

# SANCOR: Summary report on marine research 1983

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SANCOR

Summary report prepared for SANCOR by the  
chairmen of its programmes

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Cover : Chlorophyll distributions along the Cape West Coast on the 19 February 1979, derived from the Nimbus-G7 satellite Coastal Zone Colour Scanner (CZCS) data. The CZCS radiometric data were converted to chlorophyll concentrations at the National Physical Research Laboratory (NPRL) by making use of specialized algorithms developed at this Laboratory. (Photograph and above explanation by Mr N Walters, SADC0, NRIO, Stellenbosch).

## **PREFACE**

The South African National Committee for Oceanographic Research (SANCOR) Programme is one of a number of cooperative research programmes which are managed by the Cooperative Scientific Programmes (CSP) of the Council for Scientific and Industrial Research (CSIR). These programmes depend upon cooperation between Scientists from various disciplines for the solution of diverse questions, including many with important management applications.

The SANCOR programme is administered under six separate constituent programmes. These are: Benguela Ecology, Coastal Processes, Estuaries, Marine Linefish, Marine Pollution (including Oil Pollution Research) and Marine Sedimentology.

Funds to support the research undertaken within these programmes are obtained from the CSIR, the Department of Environment Affairs and the Department of Transport.

For each of these programmes, an annual status report is prepared by the respective programme committee chairmen. These status reports are prepared in a similar manner, and include summaries of the research undertaken and emphasise major findings and conclusions. These status reports have been combined with an appropriate introduction to form this annual summary report on research.

This summary report complements a limited edition volume which is prepared annually and which contains progress reports and final reports on all SANCOR supported projects as well as on many others submitted to SANCOR on a voluntary basis.

A list of all acronyms which appear in this report is given on page 47.

This report is the second in the series.

## **ACKNOWLEDGEMENTS**

The financial support of the CSIR, the DEA, and the DOT is gratefully acknowledged. Without their contribution and encouragement, the important marine research undertaken in the SANCOR programme would not be possible.

The marine community at large is indebted to all committee members, but particularly to chairmen, for their considerable efforts and personal contributions in guiding the development of SANCOR and its constituent programmes.

## **ABSTRACT**

The South African National Committee for Oceanographic Research (SANCOR) coordinates and administers a significant portion of the marine research conducted in South Africa under six discrete programmes. These are; Benguela Ecology, Coastal Processes, Estuaries, Marine Linefish, Marine Pollution and Marine Sedimentology. This report includes summaries for the activities of each of these programmes for 1983, and emphasises important findings and conclusions.

The total budget for SANCOR for 1983 was R1 831 000.

## **OPSOMMING**

'n Belangrike deel van mariene navorsing in Suid-Afrika word deur die Suid-Afrikaanse Nasionale Komitee vir Oseanografiese Navorsing (SANKON) in ses onderskeie programme gekoördineer en geadministreer. Die programme is: Benguela-ekologie, Kusprosesse, Getyrieviere, Mariene Lynvis, Seebesodeling, en Mariene Sedimentologie. Hierdie verslag bevat opsommings van die aktiwiteite van elk van hierdie programme gedurende 1983 en beklemtoon belangrike bevindings en gevolgtrekkings.

Die totale begroting vir SANKON vir 1983 was R1 831 000.

**SANCOR : SUMMARY REPORT ON MARINE RESEARCH 1983**

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## INTRODUCTION

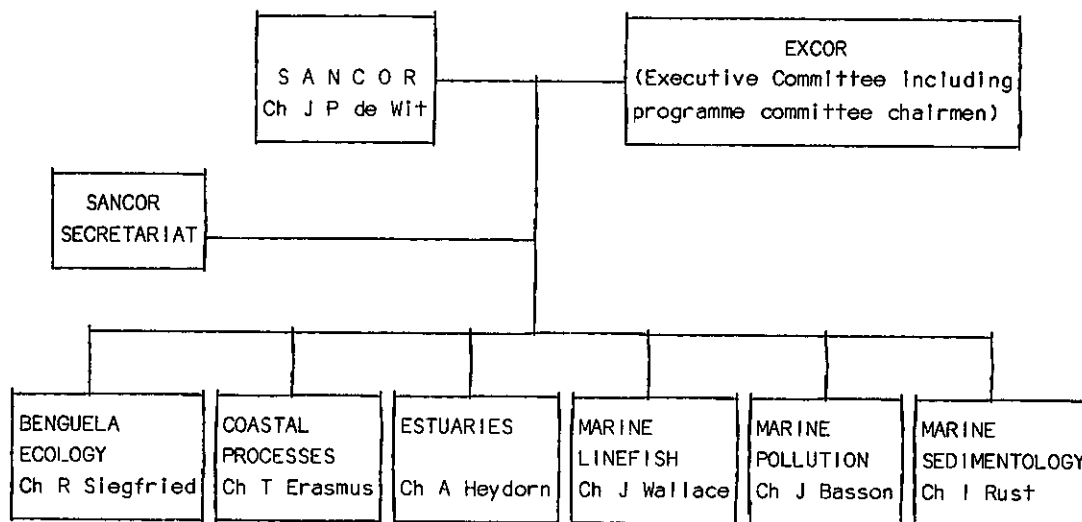
### THE SANCOR PROGRAMME

The objective of the SANCOR programme is to gain knowledge of the basic structures, processes and relationships in the marine environment around Southern Africa in order to provide a fundamental scientific understanding and to facilitate :

- the efficient exploration, exploitation and conservation of living and non-living resources;
- the judicious management of the coastal zone;
- the fuller understanding of climate;
- improved utilization of environmental information in maritime activities.

The administration of the individual research projects supported by SANCOR is undertaken through six separate programme committees, with overall policy and scientific guidance being provided by SANCOR itself (see below). The membership of SANCOR is representative of the oceanographic community in South Africa. It is shown in Appendix I, while the terms of reference of SANCOR as well as of the six programme committees are summarized in Appendix II.

### STRUCTURE OF SANCOR



FINANCES ADMINISTERED DURING 1983

An interim summary budget for finances administered by SANCOR for the financial year 1983/84 is shown below:

Income

CSIR	R 949 000
DEA - Environmental Conservation Directorate	760 000
- Sea Fisheries Research Institute	84 000
DOT	<u>38 000</u>
	<u>R1 831 000</u>

Expenditure

Research programmes :	Benguela Ecology	R 417 092
	Coastal Processes	215 000
	Estuaries	279 000
	Marine Linefish	58 000
	Marine Sedimentology	96 000
	Marine Pollution	468 000
	- Oil Pollution	38 000
	Other Projects	54 000
	Salary Bonus Payments	48 000
Programme Management (including secretariat salaries, international activities, national meetings and publication costs)		238 000
		<u>R 1 917 000</u>

It should be noted that budgeted expenditure exceeds income. This technique of overbudgeting allows for optimum use of available funds, as experience has shown that not all approved research posts are filled for the entire financial year.

STATUS REPORTS OF PROGRAMMES

An annual report for the year 1983 has been prepared for each of the six constituent programmes of SANCOR by the respective programme committee chairmen and are included here. These status reports are concerned mainly with the projects supported by SANCOR and do not in general attempt to even refer to the very significant amounts of marine research supported elsewhere. However, much of the latter work is reported to SANCOR annually for information and in such cases is included in the publication 'Progress Reports to SANCOR'. This substantial report should be referred to for further details on specific projects.

The six programme status reports have been prepared in a similar manner, to concentrate on items of special significance. Major findings and important conclusions are emphasized, particularly where they provide relevant information for management purposes. A full list of projects supported by each programme is also included.

A similar status report is available on the SASCAR Oceanography Programme which has developed from the now defunct SANCOR Southern Ocean Programme. Emphasis in the current programme is on work related to BIOMASS, and to work in the waters around the Prince Edward Islands. The BIOMASS work is designed to integrate with the efforts of the about ten other Antarctic countries active in the area and particularly those operating, like South African scientists, in the southern Indian Ocean. The results of the First International BIOMASS Experiment (FIBEX) which took place in 1981, are being finally worked up and much effort has gone into preparation for the first phase of the second experiment (SIBEX) which takes place during early 1984. The work in the environs of Marion and Prince Edward islands is aimed at an understanding of the general oceanography of the area particularly as it affects the ecosystem of the islands as a whole. In addition attention is given to the general circulation of the Southern Ocean, to phenomena at the frontal zones between Africa and Antarctica and to ocean-climate relationships.

The marine geological and geophysical work which formed part of the Southern Ocean Programme is now included in the SASCAR Earth Sciences Programme.



## BENGUELA ECOLOGY PROGRAMME

This report covers the period 1 January to 31 December 1983, being the Second Annual Report on the Benguela Ecology Programme (BEP). The momentum generated by the BEP in 1982 continued to accelerate during 1983, giving rise to many new, at times conflicting, ideas and interests. This is a very healthy sign of development but it makes the task of guiding the programme difficult, since the allocation of research priorities depends to a large extent on what is judged to be of immediate scientific and/or socio-economic importance. The question of what is of immediate importance was addressed during two meetings of the BEP's scientific planning committee during the year under review, when good progress was made towards ordering projects according to priority needs. However, the fundamental problem of where and when boundaries should be drawn for the research programme, and how rigid they should be, remains largely unresolved. My own view is that the present organization of research priorities and projects should not be altered to any great extent during the remaining three years of the BEP's first five-year phase.

### Status

The day-to-day affairs of the BEP were regulated by a small management committee with the help of a full-time liaison officer and a half-time assistant who functioned as a typist and word-processor operator. Additional help was provided by personnel of the SANCOR secretariat in Pretoria.

During the year under review, the BEP embraced 16 separate research projects funded through SANCOR. Five of these projects were the primary responsibility of senior personnel (five persons) of the Sea Fisheries Research Institute (SFRI), and the balance (eleven) was the primary responsibility of senior staff (six members of the University of Cape Town (UCT)). UCT staff were also involved in the SFRI-led projects, since SANCOR funds for salaries of researchers in these projects were channelled through UCT. An additional 70 projects which were funded exclusively by the SFRI contributed to the BEP as well. (Note: The SFRI tends to employ a more 'fine-grained' partitioning of research projects than does SANCOR). Three scientists of the South African Museum and six scientists of the National Research Institute for Oceanology participated in the BEP.

The funds granted to the BEP for the calendar year 1983 amounted to R417 092 excluding R6 400 for International Liaison). Approximately 80 % (R338 176) of this total award supported the 11 UCT-led projects (x = R30 743 per project) and the balance (R78 916) the five SFRI-led projects (x = R15 783 per project). The applications for SANCOR funds for the BEP in 1984 amounted to R666 348, which represents an increase of approximately 60 % on the 1983 budget. About 35 % (R241 393) of the total funds requested for 1984 are for support of projects led by personnel of the SFRI. The BEP's share of the total funds (R 633 945) requested by all programmes from SANCOR in 1983 was about 25 %. The amount (R679 856 including International Liaison) requested by the BEP for 1984 was also about 25 % of the total SANCOR budget.

