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**Developing a Fisheries  
Information Monitoring  
System (FIMS) for  
N.E. Nigeria**

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## Developing a Fisheries Information Monitoring System (FIMS) for N.E. Nigeria

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### INTRODUCTION

Since 1993, the TMAF (Traditional Management of Artisanal Fisheries) project has carried out research into the management of artisanal fisheries in N.E. Nigeria located in Lake Chad, the Upper River Benue and the Nguru-Gashua Wetlands (Fig.1.). The main focus is to compare the traditional and modern systems operating in the region, and to evaluate the possibilities for community-based management initiatives in the future.

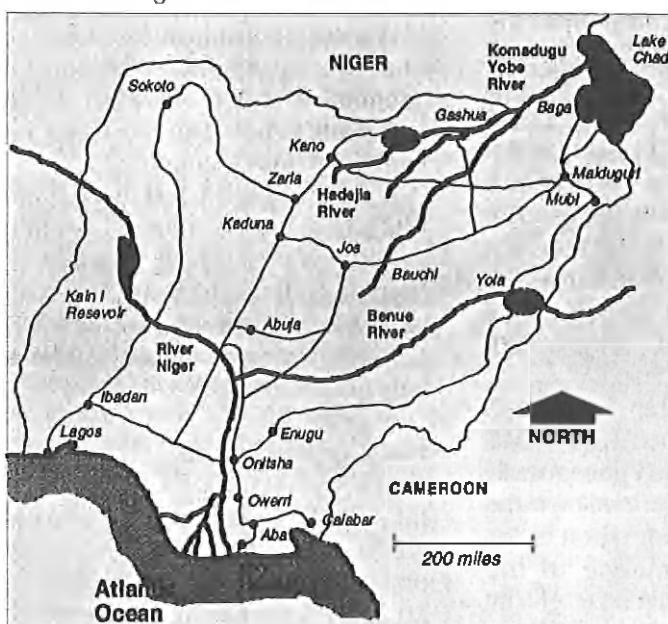


Fig. 1. Nigeria: TMAF Study regions where FIMS is operating

The 4-year project is funded under the ODA Natural Resources Policy Research Programme and is administered by Professor J R Beddington under the ODA Fisheries Programme. The project is carried out under a collaborative agreement between the University of Portsmouth, UK, and the University of Maiduguri and the Federal University of Technology, Yola, Nigeria.

The project leader is Arthur Neiland (M.Sc. Aquaculture & Fisheries, Stirling, 1984), and principal researchers include Bernard Ladu (Ph.D. Aquaculture, Stirling, 1988) (Fig.2.).

### OBJECTIVES

A major aspect of the TMAF project has been to design and test a Fisheries Information Monitoring System (FIMS) to provide multi-disciplinary information on the fisheries resource system. It is intended that the information will be used to evaluate the performance and impact of the different management systems operating locally, in



Fig. 2. Arthur Neiland & Bernard Ladu, River Benue Floodplain, Nigeria

conjunction with a range of more qualitative information collected using participatory techniques.

FIMS is also intended to demonstrate the possibilities for fisheries monitoring as a basis for management, and in doing so to provide a model for the future development of such a system and database for the region by the local fisheries authorities. The FIMS initiative is responding to the generally perceived need for more, better and regularly updated information on fisheries in order to assist the management, development and policy formulation activities of the national administration.

In addition, FIMS was designed to provide the opportunity to promote a flow of information between fishing communities and government. This could form the basis of an improved dialogue between stakeholders in the fishery system, and lead to the better planning and implementation of fisheries development schemes.

### SYSTEM DESIGN

Research into the design of FIMS has included: a desk-based study of the experiences of other fisheries monitoring systems in tropical fisheries; the identification and evaluation of key issues (e.g. data cost and pertinence)

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and methodologies (e.g. data types, sampling strategies); field trials of prototype designs in 1994 plus external reviews; and an analysis of the results and experiences of earlier TMAF surveys (see Neiland *et al.* 1994; Neiland *et al.* 1995).

The final design of FIMS centres on the collection of multi-disciplinary data covering:

- economic characteristics of the fishery
  - social aspects of the fishing communities
  - biology of the fishery resources
  - environmental trends
  - institutional features

## **ORGANISATION**

The organisational structure of FIMS is shown in Fig.3. The FIMS main office and computerised data centre is located in the Department of Biological Sciences, University of Maiduguri, Borno State, Nigeria, which is situated within one day's driving distance of the three major fisheries being monitored - Lake Chad, the Upper River Benue and the Nsaru-Gashua Wetlands.

