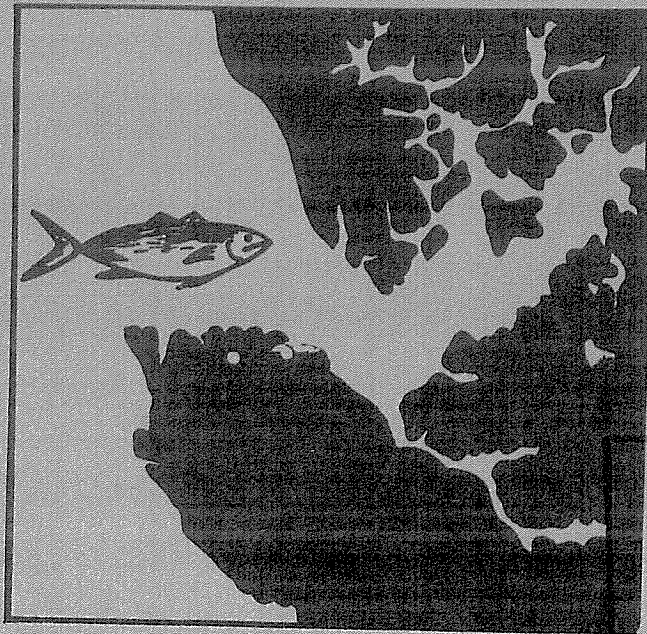


BULLETIN OF THE INSTITUTE  
OF  
MARINE BIOLOGY & OCEANOGRAPHY



FOURAH BAY COLLEGE  
UNIVERSITY  
OF  
SIERRA LEONE  
1976



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Compiled  
by  
W. OKERA

FOURAH BAY COLLEGE  
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## Preface

An agency such as ours needs to communicate to others engaged in similar activities, as well as to the outside world in general, about what we are doing and how we are doing it. Such a communication is important for certain key reasons. Firstly, it is necessary that others should hear about what we are doing directly from us and not through some third party. Secondly, those who finance our operations must have a comprehensive picture in their minds drawn by us in clear simple language. And thirdly, the public should know what we are doing and how it relates to their welfare, since public funding is clearly involved here.

These, then, spell out for us a distinct responsibility to inform - a responsibility that we have been meeting in several ways in the past, but which now is being met in a concerted effort by the Institute as a whole. This then is the justification for this Bulletin. We also hope that the Bulletin will help to focus the attention and support of both national and international bodies on the potential usefulness of the Institute's works in the scientific studies of the Atlantic seas bordering Sierra Leone, with particular reference to the rational development and conservation of the marine resources such as fish, shell-fish, coastal belt and minerals.

The Bulletin will serve as an object of information exchange with similar bodies as ours. It aims to become an annual publication of the Institute, reporting, reviewing and critically analysing the progress of our research projects on the marine and estuarine

environments of Sierra Leone in particular, and the eastern central Atlantic in general. In this regard, it will probably grow, as is our hope, so as to include not just the work performed in our Institute, but also wider information about the marine and eventually inland water studies and developments.

In a sense this Bulletin is long overdue. It should have appeared some two years ago. But even so, this first attempt is herald of better days ahead and signifies that at last Marine Biology has come alive in Sierra Leone.

At a time when the oceans of the world, which cover nearly 71% of the Earth's surface, are facing the threats of fish depletion and pollution, the modest efforts that are being made by the Institute at studying and monitoring the inshore marine and estuarine environments of Sierra Leone need every possible support. In this context, we take the opportunity of thanking the Vice-Chancellor of the University of Sierra Leone, Dr. Arthur Porter, the Principal of Fourah Bay College, Professor Eldred Jones, the Dean of the Faculty of Pure and Applied Science, Professor M.O. Williams, the Chief Fisheries Officer of the Ministry of Agriculture and Natural Resources, Mr. J.T. Shorunkeh-Sawyerr and UNESCO/UNDP for their keen interest and support in the development of the Institute.

Overseas scientists with funds wishing to come to work at the Institute are welcomed to write to the Director, Institute of Marine Biology and Oceanography, Fourah Bay College, University of Sierra Leone, Freetown, Sierra Leone. Overseas students funded by scholarships from



their Governments or international agencies and wishing to pursue the available courses in marine science should also write to the Director.

The selection of articles contained in this first issue does not by any means indicate the full scope of our interests and activities, as is mentioned in the Introduction. Later issues will carry reports of more of these. This time however, we invite reactions in comments and criticisms that will help us improve the quality of the Bulletin and so give better service to our readers.

16 November 1976

D.E.B. Chaytor  
Director.

## Introduction

This is the first bulletin to be published by the Institute of Marine Biology and Oceanography since its inception as a department of Fourah Bay College in October 1965. In this first issue, we have attempted to fulfil mainly two objectives; firstly, to trace the origin of the Institute and follow its development as a University department having very close ties with the Fisheries Division of the Ministry of Agriculture and Natural Resources. And secondly, to present concise reports on some of the current activities of the Institute that will help to demonstrate the role of the Institute in the advancement of scientific knowledge on the marine environment of Sierra Leone, as well as the Institute's involvement in the economic development and management of the marine resources of the country.

In 1961, Fourah Bay College was fortunate to inherit the laboratory and library facilities and the tradition of regional oceanographic research from the West African Fisheries Research Institute. These additions to the college, more or less laid the foundation for the future pursuit of active research and training programmes in the marine sciences at Fourah Bay. The article by Dr. I.W.O. Findlay outlines the efforts and activities of the years from 1961 to 1973 which led to the creation and establishment of the Institute.

During the past three years, the Institute has entered a period of consolidation, stability, re-appraisal and fruitful work. The Institute is, however, still very small and the reasons which will continue to limit the

impact of its activities being fully felt are given in the article on our present research facilities and activities.

The training programmes of the Institute are also outlined in this issue. The courses offered range from those given at the Undergraduate Diploma in Aquatic Biology and Fisheries to those taught at the B.Sc. Hons. level in the Biological Sciences. It is hoped that when the Institute builds its facilities in the physical, chemical and geological oceanography, short courses in these disciplines will also be given to the undergraduate classes in the faculty of Pure and Applied Science.

The past three years saw a commitment by the Institute's staff to shell-fish research. The biology of many molluscan species of Sierra Leone is still unknown and a start to study them was made by Professors A.A. Aleem and D.E.B. Chaytor. The two most important commercial bivalves, Crassostrea tulipa (the mangrove oyster) and Senilia (=Arca) senilis (the cockle) have received some indepth study. Dr. W. Okera outlines the results of his work on the cockle and further work on this species is still needed in order to find out its suitability for culture.

In an effort to find optimal conditions for the culture of oysters by the raft-technique, a knowledge of the marine and estuarine organisms which may affect the well-being and quality of the raft-cultured oysters is essential. The study of the biology and ecology of these organisms, collectively termed the "fouling"

organisms, is thus being conducted by Miss Wellesley-Cole and it is hoped that the results of her work will identify the methods for controlling or minimising the incidence of fouling of raft-cultured oysters.