In accordance with the principal objective of the BEP, viz, 'to provide scientific information on the structure and functioning of constituent ecosystems to complement the knowledge which is required for the management of the renewable natural resources of the Benguela Current region', most of the research in the BEP during 1983 was aimed at improving our knowledge of certain ecological processes in subsystems of the pelagic ecosystem. Only one of the 16 SANCOR funded projects was devoted exclusively to research work in the nearshore system, and not less than 75 % of the BEP's total budget for 1983 was given over to supporting work in the pelagic environment. As a rough estimate, about 50 % of the total budget was spent on research that is aimed directly at improving our knowledge of the distribution, abundance and population dynamics of the Cape anchovy and the pilchard.

Developing new research, monitoring research in progress, and synthesizing and disseminating research findings are promoted in the BEP by a scientific planning committee which was assisted by nine coordinating groups. One of these groups, a special systems-analysis group, helped the scientific planning committee to set targets and deadlines for specific research activities. Regular weekly seminars facilitated communication between all participants in the BEP. Approximately 30 % of the speakers in these seminars came from outside the BEP. In addition to the seminars, the BEP has set itself the goal of organizing at least one symposium-workshop in each calendar year. These meetings are designed to report scientific research findings which bear on topical problems encountered in the management of natural resources in the Benguela Current region. The users as well as the official agencies responsible for regulating the use of these resources are invited to attend the meetings. The symposia and especially the workshops have been of considerable help to the scientific planning committee in its task of identifying areas in need of research and in ordering priorities for research. Most of the changes that have taken place in the direction of existing research (ie projects commenced in 1982 and still operational), and the new projects proposed for 1984, are a direct result of the workshops which identified gaps in the pool of information needed for answering certain crucial questions. The results of these symposia and workshops have been, or are being, published in the scientific literature. In addition, the BEP has its own series of internal reports of which four have been issued to date. Forty-one research papers emanating from the BEP have been published in scientific journals during 1982-1983. The list of titles of these papers will be updated annually, and it is intended to provide a comprehensive and complete record of all publications stemming from the BEP. The list will also provide a basis for assessing at regular intervals productivity in the various components of the programme.

### Findings

A number of important findings emerged from work carried out during the period under review. First, the long-held conventional view that Cape anchovy and pilchard prefer to eat phytoplankton apparently is false. Zooplankton appears to be just as important as, if not more so, than phytoplankton in the diet of these fish.

New refinements to a suite of computer programmes to allow assessments to be made of the abundance of Cape anchovy and pilchard populations were developed. The results of this work include a best-fit stock-recruit curve, providing sustainable yield estimates for the Cape anchovy and a clear indication that the resource has been overexploited in recent years. The results of a study of the degree of genetic divergence between Cape anchovy populations indicate that a certain amount of genetic exchange could occur between the populations of South Africa and South West Africa.

Estimates of phytoplankton productivity from satellite chlorophyll measurements and shipboard experiments have been used to calculate the carrying capacity of the southern Benguela Current system for pelagic fish. Virtual population estimates and guano records indicate that the biomass of small pelagic fish has been halved from a pilchard-dominated system to one dominated by Cape anchovy. However, the productivity of fish has remained roughly constant, suggesting that the production of pelagic fish is limited by plankton production. It appears that a production of two million tonnes (wet mass) of small pelagic shoaling fish is the maximum that can be supported in the southern Benguela Current system. Estimates of the carrying capacity of the spawning area during spring and summer indicate that the maximum spawning biomass that could be supported is little more than  $500 \times 10^3$  tonnes of pelagic fish. A consideration of the fishes' food requirements and availability suggests that fish production in the southern Benguela Current system is most likely to be limited where and when spawning and recruitment take place.

Important advances were made towards a realistic assessment of the impact of natural predators on the Cape anchovy. The available information is best for seabirds and seals and worst for predatory fish, whales and dolphins. Valuable new data on the abundance of Bryde's whale, a presumed major predator of the Cape anchovy, were obtained by means of a Japanese cruise off South Africa in February. New radioisotope techniques have made it possible to estimate that the South African jackass penguin population annually consumes the equivalent of about 8 % of the commercial catch of Cape anchovy. Expressed another way, the Cape fishing industry catches Cape anchovies 13 times as fast as do jackass penguins.

Bacteria have been isolated and characterized from a variety of habitats. Inshore forms are primarily mannitol fermenters, whereas offshore ones utilize glucose. A variable proportion of bacteria appears to be inactive. If this is indeed the case it will have profound implications for tropho-dynamic and energy-budgeting studies. In the inshore environment, an important discovery was that mussels can initiate lysosyme-like enzyme secretion during upwelling in order to utilize bacterial food resources available at that time.

### Highlights

A number of symposia and workshops in 1983 served to highlight the contributions made by the BEP to national and international marine science and fisheries management. First, members of the BEP were

responsible for some 49 poster and four oral presentations of scientific papers at the Fifth National Oceanographic Symposium in Grahamstown in February. Additional contributions were made to the 'Sandy Beaches as Ecosystems' symposium at Port Elizabeth and to the Seventh Congress of the South African Biochemical Society, at Cape Town, both in January. Secondly, three BEP participants attended, and contributed to, an international "consultation of experts to examine changes in abundance and species composition of neritic fish stocks", held in Costa Rica in April. In November, a total of eight BEP members took part in an international symposium on the most important upwelling areas off western Africa, held at Barcelona.

The BEP itself organized four very productive and well-attended meetings in Cape Town, including symposia on Cape anchovy distribution and migration (June), and the Benguela 'warm event' of 1982-1983 (August). Workshops on Cape anchovy predation and 'expert systems' - a new way of identifying research priorities - were held in June and October respectively. Accounts of these meetings have been prepared for publication in the South African Journal of Science, and for distribution in the BEP's series of international reports.

A second set of highlights was provided by two successful acoustic surveys of pelagic shoaling fish carried out by RV *Africana*, and a very productive plankton survey by the same vessel. Preliminary and provisional results of the acoustic surveys *inter alia* indicate the existence of a hitherto unknown large anchovy population off the south coast and a lack of pilchards. These cruises, and others, on vessels operated by the Sea Fisheries Research Institute, have been of great value in the favourable development of the inter-disciplinary and inter-institutional nature of the BEP.

A third highlight took the form of the official report of the Scientific Committee of Enquiry into the Exploitation of Pelagic Fish Resources of South Africa and South West Africa (the so-called Alant committee report). This report contains a number of significant recent findings of the BEP, submitted to the Committee of Enquiry by senior members of the programme. Indeed, it is fair to say that the committee's report was strengthened considerably by expert scientific advice which arose directly out of the BEP.

### Shortcomings

The research priorities now being set by scientists in the BEP are more relevant to the objectives of the programme than was the case about two years ago. However, some of the questions being posed are still too broad to be useful or to lead to critical, rigorous research, and certain other proposals are not practicable within the time and manpower constraints set by the first phase of the programme. More particularly, there is room for better definition of problems and consequent integration of goals of research in the general field of biological oceanography. This matter is, however, receiving the attention of the BEP's co-ordinating group for biological oceanography, as well as that of the systems analysis group. In this context, it is important to bear in mind that at this stage of the BEP it probably would be a serious

mistake to over-plan or regiment the scientific effort that is being put into the programme.

This leads naturally to the major, and most serious, shortcoming of the BEP, which is a scarcity of senior scientists who can originate, plan, lead and organize the work of junior researchers, and then also take on the task of synthesizing and reporting the results of research. In short, there is a scarcity of innovative, experienced scientists who can act as managers of suites of integrated projects. The available trained manpower is also inadequate in three other key fields of the BEP: acoustic mesopelagic surveys, mathematical modelling and systems analysis.

Finally, the SANCOR funds allocated to the BEP in 1983 represented 91 % (excluding cost of ships' time) of the amount requested by the programme. Similarly the forecast for 1984 is that the BEP will receive from SANCOR approximately 24 % less than what was requested. These are real cuts in the BEP, since the amounts requested in all cases are for projects which constitute a full programme, as approved and pruned previously by the programme's scientific planning committee.

### Prospects

It is expected that at the end of the first five-year phase of the BEP, in 1986, 24 projects will have been completed. Three projects are scheduled for completion by the end of 1983.

An attempt will be made to synthesize, probably in book-form, many of the first-phase findings of the BEP, as one product of a multinational symposium to be held in Cape Town in 1986.

Work has already begun in planning the symposium and satellite workshops, under the preliminary and provisional title: "Population and Community Ecology in the Benguela and Comparable Systems". In effect, the symposium will aim at highlighting the factors determining population and community ecology in the Benguela system and to contrast these with those in comparable marine systems, such as the coastal upwelling regions off the Americas and North Africa, the North Sea and the coastal waters off Japan. Particular emphasis will be given to population variability, and the factors influencing the population dynamics of pelagic shoaling fish.

After the BEP's first two years, it is clear that the main thrust of the programme now is set firmly towards obtaining an improved understanding of the primary and secondary causes of variability in pelagic shoaling fish (principally Cape anchovy and pilchard). To this end, several new projects have either already been initiated or will be started in 1984. These new projects include studies on the food and feeding behaviour of small pelagic shoaling fish, as well as their large fish predators, such as snoek. Studies dealing with other aspects of the behaviour (eg shoaling) of these fish are, however, still under-represented in the BEP.

By the end of 1983 it is expected that physico-chemical oceanographic indices of upwelling, downwelling and anomalies will have been developed; and it is proposed that indices of good and poor recruitment in pelagic shoaling fish should be developed further and then related to the environmental indices on two fronts: statistically, using the historical record, and also analytically, through testing hypotheses about the processes involved. Simulation models will be developed to relate the major trophic groups and processes offshore, and to test hypotheses about plankton processes. A related development will be to consolidate fatty-acid/lipid work and to combine this with developing a lipid index of spawning condition in small pelagic shoaling fish. It is proposed to link these studies with research dealing with a potential role of bacteria in the food of pelagic shoaling fish.

#### Acknowledgements

It has been a pleasure for me to act as chairman of the BEP. This has been made possible mainly by the very willing support and cooperation that I have had from the Sea Fisheries Research Institute, the University of Cape Town, all members of the programme and the SANCOR secretariat and executive. In particular, I wish to thank Elize Auret and Lesley Shackleton for their friendly dispositions and efficiency. Among the busiest of busy BEP members, Doug Butterworth, Rob Crawford, John Field, Vere Shannon and Peter Shelton always made time available when I needed help.

