

ANNUAL REPORT 1985

Library
Netherlands Institute for Sea Research
P.O. BOX 59, Terschelling
HOLLAND



NETHERLANDS INSTITUTE FOR SEA RESEARCH

NETHERLANDS INSTITUTE FOR SEA RESEARCH
PUBLICATION SERIES

No. 12 - 1986*

Editor-in-chief

J.J. BEUKEMA

Supplementary to the Netherlands Journal of Sea Research this Series publishes separate papers dealing with the various fields of marine science. Also the Annual Reports of the Institute are published in the Series.

The Series is available on an exchange basis. Single numbers written in English, including the Annual Reports, are distributed without costs to libraries of Institutes for which the contents may be of interest and that also receive Neth. J. Sea Res. Numbers written in Dutch are distributed only within the Benelux.

Correspondence should be addressed to the editor-in-chief, J.J. Beukema, Netherlands Institute for Sea Research, P.O. Box 59, 1790 AB Den Burg, Texel, The Netherlands.

This Annual Report was produced under the responsibility of the directors:
H. POSTMA and J.J. ZIJLSTRA

It was edited by the staff members:
G.C. CADÉE, W. HELDER and J.H.F. JANSEN

Read for English by: B. BAK

and illustrated, formatted and printed by the Institute's departments of reprography and publication:

R.P.D. AGGENBACH, H. HOBELINK, J. MULDER AND N. KRIJGSMAN

Additional illustrations were provided by:

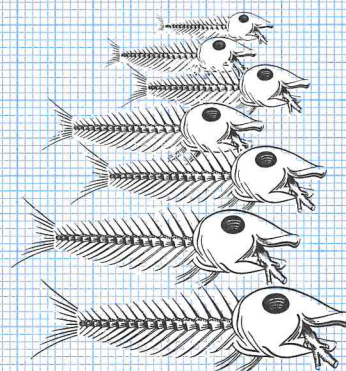
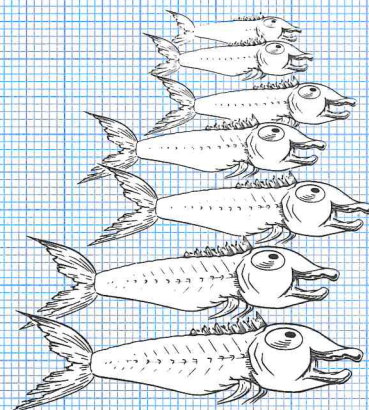
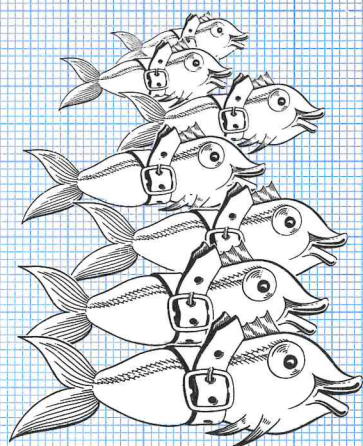
	Page:
R. Bak	61
F. Hoogervorst	45-48
A. Kop	66
G. v. Mooorsel	70-71
G. Nieuwland	6-8
R. Nolting	47
J. Visser	21

All other illustrations: NIOZ (reprography)

The illustrations of page 62 and 63 are provided by E.J. Brill (Publisher) Leyden.

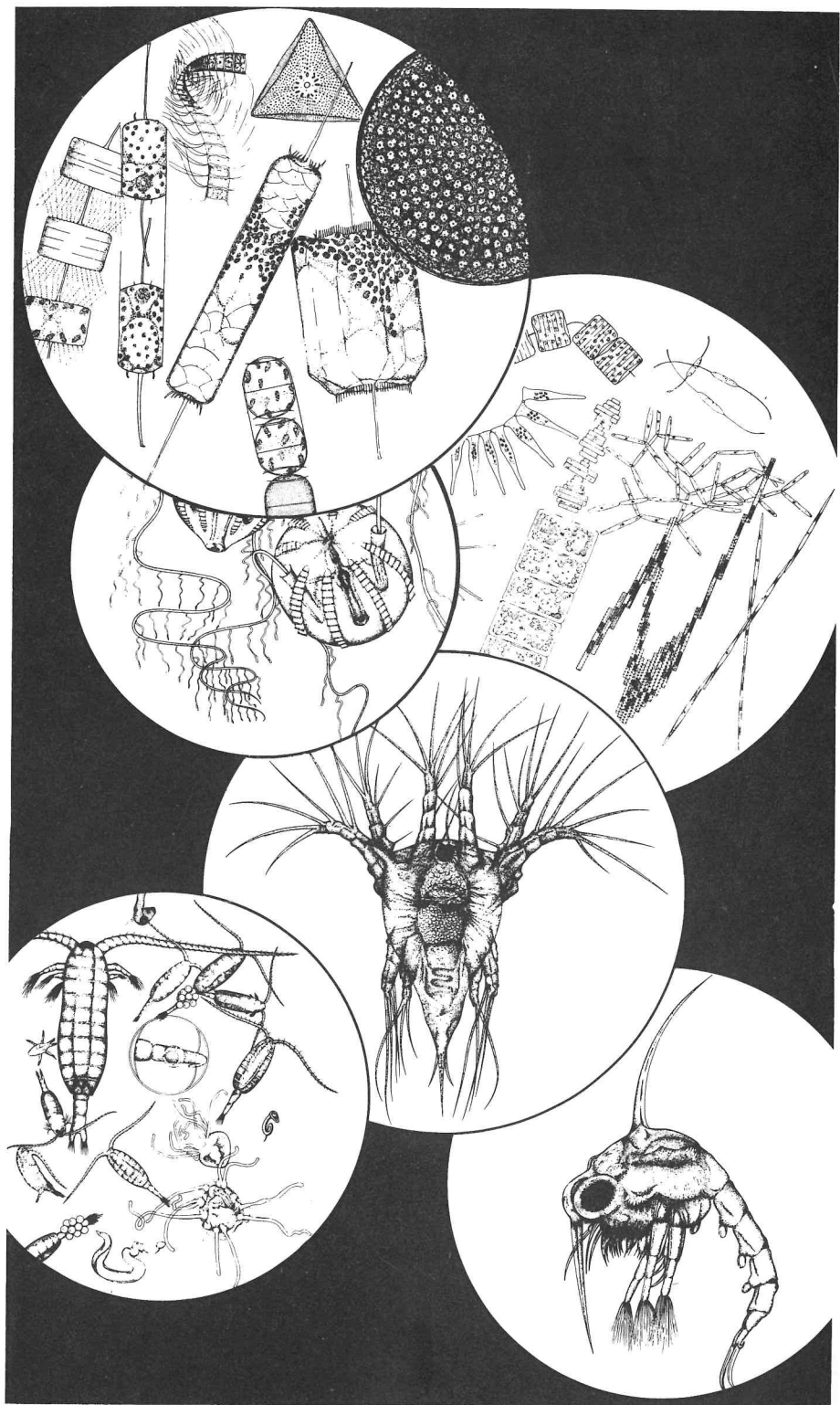
*The Annual Report 1984 was erroneously numbered 10, this should have been 11.

ANNUAL REPORT 1985



Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec.

NETHERLANDS INSTITUTE FOR SEA RESEARCH



1. Scientific activity

1.1. INTRODUCTION

As in previous years, this report describes the scientific activities of the institute in estuaries, the North Sea and the oceans. In this introduction some of the main topics of research, discussed in more detail in following chapters, are mentioned. In the middle of the year the field activities in Indonesia under the umbrella of Snellius II were terminated, so more attention can now be devoted to investigations at smaller distances. Increase in scientific staff with ten young scientists will considerably accelerate research activities.

The focal point for estuarine research was again the Wadden Sea, but comparative studies in other estuaries were not neglected. Fields of study are processes in sediments and the rate of exchange of substances between sediments and the water column. These studies include the nitrogen cycle and the diagenesis of trace elements, especially metals. Among the new techniques used is the application of so-called flux-chambers. A more detailed insight, among other things into the nitrogen cycle, was obtained by the application of these chambers. Rates of sedimentation, measured by means of radioactive lead (^{210}Pb), tend to confirm a general deposition velocity of 10 to 20 cm per century.

A beginning was made with a study of total carbon dioxide and CO_2 -species in the Wadden Sea and adjacent North Sea. This study is part of an effort to understand the exchange of CO_2 between the sea and air in relation to the rising concentrations of this gas in the atmosphere.

Biological studies have shown a slow but distinct increase in biomass of parts of the ecosystem over the last decade. This increase includes not only primary production by phytoplankton and benthic algae, but also secondary production in the benthic community. It seems probable that this increase is caused by eutrophication of the Dutch coastal area as a whole, which in turn is caused by a rise in nutrient load of the rivers.

Ecosystem research comprised studies of the carbon cycle including the role of the anaerobic environment in the sediments, and a start of the collection of additional data for biological modelling of the Wadden Sea (EON-EMOWAD). The latter study also includes physical-oceanographic aspects concerning water exchange with the North Sea and tidal residuals. The problem of exchange of water and dissolved and particulate substances between estuaries and the adjacent shelf will be given more attention in the future.

In the North Sea an investigation was carried out on the relation between underwater topography and water surface patterns seen in microwave radar pictures. Preparations were made for a continuation of the study of fronts. Studies on the Euler-Lagrange transformation of tidal currents were continued on the basis of observations in previous years.

In the field of marine geology earlier studies on the transport of suspended matter were synthesized. Relations between concentrations of suspended matter on the one hand and physical factors such as wind and wave directions, currents and gravity circulation on the other were established. More to the north, in areas of permanent settlement such as the Skagerrak, rates of deposition of up to 40 cm per century were measured. An investigation was also made of processes in sediments. These included the nitrogen cycle and the cycle of metals and metallic pollutants.

In the southern North Sea modelling of the planktonic system off the Dutch coast, carried out together with the Delft Hydraulic laboratory, was further developed. The same holds for related experimental work on plankton cultures in which dependence of copepod development on phytoplankton concentration and predation on copepods by other components of the plankton assemblage were studied. Systematic sampling of macroplankton and bottom fauna was continued.

As already mentioned, the Snellius-II expedition was finished in June. In 1985 seven cruises were carried out in which NIOZ personnel participated. The expedition was a great success and work has started to analyse the scientific data. Near the end of the year several Indonesian scientists arrived who will participate in this analysis. A finalizing symposium is planned in Jakarta at the end of 1987.

Meanwhile, plans for participation in Antarctic marine research, again under the auspices of the Netherlands Council for Oceanographic Research, were worked out. This programme is to be executed in 1986 and the following year by 8-9 NIOZ scientists on board the German research vessel "Polarstern" of the Alfred Wegener Institute in Bremerhaven. Planning for participation in other oceanographic programmes in the Atlantic Ocean is in progress. A project called DORA (Deep Sea Research on Radioactive Waste) in a dumping site for low radioactive waste in the NE Atlantic has nearly been completed. Financial support for the various programmes came again mainly from the Ministry of Science and Education. Additional sums of money were obtained from a number of other government departments, the Dutch Organisation for Fundamental Research ZWO, and industry. All these contributions are greatly appreciated. A special word of thanks is also due to the Scientific Commission of the Institute, who gave valuable advice throughout the year.

H. Postma
J.J. Zijlstra

CONTENTS

1. Scientific activity	3
1.1. Introduction	3
1.2. Estuarine Research	5
1.2.1. Physical and chemical research	5
1.2.1.1. Nitrogen cycle in the marine environment	5
1.2.1.2. Early diagenesis of trace metals in coastal marine sediments	7
1.2.1.3. Ventilation of carbon dioxide	10
1.2.1.4. Contaminants	10
1.2.1.5. Dating with naturally occurring isotopes	11
1.2.1.6. Suspended matter in the Rhône estuary	11
1.2.1.7. Production and transport of organic matter	11
1.2.2. Biological research	13
1.2.2.1. Mineralization in the Wadden Sea	13
1.2.2.2. Production and dynamics of macrobenthos on tidal flats in the Dutch Wadden Sea	14
1.2.2.3. Ecology of zoobenthos inhabiting soft bottoms along European coasts	15
1.2.2.4. Variability in annual recruitment of benthic invertebrates in the Dutch Wadden Sea	15
1.2.2.5. Protozoans	17
1.2.2.6. Chemical composition of marine organisms in relation to abiotic environmental conditions	17
1.3. North Sea Research	24
1.3.1. Dynamical oceanography	24
1.3.1.1. Small-scale turbulence, mixing layers and thermocline studies	24
1.3.1.2. Experimental dynamical oceanography	24
1.3.1.3. Theoretical dynamical oceanography	25
1.3.2. Sediment transport and Sedimentation in the North Sea	25
1.3.3. Chemistry	31
1.3.3.1. Oxygen, and the nitrogen, iron and manganese cycles in the sediment	31
1.3.3.2. Trace metal geochemistry in sediment of the Skagerrak ..	32
1.3.3.3. Trace metal in the water column	32
1.3.4. Biology	33
1.3.4.1. The pelagic system of the Southern Bight	33
1.3.4.2. Pelagic predators	34
1.3.4.3. The "REFLEX" programme	36
1.3.4.4. Experimental investigations on zooplankton	36
1.3.4.5. The benthic fauna in the southern North Sea	36
1.3.4.6. The role of carnivores in the benthic system	38
1.3.4.7. The energy budget of demersal carnivores	38
1.3.4.8. Density-dependent mortality in juvenile plaice	39

1.4. Ocean Research	40
1.4.1. Angola Basin, South Atlantic Ocean	40
1.4.1.1. Sedimentology and palaeoceanography	40
1.4.2. North Equatorial current, North Atlantic Ocean	42
1.4.2.1. Plankton research	42
1.4.3. Southern Ocean	42
1.4.3.1. Chlorophyll a and phytoplankton	42
1.4.4. Indonesia. The Snellius II expedition	43
1.4.4.1. Ventilation of deep-sea basins	43
1.4.4.2. Input of rivers into the sea	45
1.4.4.3. Geology and geochemistry of the southern basins	52
1.4.4.4. The pelagic system of the Eastern Banda Sea	54
1.4.4.5. Metabolism and productivity by benthic fauna	59
1.4.4.6. Sea-birds	59
1.4.4.7. Coral reefs	60
1.4.5. Coral reefs in Curaçao, southern Caribbean Sea	61
1.5. Special Projects	65
1.5.1. Ecological Research North Sea and Wadden Sea (EON)	65
1.5.2. Research at dumpsite for low-level radioactive waste	67
1.5.2.1. Geochemistry	67
1.5.2.2. Biology	68
1.5.3. Dutch Joint Monitoring Programme on polychlorinated hydrocarbons	69
1.5.4. Continuous liquid-liquid extraction	69
1.5.5. OPEX, oil pollution experiment	70
1.6. Additional Research	72
1.6.1. Research at NIOZ by guests	72
1.6.2. Participation in national and international programmes	73
1.7. List of research projects and research workers	75
1.7.1. Hydrography (H)	75
1.7.2. Biology (B)	76
1.7.3. Special projects	77
2. Scientific outcome	78
2.1. Publication	78
2.1.1. Netherlands Journal of Sea Research and other series issued ..	78
2.1.2. Publications NIOZ 1985	79
2.1.3. Internal Reports NIOZ 1985	83
2.2. Lectures, etc.	84
2.2.1. Colloquia and lectures at the Institute	84
2.2.2. Lectures of NIOZ scientists given elsewhere	86
2.2.3. Advice offered	89
2.2.4. Visitors from abroad	90
3. Nederlandse samenvatting van de wetenschappelijke activiteiten	91
3.1. Inleiding	91
3.1.1. Waddenzee en andere estuaria	91
3.1.2. Noordzee	93
3.1.3. Oceaan	95
3.1.4. Speciale projecten	95
3.2. Bezochte congressen	96
3.3. Bestuursfuncties	99
3.4. Studentenonderzoek	102
3.5. Cursussen, vergaderingen en excursies	103
3.5.1. NIOZ cursussen	103
3.5.2. Ontvangen gezelschappen van verwante instituten, overheids- diensten, e.d.	103

4. Hulpafdelingen	105
4.1. Bibliotheek	105
4.2. Rekencentrum	105
4.3. Reprografische afdeling	106
4.4. Biologisch studiemateriaal	106
4.5. Werkplaatsen	106
4.6. Haven en vaartuigen	107
4.7. Logeergebouwen	108
5. Sociaal jaarverslag 1985	109
5.1. Algemeen	109
5.2. Beheer	109
5.3. Werkoverleg	110
5.4. Personeelsbeleid	111
5.5. Personeelslijst	111
5.6. Tijdelijke personele ondersteuning	113
5.7. Verdere personeelszaken	116
5.8. Verslag van de personeelsvereniging	116
6. Jaarverslag ondernemingsraad 1985	118
6.1. Algemeen	118
6.2. Punten van aandacht	119
6.3. Verkiezingen en samenstelling OR	121
6.4. Commissies	121
6.5. Vergaderingen	121
6.6. Scholing en financiën	121



1.2. ESTUARINE RESEARCH

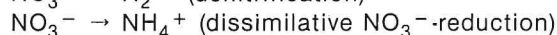
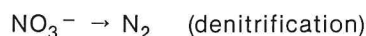
1.2.1. Physical and chemical research

1.2.1.1. Nitrogen cycle in the marine environment

H1-02, H1-03

W. Helder, J. Bakker and R. de Vries

A study was carried out in cooperation with Leo Goeyens (V.U. Brussels) to evaluate the relative importance of denitrification and dissimilative nitrate reduction.