The ability to forecast the approximate time, intensity and localities of oyster spawning and oyster larval abundance is also important to an oyster culturist dependent on natural "seed" collection. A knowledge of these conditions can help him to control the deployment of his efforts. It is thus hoped that the works of Mr. E.T. Ndomahina on the reproduction of the oyster and of Miss Thomas on the larval ecology, both reported in this Bulletin, will provide information on the above aspects of oyster biology.

Three other articles appear in this issue of the Bulletin. Dr. Okera summarises his observations on the beach-seine catches at Lumley and demonstrates the relative ease with which the catches of this fishery can be monitored on a routine basis. Dr. Okera also co-authors a short article on the West African manatee in Sierra Leone.

Finally, Mr. A.C.V. Forde gives a general account of his experiences on board the R.V. FIOLENT which carried out fisheries and oceanographic investigations along the West African Coast.

## Development of the Institute

Ivan W.O. Findlay

The Institute of Marine Biology and Oceanography is situated at Kissy Dockyard some eight miles from Fourah Bay College and almost on the southern bank of the Sierra Leone River estuary. The Fisheries Division, Ministry of Agriculture and Natural Resources and the Institute share the same building and enjoy close co-operation and collaboration in the use of available facilities for field work and teaching as well as in the planning and execution of research projects. This situation has developed as a consequence of the joint inheritance of the West African Fisheries Research Institute (WAFRI) facilities.

The West African Fisheries Research Institute was established in 1952 as an inter-territorial unit for the then four British Colonial territories in West Africa - Gambia, Sierra Leone, Gold Coast (Ghana) and Nigeria - and financed under the Colonial Development and Welfare Fund. WAFRI was closed down in March 1957 because of financial and political reasons - the Gold Coast became the independent state of Ghana and withdrew its support. In its stead was established almost immediately the Fisheries Development and Research Unit (F.D. & R. Unit) jointly financed by the United Kingdom and Sierra Leone Governments. However, this Unit was closed down in 1961 when Sierra Leone became independent. The closure of the F.D. & R. Unit marked the complete break-up of WAFRI and the establishment of the Fisheries Division, MANR and the Fourah Bay College Marine Biology Laboratory. The Sierra Leone

Government handed over the research section and available equipment of the F.D. & R. Unit to Fourah Bay College for the continuation of the Fisheries research work. Hence the present co-existence of the Institute and Fisheries Division in the same building.

The Botany and Zoology Departments were put in charge of the laboratories and equipment at Kissy. Work in relation to marine biology only began early in 1963 by the Zoology Department and a year later by the Botany Department. In the period early 1963 to June 1965 when plans were afoot for the creation of the Institute, the Board of the Faculty of Pure and Applied Science of FBC had made grants of Le2,764 (£1,382) for the purchase of research equipment for the Institute.

In October 1965 the Fourah Bay College Senate adopted the proposals of the Dean of the Faculty of Pure and Applied Science for the creation of an Institute of Marine Biology and Oceanography and the appointment of a Director, and also the setting up of an Advisory Committee to advise the Senate on the Institute's development. The Advisory Committee consisted of the representatives of the departments of ~~Geography~~ Geology, Botany and Zoology and the Head of the Fisheries Division of the Ministry of Agriculture and Natural Resources. It was given powers to co-opt.

The Advisory Committee immediately began negotiations for a gift of an oceanographic vessel by the Federal Republic of Germany. The vessel should be of 45ft in length with twin diesel engines, safe for long-range ocean-going, and fully fitted out for biological and

oceanographic research work. In February, 1966 an official request was made through the Ministry of External Affairs to the Federal Republic of Germany under its Technical Assistance Programme. In June 1966 it became known that the Embassy felt that the request should not be processed before UNESCO's assistance had been definitely secured. The necessary assurance was communicated to the Embassy.

The Fourah Bay College Council also approved the allocation of Le10,000 (£5,000) of its Non-Recurrent Vote for 1965/66 to a reserve for the Institute. However, because of severe cuts in the grant made by the Government to the College, the allocated funds were reduced to Le1,500 (£750). Much of this fund was used up in the purchase of three air conditioners to replace worn out ones at the Institute.

In the summer of 1965 the Principal, Dr. Davidson Nicol, visited Paris and held discussions with UNESCO on the question of assistance to the Institute. As a result of these discussions UNESCO agreed to provide a Director and equipment for the Institute. However, in January 1966, the Director of the Office of Oceanography (UNESCO) informed the Principal that "the budget available to his department for 1966 had been severely cut, and it might not be possible to provide a Director for the Institute for more than a two-month period." He advised that the College put forward a request for a post under the Expanded Technical Assistance Programme of the U.N. Technical Assistance Board in Sierra Leone. The Principal immediately acted on this advice. In spite of this set back UNESCO at the beginning of 1966

had provided equipment for the Institute to the total value of \$8,000.

In June 1966 the Dean of the Faculty of Pure & Applied Science put forward a strong plea for a larger grant to be made available to the Institute so as to provide a reasonable fund for its establishment in 1966/67 session. The College was able to rearrange funds within the Faculty and provided Le8,500 for the Institute. This fund was provided in September to set up the Institute financially independent of the Zoology Department to which it had hitherto been attached.

In July 1966 it was confirmed that the expert requested from UNESCO will be available in Sierra Leone for the academic year 1967/68 and also that a Dr. Hempel of the Office of Oceanography will visit the College in an advisory capacity.

In November, 1966, Senate approved the recommendations of the Advisory Committee and set up an inter-disciplinary Committee - the Institute of Marine Biology and Oceanography Committee - to supervise the affairs of the Institute. The Committee became a Committee of Senate and was "composed of the Principal (ex-officio), the Heads of the departments (or their nominees) of Botany, Geography, Geology and Zoology, a nominee of Senate, the Permanent Secretary of the Ministry of Agriculture and Natural Resources, the Chief Fisheries Officer of the Fisheries Division of the Ministry of Agriculture and Natural Resources, and the Director of the Institute who shall be Secretary of the Committee." The Committee had powers to co-opt.



Dr. Hempel attended and addressed this meeting of Senate. He had arrived early in November and made a thorough investigation of the plans for the establishment of the Institute and examined the existing laboratories and equipment available to the Institute at Kissy. He held discussions with members of the Advisory Committee and visited the Embassy of the Federal Republic of Germany to see what the position was with regard to the Institute's request for a research vessel and to see what other aid could be obtained from the Federal Republic under its Technical Assistance Programme. He advised that,

- i the Director of the Institute should be a College appointment and that the actual running of the Institute should be his responsibility;
- ii UNESCO will provide an expert to advise both the Director and the College on the development of the Institute;
- iii UNESCO will not proceed to appoint an expert or provide further assistance until the college had made provision for the following initial establishment - a Director, a Chief Technician and two Research Fellows;
- iv the Fisheries Division vessel "Fulmar" needs to be modified for basic hydrographical and biological work if it should serve the needs of the Institute and the Fisheries Division for proper fisheries surveys;
- v the College should try to receive a research vessel of about 45ft through bilateral assistance;
- vi the Federal Republic of Germany could not presently provide the Institute with a research

vessel but could provide a sea water circulation unit plus accessories if approached as soon as the post of Director has been advertised.