W R Siegfried

CHAIRMAN : SANCOR COMMITTEE ON BENGUELA ECOLOGY

BENGUELA ECOLOGY : PROJECTS 1983

<u>Projects and Project Leaders</u>	<u>Duration</u>
Community structure and energy flow in inshore ecosystems (G M Branch, UCT)	1981-1985
Role of detritus in Benguela ecosystems (J G Field, UCT)	1981-1986
Microbial decomposition of detritus and nutrient cycling (F T Robb, UCT)	1981-1986
Trophic transfers and systems analysis of Benguela ecosystems (J G Field, UCT)	1981-1986
Fatty acids/lipids as tracers in marine food webs (J G Field, UCT)	1981-1986
Benguela theoretical studies in upwelling (G B Brundrit, UCT)	1982-1986
West coast physical oceanographic field studies (G Nelson, SFRI)	1982-1986
Pelagic fish studies in the Southern Benguela : Phase I : Fish eggs, larvae and associated microplankton (J G Field, UCT)	1981-1985
Phytoplankton : Nutrient assimilation and primary productivity studies (L Hutchings, SFRI)	1983-1985
Modelling predators and predation and anchovy population studies (D S Butterworth, UCT)	1982-1986
Hydro-acoustic assessment of anchovy stock size (I Hampton, SFRI)	1982-1986
Anchovy stock separation investigation (P Shelton, SFRI)	1982-1983
Ecological relationships between seabird predators and anchovy populations (W R Siegfried, UCT)	1982-1986
Anchovy population modelling (R J M Crawford, SFRI)	1983
Benguela consultants (J G Field, UCT)	1983-1985

## COASTAL PROCESSES PROGRAMME

### Status

During 1981 an integrated approach to the study of coastal processes was developed and accepted, which gave rise to the Programme on Coastal Processes (PCP) which then began in January 1982. This implies that workers from the three main disciplines involved ie physical, chemical and biological, will cooperate in studying the coastal zone as a system to realize the objectives of the programme. These objectives are to identify the key processes which operate in the coastal zone, to define the factors and to understand the mechanisms that control them. This knowledge can then hopefully be used for the judicious development, management and conservation of the coastal zone and its resources. A detailed description of the programme is available as No 68 in the South African National Scientific Programmes Report series published in February of this year.

In evaluating the status of this programme it should be kept in mind that the PCP was initiated 18 months ago while programme guidelines were available only for the last six months.

The PCP consists currently of eight projects funded through SANCOR at a cost of R214 961. Fifty-three percent of the funds were awarded to two projects on sandy beaches, while bird-related research received 20 % and the balance was allocated to taxonomic work on benthic algae, (15 %), and sea fishes (10 %). This, however, does not reflect the total amount of research conducted in the coastal zone. A SANCOR funded project in the BEP on inshore systems, the shallow water components of research done at NRIO (eg sediment dynamics), and the sandy beach and subtidal reef components of the Eastern Cape Marine Ecology Programme of the University of Port Elizabeth, as well as a project on bait organisms in Natal, are all contributing significantly to our understanding of the coastal system, although these are not formally part of the PCP. The same also applies to coastal projects of the other programmes of SANCOR.

The PCP has not reached the stage of serving as a vehicle to draw together the various disciplines in an integrated programme to study the processes of the system as a whole. The only project that has succeeded in this is the surf zone project of McLachlan and Bate from UPE with Swart of NRIO, who have succeeded in generating results of an interdisciplinary nature for sandy beaches. The other projects concentrate only on a specific component of the coastal zone but I trust that they will serve as the nucleus for future work along the lines of the integrated research approach recommended at the Kleinmond meeting by the workers themselves.

### Finding

It is not possible to do justice to all the interesting results of the various projects. The following list is therefore highly selective and is not arranged in order of importance.



- The phytoplankton blooms in the surf off sandy beaches are related to the wind's strength and direction for the preceding three days, but the mechanism of this relationship is still in doubt. These blooms may also be related to the presence of a flow of groundwater from the dunes into the surf. These waters carry NO<sub>3</sub>-N at concentrations 10 times higher than the marine waters and the surf zone may therefore be regarded as an eutrophic zone.
- Phytoplankton masses that occur as 'blooms' on the surface may give rise to the incorrect use of the term 'bloom'. It would appear that the accumulation and subsequent dispersion are all due to the specific hydrodynamics of sandy beaches and may not be nutrient-triggered as in a classical phytoplankton bloom.
- The faunal component of the surf zone may be the major transfer mechanism of nutrients beyond the surf circulation pattern. This has interesting implications for the entire marine food web.
- From the completed atlas of South African coastal birds, it is evident that over-exploitation of fish is the most important factor causing decreases in bird populations. This atlas will serve as an important basic reference work on coastal birds for a long time.
- Shorebirds play an important role in determining intertidal animal and algal community structure.
- The marine flora in Natal has some striking species resemblances with equivalent Australian flora. This may have implications for the hitherto accepted concepts regarding the distribution of marine flora in the Southern Hemisphere.

#### Highlights

The biggest event this year was the first international symposium on sandy beaches during January 1983. The symposium went well and some very interesting ideas emerged on surf circulation patterns. Several visitors stayed on for short periods after the symposium for discussions or to conduct short research projects. Some overseas scientists have indicated their intention to join South African groups for further research. The proceedings comprising 757 pages have been published by Dr W Junk Publishers as part of their series in Developments in Hydrobiology (No 19).

Another important event was the first joint research exercise between the surf zone research group from UPE under the leadership of Dr McLachlan and Prof Bate and Dr Harry Swart's Sediment Dynamics Division from NRIO. Both groups and marine science in general benefited from this collaboration. Future joint exercises are already planned.

The recent surge of interest of botanists in the coastal zone deserves mentioning. The programme used to be dominated by zoologists, but this

recent development will certainly contribute towards a more balanced programme.

### Shortcomings

There is not sufficient interaction between the various researchers and research groups active in the coastal zone. This applies to the various participants in the PCP itself as well as to other researchers working on the coastal zone in other programmes. The concept of a programme on coastal processes in the true sense of the word is therefore not yet realized.

There is also not sufficient balance between the various disciplines in the programme to do justice to the 'integrated' approach. Projects by physical and chemical oceanographers designed to complement ongoing biologically orientated projects are needed.

### Prospects

Seven new projects have been submitted for support during 1984, and four of these are to be funded while most of the existing projects have requested additional funds. There is therefore a continued interest in research through the PCP. A shortage of researchers in the physico-chemical field is obvious. None of the proposed new projects include these disciplines.

The researchers working on soft substrates had a good opportunity to evaluate their position and progress at the sandy beaches symposium. The workers on the hard substrates (rocky shore and shallow reefs), however, have not had the same opportunity recently to exchange ideas so that the various projects on hard substrates within PCP and in other programmes are done without the same close co-operation between participants. I therefore suggested that a workshop be convened on the topic of hard substrates so that the workers funded through SANCOR and other programmes can get together and reach a greater level of awareness and integration than is the case at present. Prof G Branch from UCT will assist in convening such a workshop during the early part of 1984. An integrated project on hard bottom substrates along the lines of the successful soft bottom project, should be a worthwhile undertaking.

As far as the lack of input from physico-chemical oceanographers into PCP is concerned, it is obvious that there is no short-term solution. An active bursary scheme to attract good undergraduates must be implemented as soon as possible. The present system of allocating bursaries in marine science only if it can be coupled to a post at a CSIR institute is clearly inadequate to ensure a good flow of above-average students to the marine field.

### Acknowledgement

I would like to thank the scientists, SANCOR's management and secretariat, as well as the members of the programme committee for their

enthusiasm, support and advice. They make it a pleasure to be chairman of the PCP.

T Erasmus

CHAIRMAN : SANCOR COMMITTEE ON COASTAL PROCESSES

COASTAL PROCESSES : PROJECTS 1983

<u>Projects and Project Leaders</u>	<u>Duration</u>
The ecological role of birds in the intertidal zone (W R Siegfried, UCT)	1983-1985
Population dynamics of south coast gannets (G J B Ross, PEM)	1982-1985
Surf zone dynamics (A McLachlan, UPE)	1982-1984
Reproductive ecology of <i>Gelidium pristoides</i> (B L Robertson, UPE)	1983-1985
Revision of the JLB Smith book "The Sea Fishes of Southern Africa" (M M Smith, JLB Smith Institute of Ichthyology)	1978-1983
The Natal nearshore sand substratum (A J de Freitas, ORI)	1981-1985
Anatomy and cytology of marine angiosperms (A D Barnabas, University of Durban-Westville)	1980-1984
The benthic marine algae of the Natal and Zululand coasts (R N Pienaar, UN)	1982-1987

## ESTUARIES PROGRAMME

### Status

Until 1981, estuarine research carried out under the auspices of SANCOR was directed by the SANCOR Advisory Committee on Marine Biology and latterly by the Steering Committee of the Cape Estuaries Programme (ECRU/NRIO). With the restructuring of the SANCOR programmes towards the end of 1981, one national estuarine programme was established, encompassing research in both the Cape and in Natal. It is directed by the SANCOR Estuaries Committee. The Cape Estuaries Programme, ie ECRU and its associated activities was transferred from SANCOR in April 1982 to a direct contractual undertaking between NRIO and the Department of Environment Affairs. However, very close links are maintained between ECRU and SANCOR programmes and the SANCOR activities meet to a certain extent the Phase II requirements of ECRU, namely, more detailed studies in selected estuarine systems.

The SANCOR Estuaries Programme for the period 1982-1986 was given much sharper focus with the publication of the programme document in February 1983 (SA National Scientific Programmes Report No 67). In this document the objective of the programme was defined as follows:

The objectives of the SANCOR Estuaries Programme is to provide a scientific understanding of estuaries - in particular of the interactive physical, chemical and biological processes within them, of their interactions with their fringe areas and with their adjacent marine and terrestrial environments and finally of human impact upon them - thereby contributing information required for their wise management.

In setting this objective it was, however, clearly recognized that a major consideration in the planning of research must be that each estuary has its individual characteristics and problems which are usually closely related to the characteristics of the region in which the estuary concerned occurs. It was therefore necessary to set research priorities very carefully and to identify estuaries which require attention most urgently. It has been attempted to do this in the programme document (refer to Table 1 on page 2, Table 3 on pages 17 and 18, and Table 4 on pages 19 to 21). It can be expected, however, that these priorities will be subject to frequent revision, as for example has already been the case in the context of the Directorate of Water Affairs' request for information on the freshwater requirements of estuaries.