For this purpose surface sediments from the Mokbaai were incubated in the laboratory at 20°C after $^{15}\text{NO}_3$ -spiking. $^{15}\text{N-N}_2$ and $^{15}\text{N-NH}_4^+$ were analysed by the emission-spectroscopy technique. During the incubation (3 days) gas-composition (O_2 , N_2 , CO_2 , CH_4) was determined by "gas chromatography" and nutrients (NH_4^+ , NO_3^- , NO_2^-) by auto-analyser. Results indicate that $\pm 60\%$ of the nitrate is converted to N_2 , while $\pm 15\%$ ends up as NH_4^+ .

Sediment-water exchange of dissolved compounds and the mediation of fluxes by bioturbation were studied in cooperation with Dr. Frede O. Andersen (Odense University, Denmark). Essentially, changes in silicate concentration in overlying water of cores incubated in the laboratory with and without addition of formalin and of cores that were asphyxiated by isolation of overlying water from air were compared. Results indicate that by formalin addition or asphyxiation the Si-fluxes to the overlying water decrease by a factor ± 3 -5 and that by the killing of the sediment fauna (asphyxiation, formalin addition) the effective diffusion coefficient decreases to values similar to molecular diffusion. These cores were also used to compare O_2 -uptake by the sediment, calculated from O_2 -concentration decrease in overlying water, with the O_2 -uptake calculated from O_2 -micro electrode profiles.

Determination of N_2O . N_2O is an important intermediate in nitrification as well as in denitrification, and can play an interesting role in connecting these two processes at low O_2 -concentrations. Apart from indicating N_2O abundance, the analyses of it in sediment can be used for assessing denitrification rates of sediments in which the denitrification process is stopped at the N_2O stage by addition of acetylene. The determination of N_2O by gas chromatography is the subject of a student research project (Peter Lock). It is now possible to do reproducible N_2O measurements and in the near future methods and GC-procedures will be slightly modified to reduce the time needed to do the analysis.

In the study of nitrification, denitrification and ammonification oxygen and oxygen gradients play an important role. From the literature and our own research, it is known that the presence of oxygen determines reactions and reaction rates of the various nitrogen-cycle metabolisms. For this reason the use of oxygen micro- en needle-electrodes was introduced into the study of the nitrogen-cycle in marine sediments last year. Not only the cycling of nitrogen compounds depends on oxygen, but so do iron, manganese and sulfate reductions.

A working visit to the Vrije Universiteit in Brussels resulted in a research proposal for a doctorate student on the separation of ^{15}N ammonia from pore water. A visit to the Department of Instrumental Analysis of the TH Eindhoven may result in collaboration with Dr. Everaarts (TH Eindhoven) on the separation of dissolved mineral N-compounds. A proposal on this subject has been made.

Together with A. Vaars and the electronic Department an apparatus has been made to convert (org.) N-compounds into ammonia. Ammonia is the compound that is easiest to measure for ^{15}N enrichment in the emission spectrometer.



1.2.1.2. Early diagenesis of trace metals in coastal marine sediments

1.1. The manganese cycle

H1-06

B. Sundby, M.M. Rutgers van der Loeff

The surface sediments of coastal marine deposits are often enriched in manganese as a result of processes taking place during the early stages of diagenesis. These processes comprise burial and dissolution of particulate manganese, upward migration of dissolved manganese, and reprecipitation of particulate manganese at the sediment surface. We have applied diagenetic modelling and mass-balance calculations to box-core and sediment-trap data from three stations at 300-400 m depth in the Laurentian Trough, Gulf of St. Lawrence, Canada, to estimate downward and upward fluxes of manganese across the sediment-water interface, fluxes across the redox boundary in the sediment, rates of dissolution and precipitation of manganese, and rates of manganese accumulation. At all stations the cycling of manganese between the oxidizing and the reducing zone of the sediment was quantitatively more important than the cycling between the sediment and the water column. The redox boundary was the site of the largest fluxes. Downward fluxes across this boundary were 3-50 times the rates of sedimentation or accumulation of manganese. The production of dissolved manganese turns over the inventory of particulate manganese in the sediment surface layer in 43-207 days. A small proportion of the dissolved manganese produced (13-29%) escapes the sediment, reprecipitates in the water column and, in part, returns to the sediment. Increased rates of bioturbation increase the rate of internal manganese cycling more than they do the rate of cycling across the sediment surface (in collaboration with N. Silverberg, University of Quebec, Canada).

1.2. Early diagenesis of cadmium and cobalt

Trace metals are associated with particulate matter in a variety of ways that range from highly stable integration within crystal lattices of minerals to loose attachment to grain surfaces. In seawater, particulate cadmium is to a large extent biogenic whereas particulate cobalt is more lithogenic and has a great affinity for manganese and iron oxides. Because of this contrast, cadmium and cobalt were selected for a study of the early diagenesis of trace metals in the coastal marine environment.

The depth distributions of cobalt and cadmium in box-cores from a series of stations along the 1200 km length of the Laurentian Trough, Canada, indicate a strongly contrasting behaviour of the two elements during early diagenesis, consistent with their respective chemistries and particle-associations. Cobalt occurs mainly in a non-reactive form and is buried with the accumulating sediments. A mobile component of cobalt is associated with Mn- and Fe-hydroxides and, like these compounds, follows a redox-sensitive pattern of dissolution in the reducing zone of the sediment, vertical migration, enrichment by precipitation in the oxidized surface layer, and redistribution along the bottom in particulate form. Particulate cadmium arrives at the sediment surface associated with biogenic material, is rapidly solubilized during aerobic degradation

of the organic matter, and migrates vertically both into the reducing zone of the sediments where it precipitates, and back into the water column where it may be recycled through biological processes. In an estuary, cobalt will be concentrated in the oxidized layer of the sediments and tends to migrate landward, while cadmium will be most abundant in sediments underlying regions where plankton production is high relative to dilution by terrigenous particles (in collaboration with N. Silverberg, University of Quebec, Canada).

1.3. Fluxes of trace metals across the sediment-water interface

Because of the chemical and biochemical reactions that take place in sediments, trace metal concentrations in the porewater of sediments are different from those in the overlying water. The result is that the metals migrate across the sediment-water interface in the direction of the lowest concentration. To find out if a sediment takes up or releases a given trace metal to the overlying water, and to determine the magnitude of the flux across the sediment-water interface, one can either measure the concentration gradient of the metal in the porewater near the interface and calculate the flux, or one can place a flux-chamber over the sediment surface and measure the concentration change of the trace metal in the chamber as a function of time. Neither approach is without problems.

R.V. "Navicula" on a tidal flat



An *in situ* flux-chamber experiment that was carried out in the Gullmarsfjord, Sweden, addressed the problems that arise from isolating the sediment from the ambient bottom water, in particular the effect that changing the nearbottom turbulence structure and eliminating the supply of oxygen and particulate carbon to the sediment may have on flux measurements. The experiment used diver-operated, stirred flux-chambers, equipped so that dissolved oxygen and pH could be maintained near ambient seawater values (regulated chambers) or be allowed to change in response to benthic respiration (unregulated chambers). Radioactive tracers and a stagnant film model were used to estimate the resistance to chemical transport posed by the benthic boundary layer.

The release and uptake pattern of the trace metals fell into two distinctly different groups containing iron, manganese, and cobalt in one group and cadmium, copper, nickel, and zinc in the other. In regulated chambers the first group was taken up by the sediment while the second group was released. The metal fluxes were highly sensitive to the supply of oxygen to the sediment, and we could change the magnitude and even the direction of the fluxes by changing the flux of oxygen across the benthic boundary layer. There was no correspondence between the fluxes we measured and those we calculated on the basis of porewater profiles (in collaboration with L. Anderson, P. Hall, A. Iverfeldt and S. Westerlund, University of Gothenburg, Sweden).

1.4. Benthic respiration measured by total carbonate production

An important part of the oxidation of organic matter in the aquatic environment takes place in the sediment, especially at the sediment-water interface, and is mediated by benthic micro- and macro-organisms. The method that is most commonly used to estimate benthic community metabolism is the measurement of oxygen consumption rates, that is the flux of oxygen from the water column into the sediment. This method has been criticized for its inability to take into account the anaerobic respiration, that is the respiration with electron acceptors other than oxygen. Because the role of anaerobic respiration and the extent to which it is included in the oxygen consumption measurement depend on the balance of supply and demand of electron acceptors in the sediment, they are not easily quantifiable and the oxygen consumption rate is therefore not an ideal measure of benthic mineralization in coastal sediments.

In the flux-chamber experiment described above, we also investigated the suitability of total carbonate production as a measure of benthic respiration. *In situ* fluxes of total carbonate, oxygen, calcium, total alkalinity, nutrients and sulfide across the sediment-water interface were measured in diver-operated benthic flux-chambers. Two chambers were run in parallel in order to test the influence of oxygen and pH levels on total carbonate production. In one chamber, oxygen and pH were maintained constant near ambient levels. In the other chamber, benthic respiration was allowed to deplete oxygen and lower the pH. We found that the flux of total carbonate, corrected for CaCO_3 precipitation/dissolution, is a suitable measure of benthic mineralization in sediments where methane production can be neglected. The production rate of total carbonate was not seriously affected as long as the oxygen

concentration remained above 100 μm . The results of simultaneous oxygen consumption and carbonate production rates can be used to estimate the extent of anaerobic respiration. The estimate is uncertain, however, because of uncertainties in the respiration coefficient and should be checked for consistency with data on alkalinity production and sulfur accumulation rates (in collaboration with L. Anderson, P. Hall, A. Iverfeldt and S. Westerlund, University of Gothenburg, Sweden).

1.2.1.3. Carbon dioxide research

H1-04

H. Postma, J.W. Rommets
and M. Hoppema

A start was made in 1985 with the investigation of the carbon dioxide cycle in the Western Wadden Sea and the adjacent North Sea. Since hardly any data are now available it will in its first phase be mainly exploratory.

A study was made of the CO_2 - O_2 ratio which is expected to vary in time and place because of seasonal and local changes in production and mineralization of organic matter, in exchange with the atmosphere and in lateral exchange through the tidal inlet.

1.2.1.4. Contaminants

H1-13

J. Everaarts

For the determination of total body concentrations of four metals: zinc, cadmium, lead and copper, benthic organisms were collected in eight different areas of the Dutch Wadden Sea during a cruise in April. Species collected represent the polychaetes *Arenicola marina* and *Nereis diversicolor*, the bivalves *Mya arenaria*, *Cerastoderma edule*, *Macoma balthica* and *Mytilus edulis* and the crustacean *Crangon crangon*. The preliminary results of the analyses give no evidence for a decreasing trend in body contents of the metals in organisms from the western part of the Wadden Sea towards the eastern part. On the contrary, there appears to be an increase in the concentration of cadmium (in *Arenicola*, *Macoma* and *Mytilus*) in the eastern part of the Wadden Sea (Dollard), and to a certain extent this holds for zinc as well (in *Arenicola* and *Macoma*). Although there is no decreasing trend in internal metal concentrations in polychaetes from west to east, values from the Balgzand area are highest. Very high concentrations of zinc were analysed in *Macoma* (up to 800 $\mu\text{g}\cdot\text{g}^{-1}$ dry weight); the highest cadmium concentration was found in *Mytilus* (1.5-2.0 $\mu\text{g}\cdot\text{g}^{-1}$ dry weight) and high concentrations of copper were measured in *Crangon* (50-70 $\mu\text{g}\cdot\text{g}^{-1}$ dry weight). The data will be compared with the results obtained from cruises in 1982 and 1983, to distinguish possible "long-term" changes in body contents of metals.

During the same cruise, individuals of the same species were collected for the determination of concentration of chlorinated hydrocarbons. These results have to be worked out yet (chromatograms have just become available).

1.2.1.5. Dating with naturally occurring isotopes

H3-10
D. Eisma and G. Berger

Sediment cores (box-cores) from the Wadden Sea (tidal watersheds and Dollard) were analysed for ^{210}Pb , by which ^{210}Pb was used partly for dating, partly as a tracer for sediment re-working. In some areas on the tidal watersheds mixing was found to be very strong, in other areas not, while in some cores older material was found on top of younger material. This occurred in areas where the sediment layering indicated absence of bioturbation. Thick sediment layers (of more than 1 meter) can be deposited in a short period (in the order of several decades), although the over-all deposition rate is in the order of 10-20 cm/100 years.

1.2.1.6. Suspended matter in the Rhône estuary

D. Eisma

In February a last series of estuarine suspended matter samples was collected in the Rhône estuary, by which a total of nine series from estuaries in NW Europe was completed. All series show a finer particle size of the suspended matter at very low salinities. During winter this has been found associated with a high concentration of dissolved sugars not found in spring or summer. This is most probably related to the high level of biological activity during that period, resulting in rapid consumption of dissolved sugars. The high sugar concentrations are not related to high plankton concentrations and are most likely mobilized from particulate matter. The finer particle size at low salinity is related to the virtual disappearance of large flocs ($> 32\ \mu\text{m}$) present in the river water and consist of a mixture of organic matter and mineral particles. Carbon isotope ratios indicate that in the estuary the organic matter of fluvial origin is mineralized, mobilized or consumed and replaced by organic matter of estuarine or marine origin. This involves a break-up and reformation of flocs.

1.2.1.7. Production and transport of organic matter

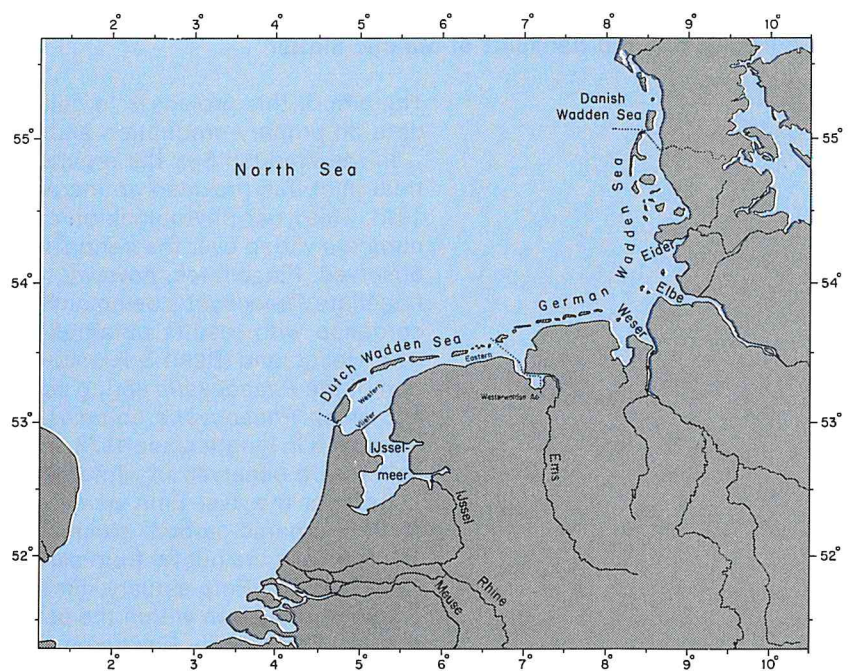
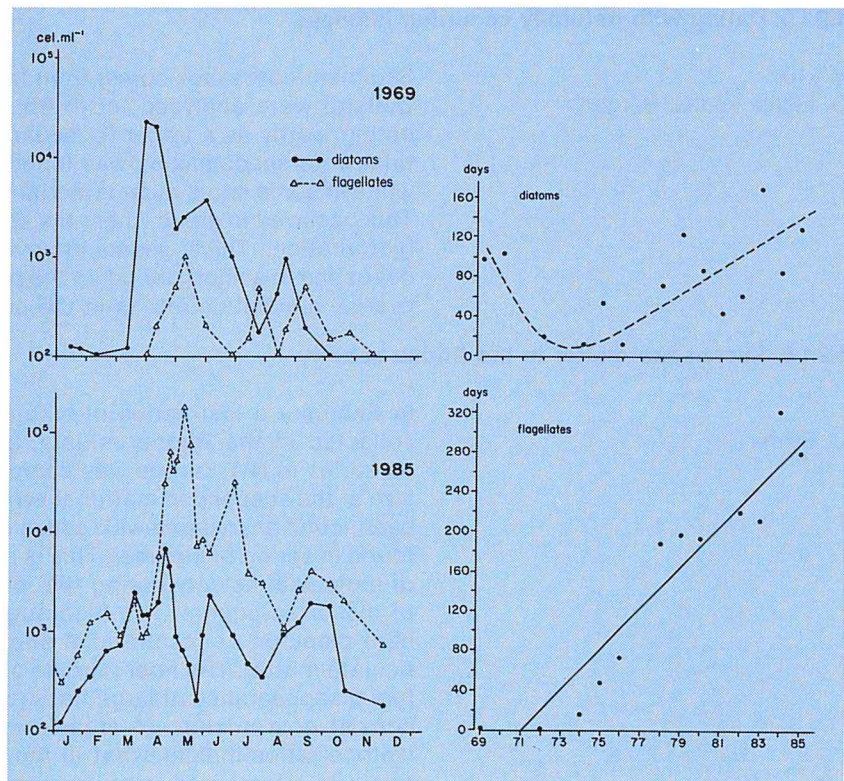
B3-01
G.C. Cadée

The aim of this project is to collect data for carbon-budget studies, *i.e.* data on primary production and input and output of organic carbon.