The Institute was constituted in November 1966. The post of Director was advertised through the agency of the Inter-University Council but no applications were received. The first Research Fellow, in the person of Mr. Ivan W.O. Findlay was appointed for two years on contract terms. He was previously a Research Assistant in the Botany Department studying for a Ph.D. Professor D.F. Owen, Head of the Department of Zoology, was appointed Administrative Director as from 1 September 1967. The staff of the Institute now consisted of the Administrative Director, a Research Fellow, a Laboratory assistant, a messenger/cleaner and a watchman. A lecturer in the Zoology Department, Mr. D. Hantschmann, also made use of the Institute's facilities. The Institute lacked a boat of its own but could make use of the Fisheries Division vessels, the "FULMAR" and "FN3".

In October 1967 a Plan of Operation for the Survey and Development of the Pelagic Fish Resources Project in Sierra Leone was signed by the Government and UNDP (Special Fund) and by FAO (the executing agency) in November 1967. The project was to last for five years from 1967 to 1972. The co-operating agency nominated by Government was the Fisheries Division, MANR. The Project (locally known as the Sardinella project) became operational as a unit within the Fisheries Division, MANR. FAO provided a research vessel "AWEFU", equipment and personnel. Close co-operation

in research and use of facilities developed among the members of the staff of the Division, the Survey Unit and the Institute.

In May 1968 Dr. Walter Fischer was appointed UNESCO expert for a year to the Institute and he took up his appointment in August, 1968. Dr. Walter Fischer came from the University of Chile Marine Biology Station. He left the Institute in March, 1969.

In October, 1968 Mr. Ivan Findlay was re-appointed Research Fellow on obtaining his doctorate degree. In December he was invited to act as Director on the resignation of the Administrative Director. He acted in this position until March, 1973, when Professor D.E.B. Chaytor of the Zoology Department was appointed substantive Director.

In September 1969, Mr. E.A.M. Leigh became the first Research Assistant in the Institute and also worked for an M.Sc. degree which he obtained in 1973. He has since left for Britain on a Commonwealth Scholarship to study for a doctorate degree.

In January 1970 Dr. A.A. Aleem joined the Institute as UNESCO expert replacing Dr. W. Fischer. In July 1970 Dr. Aleem was awarded the degree of Doctor of Science by London University for his work in the field of Marine Biology. He was also accorded the status of Professor of the University by Fourah Bay College. He left the Institute in 1974 to join the Department of Oceanography, King Abdulaziz University, Jeddah, S. Arabia.

In March, 1970 proposals for a Diploma in Aquatic Biology & Fisheries were approved by the Faculty Board and recommended to the Academic Board of the College. In January Senate gave its approval for the Course to commence in the following session (i.e. 1971/72 session). The Diploma Course is intended to provide middle-level manpower training for the effective development of the country's fisheries.

In March 1973 another Research Fellow was appointed to the Institute, Dr. Wazir Okera, and he took up his appointment in June.

The affairs of the Institute were supervised by an interdisciplinary committee. The Institute's functions include teaching, training and research. Courses in marine and freshwater biology and ecology are given as part of the requirements for the general and honours degree in Science of the University to students in the Botany and Zoology Departments. Facilities also exist for the training of postgraduate students.

## Staff

Director: Professor D.E.B. Chaytor  
B.Sc.(Aberdeen);Ph.D.(London)

Senior Research Fellows: Dr. I.W.O. Findlay  
B.A.(Keele);Ph.D.(Dunelm)

Dr. W. Okera  
B.Sc.(London);Ph.D.  
(Dar es Salaam)

Research Assistants: E.A.M. Leigh (on study leave)  
B.Sc. (Dunelm);M.Sc.  
(Sierra Leone)

J.E.H. Wilson  
B.Sc.(Sierra Leone)

Special Research Assistants:  
(Oyster Culture Project of the Government Fisheries Division)

E.T. Ndomahina  
B.Sc.(Sierra Leone)

Rebecca Thomas  
B.Sc.(Sierra Leone)

Cho Wellesley-Cole  
B.Sc.(Sierra Leone)

Laboratory Technician: C.V. Mustafa

Laboratory Assistant: A. Fofana

Clerk/Typist: Victoria Davis(Mrs.)

Messenger/Cleaner: A.B. Kamara

Research facilities and activities  
of the Institute

The terms of reference for the research and teaching activities of the Institute are scattered in several memos and it is therefore appropriate to summarise here the basis for the existence of the Institute. The research activities of the Institute are aimed at

1. pursuing studies related to the biological productivity and optimal exploitation of the fishery resources of Sierra Leone and eastern Atlantic waters;
2. finding scientific solutions to problems facing the fisheries Division (MANR) in its efforts to manage, regulate and develop rationally the harvest of marine biological resources and
3. undertake other researches in the biological, physical, chemical and geological oceanography relevant to the national and regional needs of West African maritime nations.

These aims are somewhat similar to those of the Institute's predecessor, the West African Marine Fisheries Research Institute but in the present day circumstances, the effective execution of the above objectives has been hampered by various factors.

The Institute lacks adequate working space and an offshore-going vessel. At present, the Institute is housed in an old building with the Fisheries Division and unless a new building is erected either on the present premises or on land adjacent to the present building, the functions of the Institute will continue to stifle. The Institute shares with the Fisheries

Division a Library which has been receiving many good journals. This library however, needs attention, especially in updating its systems of cataloguing and lending; and a special effort made to get the journals bound. The library of Fourah Bay College also used to receive several other marine titles, but lately both the libraries have been unable to meet the costs of some of these journals.

For several years now, due to lack of a suitable boat, the Institute and the Fisheries Division have been unable to carry out offshore work on the continental shelf of Sierra Leone, where the bulk of the fish resources of the country is found and exploited. Thus a modest fisheries research vessel, probably a 20m wooden or metal hull stern trawler/purse-seiner powered by 200-300 HP engine is very essential for the Institute and Fisheries Division to perform their functions effectively. This vessel can also be fitted for oceanographic work. The 34ft wooden boat 'Pente' owned by the Fisheries Division and at times also used by the Institute staff, is suitable only for work in the sheltered Sierra Leone River Estuary. The Institute has three 'Laros' rubber dinghies and two 15 HP outboard engines, suitable for ecological work in shallow inshore bays and estuaries. The Institute's VW van is in running order and is providing useful service. There is also a reasonable selection of laboratory glassware and chemicals but overseas scientists wishing to undertake work at the Institute are advised to write to the Director to check on items that they may require during the course of their work.