The FIMS Office receives field survey data on a regular basis from the fisheries. The data is collected by specially-trained TMAF enumerator teams lead by experienced field officers (Fig.4.). Data collection has been organised within 5 information sub-systems:

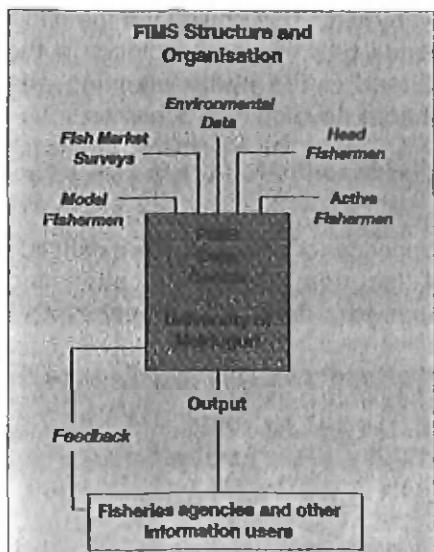


Fig. 3. FIMS structure & organisation

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- environment
  - fish markets
  - active fishermen
  - model fishermen
  - head fishermen

Each sub-system uses a particular methodology including specific sampling and data collection and analytic techniques which have been developed and tested by the TMAF team over 3 years. The basis of the approach is to collect data from 5 different sources using a range of survey techniques in order to gain a good overview of the fisheries. Information from one source will be used to validate and complement information from another.

The field data is computerised and entered into a dedicated FIMS database. The data is subsequently analysed by senior staff leading to the production of a quarterly report on the status and performance of the fisheries. The report aims to highlight important relationships between parameters and also seeks to identify aspects of the fishery which deserve particular attention in terms of management and development.

The FIMS quarterly reports are disseminated to the relevant government administrations, research agencies and local communities for review and feedback.

## **PILOT-SCALE OPERATION**

The pilot-scale operation of FIMS commenced in June 1995, and is scheduled for 12 months. To date the system has operated very successfully. The FIMS Quarterly Report No.1 covering the period June - September 1995 has been produced and distributed, and Report No.2. (September - December 1995) is in preparation.

## INITIAL FINDINGS

The FIMS results for the period June - September 1995 have confirmed the importance of the fisheries to the region by providing a means of livelihood for thousands of people. The inherent complexity of Nigerian inland fisheries, with multi-species fish stocks exploited by numerous fishing communities using a large range of gear types, within a wetlands environment which varies in form and distribution according to seasonal flood patterns, has also been demonstrated. A major challenge which the FIMS initiative has addressed is how to cope with this complexity through the development of appropriate study methodologies, and to produce meaningful information on the operation of the fisheries which can be used by managers and planners.

A summary of the first output from FIMS is shown in Table 1. A more detailed version (disaggregated by biotope within study regions), is available from the authors or FIMS Office in Nigeria on request (address below).

## Fishing Households

The study area for FIMS covers thousands of hectares of tropical wetlands containing a large population of fishing households (e.g. 10,000 at Lake Chad). The fishers at this time of year came from diverse ethnic backgrounds, a fact which was most marked at Lake Chad with 8 ethnic groups recorded. Fishers also came from fishing households (i.e. rural households who fish for at least part of the year) which obtained the largest part of their income from fishing (65-88% total income in all study regions). Farming provided the remainder. It will be interesting to see whether the nature of the participating fishing households changes over the course of the FIMS pilot year. Clearly, in the period June-September, the households encountered were heavily dependent on fishing as a means of livelihood.

Fishing was undertaken with a variety of gears (6-8 in each fishery), although gillnets and set traps predominated. Plank canoes were



Fig. 4. TMAF enumerators at Lake Chad

common, but largely unmotorised (Fig.5). At this time of year the mean catch rate varied between 2.96 kg/hr at Lake Chad down to 0.70 kg/hr for the Upper River Benue. Catch composition was diverse (16-18 genera), although *Clarias* catfish and tilapiine cichlids were found most commonly in the catch.