In the Wadden Sea the regular sampling programme of the Marsdiep tidal inlet has provided an increasingly interesting series of data since 1973. This year phytoplankton cell counts have been analysed. Diatom numbers varied over the period 1973 to 1985, but no clear trend could be observed. Flagellates, however, increased over this period, the colonial flagellate *Phaeocystis* being an important contributor. This trend is in accordance with results obtained by the Biologische Anstalt Helgoland near Heligoland (BERG & RADACH, 1985, ICES). In the Marsdiep the duration of the *Phaeocystis* spring peak as well as the period of the year during which *Phaeocystis* colonies are present in the plankton have also increased in length since 1973. In 1985, for the first time *Phaeocystis* colonies were observed in winter (January/February), among ice-flocks.

Data for the river Ems were used to estimate an annual discharge of $40 \cdot 10^3$ t organic carbon, about $\frac{1}{4}$ of which was in the particulate form. These values are not far from earlier estimates by BOEDE (BOEDE report, 1983). For the Ems estuary, Ems river input is small as compared with primary production within the estuary. Contrary to suggestions by KÜHL & MANN (1973, Arch. Fischerei), river input of organic carbon has not increased since 1950.

The seasonal variation in phytoplankton of the Marsdiep tidal inlet has been followed since 1969. Cell numbers are low in winter. After the spring diatom peak, a flagellate peak occurs. Later in the year two more diatom peaks, followed by flagellate peaks with other species, are usually observed. After a period of decrease, diatoms have been increasing in number since about 1975. Flagellates have shown a continuous increase since 1969, as indicated by the time per year during which cell numbers exceed 10^6 cell l^{-1} . As in other coastal North Sea areas, this increase is suggested to be related to eutrophication.



Wadden sea and Dutch coastal waters with geographical names mentioned in this report.

1.2.2. Biological Research

1.2.2.1. Mineralization in the Wadden Sea

B1-02

J.H. Vosjan

Vertical distribution of mineralization activity, in the sediment and in the overlying water, was measured in a natural tidal ecosystem and in an artificial tidal system. The sediment respiration, measured as ETS activity, was about 50 times higher than the activity measured in the water column. However, the ratio of ETS activity to real respiration, including various types of anaerobic respiration, is not known. Therefore, the figures obtained present only a relative picture, but at the same time clearly demonstrate the importance of the sediment with respect to the mineralization activity.

Early in September, tidal sediments at 27 different stations in the Wadden Sea were studied. In the upper 10-cm layer of the sediment, biomass of micro- and meiofauna was measured by means of the ATP method. Carbon values were calculated by multiplying the ATP figures with a factor 250. The average biomass found was $3.9 \pm 1.8 \text{ g C}\cdot\text{m}^{-2}$; maximum value was 6.8, minimum value $0.3 \text{ g C}\cdot\text{m}^{-2}$. The average biomass of organisms smaller than $50 \mu\text{m}$ in the water column amounted only to $0.25 \text{ g C}\cdot\text{m}^{-3}$. Thus in the subtidal areas, with a water depth of about 4 m, a biomass of about $1 \text{ g C}\cdot\text{m}^{-2}$ is found; in the tidal areas, with the tidal flats covered by about 1.5 m water during high water, some $0.4 \text{ g C}\cdot\text{m}^{-2}$ occurs. Assuming that the activity per biomass unit is equal in both water and sediment, the respiration in the sediment is shown to be 4-30 times larger than in the water column.

In all the sediment samples studied, the oxygenated surface layer was less than 1 cm deep and so most of the biomass is present in the anaerobic environment.

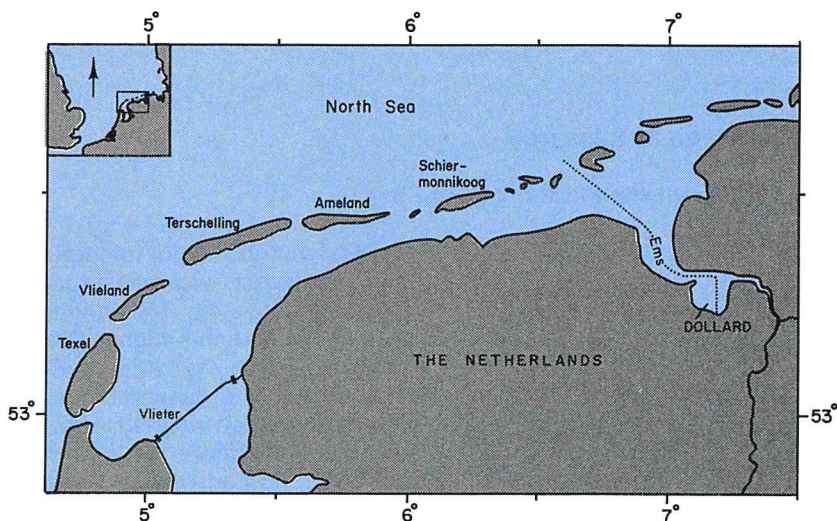
Decomposition of organic matter in the anaerobic marine environment mostly occurs by sulphate reduction. Large amounts of sulphate are available here. Sulphate concentrations were clearly found to decrease with depth; occasionally enhanced sulphate concentrations were observed in the oxic/anoxic interface of the sediment. Chemical gradients in the sediments are affected by storm, bioturbation and also tidal action. In a small gully system in the Wadden Sea, the sulphate content was measured to show the effects of the tide on the sulphate content of percolating interstitial water.

During ebb tide the water that percolates through the sediment, lowers the sulphate concentration considerably; the incoming flood water quickly restores this concentration to its normal value in sea water. In a gully with an organic-rich sediment the measured decrease of the sulphate content amounted to about 14%; in another tidal gully about 5%.

The fate of the reduced sulphur compounds is still unknown, but an intensive cycling of sulphur is concluded.

In a number of closed sediment cores a sulphate reduction of $30 \text{ mmol SO}_4\cdot\text{m}^{-2}\cdot\text{d}^{-1}$ was measured, representing an organic carbon respiration of $0.7 \text{ g C}\cdot\text{m}^{-2}\cdot\text{d}^{-1}$.

Wadden Sea with geographical names mentioned in this report.



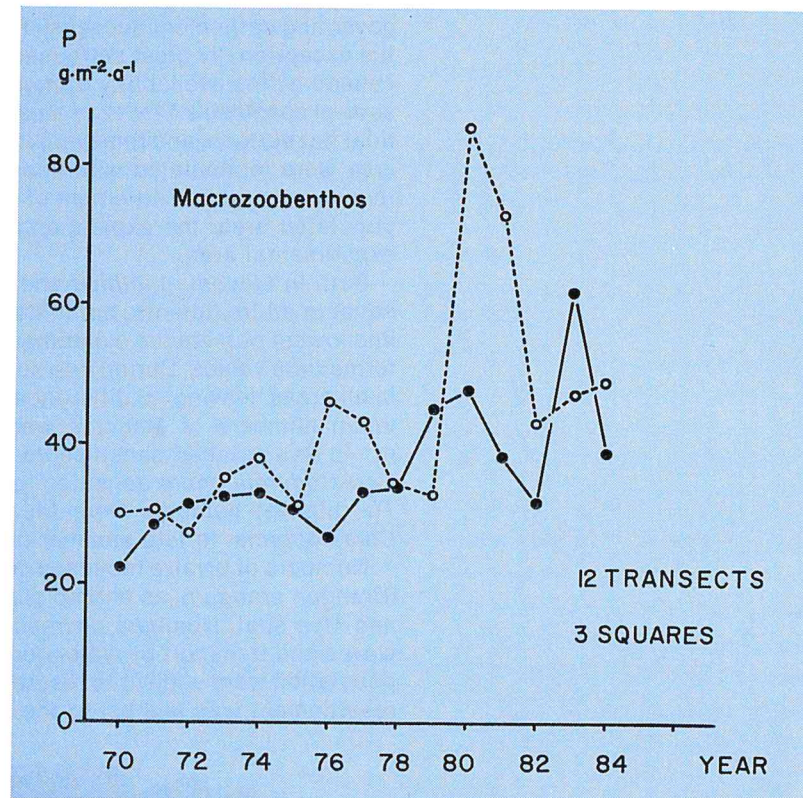
1.2.2.2. Production and dynamics of macrobenthos on tidal flats in the Dutch Wadden Sea

B3-02a
J.J. Beukema

Long-term (more than 15 years) investigations on the intertidal benthic macrofauna of the westernmost part of the Wadden Sea, covering information on mean numbers, biomass, annual recruitment, survival, growth rates and production, showed significant variations, both spatially and temporally. Population densities in the various species fluctuated roughly in parallel at the 15 different sampling stations on Balgzand (a 50 km² tidal flat area). Fluctuation patterns were found to gain in similarity as the sampling stations were more similar in environmental conditions, *e.g.* intertidal level and sediment composition. High degrees of similarity in fluctuation pattern were observed especially in species that are sensitive to low winter temperatures. Results of this study were presented at a COST-647 symposium on long-term changes in marine species.

Apart from fluctuations caused by seasonal and annual variations in weather conditions, an upward trend was observed during the last 10 or 15 years in total biomass and production of the macrozoobenthos on tidal flats of the western Wadden Sea. More than half of the 27 species studied shared this upward trend in numbers and biomass. The approximate doubling of total macrozoobenthic biomass and production during the 15-year period of observation was paralleled by a similar increase in microalgal stocks and primary production (see 1.2.1.5.), and may be ascribed to the eutrophication (increase of nutrient concentrations) of the Dutch coastal waters. A paper on these simultaneous increases was read at the EMBS.

Estimates of the annual secondary production by the larger benthic animals living on tidal flats in the western part of the Dutch Wadden Sea for 15 successive years, expressed in g ash-free dry weight per m² per year (P). The estimates are based on biomass measurements of annual samples taken along 12 long transects (○) and seasonal samples in 3 square plots (●). Biomass figures were converted to production estimates by application of conversion factors. For both data sets an increase is observed during the 15-year period, which is statistically significant at $p < 0.01$.



1.2.2.3. Ecology of zoobenthos inhabiting soft bottoms along European coasts

B3-02b
J.J. Beukema

Part of the project 1.2.2.2. is incorporated in the European Community project COST-647, an international long-term programme to assess and correlate fluctuations in numerical densities of selected species of benthic animals in European coastal seas. The aim of this monitoring programme is to detect factors, such as climatic and hydrographic events, which operate on a broad geographical scale. The effects of such factors cannot be properly studied by local investigations.

The programme has now been running for about 5 years, with participants in nearly all West European countries using the same sampling methods. Intercomparisons of fluctuation patterns in various species proved to be fruitful particularly for the sampling stations in the Wadden Sea in Denmark, Germany and the Netherlands.

1.2.2.4. Variability in annual recruitment of benthic invertebrates living on tidal flats in the Dutch Wadden Sea

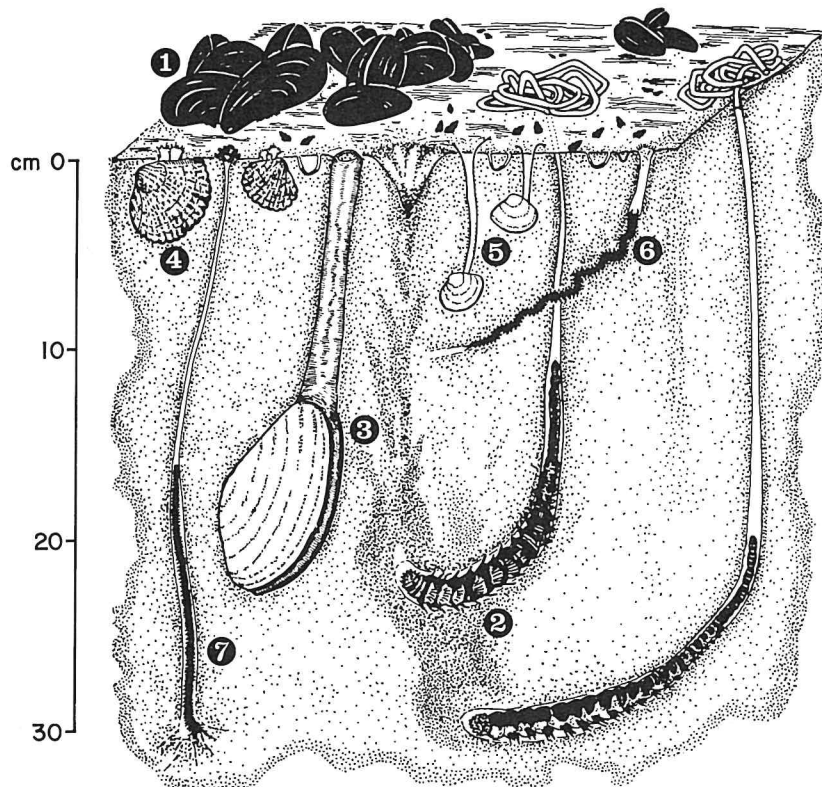
B3-05
R. Dekker

A research project on the causation of the annual variability in reproductive success in soft bottom intertidal benthic invertebrates started in June 1985. Longterm investigations in the western Wadden Sea had shown a strong year-to-year variation in the reproductive success in these animals. Both biotic and abiotic environmental factors will contribute to such variability. Available data suggest strong effects of both predators and preceding winter temperatures. To unravel the mechanism

governing settlement success, a set of field experiments was started. As the exceptionally great settlement success after severe winters might be caused by the availability of much "open" space (from high mortality in several species), a 12 × 12 m area was made azoic by putting a mat on the tidal flat surface, and removing it several months later. Parts of this azoic area were repopulated with known densities of adults of common benthic invertebrates. Settlement of bivalve molluscs was followed in the unpopulated area, the experimentally repopulated areas and outside the experimental area.

Both in *Macoma balthica* and in *Mya arenaria* settlement was nearly equal in all treatments, but initial survival was highest in the azoic area and lowest outside the experimental area. Repopulated areas showed intermediate values. During late summer, numbers decreased dramatically in all areas, leaving no differences between the various treatments. Maximum numbers of *Macoma* were reached in mid-June (about 90 000 · m⁻²). *Mya* reached densities up to 25 000 to 30 000 · m⁻² in mid-July. In *Cerastoderma edule* densities remained relatively low, up to 8000 · m⁻². The highest numbers were found in the area repopulated with adult *Cerastoderma*. In late summer numbers decreased to about 100 · m⁻².