Sierra Leone is situated centrally on the eastern side of the tropical North Atlantic in a zone which is influenced by both the warm and cold surface currents of the Central Atlantic. The seas bordering Sierra Leone are known to be fairly rich in fish resources. There is a large natural harbour on the estuary of the Sierra Leone River. The coastline stretches for about 200 miles and it is irregularly indented, providing numerous near-shore ecological habitats such as estuaries, bays, lagoons and mangrove swamps. Most of these habitats are still unspoilt and provide many interesting ecological problems for investigations.

The present research activities of the Institute are centred on the three Senior Scientists: Professor D.E.B. Chaytor continues to participate and supervise the research projects on the biological problems associated with commercial oyster culture -

- i fouling of raft-cultured oysters
- ii oyster larval ecology and
- iii oyster reproductive biology.

His project on the mullets funded by International Foundation for Science is also in progress.

Dr. I.W.O. Findlay has been monitoring several physico-chemical properties of some streams discharging into the Sierra Leone River Estuary for three years now and although short gaps occur in his sampling, the data accumulated so far should provide some useful baseline information for future pollution studies. His work on the algal ecology of one of the streams is still in progress.



Dr. W. Okera completed a project on the cockles Senilia (Arca) senilis and the first phase of the beach-seine inshore pelagic fisheries project. He will resume the latter project in due course; currently, he has started studies on the 4 species of penaeid shrimps,

### Teaching Programmes

The senior staff of the Institute teach the following University Marine Science courses:

- 1 The Undergraduate Diploma in Aquatic Biology and Fisheries, now in its sixth year of operation, was formulated by the Institute with the aim of providing a practical aquatic sciences course for a limited number of Sierra Leoneans and other nationals who would become Fisheries Field Officers or Superintendents in the Fisheries Division of appropriate Government Ministries or for appointment in similar capacities in the fishery industries. The Diploma holder is also suitably qualified for laboratory work in the water industry and municipal functions of water pollution prevention. The course duration is three years and the minimum requirement for admission is a School Certificate with 4 Credits (or equivalent G.C.E. qualification) including Biology (or Additional General Science and General Science) and Mathematics, and at least a Pass in English Language. Applicants with G.C.E. "A" levels or other comparable qualifications are also considered for admission. In the Diploma course, the students learn the elements and basic techniques of aquatic and fishery science studies. Although

presently the Institute's facilities for practical training at sea, inland lakes, rivers and estuaries are limited, the teaching staff are doing their best to provide a training that will produce practical Extension Workers for the rational exploitation, development and management of the fisheries and other marine and freshwater resources of Sierra Leone. The senior staff of the Fisheries Division of the Ministry of Agriculture and Natural Resources also participate in the teaching programme of the Diploma, thereby ensuring that the relevance of the course to the practical needs of the country is maintained. This joint effort undertaken by a department of the Government Ministry and that of the University in the training programme will also enable the students to readily appreciate the relevance of University education in the service of a nation.

- 2 At the B.Sc.(General) and B.Sc.(Hons.) degree courses in the biological subjects, the senior staff of the Institute teach courses in algae, algal ecology and limnology in the Botany Department and marine ecology and fisheries science in the Zoology Department at Fourah Bay College. Zoology Honours students in their 4th and 5th years also carry out short research projects with senior members of staff of the Institute as part of the requirements for the Honours degree.

- 3 The Institute has drawn up syllabuses for a 5-years B.Sc. Honours degree in Marine Science (specialising either in the Biological, Physical, Chemical or Geological Oceanography). At its present stage of development, financial limitations and priorities, the Institute is only able to launch the Marine Science (Biological Oceanography) degree course; it is anticipated that entry into this course will be highly competitive and restricted to really promising future Marine Biologists. Courses leading to the Marine Science degree in physical, chemical and geological oceanography cannot be started unless the Institute's facilities in the teaching and research of these subjects both on shore as well as at sea are developed. It is hoped that the development of these subjects will receive the attention that they ought to be receiving as soon as the financial circumstances permit. For without the effective establishment of these disciplines, we shall not be able to provide an interdisciplinary course in Marine Science and neither are we fully justified in calling ourselves an Institute of Oceanography!
- 4 Facilities exist at the Institute for post-graduate work in Marine Biology and Fisheries Biology, leading to higher degrees of the University of Sierra Leone. Post-graduate research projects are oriented towards finding practical solutions of biological problems associated with the exploitation, development and conservation of the aquatic resources of Sierra Leone.

## PROJECT SUMMARIES

## Marine Mollusca of Sierra Leone

D.E.B. Chaytor &amp; A.A. Aleem\*

A collection of the marine mollusca has been assembled for reference purposes in the Institute of Marine Biology and Oceanography. It has been made over a period of five(5) years from several localities around the Sierra Leone River Estuary and the Freetown Peninsula. This is part of a bigger effort to build up a reference collection of the marine fauna and flora of Sierra Leone. Notes have been included on the occurrence and abundance as well as on general ecology of the species. So far the Cephalopoda and Polyplacophora have been excluded.

Sixty species of gastropods have been documented; fifty species of bivalves and one scaphopod complete the present list.

The list is accompanied by a short note on the marine mollusca of economic importance in Sierra Leone, namely Ostrea (= Crassostrea) tulipa and Arca (= Senilia) senilis. Cymbium neptuni, C. proboscida and Tonna galea are large edible molluscs inhabiting deep waters and frequently taken in trawl nets and beach-seines. Other bivalves sought for food are Chama, Donax, Tellina and Tagelus angulatus. The biology of these species, being so little known, should be fertile ground for studies in the near future.

The general picture of rocky shore zonation shows the periwinkles dominant in the upper littoral zone, with Littorina angulifera occupying the more sheltered shores while L. punctata and Tectarius granosus occupy more exposed shores. T. granosus penetrates higher up the shore than the other two periwinkle species.

The mid-tide zone is the site of the oysters and the barnacles, with Brachyodontes puniceus occupying the crevices among the barnacles and extending down to the lower littoral zone. The limpet Siphonaria pectinata abounds just below the barnacle zone along with the key-hole limpet Fissurella. This is also the zone of Chama and Thais which extend even to the infralittoral zone.

Tectarius, Littorina and Nerita display vertical migrations following the rise and fall of the tidal level.

Fuller details of the biology and ecology are to be found in Aleem and Chaytor (1976).

\*Present address: King Abdulaziz University,  
Jeddah, Saudi Arabia.