This provides a good background for looking at the applications to SANCOR for 1983 and 1984 which reveal that:

- Seven applications (five from UCT, one from Rhodes University and one from NRIO) are for research in estuaries of the western and southwestern Cape, between the Berg River and Knysna.

- Nine applications (five from UPE and four from Rhodes University) are for research in eastern Cape estuaries.
- Two applications (one from the University of Natal and one from ORI) are for research in Natal estuaries.

Coastwise the coverage is therefore fairly good but it is striking that the important estuarine environment of the Transkei receives no coverage, nor do the estuaries of the west coast north of the Berg River. A certain amount of research not sponsored by SANCOR, does, however, take place in these areas.

Such scrutiny furthermore reveals that out of 23 applications, 15 are for research of a biological nature, two for research of a sedimentological nature and three for research of a physico-chemical nature. Three projects are aimed at providing answers to specific management problems but most of the others are also relevant in terms of environmental and/or resource management. As biological characteristics usually represent a response to physical conditions in estuaries, it is evident that the balance of topics covered by the SANCOR Estuaries programme needs careful attention.

#### Findings

As the SANCOR Estuaries Programme only came underway in its present form in 1982, it is premature to refer in detail to findings from the programme as a whole. However, the following projects have either been completed, or rounded off because the project leaders have left:

- Comparative study of fish recruitment in estuaries and the sea (UPE/PEM),
- The ecology and energetics of *Palaemon pacificus* (UPE),
- An ecological study of the *Zostera* beds in the Kromme estuary (UPE),
- The feeding ecology of the Spotted Grunter and Stumpnose in Natal estuaries (UN),
- Influence of turbidity on fish distribution in Natal estuaries (UN),
- Physico-chemical and biological responses of the Siyaya lagoon to integrated catchment management (NIWR). This is a monitoring activity which should continue,
- The biology of Chandidae (Glassies) in Natal estuaries.

While space does not permit detailed analysis of the findings of each of these programmes, the following comments can be made:

- The collaborative programme by the PEM and UPE on fish recruitment in estuaries and in the sea has shown that in the

southern and southwestern Cape, the high energy inshore environment does not appear to provide significant nursery areas for the numerous food and angling species occurring in these waters. Sampling in both estuaries and the sea has consequently provided valuable additional evidence confirming the important role of Cape estuaries as fish nurseries. This reinforces circumstantial evidence of estuarine dependence of many marine fish species in the Natal/KwaZulu region during the juvenile phase of their life-cycle.

- Similarly the UPE project on the estuarine crustacean *Palaemon pacificus* shows that although intertidal rock pools provide a habitat for juveniles following offshore breeding, *Zostera* beds in estuaries probably represent more important nursery grounds for the species.
- The work done in Natal estuaries shows that while *Zostera* beds do not occur as extensively here as further south along the east coast, the fringing vegetation fulfils a similar role. The Siyaya study attempts to quantify the extent to which such fringing vegetation can be destroyed by poor catchment management and the recovery which follows in the estuarine system in response to catchment restoration.

These findings highlight a few important points:

- The importance of maintenance of interactive processes between the sea and estuaries.
- The need to consider these interactions not only from the biological point of view but also in terms of processes of hydro- and sediment dynamic nature. In the vast majority of cases, the biological processes represent a direct response to the physical characteristics of the estuarine environment.
- The process of hydro- and sediment dynamics in turn, need to be seen in the perspective of long-term continuous changes brought about by interaction between climate and the geomorphological features of regions, and the effects of intensive human activity over the past one or two hundred years in catchments and on the coast.

In the light of this perspective, it again becomes clear that the balance of research projects within the constraints of the finances available to the SANCOR Estuaries Programme, warrants careful thought.

#### Highlights

During the past year there were no "spectacular events" in the SANCOR Estuaries Programme, which warrant "highlight" description. Nevertheless there are certain developments which I should like to mention under this heading.

The SANCOR Estuaries Programme 1982-1986 Document represents the culmination of efforts since 1974 to get a properly coordinated national estuarine programme off the ground, covering work in both the Cape and Natal. Awareness of present shortcomings will facilitate further refinement and improvement of the programme.

It is gratifying that while the NRIO/ECRU programme is mainly management orientated, the SANCOR programme is providing an urgently needed input of fundamental knowledge for this work. It is therefore important that close liaison between the two programmes is maintained at all times. In 1984 an ECRU type of activity is to be established in Natal through the offices of the NTRPC and CSIR and with financial assistance from the DEA.

Bearing in mind the comments in the previous section on the importance of maintenance of inter-active processes between the sea and estuaries and, in this context, understanding the hydro- and sediment dynamics, two developments over the past year are seen as being of special significance:

- the Directorate of Water Affairs is at present assessing the amounts of water which will have to be released from dams if the ecological viability of estuaries and other downstream areas is to be safeguarded. This is part of its task of determining the country's present and future water requirements on an ongoing basis. A present estimate is that about 11 % of the country's water requirements by the year 2000 will have to be allocated for environmental purposes (in contrast to 1 % as had been envisaged in 1970). This estimate needs to be refined before it can be adopted as official policy and Dr C P R Roberts has turned to the SANCOR estuarine research community for assistance in this regard. While this is a very encouraging development, it also places a heavy responsibility on the shoulders of our estuarine scientists.
- the increasing involvement of the Sediment Dynamics and Numerical Modelling Divisions of NRIO in estuarine research, including that carried out under the auspices of SANCOR such as the Bushmans and Touw River studies. The collaboration between scientific and engineering disciplines in estuarine research is considered to be of vital importance for the development of effective estuarine and coastal policies. For this reason the chairmanship by my predecessor, Prof G de F Retief who is an engineer, was highly appropriate.

During the past year the Council for the Environment was established by the Minister for Environment Affairs with the Chairman of SANCOR, Mr J de Wit, and Dr A Heydorn as members. Coastal zone management and coastal research are seen as a top priority and this will also have a bearing on the work of the SANCOR Estuaries programme.

A personal highlight for me was my visit to Western Australia in May 1983 as guest of the Australian-New Zealand Association for the Advancement of Science and the opportunity of doing field work in

estuaries situated along some 800 km of western and southwestern Australian coastline with a group of eminent Australian scientists. Subsequent to this field trip, all of us participated in the session "Man's impact on estuarine environments" of the 1983 Australian-New Zealand Association for the Advancement of Science Congress held in Perth. A report on this trip is available.

### Shortcomings

Some possible shortcomings have already been mentioned. The following aspects need to be looked at by the SANCOR Estuaries Committee:

- There is a tendency to select research topics which have a bearing on the present situation in estuaries or the solving of immediate problems. While this need is acknowledged, it must be recognized that man's activities over the past 200 years are superimposed on natural landscape-shaping processes going back to Holocene and Pleistocene times. The question must be asked whether more attention should not be given to these long-term paleoclimatic, -sedimentological and -ecological processes, if we are to understand the implications of modern-day environmental manipulation by man and acceleration of processes such as erosion and siltation as a result of his activities.
- The SANCOR Estuaries Programme 1982-1986, lists estuaries which are in need of priority attention, so as to give more insight into the functioning of estuaries as systems along various sectors of the South African coastline (eg Natal - summer rainfall; southern Cape - bimodal rainfall; southwestern Cape - winter rainfall; Namaqualand/Walvis Bay - desertic conditions). The tendency of institutions to select work in the logistically most convenient regions is understandable, but is this compatible in all respects with the objectives as set out in the programme document?
- Although the need for a multi-disciplinary approach to estuarine research is generally acknowledged, there are cases where projects appear to be planned in isolation without consideration of the requirements of the SANCOR programme as a whole or other ongoing work.

It is acknowledged that this criticism is easily made but that the problem is not as easy to address when working, for example, with a student only available for a relatively short period and with a limited budget. Nevertheless the Estuaries Committee should look at the question as it has a bearing on the balance between the biological and other disciplines within the overall programme and the areas to which more emphasis may have to be given.

- Is communication between the SANCOR Estuaries, Coastal Processes, Marine Linefish and other programmes adequate in terms of the setting of priorities for future work on SANCOR as



a whole? This is a matter which needs to be addressed carefully by Chairmen of SANCOR Programmes during their annual meetings.

### Prospects

The last five years have seen a vast improvement in the perception of governmental authorities at all levels to:

- the sensitivity of the estuarine environment to many forms of coastal development,
- the interdependence and interactions between estuaries, their catchments, the adjacent coastal environments and the sea,
- the dependence of economic viability of coastal regions upon their ecological viability and in particular that of estuaries.

This has led to the provision of more funds for estuarine research (thanks largely to a few far-sighted individuals) and, as described earlier, greatly improved organization and coordination of estuarine research in South Africa. The prospects for future work in this field are therefore good. It is, however, necessary to remain aware at all times of the vast pressure being exerted on estuarine environments by various forms of development, conflicting human interests and the cumulative effect of human activity in catchments and around estuaries over the past 100 years and more. Inevitably this means that advice is required with increasing urgency on how ecological viability of modified systems can be retained by artificial management procedures. "Ecosystem management", in the sense of managing naturally sound (or unspoilt) estuarine ecosystems is still possible in only a few very isolated cases. From this the urgency for and the need for optimum coordination of estuarine research in South Africa, is clearly evident.

A E F Heydorn

CHAIRMAN : SANCOR ESTUARIES COMMITTEE

ESTUARIES : PROJECTS 1983

<u>Projects and Project Leaders</u>	<u>Duration</u>
Dynamics of the Bot River estuary (G M Branch UCT)	1980-1985
Geochemistry and physical characteristics of sediments from Botrivervlei (J P Willis, UCT)	1982-1985
Disturbed estuarine ecosystems (J R Grindley, UCT)	1982-1984
Comparative study of fish recruitment in estuaries and in the sea : estuaries and nearshore sections (D Baird, UPE)	1980-1984
Ecology and energetics of the free-swimming crustacean <i>Palaemon pacificus</i> (W Emmerson, UPE)	1982-1983
Research on sedimentation in estuaries (I C Rust, UPE)	1980-1983
Exchange of nutrients, organic particulates, phytoplankton, zoo- and ichthyoplankton between Swartkops estuary and the sea (D Baird, UPE)	1983-1985
Bacterial decomposition of detritus and dissolved organic matter in the Swartkops estuary (G C Bate, UPE)	1983-1986
The influence of oil and marine oil effluents on phytoplankton (G C Bate, UPE)	1983-1986
Trophic relationships and resource utilization by the dominant fish species associated with the seagrass beds of the Swartvlei estuary (A K Whitfield, RU)	1983-1985
Community structure and energetics of benthic invertebrates living in the lower reaches of some eastern Cape estuaries (A N Hodgson, RU)	1983-1985
The fate of allochthonous material in estuaries (G H L Read, RU)	1983-1986
The feeding ecology of <i>Pomadasys Commerconni</i> and <i>Rhabdosargus sarba</i> in Natal estuaries (S J M Blaber, UN)	1982-1983
The influence of turbidity on fish distribution in Natal estuaries (D P Cyrus, UN)	1981-1983
The biology of the <i>Chandidae</i> ( <i>Ambassidae</i> ) of Natal estuaries (S J M Blaber, UN)	1981-1983

ESTUARIES : PROJECTS 1983 (Continued)

<u>Projects and Project Leaders</u>	<u>Duration</u>
Recruitment and distribution of Penaeid prawns in the St Lucia system (A T Forbes, UN)	1982-1984
Estuaries studies : Palmiet River (G A Eagle, NRIO)	1983-1984
Research on restoration of a river system. Part II - Determination of the physico-chemical and biological responses of the Siyaya lagoon to integrated catchment management (A D Connell, NIWR)	1982-1985

## MARINE LINEFISH PROGRAMME

### Status

The historical background to this Programme was included in last year's status report and is not repeated here. The Programme was developed under the auspices of SANCOR and is described in Report No 37 of the South African National Scientific Programmes Series published in 1979. Its main aims are to identify priorities and to coordinate research needed to provide a scientific basis for the rational exploitation of South Africa's marine linefish resources. Emphasis is placed on the compilation of catch and effort statistics to detect trends in the fishery, and on studies of the biology of exploited species to determine effective methods of resource management. The Programme is applied in its objectives but encourages the attainment of high academic standards in the achievement of its goals.