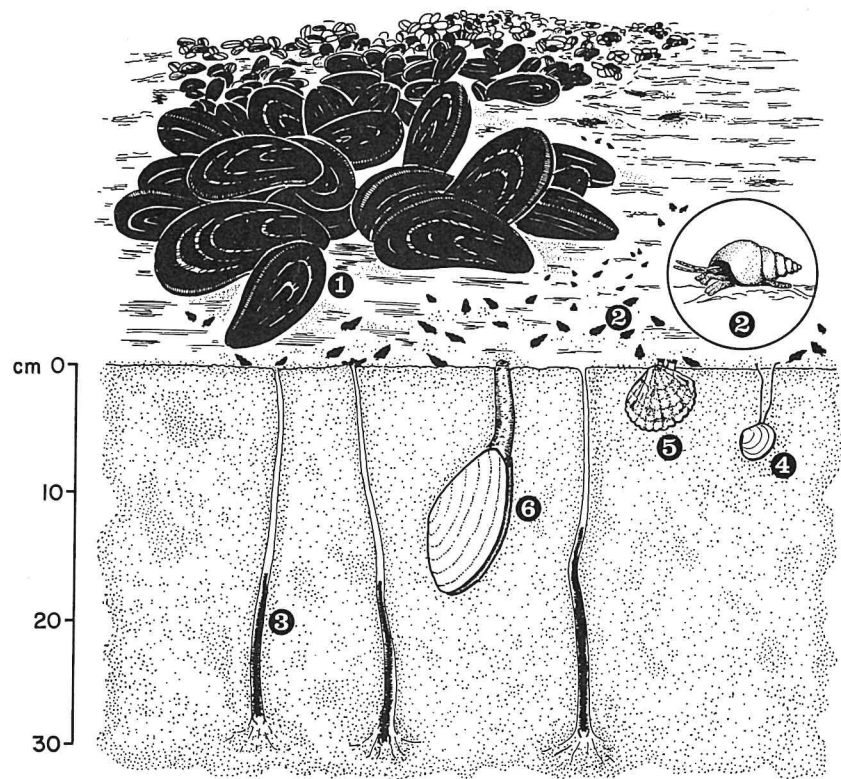
Numbers of bivalve molluscs decreased partly by predation by shrimps (*Crangon crangon*), as shrimp stomachs were found to contain *Macoma* and *Mya* spat. Numbers decreased also as a result of resuspension by waves and transport by water currents. In *Mya* higher percentages of the population were subject to resettlement than in *Macoma*. In both species resettlement was highest in the smallest size classes.



The most important species of the Wadden Sea macrofauna

Of intertidal flats (1. *Mytilus edulis*, 2. *Arenicola marina*, 3. *Mya arenaria*, 4. *Cerastoderma edule*, 5. *Macoma balthica*, 6. *Nereis diversicolor* and 7. *Heteromastus filiformis*.

The most important species of the Wadden Sea macrofauna of subtidal areas (1. *Mytilus edulis*, 2. *Hydrobia ulvae*, 3. *Heteromastus filiformis*, 4. *Macoma balthica*, 5. *Cerastoderma edule*, 6. *Mya arenaria*).



1.2.2.5. Protozoans

B1-06
R.P.M Bak

To avoid the effects of unsatisfactory fixation procedures, a method has been developed to count samples of living protozoans without preceding preservation. So far, results with natural Marsdiep populations, indicate that the majority of small protozoans ($<50 \mu\text{m}$) is heterotrophic and has a maximum size of $20 \mu\text{m}$.

These organisms are numerous in July (mean $4.6 \cdot 10^3 \cdot \text{ml}^{-1}$), low in October (mean $1.4 \cdot 10^3 \cdot \text{ml}^{-1}$) and lower in November ($0.3 \cdot 10^3 \cdot \text{ml}^{-1}$). This decrease parallels a drop in sea water temperature from 18 to 7°C .

To obtain qualitative data on the composition of this small fauna, samples are prepared for the Scanning Electron Microscope. An unsolved problem here remains the shrinkage of cells.

Two species of heterotrophic flagellates from Marsdiep water are being cultured in the laboratory.

1.2.2.6. Chemical composition of marine organisms in relation to abiotic environmental conditions

B3-04
D.H. Spaargaren

In the framework of this project a study was designed to determine if differences in glucose concentrations in the haemolymph and in the tissues can be correlated with known osmotic and ionic regulatory patterns of the common shrimp. It was hypothesized that the expenditure of energy in osmotic and ionic regulation is dependent on the availability of carbohydrate to the regulatory tissues.

Fig. 1 Frequency distribution of blood glucose concentrations in shrimps *Crangon crangon* male (black bars), female without eggs (white bars) and ovigerous female (blue bars).

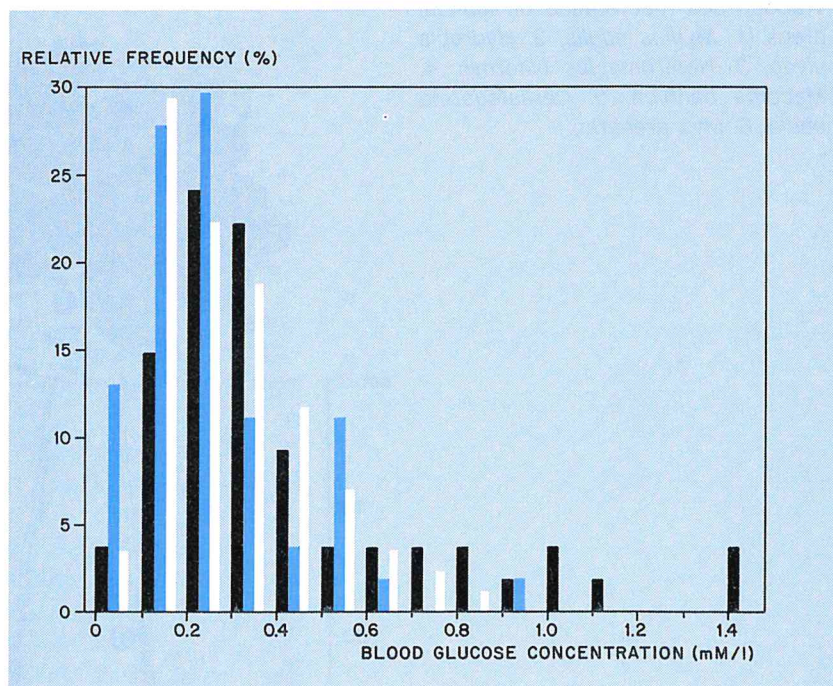
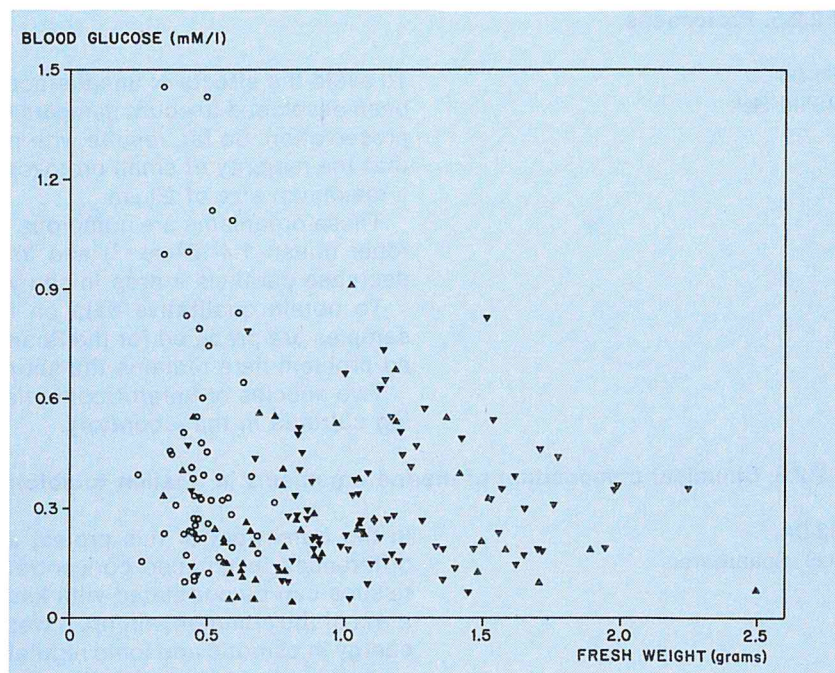


Fig. 2 Blood glucose concentrations in *Crangon crangon* as a function of sex and size. (males $\circ$, females without eggs $\blacktriangle$, ovigerous females $\blacktriangledown$)



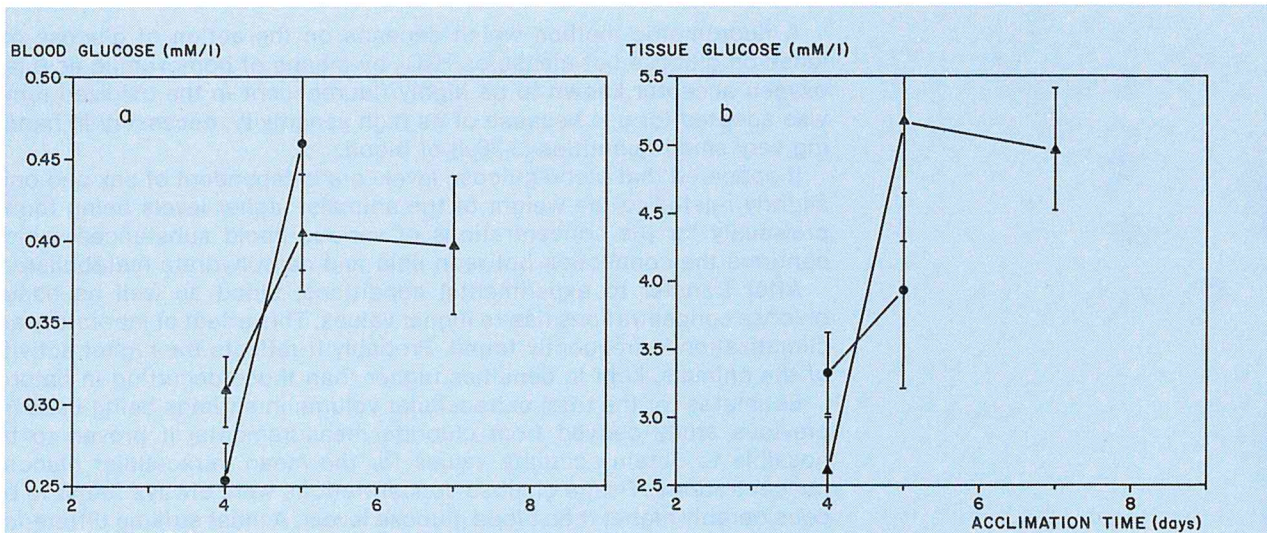
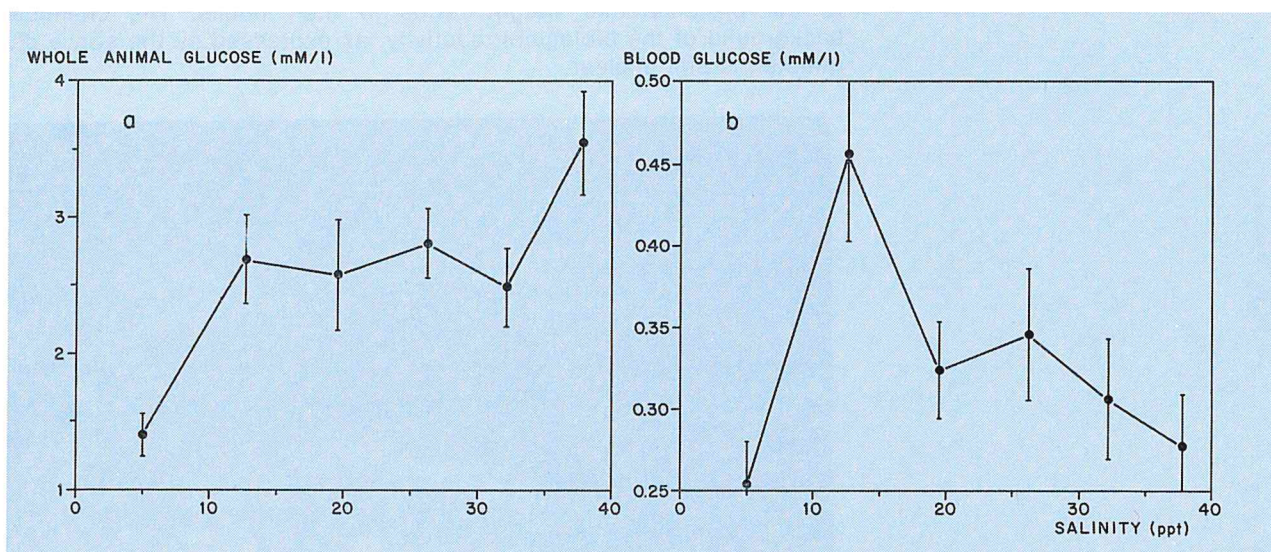


Fig. 3 Increase in blood glucose concentrations (a) and tissue glucose concentrations (b) after transfer to experimental conditions. Temperatures 8.5° C (●) and 18.5° C (▲); Vertical bars represent the standard errors of the means.

Fig. 4 Whole animal glucose concentrations (a) and blood glucose concentrations (b) in common shrimps as a function of external salinity. Data for low and high acclimatization temperatures, not significantly different, are taken together.



A fluorometric method which depends on the action of glucose oxidase on glucose but measures H_2O_2 by means of homovanillic acid (an oxygen acceptor known to be highly fluorescent in the oxidized form) was adopted for use because of its high sensitivity, necessary in handling very small quantities ($3-26\mu l$) of blood.

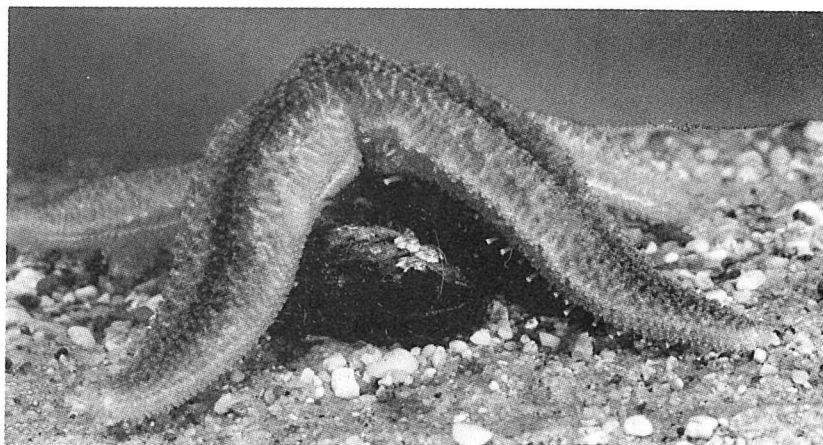
It appeared that blood glucose levels are independent of sex and only slightly related to the weight of the animals, higher levels being found previously for the concentrations of various lipid substances, which confirms the connection between lipid and carbohydrate metabolism.

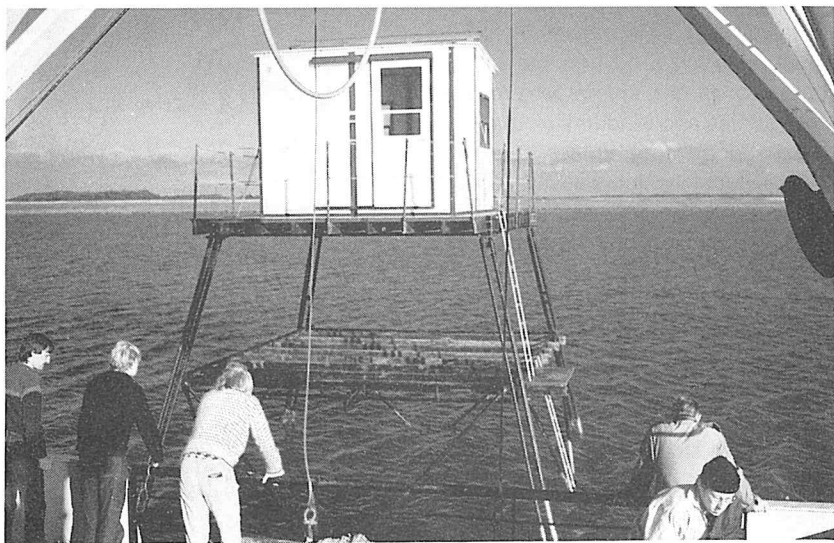
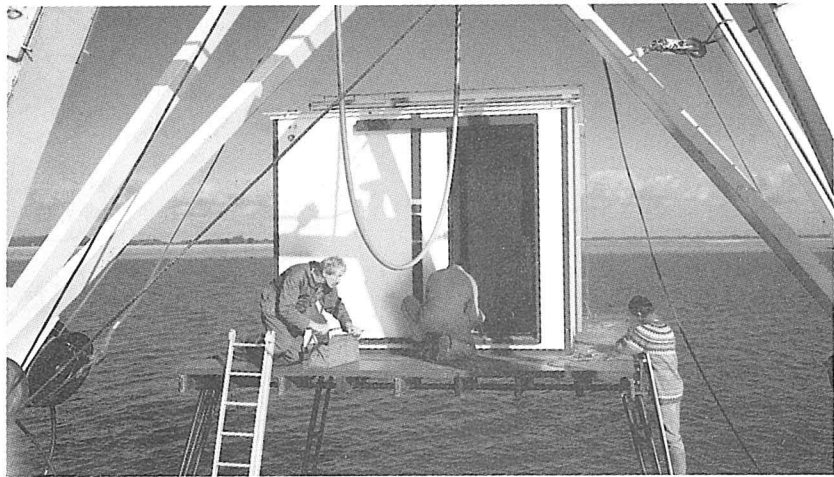
After transfer to experimental conditions, blood as well as tissue glucose concentrations rise to higher values. This effect of laboratory acclimatization is frequently found. Probably it reflects the higher activity of the animals, kept in densities higher than those occurring in nature.