## The cockle fishery of Sierra Leone

W. Okera

In Sierra Leone, several marine molluscan species are gathered for food by the coastal inhabitants. The mangrove oyster Crassostrea tulipa which is also found growing on estuarine intertidal rocks and the brackish and estuarine intertidal cockle, Senilia senilis(L.) (= Arca senilis L. 1758) are the most important exploited species. Other molluscan species eaten include the sublittoral rock oyster Crassostrea denticulata, the gastropod Cymbium spp. and the cuttlefish, probably Sepia officinalis hierredda. From the estuaries and mangrove creeks, the bivalves Iphigenia laevigatum, Tagelus angulatus, Tellina nymphalis and the gastropods Tympanotonus fuscatus and Semifusus morio are also collected. While some work has been done on the oyster, the biology and fishery of the remaining species are poorly known.

The cockle is frequently seen being gathered in the villages dotting the coastline of Sierra Leone River Estuary and the smaller estuaries of the Freetown Peninsula. Dried cockle meat is often on sale in Freetown markets and the shells, with their convex surfaces uppermost, are fixed in the soil around the village huts. The latter practice probably minimises the erosion of the soil that can be caused by heavy rain-water runoff from the roofs. Cockle shells are also used in making handicrafts.

All the cockle collection sites examined were exploited and had cockle densities of about 9 large (>10mm)

individuals per m<sup>2</sup>. At River No.2 estuary at peak spatfall, there were about 130 seed cockles per m<sup>2</sup>. Spat settlement began in November-December after the rainy season, reached the peak in January-February and continued to early part of the following rainy season (May-June). Seed cockles were absent from August to October.

Rings on the cockle shells were formed once a year, during July to September (maximum rainfall) and they were successfully used in ageing the cockles. The first ring was formed at a mean age of 7 months and the subsequent ones annually. The growth period of the inter-ring bands, considered to extend from August to following July (Senilia senilis growth year), may actually be of only 10 months duration. Sublittoral cockles from No.2 estuary showed higher growth rate compared to those of the beds exposed at low tide and subjected to greater exploitation. Those from the Sierra Leone River Estuary showed even greater growth. Senilia senilis grows slowly and lives long (up to 8-9 years) but heavy exploitation in many places reduces the stocks to young and few year-classes.

Preliminary investigations on the fouling  
organisms affecting raft cultured oyster  
populations in Sierra Leone

Cho Wellesley-Cole

Earlier work on oyster culture in Sierra Leone was done by E.T.A. Golley-Morgan during 1964 and 1965 at Bonthe. Further work was done in the Sierra Leone River Estuary in 1965 by two oyster culturists from Taiwan and by J.B. Hunter in 1969. These earlier studies led to systematic attempts at culturing oysters, beginning in February 1974. This present study is part of the Oyster Culture Project of the Fisheries Division, Ministry of Agriculture and Natural Resources. It deals with fouling organisms which are marine and estuarine organisms interfering with the growth of oysters on raft cultures. The preliminary investigations were carried out during December 1975 and January 1976.

Three stations to be studied were selected and visited on a weekly basis. These were,

- 1 Jui, situated on the east coast of the Freetown Peninsula off the Bunce River, a tributary of the Sierra Leone River;
- 2 Kissy Dockyard I, also situated on the east coast of the Freetown Peninsula on the Sierra Leone River Estuary and
- 3 Dare, 35km north east of Freetown on the Sierra Leone River Estuary.



Tray, rack, beach and raft culture methods have been used in Sierra Leone; however, raft culture has been found to be most productive and therefore research was focused on foulers affecting raft-cultured oysters. Oyster shells, bamboo and asbestos panels measuring about 8 x 6 x 1 cm were punched through the middle and strung out 0.5m apart on weighted nylon strings to a depth of 2m. These strings bearing the panels are known as the cultch and they were hung on the rafts at the different stations and exposed for one month.

At Jui and Dare, Crassostrea tulipa spat, Nereis sp. (a polychaete worm), Membranipora annae (a bryozoan), Balanus amphitrite (a barnacle), Enteromorpha sp. (a green alga) and Polysiphonia (a brown alga) settled on the cultch to 1m depth. Eudendrium sp. (a hydroid) was found at this depth at Jui, but not at Dare. Brachyodontes puniceus (a mussel) was found at Dare at this depth, but not at Jui or Kissy Dockyard I. Eudendrium sp., Enteromorpha sp. and Balanus amphitrite settled above 1m at Kissy Dockyard I, B. amphitrite being the main fouling organism at this depth.

From 1m to 2m depth, Balanus amphitrite was the main fouler at the three stations. About this depth, C. tulipa settled at Dare and M. annae, Nereis sp. and Eudendrium sp. were found at Jui.

Polysiphonia sp., Enteromorpha sp., Eudendrium sp. and C. tulipa were found on the dorsal surfaces of the cultch panels. M. annae and B. amphitrite set on the under surfaces of the panels. Below 1m, B. amphitrite set on both the upper and lower surfaces of the cultch.

Nereis sp. was found on both surfaces but predominantly on the ventral surfaces, underneath M. annae. At Dare, B. puniceus was found among the algae on the dorsal surfaces of the cultch. At Kissy Dockyard I, B. amphitrite set on both the surfaces of the cultch, from 0.5m to 2m depth. M. annae was found at the same depth on both the surfaces of the cultch at Jui.

This preliminary short-period investigation gave an indication of the type of fouling organisms colonising raft-cultured oysters at the various stations and the variation of fouling with depth at each locality. It also appeared that there is some synchronisation in the reproductive cycles of the foulers and the oysters. All these aspects of the work are still under fuller observations.

Larval oyster ecology  
in relation to oyster culture

Rebecca Thomas

The purpose of the study is to obtain a general seasonal and spatial distribution of the abundance of oyster and other lamellibranch larvae in the plankton of the Freetown Estuary. The larvae of fouling organisms such as barnacle nauplii and cyprids and the cyphonautes larvae of bryozoans are also monitored. Both these parts of the study complement the concurrent studies on the organisms fouling oysters on raft cultures and also on those dealing with the reproductive cycle of the oyster.

Work is done at various stations (Dare, Pothko, Jui and Kissy Dockyard) in the Sierra Leone River Estuary. There is also a station on the Freetown Peninsula at No.2 River Estuary. Weekly sampling at the various sites for hydrological data and plankton is undertaken. A standard plankton net of No.21 silk is used and only 5-minutes surface tows are made. When the Clarke-Bumpus sampler and a pump become available, vertical tows and quantitative work will be undertaken. When lamellibranch larvae such as those of oysters, mussels and shipworms are observed in the samples, they are separated from the rest of the plankton. The larval stages of fouling organisms, especially those of the barnacles and bryozoans are also noted.

Quantitative analysis of the present samples is difficult because they often contain considerable

amount of silt or are dominated by blooms of centric diatoms, mostly Coscinodiscus spp. Thus the samples are analysed qualitatively using an arbitrary scale to indicate relative abundance.