In order to ensure a balanced approach close collaboration is maintained with resource regulatory agencies and with resource users through their representatives on the Linefish Committee. The organizations concerned are the Marine Development Branch through the SFRI, NPB, Cape Department of Nature and Environmental Conservation and the SAAU.

Only four research projects are currently financed by SANCOR but the Programme also fulfils a valuable function through coordinating the linefish research conducted by other institutions which include the SFRI, the ORI, the UPE, the PEM, RU and the UCT.

### Findings

Research is currently being conducted on approximately 50 linefish species and important results will be published within the next year. For some species reasonably comprehensive life history data will become available, examples being the kob (*Argyrosomus hololepidotus*), the elf (*Pomatomus saltatrix*), the queen mackerel (*Scomberomorus plurilineatus*), the leervis (*Lichia amia*), the slinger (*Chrysoblephus puniceus*), the dageraad (*C. cristiceps*), the roman (*C. laticeps*) and the soldier (*Cheimereus nufar*). For other species data have been collected opportunistically and are somewhat fragmentary.

An overview of current knowledge is provided in the publication entitled "Marine Linefish Programme Priority Species List", details of which are given later in this report. A significant finding was that data are inadequate for management of most linefish species because even in cases where knowledge of biology is satisfactory, little attention has been given to stock assessment. A shift in research emphasis to include stock assessment is therefore required and should include a large scale tagging project on selected target species.

The progress reports for ongoing research reflect generally satisfactory achievement of their objectives, but in view of the large number of species and parameters involved it is impractical to attempt a comprehensive description of the results obtained during the past year.

One interesting aspect that bears mentioning is the sex reversal that occurs during the lifespan of numerous sparid fishes. For example in the slinger the change from female to male is related to size, with males restricted to the larger size classes within the population. The lowering of the mean size of this species in Natal waters has reduced the number of males present and there is a highly unusual male to female sex ratio of 1:18.8. This has important management implications because removal of too many large fish may be more detrimental to successful reproduction in this species than was previously realized. Similar sex reversals have been documented in the dageraad and roman. Four major projects will yield published results within the next year (Natal game and deep reef projects, South Coast game and deep reef projects).

Final reports were submitted for two projects. The elf tagging project revealed two-way migrations between Natal and Zululand and between Natal and the Eastern Cape. Less is known about the migrations of Cape south coast elf and the status of the population on this part of the coast requires further investigation. A very high fishing mortality of 48,5 % per annum was recorded in Natal compared with 13,15 % for the Cape. This shows that high fishing pressure on elf once they enter Natal waters is responsible for the greater part of this species' overall annual fishing mortality, and hence it seems fair to conclude that management by means of catch restrictions will have a better result if applied in Natal than in the Cape.

The project entitled "Comparative Study of Fish Recruitment in Estuaries and in the Sea" forms part of the SANCOR Estuaries Programme but is mentioned here insofar as it affects linefish. A total of 81 species are reported to be wholly or partially dependent on South African estuaries, of which 29 species are sport angling fishes. None of these are dependent on estuaries during their entire life cycle, but nine species are dependent on estuaries during the juvenile phase of their lives. These include the leervis, white stumpnose (*Lithognathus lithognathus*), the spotted grunter (*Pomadasys commersonni*) and the Cape and Natal stumpnoses (*Rhabdosargus holubi* and *R. sarba*). Juveniles of a further eight species occur mainly in estuaries but are also found in the sea. Juveniles of 12 species use mainly inshore marine nursery grounds although they are also abundant in estuaries. An important finding was that the elf, kob and white stumpnose (*Rhabdosargus globiceps*) fall into this latter group.

### Highlights

An important step forward was circulation to researchers of the comprehensive report emanating from the Linefish Workshop held at the ORI in April 1982, which reviews progress, identifies shortcomings and maps out future research needs within the Programme. As a result of this Workshop South African National Scientific Programmes Report No 70, entitled "Marine Linefish Programme Priority Species List", was published. This provides an overview of existing knowledge of the biology of 84 linefish species, and more importantly identifies those species most urgently requiring research, gaps in existing knowledge and priority parameters that need investigation. It will thus serve as a working document to scientists and managers and will assist in directing

research towards providing the information needed for management of marine linefish resources.

Collaboration between researchers resulted in progress being made towards defining uniform minimum size limits for linefish. The object is to eliminate anomalies between the Sea Fisheries Act and the Natal Provincial Ordinance in respect of both the methods of measuring fish length and the different minima applied to individual species. It was accepted that insufficient data were available on growth and mortality rates to enable yield-per-recruit calculations of optimum minimum sizes, and that the standard would have to be based on sizes at sexual maturity. It was also agreed that precision might have to be sacrificed in the interests of uniformity and simplicity, thereby reducing the number of minimum sizes and improving the acceptability to resource users and practical implementation of the regulations.

Due to the considerable length of South Africa's coastline and the difficulty of maintaining an effective policing presence, the Linefish Committee is aware that to be effective, management measures will not only have to be biologically sound, but will also need the support of recreational anglers and commercial fishermen. It is therefore important to involve resource users in the development of management strategies. Unfortunately this has not been achieved in respect of commercial fishermen due mainly to their not being organized into a representative organization. However, a significant proportion of recreational anglers is affiliated to the South African Anglers Union and considerable progress has been made in strengthening links with this organization. Examples are participation in the SAAU's 1982 Symposium which produced a valuable listing of fish species considered by anglers to have declined in abundance on different stretches of the coast; the hosting of a Sport Fish Workshop by ORI at which a scientific panel and anglers discussed issues of mutual interest; the convening of a meeting by the Chief Director of the Marine Development Branch (Dr J Serfontein) between representatives of organized angling and officials of SFRI to discuss methods of linefish management; and finally, organization of this year's Linefish Committee Meeting to enable members to participate in the 1983 SAAU Symposium and Annual Board Meeting.

A further highlight was the visit to South Africa by Prof Don de Sylva of the University of Miami, an eminent authority on sport fisheries who spent time at the different institutes involved in the Programme and with the President of the SAAU. Prof de Sylva served as a valuable independent appraiser of the progress and emphasis of research and expressed himself impressed by the enthusiasm, concern and dedication of our scientists, as well as by the ecological approach adopted. The most valuable outcome of his visit is considered to have been confirmation that the Programme is developing satisfactorily.

It is encouraging to have received two new project applications in fields previously identified as gaps in the Programme, namely the study of inshore reef fish of the western and south-western Cape coasts with emphasis on the galjoen (*Coracinus capensis*) and hottentot (*Pachymetopon blochii*) (UCT); and the study of the Serranidae (rock-cods) and Scianidae (kobs) of Natal (ORI).

### Shortcomings

The catch and effort statistics project is vitally important to the Programme and has been successfully pioneered and operated by the ORI since its inception. Although the SFRI has accepted responsibility for this project, involving establishment of a computer facility in Cape Town and secondment of a staff member to the ORI, administrative problems have unfortunately delayed implementation of this plan. The ORI staff are to be complimented for having continued to process incoming data, albeit at the expense of other research, and it is hoped that the problems encountered by the SFRI will be resolved in the very near future.

A shortcoming which weakens the data base available for catch and effort monitoring is the absence of a national system of licensing saltwater anglers and all boats used for commercial and recreational fishing. This is a complicated issue and the various alternatives are currently under investigation by the Marine Development Branch of the Department of Environment Affairs and Fisheries. Introduction of an appropriate national licensing system is supported by the SFRI, the Marine Linefish Committee and by the SAAU. It is to be hoped that finality will be reached during 1984.

Unfortunately attempts to stimulate a Fisheries Development Corporation assessment of the direct and indirect value of the linefishery to the South African economy has so far proved unsuccessful. Nevertheless, it is considered vitally important that such an investigation is undertaken because the allocation of funds and manpower for research and management of linefish resources will predictably remain woefully inadequate in the absence of factual information concerning their value to the economy.

S A National Programmes Report No 70 (already mentioned) list 32 top priority species for which the present state of knowledge is inadequate in respect of the following parameters: length and weight composition of catches; juvenile nursery areas; distribution of stocks, residency and migration; ageing and growth; estimates of catch per unit effort, total catch and total effort. For many of these species inadequate information is available on length and weight at sexual maturity, as well as on spawning areas and spawning seasons.

From the above and from the Linefish Workshop report it is clear that the present state of knowledge is totally inadequate to provide a basis for management of most of South Africa's linefish resources. Attention urgently needs to be given to research on priority species and to parameters fundamental to stock assessment.

### Prospects

The 1982 FOB wholesale value of commercially-caught linefish exceeded R40,3 million which places it in third position after off-shore trawl (R144,6 million) and purse seine (R57,2 million) landings, and ahead of rock lobster landings (33,6 million). However, the total value of linefish landings considerably exceeds R40,3 million because this figure is based on catches of commercial line boats operating from harbours

monitored by the Marine Development Branch and takes no account of catches by unregistered vessels, such as most ski-boats, and omits catches of estuarine and rock and surf anglers. It also excludes the value of economic activities associated with recreational angling such as expenditure on accommodation, boats, motors, fuel, fishing tackle, etc. Despite the absence of such figures it can be concluded that the overall value is considerable and that it is of national importance to provide an adequate data base for scientific management of South Africa's linefish resources.