Estimates for the total extracellular volume in shrimps being used (in previous study derived from chloride measurements) it proved to be possible to obtain accurate values for the mean intracellular glucose concentrations. Tissue glucose concentrations were always found to be considerably higher than blood glucose levels. A most striking difference was found in the effect of salinity on blood and tissue glucose levels. Blood glucose concentrations show an optimum curve with decreasing values towards extreme salinities. Tissue glucose levels, however, show a regulation pattern, with more or less constant values in the salinity range between 10 and 35 ppt.

The results obtained are the first to demonstrate a link between the mineral metabolism of a species and its carbohydrate metabolism. The work on this subject, not completed yet, was carried out in cooperation with Prof. Dr. P.A. Haefner Jr. (Rochester Institute of Technology, Rochester, NY, USA), who visited the institute on a sabbatical leave financially supported by a Fulbright grant.

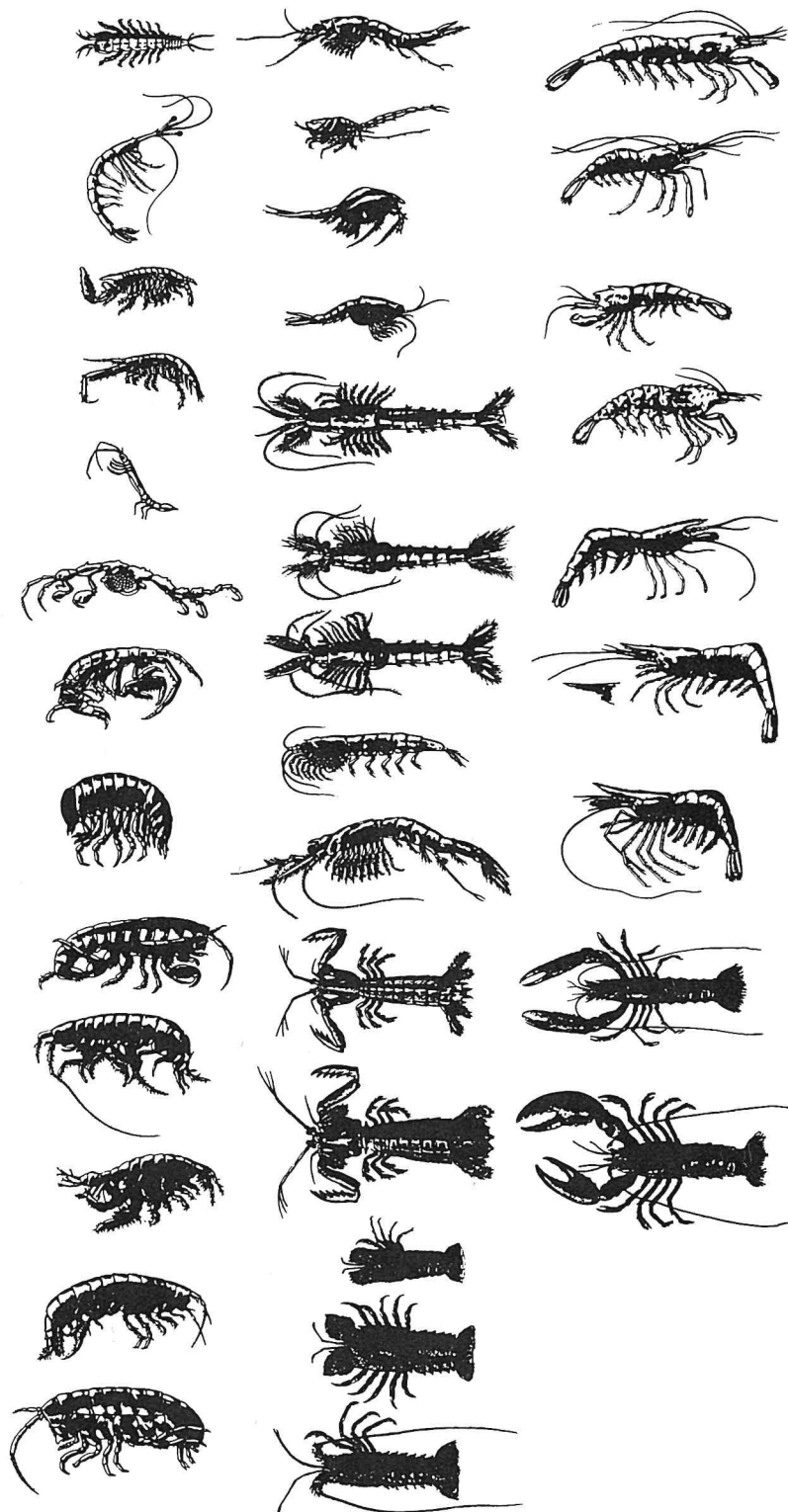
Apart from the work mentioned above, attention was paid to a study on the biological utilization of chemical elements. The occurrence of chemical elements in biological material was found to be closely related to the proton/atomic weight ratios in their nuclei. The chemical background of the biological reactivity, as expressed by the above parameter, is still unclear.

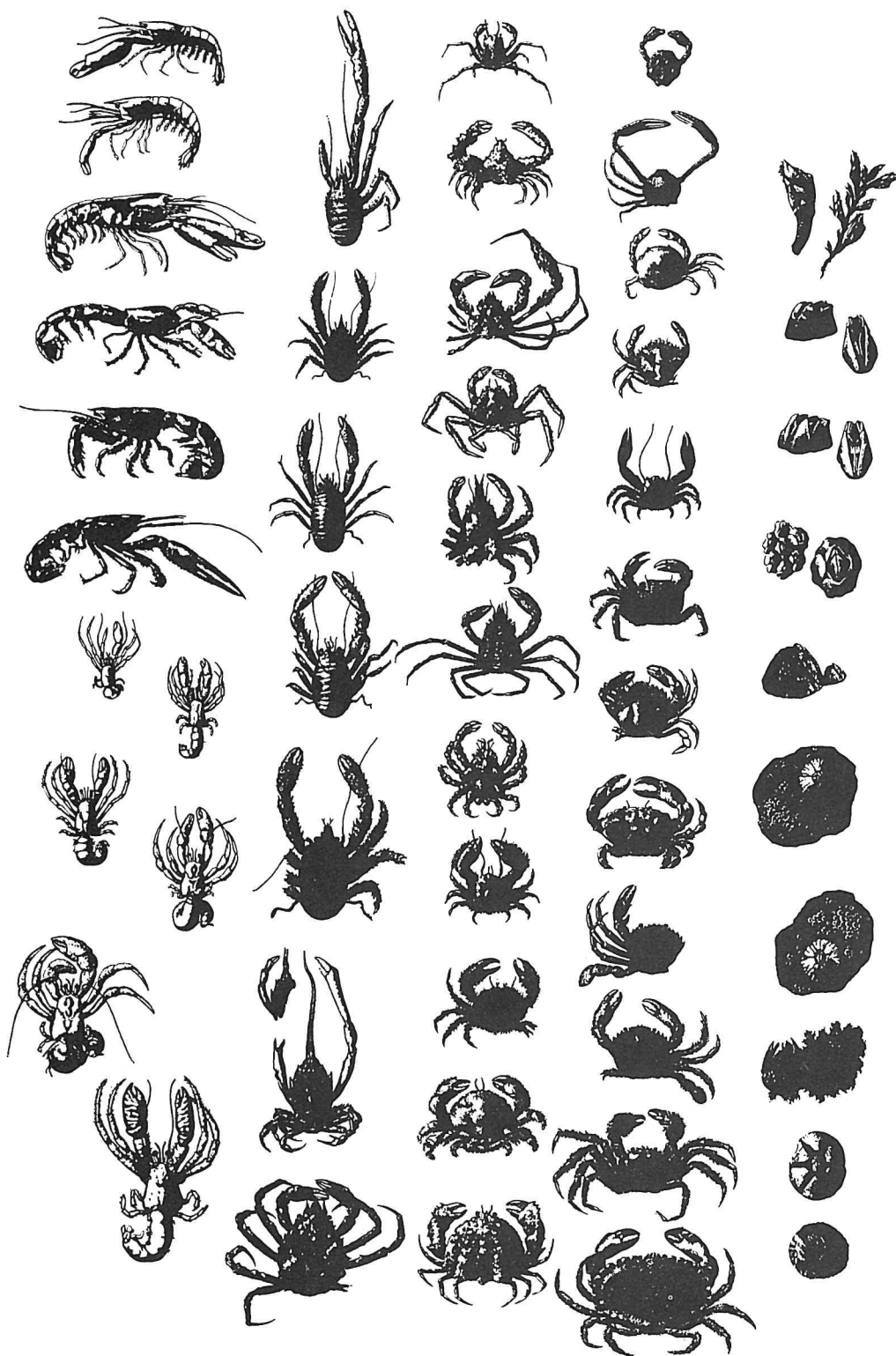




Construction of a mobile platform on a tidal flat in the Wadden Sea.

Morphological variation in some macroscopic Crustacean from the North Sea and East Atlantic Ocean. To obtain a higher physiological stability a species needs to increase its body volume (reduce the ratio surface area/volume). This, however, has unfavourable hydrodynamical consequences: larger animals have lower buoyancies and tend to sink to greater depths where food is less abundant. In a phylum in which a swimming bladder is not yet introduced as an effective mechanism for the regulation of specific gravity, the various species attempt to escape the above dilemma by variation in body shape. Study of the hydrodynamical properties of macroscopic Crustacea is part of the project (B3-04) in which attention is paid to the significance of abiotic environmental factors on marine organisms.





1.3. NORTH SEA RESEARCH

1.3.1. Dynamical oceanography

1.3.1.1. Small-scale turbulence, mixing layers and thermocline studies

H2-04
C. Veth

Turbulence measurements, carried out in the framework of a joint project of KNMI and Rijkswaterstaat on how underwater dunes in the Eurogeul area influence phenomena made visible by microwave radar techniques, have now been worked out provisionally. These turbulence measurements were done at a short distance downstream of the crest of an underwater dune. The preliminary results show that the turbulence profile near the crest is similar to the profile in the area between two crests, as was studied during the "Bree-14 project" in 1982. The consequence is that a difference in turbulence intensity near crests and near troughs of underwater dunes is unlikely to be the cause of the surface phenomena determined by microwave radar. In addition, measurements show that this sea area is characterized by a very large bottom drag coefficient, which is in accordance with the very strongly rippled structure of the bottom.

For the determination of a relation between the bottom distance and the length scale of the energy-containing eddies of turbulence generated by bottom friction, a series of turbulence measurements have been carried out close to the amphidromic point in the southern part of the North Sea (K13 area). This place has been chosen because at an amphidromic point the tidal current speed does not vary much during a tidal cycle; only the direction of the tidal current is rotating continuously. This means that the water column remains in a more or less stationary state of turbulence, and so it is possible to take a turbulence sample of a longer duration than in an area with a strongly changing tidal current speed.

1.3.1.2. Experimental dynamical oceanography

H2-03
C. Veth

A start has been made with the "Frisian Front Project", a project in which the circulation, exchange and transport of water in the frontal zone north of the Dutch Wadden Islands are to be studied. In this multi-disciplinary project, the physical study of water motions in the frontal area will be related to the several biological and chemical phenomena in the area. Preliminary work has been done on observational material obtained during the project "Central North Sea 81/82" and the results of this study are to be used to decide in which way the measurement campaign in 1986 should take place. The application made for observation time in 1986 on the R.V. "Tyro" has been granted. A series of self-registrating current meters and a CTD-system have been obtained from the so-called "Intentioneel apparaat schema" and will be used during the project. In this project NIOZ is to cooperate with several other Dutch institutes and contacts with foreign institutes have been made through COPE and SCAPINS. In particular, the contacts with the Institut für Meereskunde, Bremerhaven, West Germany, seem to be promising, as they are working on comparable problems in the German Bight.

1.3.1.3. Theoretical dynamical oceanography

H2-05

J.T.F. Zimmerman

Theoretical analysis of non-linear, wind-driven circulation was extended by including oscillatory forcing. The rectified response for "weak-forcing" was investigated. It appeared that in this limit the problem is very similar to tidal rectification problems, producing maximum response for intermediate Reynolds numbers.

Together with the Centre of Mathematics and Informatics, Amsterdam, an earlier study on tidal rectification in oscillatory frictional side-wall boundary layers was re-examined for the effect of so-called "double boundary layers" in strongly non-linear regimes. It appeared that the earlier approach had a smaller range of applicability so that the problem had to be reformulated.

For two journals a "state of the art" report was made concerning tide-topography interaction and its bearing on radar imaging mechanisms of the sea bed. Recent results strongly suggest that the phenomena of the sea bed appearing in radar images of the ocean surface can be explained by interaction of smaller wind waves with tidal currents modulated by the topography.

1.3.2. Sediment transport and sedimentation in the North Sea

H3-01

D. Eisma, T.C.E. van Weering

The results on suspended matter transport in the North Sea obtained during the past years were brought together. Sources of suspended matter are chiefly found near the shore. Near-shore concentration occurs by a combination of quasi-estuarine near-shore circulation, on-shore waves, offshore winds, and along-shore currents. Therefore, deposition is favoured in near-shore areas, such as lagoons, river mouths, tidal flats, near-shore seas. Further concentration takes place near the shore, where deformation of the tidal wave results in flood transport being stronger than ebb transport, and where large residual vortices develop and resultant suspended matter transport directions converge. Once suspended matter is concentrated, low wave activity appears critical for the formation of mud deposits.

In the Skagerrak, 28 box-cores were collected in 1984 for the study of the relationship between the living and dead foraminiferal benthic assemblages and the hydrographical and sedimentological conditions on the bottom and in the overlying water mass. The box-cores were studied for their organic carbon content and C/N ratio. ETS (Electron Transport System) measurements were carried out in 20 samples, and ^{210}Pb decay profiles, allowing the determination of sedimentation rates, were determined in 14 box-cores. The results show a 2-4 mm thick homogenous, brown surface layer. A peak in ETS activity occurs in this layer, indicating that intense burrowing causes sediment-particle mixing. Consequently, in the sediment mixing layer ^{210}Pb values are low compared to those of arriving "fresh" ^{210}Pb at the sediment-water interface.

^{210}Pb profiles show that sedimentation rates are highest (>40 cm/100 yr) in the eastern Skagerrak. The lowest rates (7-10 cm/100 yr) occur in the central basin. There are variations in the surface ^{210}Pb excess rate that can be explained only partly by differences in grain size.

The organic carbon content is $\sim 2\%$ and shows little variation with sediment depth. Inorganic carbon content ranges up to 1.5%, except in some cores from near the Norwegian coast, where it is ~ 2.5 to 3%.