From the results obtained so far (January 1976 to August 1976) it has been observed that the occurrence of oyster larvae in the plankton varies from month to month for each station. Oyster larvae are present at all the stations from January to about August with a decrease in the abundance during July and August. It appears that the larval stages of the oyster spend about a week in the water; however, it is hoped that the correctness of this observation will be established as the work progresses. The different stations have been observed to be rich in plankton species, with a reduction in the number of species when the salinity drops. This was especially marked at the No.2 River station. Barnacle nauplii are frequently observed and occasionally they become quite abundant. Cyphonautes larvae are rare though the adult colonies are observed on the cultch.

Preliminary studies on the reproductive  
cycle of the mangrove oyster Crassostrea tulipa

E.T. Ndomahina

A part of the current Oyster Research Project being carried out by the Fisheries Division of the Ministry of Agriculture and Natural Resources involves the study of the reproductive and gonad changes in the mangrove oyster Crassostrea tulipa. It is hoped that at the end of this study the following aspects of the reproductive biology of the oyster will become known:

- 1 Gonad morphology and development
- 2 Gonad histology and germ cell development
- 3 Nuclear maturation and early cleavage
- 4 Breeding season
- 5 Age at first maturity
- 6 Sexuality
- 7 Glycogen cycle
- 8 Effects of environmental factors such as temperature and salinity on the gonadal changes.

The specimens of wild oysters were obtained from a station at Jui and were collected at approximately monthly intervals. In the laboratory, a selected number of oysters was divided into size-groups and measured for certain metrical characters. The hinge or umbral region is dorsal and the shell edge directly opposite is ventral. Externally the byssal notch is in anterior region. The maximum distance in the dorso-ventral direction is referred to as the dorsoventral measurement (D.V.M.). The anterior-posterior measurement is referred to as (A.P.M.). The thickness of the

valve at the hinge line is referred to as the heel depth (H.D.). The metrical characters are important in growth studies as well as taxonomic studies. Three size groups have been recognized beginning from the smallest to the largest.

The gonadal tissues were removed, fixed in Buoin fluid and processed using standard method of paraffin section. A group of large oysters was fixed in Bauer-Feulgen so that the glycogen content could be estimated. So far, only a limited number of large specimens kept in wax have been sectioned at 15 $\mu$  thickness and stained in haematoxylin and eosin.

By looking at the "visceral mass" around which is wrapped the gonads and also making smears of the gonadal tissue there is hardly any specimens above 10mm (dorsoventral measurement) without a visible trace of gonad. This is in sharp contrast with some bivalves reported in temperate regions e.g. Pinctada albina, Avicula lucunata and Pteria vulgaris, for which such sizes are regarded as juvenile. This probably suggests that Crassostrea tulipa has a shorter life-span.

The cross-section of the gonad is in the form of an inverted U as in Paphia staminea. Sections across the same gonad will cut through follicles showing identical gonad condition, thus making the choice of site relatively unimportant. A significant number of male and female gonads in large oysters is normally cream and yellow respectively. But this is not a good method of determining sex since up to 10% error can occur.

Since no sections have yet been taken of young oysters, no definite statement can be made about the exact region from which the gonad arises. It is, however, believed to be due to the activity of a pair of primordia (thin layers of cells) immediately posterior to the urogenital papillae. As each layer spreads, the group of cells attach themselves to thin membranes that later develop into follicles. The primary follicle proliferates longitudinally as far as possible. When the follicles are fully developed, the cells cease to multiply and gametogenesis begins.

There is no set pattern for the classification of gametic activity but three important scales of reference are in wide use:

- 1 The relative abundance of glycogen in ripe and unripe gonads.
- 2 The extent of gonad development based on the area occupied by the gonad follicles relative to the connective tissue.
- 3 Recognition of phases of gamete development based on histological features e.g. nuclear features, cell sizes and staining characteristics.

It is hoped that all these three criteria of gonad maturation will be examined during the course of study.

As many as eight stages of gonadal activity, five of which are developmental and three regressional have been recognised by earlier workers. In addition, there is an inactive stage called 'i'. Dinamani (1973) working on Crassostrea glomerata recognised six stages for both male and females and an 'R' stage of

indeterminate sex. Dinamani's view has been adopted after a careful observation of a few sections of oyster gonads collected from December 1975 to July 1976.

Gonadal smears and the presence of oyster spat on samples of wild oyster colonies obtained each month suggest that spawning occurs for most part of the year. There is a variation in the intensity of spawning from time to time. Observations made so far, strongly suggests that the gonads are in developmental stages during most part of the dry season (December to March). They are mature in April to the end of May when spawning begins in the wet season.

A study of the reproductive cycle of the oyster is important because the information obtained on the spawning times, localities and behaviour may enable spat ("seed") collectors to be set up in time before the spawning peak or peaks. It is also necessary to identify which of the spawning peaks will be more advantageous than others with respect to the growth and fattening of the cultured oysters.



Fishes taken by the beach-seines at  
Lumley, Freetown

W. Okera

The inshore-pelagic fisheries of Sierra Leone is of considerable local economic importance. Pelagic fishes account for nearly 80% of the total catch of the indigenous Sierra Leone fishing industry. The entire inshore pelagic fisheries of the coast is presently dependent on the canoe fishermen, also now called the artisanal fishermen. Their main fishing gears are the beach-seine, cast-, drift-, ring- and set-nets.

From July 1974 to May 1976, the author frequently visited Lumley beach, Freetown, to examine the catches taken by the beach-seines. One or two beach-seines fish from the sandy Lumley beach daily, except on Sundays. The nets are shot in Cockerill Bay in depths extending from the surf line to ca 7m at the furthest point reached by the net.

Sixty two species were recorded from the catches of the beach-seines. The five pelagic species Sardinella eba (flat herring), Cybium tritor(mackerel), Caranx hippos (cowreh), Caranx senegallus(joe fish) and Caranx crysos(pollock) dominated the catches most of the time. Juvenile Sardinella eba, and at times mixed with young Sardinella aurita(round herring) were the most important, both in numbers as well as weight. Of the larger species, a total of about 1266 Cybium tritor, 791 C. hippos, 921 C. senegallus and 698 C. crysos were counted but in terms of weight, C. hippos was probably

the most important, followed by Cybium tritor, C. crysos and C. senegallus in that order, the last two species probably occurring in roughly equal proportions by weight. Occasionally, the Sardinella-Cybium-Caranx dominance was obscured by the preponderance of one or few of the smaller species such as Chloroscombrus chrysurus(cutmoney), Brachydeuterus auritus(caiman), Vomer setapinnis(pomp), Engraulis hepsetus(langa-mina), Ilisha africana(lati); Caranx rhonchus(?) and young Sphyraena guachancho(kinni). Several other species occurred in the individual hauls, mostly in unimportant quantities.