It is encouraging to note an increasing awareness of this need. In addition to undertaking research on the most important commercial linefish species of the south and south-western Cape, the SFRI is expanding its involvement in linefish as evidenced by acceptance of responsibility for the catch and effort monitoring project, financing of the W/S-W Cape inshore reef fish project, and initiation of discussions with representatives of organized angling through the meeting called by the Institute's Chief Director. SANCOR has increased its linefish research budget substantially (1982: R28 000; 1983: R57 000; 1984: R95 000), there is a most encouraging acceptance of the need for research and resource management among senior representatives of organized angling, and there is enthusiasm amongst biologists to become involved in linefish research.

Unfortunately despite these positive signs, prospects for effective linefish resource management in the foreseeable future are not good. The serious shortcomings in the data base have already been outlined; while implementation of effective management is complicated by the multi-species nature of the fishery, the many methods of exploitation, the multiplicity of landing sites, the lack of organization of commercial fishermen into a cohesive negotiating body, and finally, the dearth of fisheries inspectors along our extensive coastline.

In the final analysis, it is the practical implementation of research results in the form of sound management that will allow for the optimal exploitation of South Africa's Linefish resources. In this regard, the Marine Linefish Programme considers there to be an urgent need to increase the funding available for both research and for the enforcement of legislation.

John H Wallace  
CHAIRMAN : MARINE LINEFISH COMMITTEE



MARINE LINEFISH : PROJECTS 1983

<u>Projects and Project Leaders</u>	<u>Duration</u>
Marine linefish south coast deep reef programme (M J Smale, PEM)	1980-1984
Marine linefish south coast game fish programme (M J Smale, PEM)	1983-1987
Biology and angling fish species and trends in the angling fishery in the eastern Cape (D Baird, UPE)	1979-1983
Catch-statistics sampling strategy evaluation (D S Butterworth, UCT)	1983-1984

## MARINE POLLUTION PROGRAMME

### Status

The planned redirection of this programme to include greater emphasis on detailed site specific investigations and problem specific studies is virtually complete.

During the financial year 1983/84, a total of 13 projects was supported by the Marine Pollution Programme for a total budget of R468 42. Major participants in this programme are the National Research Institute for Oceanology, the University of Cape Town, the University of Port Elizabeth, the National Institute for Water Research and the Oceanographic Research Institute. Participation is therefore distributed along the entire coastline. In addition, considerable attention is paid to marine pollution matters by the Sea Fisheries Research Institute based in Cape Town, although they derive no funds from the programme.

Considerable interaction with the Environmental Conservation Directorate has always been a feature of this programme. During this last year, an awareness by the Marine Pollution Programme of the important decisions being made in marine issues with potential marine pollution components has prompted far closer contact with the Planning Branch of the Directorate of Water Affairs as well as with the Planning Branch of the DCDP. Close cooperation with other SANCOR programmes continues, while in addition, activities of direct interest to the Marine Pollution Programme such as those undertaken under the auspices of the NRIO contract programme 'Marine Disposal of Effluents', are regularly reported to the Marine Pollution Programme.

The programme description booklet has not yet been printed. Although the first draft was completed early this year and has been available to committee members and participants, final comments on this booklet have only now been received and are being incorporated into the final draft.

This status report does not include any aspects of the work on oil pollution research - this is reported on separately.

### Findings

In general, research undertaken this year has been typified by an increasing requirement to quantify and predict effects of any environmental perturbation, and in particular, to emphasize long term sublethal effects. Toxicity studies consequently form a significant part of the programme (four projects), and the collaboration between workers has led to the successful development of various bioassay techniques, using the organisms, the sea urchin (*Parechinus*), the coral reef fish (*Dascyllus*) and a burrowing amphipod (*Grandidierella*). A variety of industrial and synthetic effluents have been tested using these organisms. For example, bioassays of the various components of the Durban sewer effluent have allowed minimum dilution levels for these materials to be recommended. This information, when coupled with

materials to be recommended. This information, when coupled with oceanographic data from the area as well as discharge pipeline characteristics has enabled appropriate conditions for discharge to be stipulated by the Department of Environment Affairs.

Laboratory toxicity studies using organisms from the west coast (crabs and prawns) have shown that limited temperature elevations in these waters (as would be obtained from a heated power station effluent) would in fact have beneficial effects on the growths of these animals - deleterious effects only being noted above 21°C.

Studies in Table Bay, where measurements are being made to assess the mass balance of selected materials (particularly heavy metals) are nearing completion. This work, undertaken with specific regard to the Green Point outfall, indicate some level of heavy metal accumulation in sheltered areas where sediment occurs (Granger Bay to harbour). Initial indications are that contributions of heavy metals from various sources in Table Bay are small but finite.

A major survey of trace metal levels in the south east Cape coastal areas between Mossel Bay and the Great Fish River has now been completed. Results show that this area is relatively unpolluted with regard to metals, other than in specific areas such as the Hartenbos River close to Mossel Bay, the Papenkuils River in Port Elizabeth, and small isolated locations in the Knysna estuary (around Thesens Island) and the Swartkops River (Redhouse, the brickworks, Swartkops and Amsterdamhoek).

Further along the coast, preliminary investigations in the East London area indicate that the mouth of the Buffalo River is affected by bacteria, heavy metals and chlorinated organics. Bats Cave (untreated sewage) and West Bank (industrial effluent pipeline) are also sources of discharges. This work is being conducted at the specific request of the Department of Environment Affairs, and, in the future, will increase in intensity and will also include oceanographic measurements.

In Natal, interesting anomalies have been obtained from analyses for pesticide residues in mussels collected from the vicinity of the Reunion Canal. Results indicate significantly elevated body burdens in mussels collected immediately adjacent to the Canal. However, within 1.5 km from the Canal, levels are back to normal. The source(s) of these contaminants is/are being investigated by the NIWR. Also of considerable interest along this coast is that mercury discharges from industrial areas have decreased between one to two orders of magnitude this year. The effects of this decrease - which has been partly attributed to the drought - should be reflected in the results of a regular mussel sampling programme undertaken in the area.

Considerable effort is being expended to gather further baseline data in the sea off Richards Bay prior to the discharge of effluents from the new marine pipeline. Pipeline construction is well underway and is planned to be complete in March 1984, with discharge commencing during late 1984.

Background surveys of the seabed, water column and indicator fauna continue, with results substantiating previous findings that benthic fauna in the area are poor in abundance and low in diversity. In addition, artificial substrate samplers are being deployed in the area to collect juvenile ichthyofauna and sessile organisms as indicators of water quality. These sessile organisms settle rapidly and in great abundance on the substrates provided.

### Highlights

Among the significant achievements by the MPP during this year have been: the organization of an important workshop on effluent disposal to sea via pipelines; the decision originating from this workshop to produce water quality criteria for South African marine and estuarine waters, and the completion of an excellent interpretive report on all marine pollution data collected in South Africa from 1976-1979.

The workshop entitled 'Pipeline Discharges of Effluents to Sea', was held in May, and was attended by 45 persons. Perhaps the most significant accomplishment of the workshop was the interaction which occurred between "planners and decision-makers" (ie State and Provincial bodies mainly), the marine research community (ie biologists, physicists, chemists and engineers working mostly on quite specific research interests), and the practitioners (ie the consultants and contractors who design and build pipelines). The extremely broad representation at the workshop enabled each of these groups' interests to be represented. It was made clear that continual close liaison between the Department of Constitutional Development and Planning, and the Planning and Water Quality Branches of the Directorate of Water Affairs and the marine research community is needed to

- ensure that planners and decision-makers are getting the right kind of information in the form that can be used, and
- the scientific community can plan their work to accomplish their goals properly in the available time.

The role of the practitioners in this interactive process is essential, particularly due to their wealth of practical experience.

The proceedings from this workshop are in the final stages of editing.

The workshop endorsed the recommendation that South Africa prepare its own water quality criteria for marine and estuarine waters; the publication of such criteria representing a significant contribution to the available information on which standards for the discharge of wastes can be based. These criteria do not represent actual conditions in the water, but represent upper limits which should not be exceeded in order to maintain a specific use of that water. (Such uses will probably be called beneficial uses, and range from recreation and boating, to industrial cooling water).

A small technical subcommittee was appointed to prepare these criteria. A draft report for wide distribution should be completed by the end of 1983.

A report, synthesizing and interpreting all the data collected by the Marine Pollution monitoring programme for the period 1976-79 has been completed and is in press. This extremely valuable compilation of information will form an important base for further comparative work. A similar report for the period 1979-1981 inclusive is now being compiled.

### Shortcomings

Within the recent past, the Marine Pollution Programme has recognized a number of issues demanding more detailed and intense investigation.

Included here is the need to establish more definitively the fate of viruses discharged in sewage effluents. Projects along these lines have been solicited, and should commence in 1984.

The assessment of low level and subtle effects of pollution will always be a complex task. Programmes in this field must of necessity be designed to be statistically sound in order to ensure that the results obtained will be significant in assessing whether change has or has not occurred, and also to reduce sampling effort to manageable proportions. One project in this field has been recommended for support during 1984.

A shortcoming which has now finally been virtually overcome is the inclusion of all marine pollution data into SADCO. As soon as this is complete, work can commence on the preparation of an interpretive report for the period 1979-1981. The NRIO staff of SADCO should be congratulated on completing this exacting task.

At present, the geographical balance in the programme is relatively sound, although any further expansion in effort should be in those geographical areas where pressure on the coast via industrial development is greatest, namely the east coast - particularly Natal. The balance of disciplines of involvement is less even, with a heavy dependence on chemical measurements and on bioassay work. Further activity of a more physical nature would be beneficial particularly where this allowed for more fruitful integration of the chemical and biological data obtained into predictive models of fate and effects of pollutants.

The working group on chemical methods has re-emphasized the extreme importance of routine intercalibration as part of good laboratory practice. A recommendation has been made to participants in the programme who rely heavily on chemical measurements as to the frequency and nature of internal calibration exercises. It has also been recommended that the results obtained from these exercises be contained in annual progress reports.

### Prospects

The scope of opportunity within the Marine Pollution Programme continues to be extremely large, and in the future will be mainly limited by financial and personnel constraints. Nonetheless the Marine Pollution Programme has been able to address all the important problems that have been encountered, albeit at a relatively low level in certain cases.

For this year, the completion of some of the existing projects has enabled support for a significant number of new projects to be recommended. These projects include:

- an assessment of the fate of viruses in the sea water and the accumulation of hepatitis A virus in shellfish;
- a study on the bioaccumulation of three selected organic materials in an estuarine food chain. The ultimate goal of this project is to produce a predictive model of such bioaccumulation under local conditions;
- an assessment of indicators of sewage "pollution". This project will attempt to quantify indicators that will enable the historical presence (up to five years perhaps) of sewage to be assessed;
- expansion of the existing work in East London to include detailed oceanographic work particularly in the vicinity of the West Bank outfall, and
- assessment of the occurrence of plastic materials in seabirds.