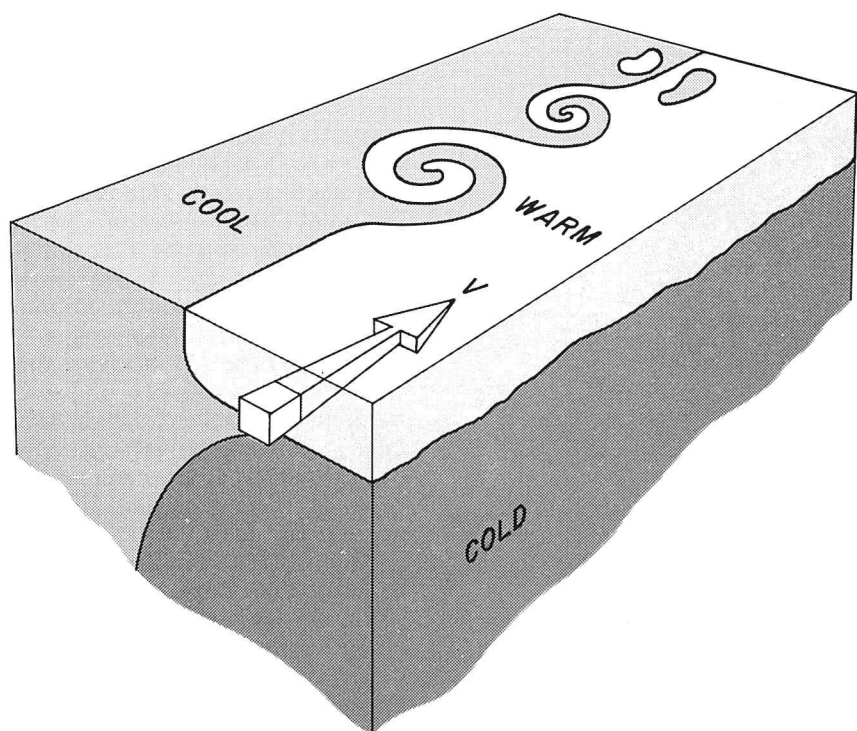
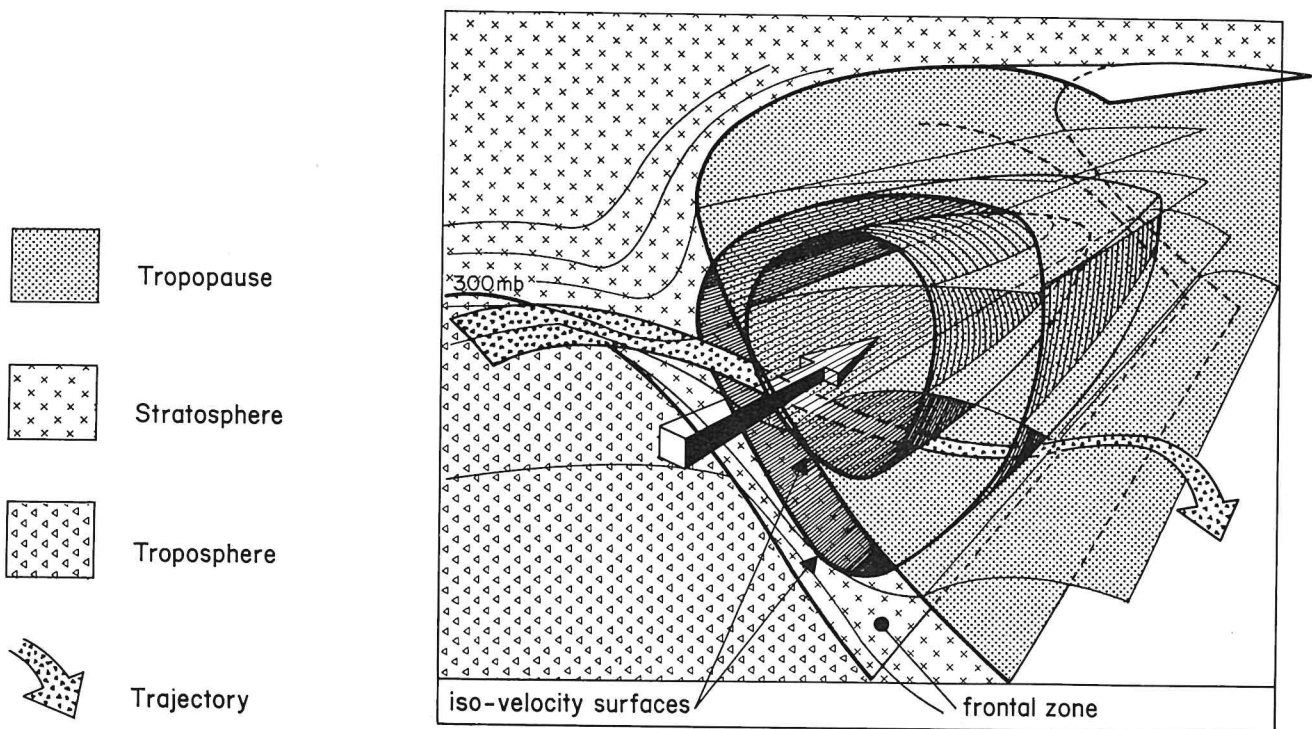


Fig. 1) Three-dimensional structure of (a) the atmospheric jet stream (iso-velocity surfaces) and its associated frontal structure (constant density and pressure surfaces), together with a typical particle trajectory (after the brochure for the conference on Air Quality Meteorology and Atmospheric Ozone, July 31-August 6, 1977, University of Colorado at Boulder). (b) Scheme of an oceanic front and associated frontal jet (arrow) and cross-frontal motions (after Simpson (1981), Phil. Trans. R. Soc. London. A 302: 531-546).

Observations of fronts in the North Sea

Two artists' impressions of the dynamical structure of a front (Fig. 1) demonstrate the presence of a strong current jet parallel to the front. The coriolis force, acting in a direction perpendicular to this current, balances the cross-frontal pressure gradients created by the density gradients.

The structure of such a front in the stratified central North Sea was studied in cooperation with H.M. van Aken and G.J.F. van Heijst (Institute for Meteorology and Oceanography, Utrecht University). Qualitatively this front corresponds rather to an atmospheric front (Fig. 1a) than to a typical, surfacing, oceanic front (Fig. 1b). The front observed at position A (Fig. 2) is aligned approximately in SW-NE direction. For a temperature section perpendicular to this direction (Fig. 3a), evolution in time is interpreted as spatial evolution from the observed advection of the background fields at position A. The accompanying currents (Fig. 4) projected in the frontal SW-NE direction (Fig. 3b) show the presence of a current jet (magnitude $\sim 15 \text{ cm s}^{-1}$) simultaneous with the passage of the front (the strongest sloping isotherm region in Fig. 3a) during the days 230-250 (August 18 to September 2).

In the next two years NIOZ will perform a multidisciplinary study on the structure and dynamics of such frontal regions with the name: Frisian Front Project.

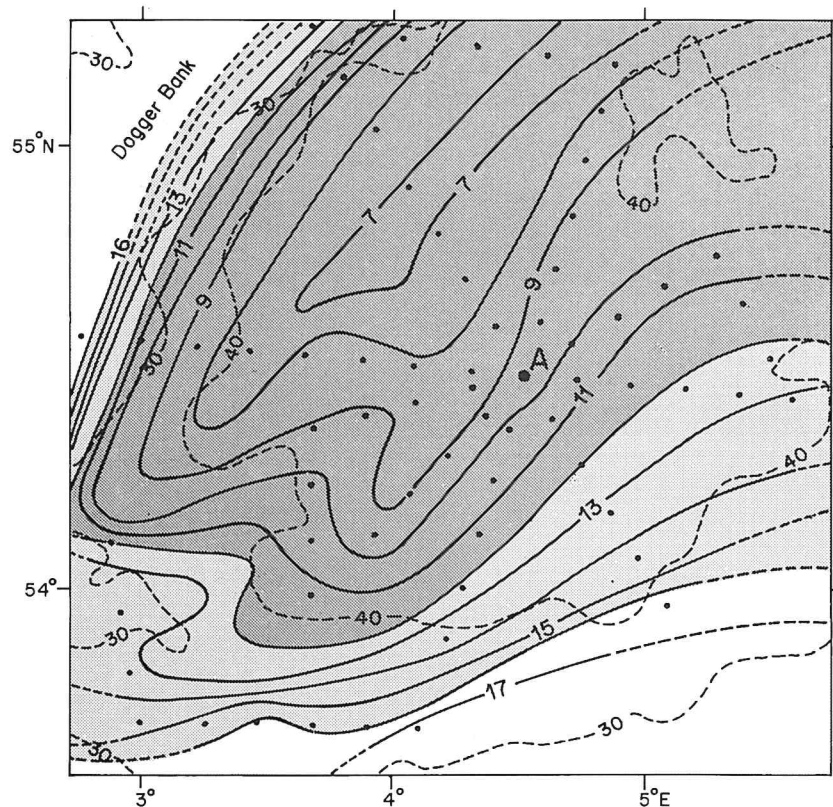


Fig. 2) Bottom temperatures in °C (drawn lines) and depth contours in m (dashed) during a hydrographic survey in the central North Sea (SE of the Dogger Bank, August 1982). Positions of temperature observations are denoted by dots.

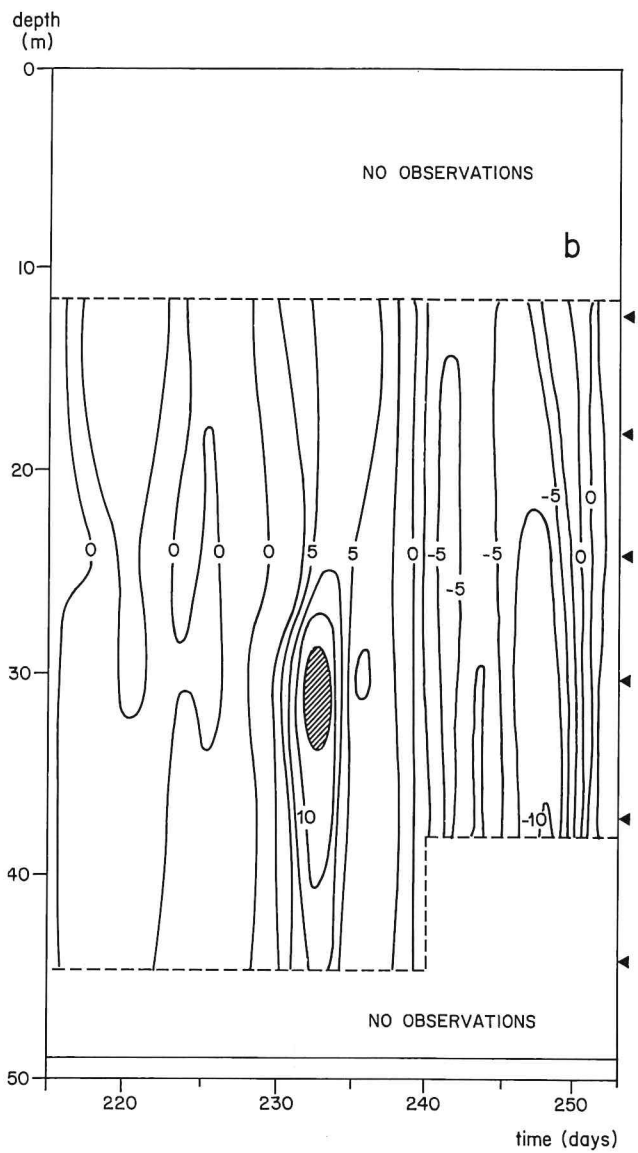
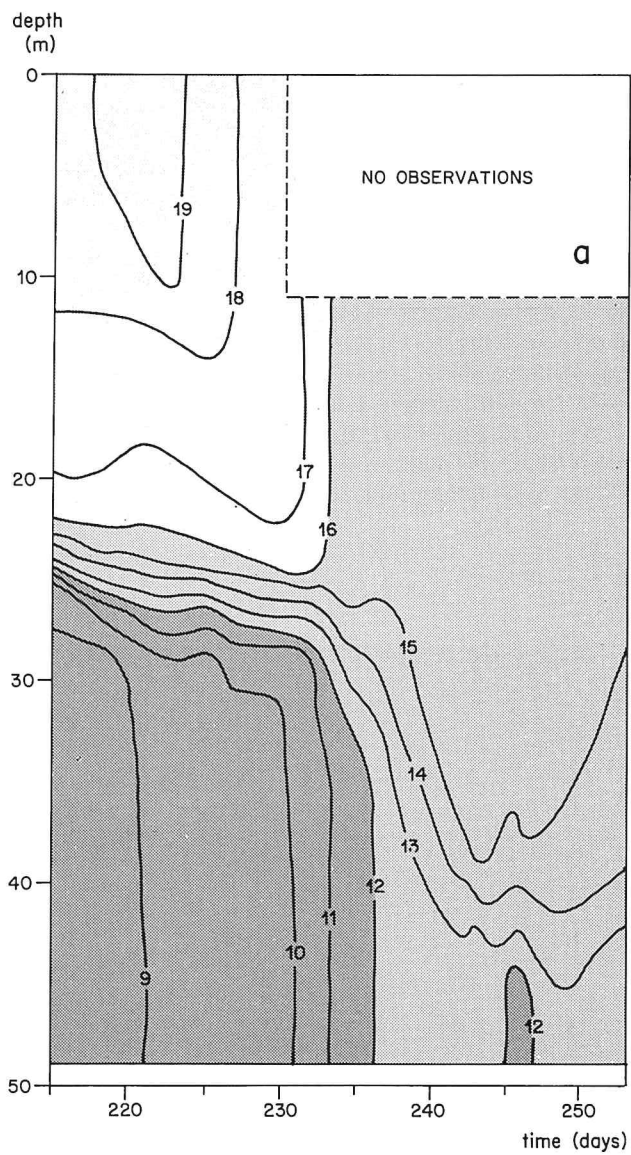


Fig. 3) Low-passed time series of (a) temperature ($^{\circ}\text{C}$) and (b) SW-NE velocities ($\text{cm}\cdot\text{s}^{-1}$) obtained at site A (Fig. 2) as a function of time (day 215 is August 3) and depth (m).

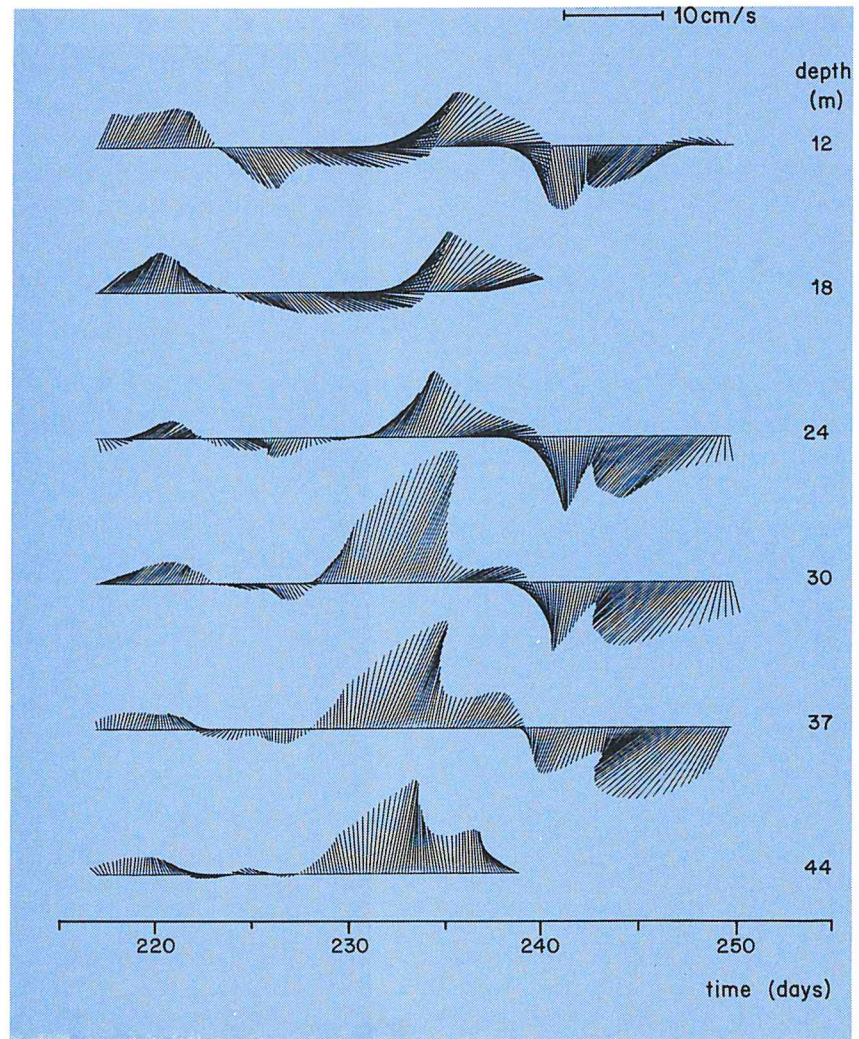
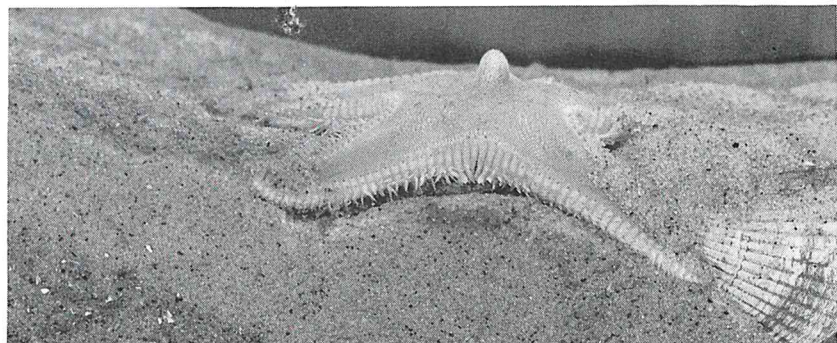
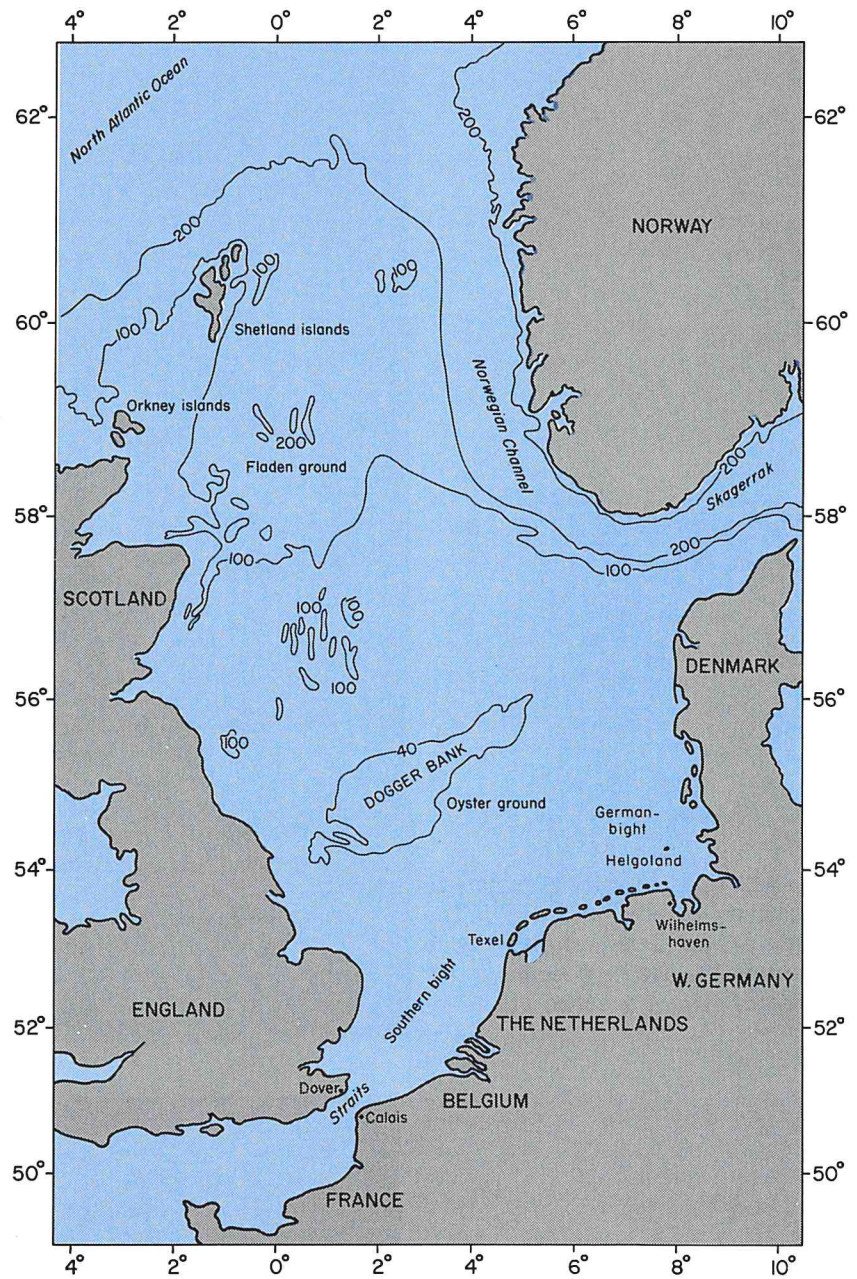