#### Fishing effort and income

Fishing effort (aggregated for all gears and standardised for gillnets) was high in all three fisheries, and highest of all in Lake Chad (2.67 hr/100m<sup>2</sup> gillnet/ha/month). Key interviews with head fishermen in the fisheries revealed that fishing effort was perceived to be increasing each year. The extent to which fishers participated in the local fisheries management systems varied between fisheries. In the Nguru-Gashua Wetlands, where traditional community-based management systems are still common, almost all fishers had some form of permission (98%), whereas the proportion of fishers with permission was lower (48-60%) in the other two fisheries. The impact of the management systems operating in the study regions will be analysed in detail by the TMAF project in the near future.

Fishing income was found to be relatively high during June - September 1995 in the Lake Chad (Naira 1,174/day, equivalent to US\$15/day) and Nguru-Gashua Wetland (Naira 575/day or US\$7/day) fisheries, but lower in the Upper River Benue (Naira 77/day or US\$1/day), when compared to the income for farm labouring which was about Naira 100/day or US\$1.25/day.

Fishing was therefore an attractive occupation for rural households, giving a potentially high return at this time of year. Putting these figures into context, the World Bank defines poverty as an income of below US\$300/year.

It will be interesting to observe whether the relationship between fishing and other income sources changes over the course of the FIMS pilot year, and the implications which this might have for fisheries management. In addition, the extent to which "fishers" represent a homogeneous socio-economic grouping will be examined. For example, to what extent do particular fisheries management systems ensure an equitable share of fishing rights and income? Are there

a significant number of fisher households who are not earning a high income from fishing, possibly below the poverty line, and should this group become a target for development policy? High fishing income was associated with the strong market for fish. The fish markets in all three study regions were found to be handling large quantities of valuable processed fish for shipment to the urban markets of southern Nigeria, especially the cities of Onitsha and Enugu, some 2-3 days away by road. The largest market at Doron Baga at Lake Chad, handled 2,716 MT fish valued at Naira 22 million (equivalent to US\$275,000) for June - September 1995.

#### Productivity & economic benefits

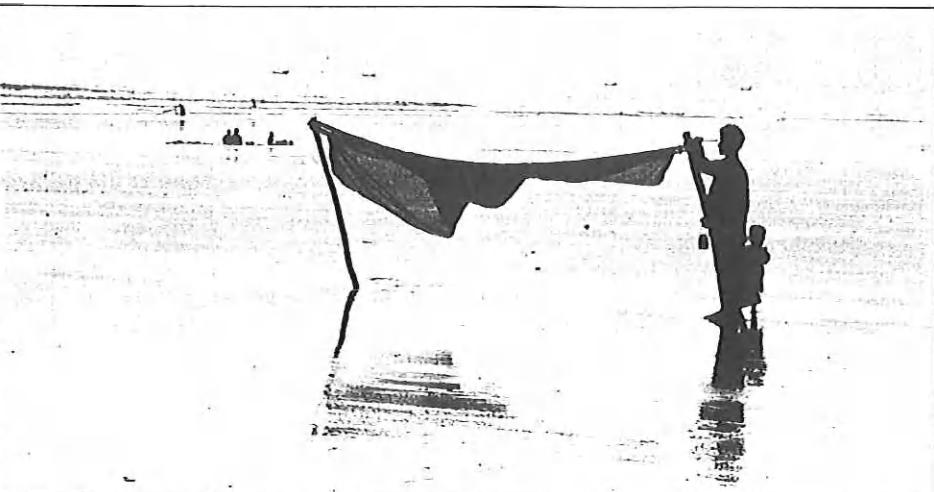
In comparing productivity between the three fisheries in terms of landings weight per hectare of floodable area, Lake Chad (97 kg/ha/yr) was found to be most productive, followed by Upper River Benue (58 kg/ha/yr) and Nguru-Gashua Wetlands (23 kg/ha/yr). Compared to the predicted fish yield for tropical flooded areas of 40-60 kg/ha/yr (Welcomme, 1979), both Lake Chad and the Upper Benue were reasonably productive, but the Nguru-Gashua Wetlands had a poor level of productivity. The net economic value of production per hectare (Naira 16-55/ha/month) was found to be relatively high in all three study regions at this time of year when compared to the findings of other studies (e.g. Barbier *et al.* 1991 estimated a mean net economic benefit of Naira 15/ha/month for fishing in the Hadejia-Jama're floodplain in N.Nigeria).

#### OVERVIEW

The first set of FIMS data provides an interesting and unique overview of the operation of the fisheries in N.E. Nigeria during the rainy season period, June-September 1995. The fisheries were shown to be a significant component of the regional economy providing a means of livelihood for thousands of rural households. Surprisingly, in contrast to many other fisheries worldwide, there are preliminary indications (albeit based on 3 months data) that the fisheries are not overexploited, either in biological or economic terms. The fisheries appear to give a high weight yield per hectare of wetland, fishing income is relatively high, and the net economic benefits per hectare are also significant.