For future years (1985 onwards), a number of activities should be added to the Marine Pollution Programme. With discharge commencing from the Richards Bay outfall, a significant (2-4x) increase in monitoring effort will initially be required, this later decreasing. Apart from work to be supported by the Marine Pollution Programme, there will be a considerable amount of additional work conducted in the area, for example, to assess the validity of the hydraulic model upon which the pipeline was designed.

Over the years, a useful set of data on pesticide residues in marine fauna around South Africa has developed. It is time to assess where and how further data of this kind should be collected, and also, the analytical requirements for pesticide residue analysis. A major exercise to conduct a global pesticide residue monitoring programme (of the marine world) is being considered, and the MPP has indicated its interest in participating.

J K Basson

CHAIRMAN : SANCOR MARINE POLLUTION COMMITTEE

MARINE POLLUTION : PROJECTS 1983

<u>Projects and Project Leaders</u>	<u>Duration</u>
Effects of temperature variations and chlorination on marine organisms on the west coast of South Africa especially near the Koeberg Nuclear Power Station (P A Cook, UCT)	1981-1984
Interlaboratory analytical calibration studies (R J Watling, UPE)	1980-1983
The study of the chemical speciation of toxic metals in the environment and their determination (R J Watling, UPE)	1979-1984
The distribution and effect of selected pollutants in the East London area (D Baird, UPE)	1982-1986
Marine pollution surveys : Toxicity (G A Eagle, NRIO)	1983-1984
Marine pollution surveys : Metal binding proteins (G A Eagle, NRIO)	1983-1985
Marine pollution surveys : Mass balance studies (G A Eagle, NRIO)	1983-1984
Marine pollution surveys : Trace metal inventory (G A Eagle, NRIO)	1983-1985
National marine pollution surveys : East coast region (A D Connell, NIWR)	1981-1985
Toxicity testing of specific effluents with selected marine organisms (A D Connell, NIWR)	1982-1985
Monitoring environmental effects of the Richards Bay pipeline (A D Connell, NIWR)	1981-1985
Preparation of report and publications on surveys (W D Oliff, NIWR)	1982-1983
Juvenile ichthyofauna and sessile marine organisms as indicators of water quality (R P van der Elst, ORI)	1981-1984

## OIL POLLUTION PROGRAMME

### Status

Oil pollution research in South Africa is financed by the Department of Transport and managed by the CSP division of the CSIR as a subsection of the SANCOR - Marine Pollution Programme. In addition, the SFRI conducts appropriate research on effects of oil pollution, which is not directly funded by the Programme but is coordinated where necessary. The status report is restricted to the work funded by the DOT. Details of the SFRI work can be found in their annual report.

From 1974-1980 a number of university research projects were carried out within the programme which provided insight into the effects of oil on coastal marine plants, various seabirds and specific ecosystems. During 1980, in an attempt to answer the Department's most urgent needs with respect to oil pollution contingency planning, a number of working groups were set up to explore these needs and translate the resulting programme into a number of specific projects, each with an estimate of time, manpower and funding requirements. After these project descriptions had been reviewed by the Department and the programme committee, several projects were initiated in 1981, with progress being summarized at a one day workshop in July 1982 where the previously completed projects and all ongoing research were reviewed.

After the **Castillo de Bellver** incident in August 1983 further discussions were held with the Department in order to identify shortcomings in the programme. A working group was set up to explore further research needs with particular attention being given to the Department's contingency planning requirements.

An addendum has subsequently been added to the 1981 Programme document where the emphasis can be seen to have moved towards more active involvement by the Programme in the compilation of contingency plans and closer continuous interaction with the Department.

The objectives of the Programme remain unchanged and can be paraphrased from the 1981 Programme Document as follows:

to provide the Department of Transport with the relevant scientific information to combat oil pollution

to assist in the interpretation of this information

- for the purpose of establishing procedures and standards, required for contingency planning,
- for decision making during an oil spill event.

### Findings

During the 1983 calendar year activities have centred around the following four projects:



**Predictive Studies:** This project, under the leadership of Dr E H Schumann, is aimed at identifying probable oil drift trajectories along the South African coast and is being carried out in collaboration with Mr B R Ferguson of Rhodes University. Use is being made of the USA Geological Survey Drift Probability model and the first stage of the work has concentrated on the Natal coast where a great deal of relevant oceanographic information is available. The results of this study will be coupled to the sensitivity atlas (below) at a later stage to assess vulnerability of the coast to potential oil spills.

**Planning :** Compilation of the oil sensitivity atlas of the South African coast has progressed very well during the year with publication of the initial 2000 copies planned for March 1984. The DOT will control distribution of the atlas which will be available at a price yet to be determined.

**Protection of Estuaries:** Potential oil boom installations have been studied in the Langebaan lagoon and the following estuary systems : Berg, Kowie, Kromme, Keurbooms/Bitou, Nahoon, Buffalo, Knysna and Swartkops. In the case of Langebaan no effective system could be found for protection of the Langebaan lagoon and a further effort will be required to assess alternative methods of protection.

An enquiry has been received in connection with possible protection of the Koeberg cooling water basin and the committee has assisted ESCOM in setting up a suitable study programme.

**Literature Review :** This immense task being carried out by Prof Brown, based on nearly 12 000 oil pollution references, has reached a stage where a final report and publication can be expected shortly. Some interesting and valuable interim conclusions drawn by Prof Brown include the following:

- There is no evidence that some animal groups or organisms from specific habitats or latitudes are more sensitive to dissolved oil than others but individual species within groups can show a wide variation in sensitivity.
- Phytoplankton shows a sensitivity which is not statistically different from that of animal groups;
- Oil dispersant mixtures are more toxic, under all circumstances, than the oil by itself;
- The CONCAWE report on clean-up procedures is directly applicable to South African conditions;
- Too much research has been undertaken on the effects of oil spills and too little on the effects of low level, chronic oil pollution.

### Highlights

Apart from the progress which has been achieved in the projects described viz.

- the sensitivity atlas which promises to be a very useful tool for much wider application than merely the prevention and combating of oil pollution,
- the drift trajectory modelling and oil boom design procedures, and
- the valuable literature review,

a major event was the **Castillo de Bellver** incident where findings from this programme could be directly applied, eg treatment of oiled birds, use of sensitivity mapping of the Saldanha Bay coastline and previous oil boom studies in the Langebaan lagoon and Bergrivier.

This incident provided members of the committee and other relevant authorities with the opportunity of reassessing the programme in terms of an actual spill of major proportions and this has led to the addendum to the 1981 Programme Document.

### Shortcomings

The major shortcoming of the Programme identified by the post-mortem held on the **Castillo de Bellver** incident was that of insufficient interaction with the DOT.

The addendum to the 1981 Programme Document has given specific attention to the following:

- Projects of an applied nature, of direct relevance to the DOT's contingency plans, and which include the development or provision of equipment necessary for implementation of these plans.
- Interpretation of research results and inclusion in contingency plans.
- Codes of practice for use of dispersants, beach cleaning, etc.

### Prospects

Apart from the existing projects, which will continue, the coming year will also see an even deeper involvement by the Programme with the DOT, to the point of conducting 'non-research' type work on a contract basis, eg equipment evaluation and feasibility studies.

The committee will also act as a 'broker' for other parties concerned with oil pollution, eg ESCOM.

As before, every effort has and will be made to produce results which are of optimum use to the Department, and it is hoped that this new phase of work can effectively contribute towards the Department's oil pollution response capability.

G de F Retief  
CHAIRMAN : SANCOR OIL POLLUTION COMMITTEE

OIL POLLUTION : PROJECTS 1983

<u>Projects and Project Leaders</u>	<u>Duration</u>
Probable effectiveness of protection of sensitive areas at Saldanha/Langebaan by oil booms (PEPSAE) (G de F Retief, US)	1982-1984
Review of oil toxicity Literature (A C Brown, UCT)	1981-1982
Coastal sensitivity atlas for oil spill planning (H L Zietsman, US)	1982-1983
Oil movement in the South African environment (E H Schumann, NRIO)	1983

## MARINE SEDIMENTOLOGY PROGRAMME

### Status

This is a newly formulated programme emanating from the now defunct SANCOR programme on Marine Geology and Geophysics. The latter included all the marine geoscience activities undertaken by South African research groups but had to be divided when it was decided that research in the Southern Ocean undertaken off the SA Agulhas should be included in the Antarctic programme coordinated through SASCAR. Because there was a strong sentiment at the time that the SANCOR Programme should not be limited to coastal oceanography, serious consideration was given to the development of an Open Oceans programme within SANCOR of which the activities of this programme - deep water marine sedimentological studies - would form a part. It was realized, however, that the available resources do not at this stage warrant such a programme and accordingly it was decided to formulate a much more narrowly defined programme on marine sedimentology. Neither the main thrust of this aspect of the work nor the central core of workers has changed, however. Work of this type has been going on since 1966.

The compilation of the new programme document is in its final stages. The objectives stress the development of models related to sedimentological aspects of the South African marine environment and development of the continental margin and adjacent oceanic basins. Apart from purely scientific applications this work will have wide use in economic and geotechnical matters.

### Findings

Results obtained under the new dispensation are obviously limited and it is not really possible yet to place these in perspective with respect to the newly formulated objectives. However, the track record of this group of researchers is excellent and their results have been dealt with in previous status reports.

The main work done since the inception of the Marine Sedimentology Programme has been cruise 434 (UCT RV **Thomas B Davie**, January 3-27, 1983) during which some work was done in the southern Natal Valley.

The objectives were to collect piston cores (done), launch two long-term current meter strings (done) and retrieve a previously placed string (failed), test the benthic boundary layer package being developed (failed), collect water samples for coccolithophorida studies (done), and do some photography of the ocean floor (not done).

The cruise was plagued by bad weather and instrument malfunctions. It produced about 3420 km of bathymetry profiles and 21 cores (about 60 m of core, maximum single core length about 6 m). Nine water samples for coccolithophorida work were collected.

Two unplanned port visits to East London were made to repair and rebuild equipment.

The two new current meter strings were deployed without trouble but the established string could not be retrieved due to initial instrument malfunction, and later due to inclement weather. The string will now be retrieved later in 1983 or early in 1984. All 6 of the current meters and 3 flotation units are on the seafloor now.