Adult Cybium tritor, the three large species of Caranx and Trygon margarita(stingray or skeete) were most abundant during the last two months of the rainy season (September and October) and first four months of the dry season(November to February). Large quantities of Chloroscombrus chrysurus, Vomer setapinnis and Brachydeuterus auritus were caught during the rainy season(May to October) and they were also present during February.

Young Sphyraena guachancho and Caranx senegallus also appeared during some months of the rainy season and they probably represented broods spawned during the preceding months of September to February.

For the purposes of managing the pelagic fisheries of Sierra Leone for rational exploitation, it is necessary to monitor all the different pelagic fisheries of the country and collect accurate data on the quantities of fish caught and the biological characteristics of the

exploited species. From this study it became apparent that the routine statistical sampling of the beach-seine catches for numbers, weights and lengths of each of the major species caught can be achieved without much difficulty.

For further information on the beach-seine fishery of Lumley, the reader is referred to the paper by the author entitled "Some observations on the catches of beach-seines fishing at Lumley, Freetown, Sierra Leone" which is to be published in Bulletin IFAN.

#### Additional articles

Participation in the Fishery Research Expedition  
of the R.V. FIOLENT - 9 July to 6 September 1976

A.C.V. Forde\*

In accordance with a contract between FAO and SOVRIBFLOT (Soviet Fishing Fleet), the R.V. FIOLENT has been undertaking fisheries research along the West African coast between latitudes 4°N and 17°S. The vessel 'FIOLENT' is 82m long stern-trawler and had on this expedition, 18 Russian scientists on board, 70 men crew and 7 participants from some of the West African maritime countries (2 from Sierra Leone, 2 from Nigeria, 2 from Benin and 1 from Guinea). I boarded the FIOLENT on 5 July at Dakar and the cruise sailed on 9 July 1976.

The aims of the cruise were to investigate resources distribution, evaluation of bottom and pelagic fish stocks and crustaceans and ways of developing the fisheries of the regions. The oceanography of the fishing areas was also studied. The cruises of the FIOLENT consisted essentially of background surveys, each series of surveys lasting for 6 months (January to June and July to December). Each survey covered 75-80 stations. At each station, temperature and salinity were measured by reversing thermometers and electro-salinometers respectively. At the deeper stations, measurements were taken to depths of 1000-1500m. Alternate stations were established for hydrochemical studies but the latter became more frequent with sharp changes in the hydrochemical environment.

During background surveys, biological work included observations on the fish catches to determine the following catch characteristics:

- 1 species composition
- 2 total weights of leading species in each haul, and
- 3 determination of weight, sex, gonadal state, stomach contents and fat content of individuals of the most important species.

The results of the background surveys were analysed to determine areas to be studied in detail by microsurveys. Two microsurveys were carried out, each lasting for 6 days, the first between Gabon and Zaire from 1 August to 7 August 1976, and the second along Angola.

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Hydroacoustic work and controlled fishing were the most important components of these investigations.

The expedition also undertook some tests on fishing techniques and fish processing.

The research activities of the FIOLENT started on 18 July 1976, off the island of Marias Nguema Biyoge (formally Fernando Poo). By 24 July, the vessel was off Gabon but Libreville did not give permission for investigations of the stations within the territorial limits. The FIOLENT arrived Luanda on 16 August but permission was refused by the Angolan Government to carry out the microsurvey within the territorial waters. The ship left Luanda on 18 August and arrived at Lagos on 6 September, where I disembarked.

It is hoped that the data collected by the expedition, which were only partially analysed during the expedition for cruise purposes, will yield information on the following topics:

- 1 Oceanographic conditions in the area during the period of investigations.
- 2 Distribution of the main hydrochemical elements.
- 3 Development and distribution of plankton and identification of most productive areas.
- 4 Biological characteristics of the fish population of the area.
- 5 Stock assessments of the commercial fish species and their tendency to change.
- 6 Fishery potential of the different regions, both demersal and pelagic.

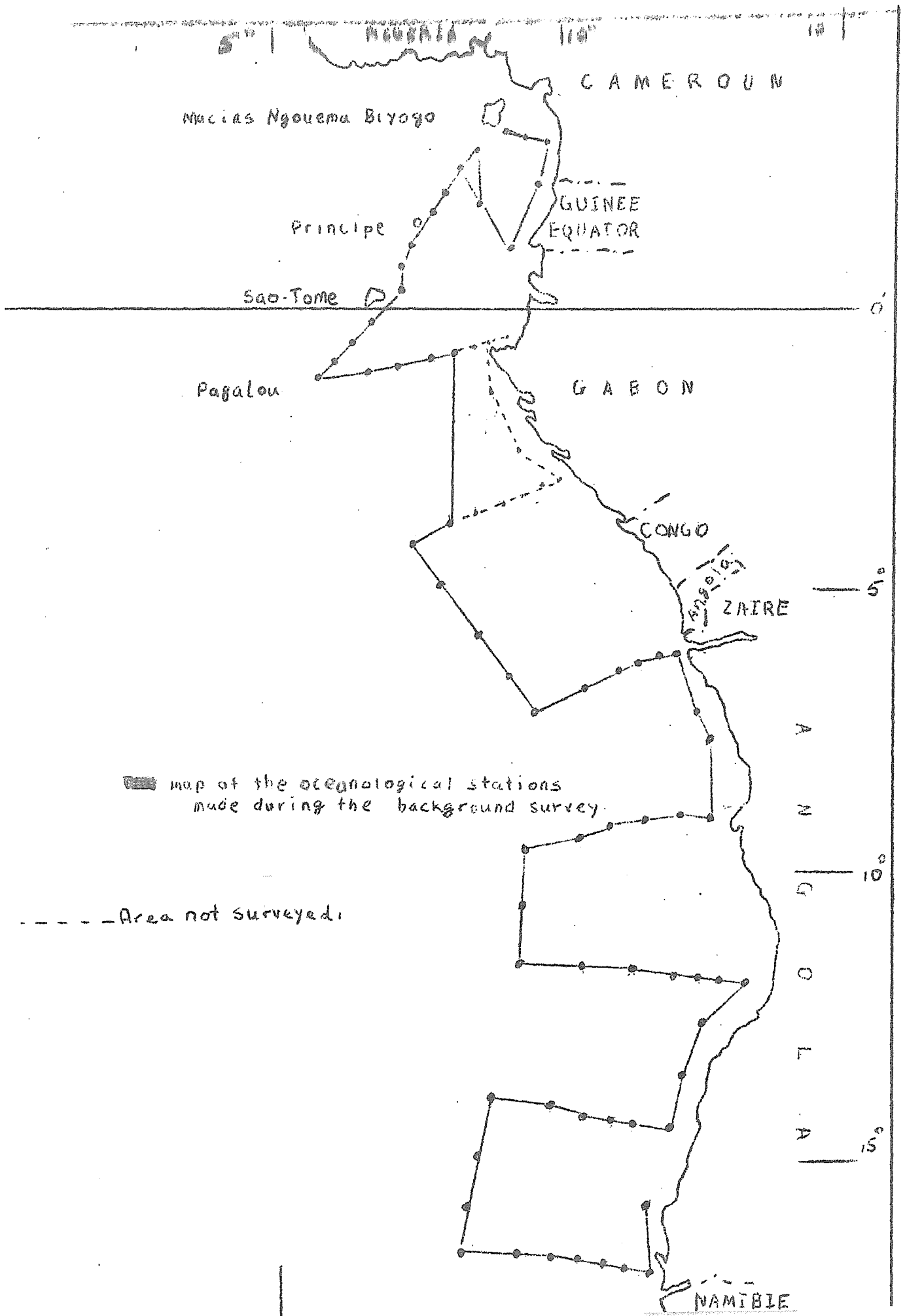
7. Techno-chemical, quantitative and economic aspects of the fished species.