Despite the potential threat of overexploitation due to the large numbers of fishers, and the stimulus to fish intensely provided by the demand from commercial markets, there are a number of probable reasons why overexploitation has not occurred. Firstly, the fishing communities have a limited technical capability for fishing at present. Modern gears and motorised fishing craft are expensive and not widely available. The wetland environments of the region are large, inaccessible and subject to spatial and temporal variations in size and distribution, and the associated fish stocks are highly mobile. In addition, the stocks possess amazing regenerative capacities which will greatly offset the impact of intensive fishing (up to a point). Secondly, there appears

(cont'd on page 32)



End of a day's fishing on the beach at Cox's Bazar, Bangladesh

Funge-Smith, also of IASU, who has provided inputs on the training courses.

The aim of the workshops is to provide training in environmentally sensitive management methods designed to reduce the impact of disease, chemical interventions and harmful effluents. They also serve as a useful vehicle for the dissemination of ODA's research findings.

Losses from disease in Thailand this year are estimated by some to be in the region of 80% of production and many other shrimp producing countries in the region have suffered similar losses. With the impact of disease on the shrimp industry and the absence of quick and simple remedies, assimilation of health management practices into the general management of shrimp aquaculture facilities becomes increasingly important.

## ■ IMMUNOLOGY

This is a subject which excites much interest both as a tool for rapid diagnosis and in the field of vaccine production. Unfortunately, the subject is not widely understood, and many basic errors and assumptions have been made concerning the immune response of fish and the efficacy of vaccines. This is even more evident in relation to the general lack of understanding of the crustacean response to diseases. In order to address some of these issues a basic immunology course was held in October 1994 which was attended by nine participants from the region. The course was delivered by Dr Sandra Adams of IASU and generated a lot of interest. A more advanced workshop is planned for later in 1996.

## ■ ANTIBIOTICS SURVEY

This survey began in the first phase of the project and was completed in November 1994. A great deal of effort

was put into this by the participants from Indonesia, Thailand, Philippines, Malaysia and Bangladesh. With the guidance of Dr Valerie Inglis of IASU the data were collected and analysed following a roundup workshop in November 1994 attended by the participating scientists. This is, we believe, the only attempt that has been made to provide baseline information on the patterns of antibiotic sensitivity and resistance of fish and shrimp pathogens in the region. The results are very interesting and have since been presented at the 3rd Symposium on Diseases in Asian Aquaculture, held concurrently with the WAS meeting in Bangkok in January this year.

The bacteria collected during this survey are now stored in AAHRI and will be a very useful resource in continuing investigations into the development of bacterial resistance. It is hoped that a follow-up survey can be carried out towards the end of the project to look for any changes in the pattern of resistance.

## ■ HISTOPATHOLOGY

Histopathology is one of the fundamental tools of disease diagnosis and therefore health management. Facilities for this discipline already exist in some laboratories in the region and, although the techniques can be difficult, many are used routinely. It is apparent however, that many scientists using the techniques lack the experience to make an accurate diagnosis from the finished slides. The training course that was run at AAHRI was designed to address this deficiency by providing an understanding of disease processes and by intensive exposure to the reading of histopathological material. This was no easy task and it is a tribute to both Professor Roberts of IASU and Dr Supranee Chinabut of AAHRI that the

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participants left with a far greater understanding of the subject.

This course was aimed at fin-fish histopathology, but it was apparent from discussions with the participants that there is a great demand for similar training on crustacean pathology. It may be that this need will be addressed later in the project.

## ■ VIROLOGY

The importance of viral diseases is well understood, however, few institutions in the region have the facilities to carry out the techniques involved and it is still a discipline that is in its infancy. Our contact with institutions in the region indicates that there is interest in developing the technology and it was with this in mind that a short course in cell culture and virology techniques was prepared and delivered in March 1996 by Somkiat Kanchanakhan of AAHRI and Stuart Millar of IASU. Although the participants may not immediately have access to suitable facilities in their own laboratories, they were able to obtain first hand experience of the techniques and to familiarise themselves with the necessary facilities and equipment, allowing them to better plan for the future. Participants



Fish for sale at Nam-Ngym dam,  
Lao PDR