A defective data logger foiled the planned deployment of the benthic boundary layer package. The coring device malfunctioned partly due to some unexplained circumstance, and partly due to poor workmanship. A new core head made in East London functioned satisfactorily. The on-board electronic equipment performed poorly and resulted in serious disruption of the scientific work.

### Highlights

During 1982/83 the group at the University of Cape Town has been expanded handsomely by the addition of three well qualified researchers.

I C Rust

CHAIRMAN : SANCOR MARINE SEDIMENTOLOGY COMMITTEE

### MARINE SEDIMENTOLOGY : PROJECTS 1983

<u>Projects and Project Leaders</u>	<u>Duration</u>
The relationship between deep ocean currents and sediment dispersion in the Agulhas Passage, Transkei Basin and Natal Valley (R V Dingle, UCT)	1977-1984
Benthic boundary layer sensing package (R V Dingle, UCT)	1981-1984
Compilation of data for preparation of sea floor geological/tectonic maps (E S W Simpson)	1982-1986

## SOUTH AFRICAN NATIONAL COMMITTEE FOR OCEANOGRAPHIC RESEARCH - 1983

Mr J P de Wit	Chairman	Deputy-President, CSIR
Dr G Heymann	Vice-Chairman	Deputy-President, CSIR
Dr J K Basson		NUCOR - Chairman of Marine Pollution Programme
Prof T Erasmus		UPE - Chairman of Coastal Processes Programme
Dr A E F Heydorn		NRIO - Chairman of Estuaries Programme
Prof I C Rust		UPE - Chairman of Marine Sedimentology Programme
Prof W R Siegfried		UCT - Chairman of Benguela Ecology Programme
Dr J H Wallace		PEM - Chairman of Marine Linefish Programme
Dr H J Smith		Office of the Prime Minister
Mr L N J Engelbrecht		Geological Survey
Dr J G Malan		Institute of Maritime Technology
Mr G H Stander		SFRI
Mr W S van Dijk		FDC
Capt C J H Wagenfeld		South African Navy
Prof G de F Retief		SANECOR
Prof J G Field		UCT - Marine Biology Representative
Prof M J Orren		UCT - Marine Chemistry Representative
Dr E H Schumann		NRIO - Physical Oceanography Representative
Mr F P Anderson		Director, NRIO
Dr D A Lord		Coordinator - CSP, CSIR
Mr O A van der Westhuysen		Programme Manager - CSP, CSIR

### SOUTH AFRICAN NATIONAL COMMITTEE FOR OCEANOGRAPHIC RESEARCH (SANCOR)

The objective of the SANCOR programme is to gain knowledge of the basic structures, processes and relationships in the marine environment around southern Africa in order to provide a fundamental scientific understanding and to facilitate :

- the efficient exploration, exploitation and conservation of living and non-living resources;
- the judicious management of the coastal zone;
- the fuller understanding of climate;
- improved utilization of environmental information in maritime activities.

The terms of reference of SANCOR are to provide policy and scientific guidance in matters pertaining to oceanographic research in South Africa by designating priorities. Specifically it :

- takes cognizance of actions and developments affecting marine science and technology in southern Africa and promotes communication within the oceanographic community;
- reviews the objectives, priorities and progress of its constituent programmes;
- guides effort by deciding on the funding of its constituent programmes, keeping in mind also the need for balance both geographical and disciplinary;
- ensures that its research findings reach decision makers;
- keeps informed on international developments in marine science, inter alia by acting as national committee for the Scientific Committee for Oceanic Research (SCOR) and related international bodies.

Within the SANCOR programme the following constituent programmes exist :

#### 1. BENGUELA ECOLOGY PROGRAMME

The objective of this programme is to provide information on the structure and functioning of constituent ecosystems, to complement the scientific knowledge which is required for the management of the renewable natural resources of the Benguela System.

The main geographical focus of this programme is roughly between Cape Agulhas and the mouth of the Orange River, and extending from the coast approximately 200 nautical miles into the ocean. This programme does not incorporate all research along this coast. Rather, it is a multi-disciplinary and inter-disciplinary programme which gives priority to ecological research in the subtidal and pelagic environments, and devotes a major part of its resources to obtaining ecological information on pelagic shoaling fish of commercial importance, particularly the anchovy.

The programme is undertaken jointly between the Sea Fisheries Research Institute, the University of Cape Town, the South African Museum and the National Research Institute for Oceanology under the aegis of SANCOR. It builds on a successful SANCOR programme on the communities which live in the kelp beds of the west coast - with the rock lobster as the major commercial resource - and on the research work over many years of the Sea Fisheries Research Institute. Through the integration of effort which it has now achieved, it is confidently expected that it will aid substantially those responsible for the management of our fisheries resources. In addition it should contribute state-of-the-art scientific information which will be useful in international efforts aimed at synthesizing, through the comparative approach, knowledge that will reveal universal principles necessary for our understanding of how natural systems are structured and function.

## 2. PROGRAMME ON COASTAL PROCESSES

This programme is limited to the study of those parameters which have a direct bearing on coastal systems. As such, this loose definition implies a system with open boundaries which may include estuaries, onshore areas and offshore areas whenever they form an integral part of the system under investigation; and the zone could vary in width and could extend from the coastal dunes out across the continental shelf.

The objectives of the programme are :

- to identify the key processes which operate in the coastal zone and to define the factors and understand the mechanisms that control them (in the context of the accepted definition);
- to contribute information required for the judicious development, management and conservation of the coastal zone and its resources.

An integrated systems approach is followed within which physical, chemical and biological aspects and their interactions are studied. Processes are identified in terms of input/output to and from the coastal zone, external driving forces, including human interference, basic features (including habitat features) and the responses and interactions within the zone.

Priorities on which research is concentrated in this programme are identified and emphasis is given to the study of those factors which are



most needed for the understanding of the coastal zone as a whole with particular reference to understanding the effect on the environment of human interference.

### 3. ESTUARIES PROGRAMME

The objective of this programme is to provide a scientific understanding of estuaries - in particular of the interactive physical, chemical and biological processes within them, of their interactions with their fringe areas and with their adjacent marine and terrestrial environments and finally of human impact upon them - thereby contributing information required for their wise management.

While it is easy to set such general objectives, a major consideration is that each estuary has its individual characteristics and problems. It has therefore been necessary to set priorities as to which estuaries should receive attention, bearing in mind both research and management needs and to identify specific research requirements.

The following considerations *inter alia* played a role in the identification of the priorities : research and management considerations, industrialization and urbanization, freshwater requirements, agricultural development and forestry, recreation and conservation.

The programme covers estuaries from the Orange River to Kosi, including Langebaan, the Wilderness System, St Lucia and the Kosi System.

### 4. MARINE POLLUTION PROGRAMME

The objective of this programme is to provide a scientific understanding of the influences of discharges to the sea, in particular of the interactive physical, chemical and biological processes within them, and of their human impact, thereby contributing information to the management of coastal resources.

The major activity undertaken by this programme has been a survey programme of polluted areas as well as control sites along the South African coast, followed by routine monitoring at these locations. Information obtained up to 1975 showed that, in general, the South African coastline was relatively unpolluted, except for a few isolated instances (e.g. Table Bay, Durban Harbour and East London). Since then, the pace of coastal industrialization has increased, and substantially more discharges are reaching the sea. This programme has expanded its survey programmes with specific effort being directed into conducting detailed surveys in areas of proposed or of existing development such as Table Bay, East London and Richards Bay.

The programme has also become involved in research into various aspects of oil pollution arising from ships. In addition, the Sea Fisheries Research Institute conducts appropriate research on effects of oil pollution.

## 5. MARINE LINEFISH PROGRAMME

In this programme an attempt is made to assess the state of knowledge about marine line fisheries. Certain common problem areas are recognized and the different components of the resource are considered with regard to available knowledge and current research. Important gaps in existing knowledge and research requirements, particularly in terms of fishery management needs, are identified according to type of fishery and geographic area.

The objective of SANCOR is to gain scientific knowledge required inter alia to facilitate the efficient exploration, exploitation and conservation of marine resources and the judicious development, management and conservation of the coastal zone. The objective of this programme which has been developed within this framework, is specifically to provide scientific information about this valuable component of the marine food web to aid the development of effective management strategies.

At present research is directed at angling fishes caught in estuaries, rock, surf and open sea environments along different parts of the coast, that biological research on its own would not be adequate and that trends in the fishery for individual species could only be determined through the analysis of catch statistics, which are provided through the close cooperation of the organized angling community in the country.

## 6. MARINE SEDIMENTOLOGY PROGRAMME

This programme seeks to advance our understanding of marine sedimentary processes and products in the South African marine sedimentary environment.

In the broadest sense the programme's main objectives are:

- The establishment of geological models for marine sedimentary environments, in particular with respect to those typical of the South African marine environment.
- The recognition of the evolution and development of the South African continental margin and adjacent ocean basins, including the identification of those sedimentological, geological, physical, chemical and biological features which characterize and contrast the eastern and western continental margins and basins.
- The development of models relating to the physical, chemical and biological processes affecting the transportation, deposition, erosion and diagenesis of marine sediments.
- The production of palaeo-oceanographic and palaeo-geographic models which would be applied to the historic sedimentological and stratigraphic record.

- The prediction of expected changes in sedimentological, climatological and related trends in the marine environment around southern Africa.

Although mainly sedimentological in emphasis, the programme encompasses other scientific disciplines as well. Furthermore, some of the problems addressed will require interaction with other CSP programmes. When this happens, it may be appropriate to carry out some of the work under the auspices of those programmes.

LIST OF ACRONYMS

BEP	Benguela Ecology Programme
CONCAWE	Oil Companies International Study Group for Conservation of Clean Air and Water in Europe
CSIR	Council for Scientific and Industrial Research
CSP	Cooperative Scientific Programmes
DCDP	Department of Constitutional Development and Planning
DEA	Department of Environment Affairs
DOT	Department of Transport
ECRU	Estuarine and Coastal Research Unit
ESCOM	Electricity Supply Commission
FDC	Fisheries Development Corporation
MPP	Marine Pollution Programme
NIWR	National Institute for Water Research
NPB	Natal Parks Board
NRIO	National Research Institute for Oceanology
NTRPC	Natal Town and Regional Planning Commission
NUCOR	Nuclear Development Corporation of South Africa (Pty) Limited
ORI	Oceanographic Research Institute
PCP	Programme on Coastal Processes
PEM	Port Elizabeth Museum
RU	Rhodes University
SAAU	South African Anglers Union
SADCO	South African Data Centre of Oceanology
SANCOR	South African National Committee for Oceanographic Research
SANECOR	South African National Engineering Committee for Oceanic Research
SFRI	Sea Fisheries Research Institute
UCT	University of Cape Town
UPE	University of Port Elizabeth
UN	University of Natal
US	University of Stellenbosch

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