Several of the observations made on the fish catches were quite interesting. For example,

- 1 some species of fish caught during the cruise such as Pagrus ehrenbergi, Pseudotolithus senegalensis, Dentex angolensis, Sardinella aurita, Torpedo torpedo and Decapterus punctatus were also to be found in Sierra Leone.
- 2 A total of 27 demersal trawls were made during the background surveys and altogether 243 species of fish were caught. Of these, 136 species were caught only once and one species caught 13 times.
- 3 A total of 53 species were caught during the two micro-surveys of which 27 species were caught more than 4 times.
- 4 There were some species which had characteristics of being caught only during the day and some only at night.

Map showing the route of FIOLENT  
during background survey

(See page 41)







Records of the west African manatee,  
Trichechus senegalensis Desm. in Sierra Leone.

A. Cole\* & W. Okera

With the growing international interest in the manatees as biological weed controllers, their value as a food source and their vanishing numbers (Allsopp, personal communication), this article sets out the information currently available on this mammal in Sierra Leone.

A specimen of female T. senegalensis was accidentally captured on 9 December, 1973, in a demersal trawl fishing in 2-4 fm depth of water in the upper reaches of Sierra Leone River Estuary. Its total length (tip of snout to the rounded middle portion of the tail end) was 2.43m, maximum girth 1.63m and weight 228kg. The intestine was full of thoroughly crushed unidentifiable leaves.

There are three other unconfirmed reports of manatee finds in Sierra Leone: One is said to have been caught at Rokia Village on the estuary of Great Scarcies River some time in July 1954; another trawled in March 1959 in the Sierra Leone River Estuary and a third trapped in a fish fence located in the same body of water, some time during 1963 and landed at Rokupa Village on the Bunce River. Morton (quoted from Allsopp, 1969) mentions about the manatee occurring in Sierra Leone and of its capture for food.

\*Fisheries Division, Ministry of Agriculture and Natural Resources, Freetown, Sierra Leone.

Little is known of the biology and exploitation of the manatee in Sierra Leone. Dr. Allsopp says that there are very few of the African species. Also, there are reports of the manatee eating and destroying rice planted in the cleared mangrove swamps and of villagers setting traps probably for the dual reasons of reducing damage caused by them and for the flesh that has a high esteem in the area. These reports are said to be particularly true of the Sherbro riverine system.

Reference:

Allsopp, W.H.L.(1969) Aquatic weed control by manatees - its prospects and problems. In Man-made lakes: the Accra symposium Ed. L.E. Obeng. Ghana Universities Press.

Visitors to the Institute during the period  
November 1975 to November 1976

- |  |   |
|--|---|
| Dr. D.B. Quayle                                      | International Development<br>Research Centre, Canada,<br>(Lectures and field demon-<br>strations on the biological<br>problems of oyster culture).                                      |
| Professor G.W. Lawson                                | School of Plant Biology,<br>University College North<br>Wales, Bangor, U.K. and   |
| Dr. D.M. John  | Department of Botany,<br>University of Ghana, Legon,<br>Accra.<br>(Study of the littoral and<br>sublittoral algae of Sierra<br>Leone).  |
| Professor E.W. Knight-Jones<br>and Mrs. Knight-Jones | Department of Zoology,<br>University College Swansea.<br>(Collection of littoral and<br>sublittoral spirobids).   |
| Dr. F.T. Banner                                      | Department of Oceanography,<br>University College Swansea.<br>(Proposals for a joint<br>oceanographic link between<br>University College Swansea<br>and University of Sierra<br>Leone). |
| Dr. D. Kaniaru and<br>Dr. P. Angot                   | United Nations Environmen-<br>tal Programme, Nairobi,<br>Kenya. (Regional<br>co-operation in marine<br>pollution study and control).  |
| Mr. E.P. Sellner                                     | Daniel, Mann, Johnson &<br>Mendenhall, Freetown and<br>Los Angeles and  |
| Mr. Alex Harleston                                   | Ministry of Works, Energy<br>& Power and  |
| Mr. Charles Gunnerson                                | Marine Ecosystem Analysis<br>Program, NOAA, USA.<br>(Ecology of Sierra Leone<br>River Estuary in relation<br>to pollution problems).  |

Mr. John Kambona	FAO Regional Office, Accra. (Familiarisation tour).
Professor C.I.O. Olaniyan	Department of Biological Sciences, University of Lagos. (External Examiner for B.Sc. Zoology and Diploma in Aquatic Biology and Fisheries).
Mr. B.F. Dada	Director, Federal Depart- ment of Fisheries, Nigeria and
Mr. T.W. Maembe	Chief Fisheries Officer, Tanzania and
Mr. P.K. Mushinge	Deputy Director, Fisheries, Zambia. and
Mr. Y.I. Medani	Chief, Fisheries Department, Sudan and
Mr. N. Odero	Director of Fisheries, Kenya and
Mr. A.O. Taylor- <sup>Thomas</sup> <del>Smith</del>	Senior Fisheries Officer, Gambia and
Mr. A.R. Biribonwoha	Acting Chief Fisheries Officer, Uganda. (Familiarisation tour).

## Other publications from the Institute

- Aleem, A.A. & D.E.B. Chaytor Further observations on the marine molluscs of Sierra Leone. 1976 (in press; Bull. IFAN).
- Findlay, I.W.O. A report on the poor performance of Sierra Leone candidates in the West African Examination Council School Certificate/General Certificate of Education Ordinary level Examination in Science subjects during the period 1968-1973. July 1975.
- Findlay, I.W.O., Ayodele Cole, N.H. & Williams, M.O. Inadequacies of Science teaching in African Schools; paper presented at UNESCO Conference on Problems of Teaching Science in African Universities, Nairobi, Kenya, August 1975.
- Okera, W. Observations on some population parameters of *Senilia senilis* (L.) (= Arca senilis L.) in Sierra Leone. Marine Biology 1976 (in press).
- Okera, W. Some observations on the catches of beach-seines fishing at Lumley, Freetown (Sierra Leone). Bull. IFAN