Fig. 4) Low-passed velocity vectors as a function of time and depth. The length of each arrow corresponds to its magnitude and its direction to the observed current direction.





North Sea with geographical names mentioned in this report.

1.3.3. Chemistry

1.3.3.1. Oxygen, and the nitrogen, iron and manganese cycles in the sediment

H1-02, H1-03

J. Bakker, W. Helder
and M. Rutgers van der Loeff

Oxygen and oxygen gradients play an important role in the processes of nitrification, denitrification and ammonification. From the literature and research at our institute, it is known that the presence of oxygen determines the various reactions of the nitrogen cycle. For this reason, the use of oxygen micro- and needle-electrodes was introduced into the study of the nitrogen cycle in marine sediments last year. Not only the cycling of nitrogen compounds depends on oxygen, but so do iron, manganese and sulfate reductions.

In the course of the study of the Skagerrak samples collected in 1984, emphasis has been put on oxygen as a major regulatory mechanism on the nitrogen, iron and manganese cycles. These three cycles are closely interrelated, because the Gibbs free-energy yield from organic matter degradation is almost equal for nitrogen, iron and manganese oxides as terminal electron acceptors in the electron transport chain. Profiles from six stations have now been interpreted.

The interpretation of oxygen profiles poses problems. As the samples were taken with an open box-core, which increases the chance for disturbance and resuspension at the sediment-water interface, the top part of the profile is difficult to model. On the one hand, irregularities could be caused by resuspension; on the other hand, bioturbation, especially by copepods and nematods, could also cause the oxygen-rich conditions of the top 2-4 mm. Nutrient-N porewater profiles show a small nitrate peak below the level of zero-oxygen concentrations. Unfortunately, we did not measure deeper into the sediment because of the length of the O_2 -needle electrode (25mm), so we do not know if there was oxygen at the same depth.

Nitrate maxima, if present, show excellent agreement with oxygen microprofiles at the top of the sediment. At most stations there is production of nitrate in the upper 5-15 mm, whereas subsequent diffusion results in a loss from the sediment to the water column by denitrification in deeper layers.

Solid iron and manganese profiles correlate very well with oxygen profiles. They show a sharp decrease in concentration at the depth where oxygen is depleted. Most solids seem to be in the form of iron and manganese oxyhydroxides, but sometimes also a large peak of $MnCO_3$ was found.

Dissolved iron and manganese profiles agree very well with oxygen profiles at all stations: concentrations are at minimum values where oxygen is present and start to increase as soon as oxygen is depleted. Increase can be very sharp or gradual. So far, three cores have been analysed for solid iron and manganese (see 1.3.3.2.).

1.3.3.2. Trace metal geochemistry in sediments of the Skagerrak

H1-09

Three sediment cores from the Skagerrak were selected for a study of the behaviour of the metals Mn, Fe, Zn, Cu, Co, Ni and As. Selective sequential extraction was used to find the vertical distribution of different forms of metals, *i.e.* carbonate, Mn-oxyhydroxide, Fe-oxyhydroxide and acid-leachable phases. The total content of these metals was also determined after strong acid digestion.

Oxygen penetration depth varied from 3.0 mm to 14 mm. Manganese showed a subsurface minimum and maximum in 2 cores and enrichment in the surface layer of the cores. Higher downcore concentration in all phases of manganese was found in one core from the central and deepest part of the Skagerrak. In this core, manganese concentrations were at least 10 times higher than in the other two cores. All other metals, *i.e.* Fe, Zn, Cu, Co, Ni, and As, also showed higher values in this core. There was no difference in extractable zinc among the three cores, though the total zinc content was twice lower in one of the two cores. 99% of the total manganese content in all cores are easily extractable, whereas other metals showed a variation between 20 and 50% extractable.

The concentration of the oxyhydroxide phase of manganese, hydroxylamine hydrochloride (pH 5.0) extractable, was always high in the top layer of the core and then decreased to a minimum. This manganese phase showed a distinct subsurface maximum in the redox environment. A major part of the extractable iron and zinc is found to be in the Fe-Mn phase. Fe oxyhydroxide and acid-leachable phases form a major portion of the extractable copper and cobalt. The proportion of the different forms of extractable Ni in the cores was variable. The acid-leachable fraction formed a major portion of the extractable arsenic in these sediment cores. (This project was carried out by A. Rajendran, National Institute of Oceanography, Goa, India).

1.3.3.3. Trace metals in the water column

H1-07

R. Nolting

The distribution of the trace metals Ni, Cd, Cu, Zn, Fe, and Mn in the water phase and suspended matter phase was determined in the Rhine estuary and Southern Bight of the North Sea.

Four distinct areas, the Rhine estuary, the Dutch coastal waters, the Central Bight and the English coastal waters, can be distinguished, based on the distribution of trace metals. The total concentrations of all the metals were high in the Rhine estuary, decreased in seaward direction towards low values comparable to continental shelf water in the Central Bight, and increased again towards the English coast. Concentrations of dissolved metals in the Central Bight are Cu: 3.8 nM, Cd: 0.14 nM, Ni: 2.8 nM, Zn: 3.0 nM and Fe: 20 nM. Elevated concentrations of dissolved Cu, Ni, Cd and Zn near the English coast are not only due to river input; release from partly reduced bottom sediments and dumping activities are a source not to be ignored. Over the entire region, the fraction of Cd, Ni and Zn in solution was consistently more important than the fraction in suspension. In contrast, the fraction of Fe, and Mn in suspension was consistently larger than the fraction in solution. The total concentrations of Fe, Mn, and Cu are dictated by the suspended matter concentration rather than the concentrations of Cd, Ni and Zn.

1.3.4. Biology

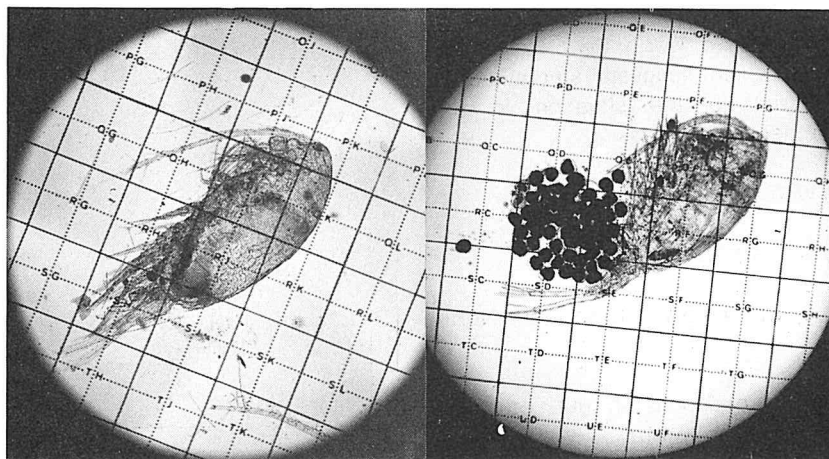
1.3.4.1. The pelagic system of the Southern Bight

B4-01

H.G. Fransz

The SEAWAQ (Seasonal Development of Water Quality) model for simulation of phytoplankton dynamics in the Southern Bight of the North Sea was translated for use in the NIOZ Nord 530 computer. To facilitate simulation of continuous processes by incidental users of such models, a simulation language programme essentially similar to the IBM language CSMP III was developed. Adoption of higher turbidity values in the near-coastal compartments of the model gave fairly realistic primary production levels, but in contrast to observations the main production period persistently remains July-September in the coastal zone. This year research was started to increase the knowledge of limiting factors during summer. Comparison of the plankton data with data of the Rijkswaterstaat monitoring programme indicates that the highest plankton biomass coincides with the highest temperature and Fe concentration, which occur south of the Rhine/Meuse outlet, but not with the lowest salinity and highest N, P, and Si concentrations found in the northwards flowing river plume.

In a Ph.D. dissertation finished this year and presented at the University of Nijmegen in December by R. Leewis, a detailed description of the succession of algal species in Dutch coastal waters in 1974/75 has been given. It was possible to identify 307 species and to indicate their seasonal distribution, but many nanoplankton species could not be named. They may, however, form 90% or more of the cell numbers. The continued research on the important species *Phaeocystis pouchetii* in cooperation with the University of Groningen was discussed during a minisymposium with Belgian and German scientists also engaged in investigating this major bloom contributor. More cooperation was planned for 1986.



Estuarine calanoid copepods:

Left: *Acartia tonsa* ♀

Right: *Eurytemora affinis* ♀ with egg-sacs.

1.3.4.2. Pelagic predators

B2-03

H.G. Fransz, R. Daan

For the study of effects of predation by pelagic carnivores on the summer development of copepods, a mathematical method was developed to estimate copepod mortality from changes in abundance and known development rate of stages. In 1983 and 1984 a stagnation in copepod production, which is often seen in summer in the southern North Sea, was caused by a steep decline in nauplii. In 1984 during a frequent sampling programme of the RSW platform "Meetpost Noordwijk", this decline coincided with a drop in chlorophyll *a*, disappearance of diatoms > 10 μm , and a peak of two predators that both feed almost entirely on copepod eggs: the zooflagellate *Noctiluca* and the hydromedusa *Phialidium*. In 1985 a rehearsal of such a measuring programme over an 8-week period generally gave the same result. In the fourth week a dramatic decline was observed in the densities of nauplii of *Temora*, *Acartia* and *Centropages*, which was followed by a decrease in adults, particularly in *Temora*, a week after.

Herring larvae (all ca 10 mm length) collected during a comparative study of food availability and food consumption in the northern and southern North Sea (in cooperation with the State Institute for Fisheries Research, IJmuiden).

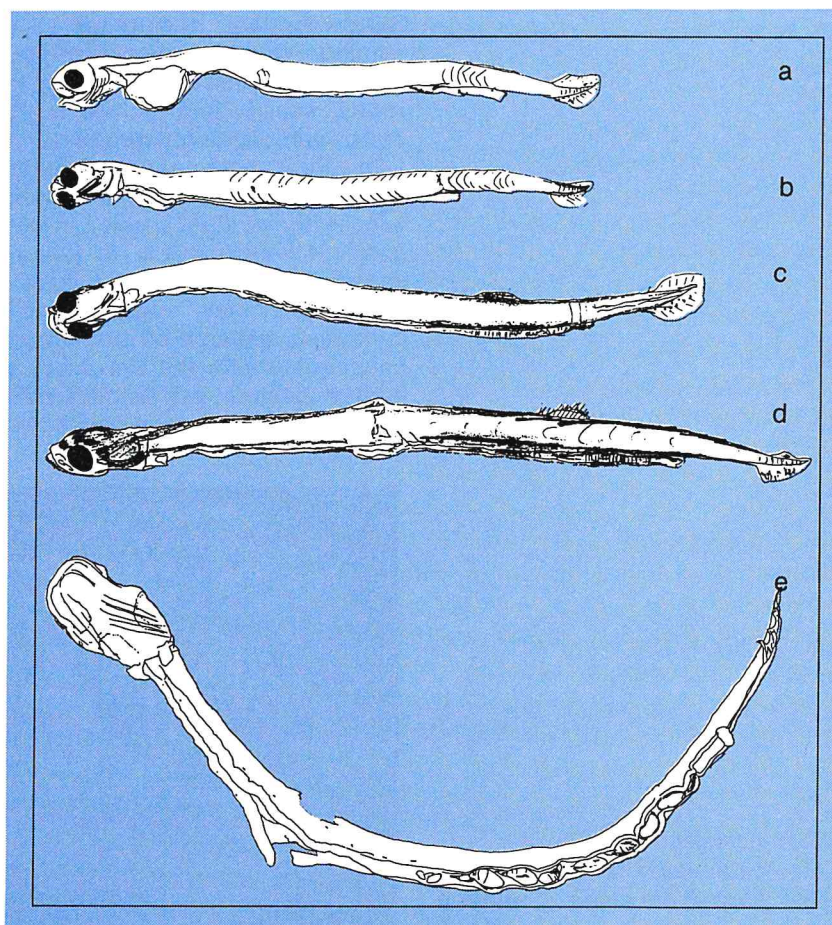
A relatively large number of larvae in the northern North Sea had empty guts, which suggests starvation, in contrast to the situation in the southern North Sea.

a) with yolk sac

b) yolk sac nearly digested

c, d) with empty gut, northern North Sea

e) with copepods in gut, southern North Sea



Special attention was paid to the zooflagellate *Noctiluca*, which is a predator of copepod eggs. This species occurred in huge numbers during the first 5 weeks, reaching maximum densities of over 200 cells per litre, *i.e.* about seven times as much as in the preceding year. On average, one out of 3 cells contained one copepod egg. At the peak of its bloom, half of the total number of copepod eggs found in the samples was eaten by a *Noctiluca*. In the fourth week an estimate of maximum daily egg consumption by *Noctiluca* matched the daily production of eggs by copepods, which was then at its lowest point. The hydromedusa *Phialidium* seemed to be a less important egg predator; it had a short peak with densities of 150 per m³ in the fourth week.

Complementary experiments showed a decreasing egg production per *Temora* female in the fourth week. Moreover, a substantial portion of incubated eggs did not hatch. Cannibalism on nauplii could be of importance if adults were abundant and food was scarce. A provisional conclusion may be that in summer after a period of favourable conditions, copepod development suddenly becomes food-limited. Adult females diminish egg production and the few hatching nauplii are exposed to a relatively high predation pressure, exerted by cannibalistic adults, which are numerous at the time.

