-resolution) GIS.

While being directly linked to its own LL-GIS, FIDAS can still be used to create the necessary output for a high-level GIS, as the one presently developed for West Africa on a regional basis by FAO.

The project is expected to have a major impact in strengthening the role of IMBO in fisheries research and the formulation of management strategies. Use of a highly integrated fishery information system such as the proposed FIDAS will assist in the analysis of the status of the fisheries resources both in the light of historic and present data. In this, FIDAS is meant to be complementary to similar efforts by the FAO and, thus, might serve as a model to be applied to other fisheries in West Africa.

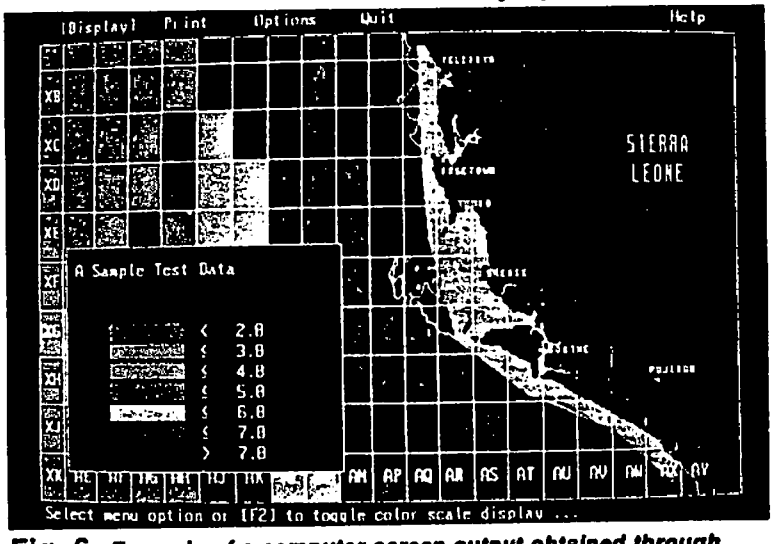


Fig. 6. ***Example of a computer screen output obtained through "Sierra", a low-resolution geographic information system (LL-GIS) for display and analysis of fisheries data in Sierra Leone.***

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New NTFS Members

THE RECENTLY concluded International Course on Data Handling for Tropical Fisheries Management, which was held from 5 January to 15 February, 1992 in Wageningen, The Netherlands, resulted in sixteen new NTFS members. The new NTFS members, who come from Africa, Southeast Asia, the Pacific and South America, were nominated by Dr. Martin van der Knaap of the International Agricultural Centre of the University of Wageningen. We hope the new members will take part in the lively exchange of information about their research work and also that they actively contribute to the Fishbyte section of *Naga*. A warm welcome to all!

News About NTFS Members

M. BADRUDEEN (Central Marine Fisheries Research Institute, Marine Fisheries P.O., Mandapam Camp, India) is working on the systematics, fishery, age and growth, mortality, reproduction and food and feeding habits of silverbelly (Leiognathidae). He is also involved in research projects like demersal, artisanal and gillnet fisheries resources assessment from the southeast coast of India and likes to correspond with Network members working on Leiognathidae.

Recent Publications of NTFS Members

Baino, R., P. Mannini and C. Volpi, 1988. Predictive use of length-weight regression in *Eledone cirrhosa*. Rapp. Comm. Int. Mer. Medit. 31(2):254.
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Free Publications

Free copies of UNESCO publications are still available from the Network. Check your back issues of *Fishbyte* for these titles. In addition, UNESCO Tech. Pap. 63, "Coastal systems studies and sustainable development", is now available to interested Network members free of charge.