Investigations on the impact of predation by macroplankton on copepod populations in the southern North Sea were focussed on a few detailed questions put forward by previous research. First, near the "Meetpost Noordwijk", horizontal and vertical density variation and the reliability of density estimates were studied. With the aid of the new large-volume water sampler, data were collected in the area.

Second, the near-bottom layer between 25 cm and 80 cm above the sea bed was sampled repeatedly with a newly-constructed "Mysid-net" in search of possible high macroplankton concentrations near the bottom that could have escaped the Isaacs Kit midwater-trawl hauls and torpedo hauls of previous years.

Third, 120 KH and 38 KH echo-recordings were made during a number of cruises, in an attempt to find aggregations of organisms in the area that might have biased former conclusions. Such aggregations were not found, however. The methods applied in 1985 appear to corroborate the main view that macroplankton predation on copepods is not a key factor in the control of zooplankton densities in thoroughly mixed coastal water. This leaves density or food quality as the most likely limiting factor. The same conclusion was reached by Dr. B. Miller (a guest from Bedford Institute for Oceanography, Halifax), who made a series of predation experiments on board the R.V. "Aurelia". He sampled predator and food organisms with a 150-litre water sampler and used these in incubation experiments on deck. He found that even ten-fold concentrated predators hardly affected copepod densities in 12-litre bags.

Outside the coastal waters, macroplankton concentrations have always been found to be much lower. This large area, however uninteresting in terms of macroplankton research, deserves much more attention, since echo recordings point to the overwhelming importance of frontal zones. Along the Frisian front, in the Oyster Ground area, very clear concentrations of one-year-old sprat were found precisely over the enriched benthic zone (see 1.3.4.5.). These masses of fish showed a neat diurnal vertical migration; during darkness, they fed on copepods in the surface layer, presumably *Temora longicornis*. The observed "sprat zone" agreed well with the distribution of sea-birds in the area.

Zooplankton samples collected by RIVO (State Institute for Fisheries Research) during herring larvae surveys in the northern and southern North Sea were analysed, together with stomach content and condition factors of the juvenile herring. *Pseudocalanus* copepodites were most abundant, and with copepod nauplii and eggs most preferred as food. At a high food density, these organisms are selected as food. The food density was highest in the northern North Sea. It is remarkable that here the low percentage of larvae with ingested food indicates starvation of larvae, whereas in the southern North Sea at a much lower food density, the high percentage of larvae with ingested food (even of larvae with yolk sacs) shows a much better food utilization. The conditions leading to such differences in food utilization may be key factors in the recruitment of herring populations.

1.3.4.3. The "REFLEX" programme

B4-02

M.A. Baars, H.G. Fransz
and W.W.C. Gieskes

During the "REFLEX" cruise (Repeated Fladen Ground Experiment, April/May 1983) the dynamics of the copepod *Calanus finmarchicus* was studied in relation to the phytoplankton spring bloom. Most of the data have been published now. Data on grazing experiments (see Annual Report 1984) were discussed during a long series of meetings in a BION Dutch-Belgian discussion group, which resulted in a special volume of the Hydrographical Bulletin.

1.3.4.4. Experimental investigations on zooplankton

B4-04

W.C.M. Klein Breteler

Pelagic calanoid copepods were cultivated continuously in the laboratory for experimental purposes. The species *Temora longicornis* has been bred through the 50th generation. Grazing experiments were performed to study the influence of crowding on food intake; it appeared that at more than 25 to 50 copepods per litre, food consumption by *Temora* was depressed.

Several North Sea algae were isolated, and continuous cultures of *Nitzschia longissima*, *Streptotheca thamensis* and *Coscinodiscus eccentricus* were set up successfully. As a result, grazing experiments with *Temora longicornis* (females C VI) and *Streptotheca thamensis* as food were initiated.

A second copepod species, *Pseudocalanus*, was isolated from the sea. As an automatic food control system has not yet been accomplished, growth and development of this species will be determined at different combinations of temperature and food concentrations.

1.3.4.5. The benthic fauna in the southern North Sea

B2-02e

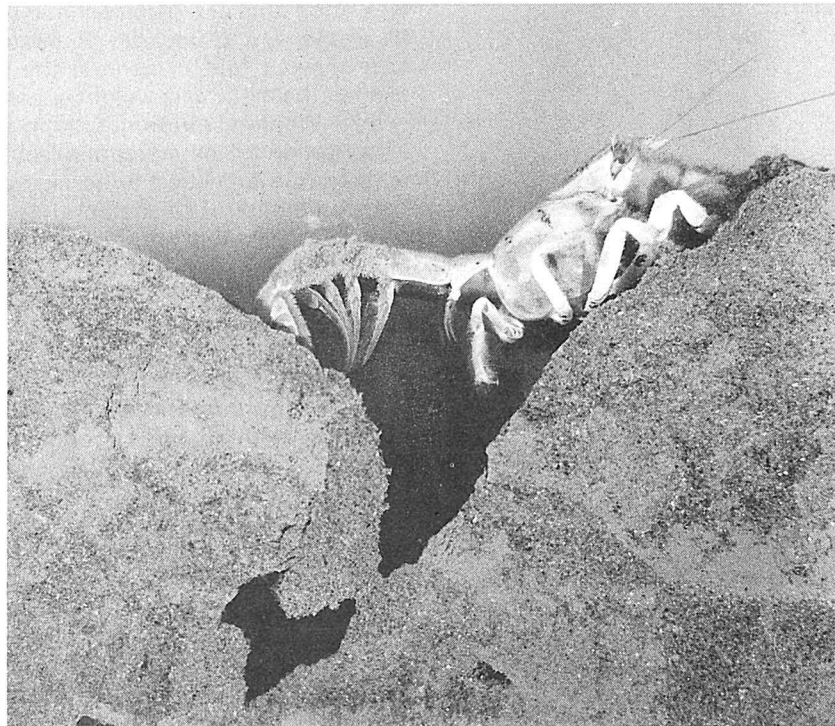
F. Creutzberg, G.C.A. Duineveld

Some time was spent on the analysis of samples taken during the intercalibration exercise of the ICES Benthos Working Group in November 1984. Two stations were sampled: a fine-sand station and a muddy-sand one. At either station two series of samples were taken. In one series the type of gear used was the same for all participants; in the second series each participant used his own gear.

At the sand station there were very highly significant differences between results when the participants' own gear was used, but no differences with the same gear. At the mud station there were no differences in density estimates, but the number of species counted varied even in standard samples.

A comparison was made between the macrofaunal and meiofaunal communities at three different stations on a transect in the southern North Sea. It was found that the meiofaunal biomass does not increase with the carbon content of the sediment at the same rate as the macrofaunal biomass. The reactions among the separate meiofaunal taxa are, however, different. The structure of the sediment probably plays a more important role than competition with macrofauna for space or food.

In spring, a study was started on the distribution of pelagic macrobenthic larvae across the boundary zone between the summer-stratified water of the Oyster Ground and the mixed water of the Southern Bight. At present, only two easily identifiable species of echinoderm larvae have been dealt with, *i.e.* the larvae of *Echinocardium cordatum* and *Amphiura filiformis*. The adults of both species have different distributions. *Amphiura filiformis* occurs only north of the boundary zone and *Echinocardium* on both sides, although there is some evidence that reproduction of the latter species is low north of the boundary. Pelagic larvae of *Amphiura* were found only together with adults, *i.e.* they were absent south of the front. *Echinocardium* larvae, on the contrary, showed a strong decrease when the front was crossed from south to north. Consequently, the frontal zone proves to be a significant barrier in the transport of pelagic larvae, and so echinoderm larvae function as a useful biological tracer of transport processes across the Frisian front.



Upogebia deltaura is one of the typical inhabitants of the muddy substrates in the southern North Sea (Oyster-grounds). This species burrows extensive tunnels in the sediments.

1.3.4.6. The role of carnivores in the benthic system

B2-02a-c
F. Creutzberg

As a support for studies on the role of epibenthic carnivores in the southern North Sea, maps based on the "Aurelia" cruise reports are in preparation (no. 9, completed in 1985). These maps show the biomass distribution of different taxa in this area and facilitate the comparison between epibenthic and (macro)infaunal biomass values over large areas, hence throwing some light on trophic interrelationships of these groups.

With the aim of investigating the ground-rope effect on the efficiency of the fishing gear, fishing experiments were carried out with different numbers of tickler chains. In general, no significant effect was found at muddy stations. At sandy stations, on the other hand, more tickler chains caused greater catches of occasionally burrowing species that cling strongly to the bottom. In several species the catches reached an asymptotic level with increasing numbers of chains, whereas in other cases the increase in the catches was still significant when the maximum number of 6 chains was reached.

Studies on the relation between benthic food populations and individual species of demersal fish were continued. The study of the role of the lesser weever *Trachinus vipera* in the Southern Bight is still in progress. An attempt has been made to obtain more objective estimates of its growth and survival rate through computerized analysis of size frequency distributions.

1.3.4.7. The energy budget of demersal carnivores

B2-01c
M. Fonds

Measurements of oxygen consumption, food intake, and growth of plaice (*P. platessa*) and flounder (*P. flesus*) in relation to temperature and fish size showed that in general the relationships with fish weights were similar; the metabolic weight exponent of both species was approximately 0.78. When respiration, food intake and growth were all expressed as a proportion of the metabolic wet weight ($W, g^{0.78}$), the relationship with temperature appeared to be sigmoidal with a maximum at 18-22°C.

The increase with temperature (2 → 18°C) was described by an exponential relationship. In general, the flounder showed a higher metabolic rate and a much higher temperature coefficient ($e^{0.17T}$) for feeding and growth than the plaice ($e^{0.13T}$) (T in °C). For oxygen consumption in both species (flounder $e^{0.10T}$, plaice $e^{0.08T}$) the lower temperature coefficient found suggests that the respiratory capacity of the fish limits increase in feeding and growth at temperatures higher than 18°C. The gross energy conversion efficiency of food (mussel) into fish growth varied between 3.1 and 4.0 for plaice and 3.3 and 5.2 for flounder. The net conversion efficiency was calculated as 1.66.

B2-02d
M. Fonds

For the investigation of the quantitative role of carnivores in the benthic system, field data (see 1.3.4.6.) are supplemented with laboratory data on feeding, growth and respiration of the most important predators under controlled laboratory conditions with regard to substrate, amount of food, and temperature.

Some preliminary results of measurements of oxygen consumption, food intake and growth in O-group cod (*Gadus morhua*) can be summarized as follows.

Temperature	5°		10°	15°		20°
Number of fish	10	11	11	10	11	11
Mean wet weight (g)	11.5	10.9	14.6	13.7	13.4	9.4
Growth in length (cm·month ⁻¹)	1.5	1.6	3.7	3.2	4.7	1.7
Growth in weight (% W·d ⁻¹)	1.2	1.3	3.3	3.2	4.7	1.9
Weight loss at starvation (% W·d ⁻¹)	-0.6	-0.6	-1.0	-1.5	-1.5	-2.2
Max. food intake (g AFDW·d ⁻¹)	1.0		1.9			
Oxygen consumption (mg O ₂ ·d ⁻¹)						
minimum (starvation)	26		39			
maximum (feeding)	53		126			

Food intake and growth between 5 and 15°C are related to $e^{0.08T}$, oxygen consumption is related to $e^{0.14T}$.

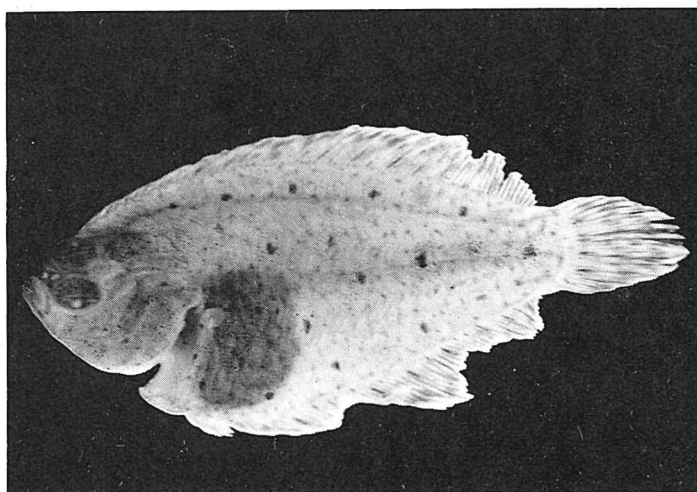
1.3.4.8. Density dependent mortality in juvenile plaice

B2-01a

H. van der Veer

Previous studies suggested the existence of a period of high, density-dependent mortality occurring during and shortly after the settlement of O-group plaice on Wadden Sea tidal flats. However, the main conclusion of this study has been that year-to-year fluctuations in year-class strength observed in North Sea plaice are already present at the end of the larval stage and are thus generated in the open North Sea. The fluctuations observed in the pelagic stage seem, however, to be reduced in the Wadden Sea. This is attributed to density-dependent mortality in the early post-larval stage (up to a length of ~30 mm) inflicted by predation, mainly by shrimps.

This project is finished now and a new one has been started (B2-01a) in close cooperation with the State Institute for Fisheries Research. The new project, which is a logical continuation of the previous, now terminated one, aims at disclosing the factors responsible for the generation of year-class fluctuations, presumably operative in the egg and larval stages.



O group plaice (20 mm) with typical fin damage as a result of unsuccessful attacks by shrimps

1.4. OCEAN RESEARCH

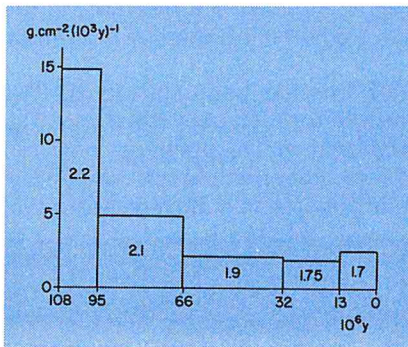
1.4.1. Angola Basin

1.4.1.1. Sedimentation and palaeoceanography

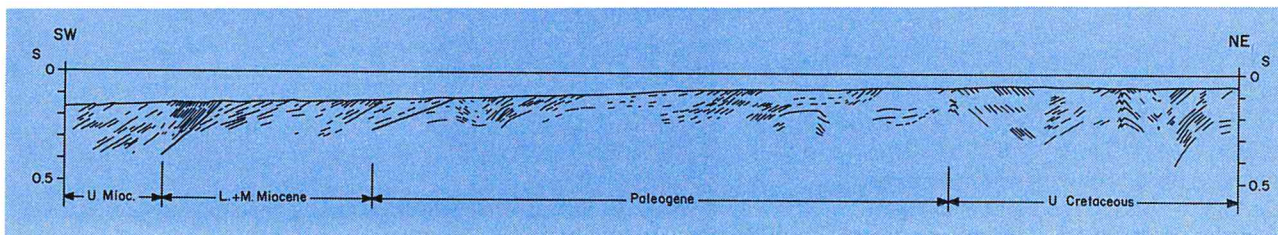
H3-03

J.H.F. Jansen

Calculated Mesozoic and Cenozoic sedimentation rates and estimated sediment densities ($\text{g}\cdot\text{cm}^{-3}$) of the Zaire fan and slope (500-3200 m water depth).



Seismic reflection record across the continental shelf off Gabon.



Cretaceous and Cenozoic hiatuses

In the seismic profiles of the Zaire deep-sea fan and the Congo-Gabon continental shelf, several major widespread horizons occur. Compressional wave velocities were calculated from multi-channel profiles made accessible by Shell Exploration, the Hague. These velocities could be correlated with data from nearby Deep-Sea Drilling Programme and other literature data.

With density dates from these holes, accumulation rates were calculated for the Zaire fan. The development of the accumulation in the course of time shows that the greatest interval of deposition (40% of the total) dates from the Albian (Upper Cretaceous), the first period after the opening of the South Atlantic, and that 70% of the sediments were already supplied before the Tertiary. The initial ocean opening clearly led to a reorganization of the river drainage pattern in Africa, with vigorous new incisions and strong erosion.

Three major reflectors, at the Cretaceous/Tertiary boundary, in the Late Eocene-Oligocene and in the Late Miocene, are visible as regression levels on the Congo-Gabon shelf. There they separate seismic units of different tectonic character, also known from the west equatorial African continent. These tectonic differences are the result of Late Cretaceous tensional activity, subsequent Early Palaeocene compression that attained its climax during the Middle Eocene and, finally, a Miocene tensional regime.

The reflectors represent common deep-sea hiatuses, often attributed to periods of global low sea-levels. The tectonic changes recorded in the shelf sediments indicate, however, that the hiatuses on the equatorial Atlantic shelves and margins are at least caused partly by large-scale tectonic processes in Africa.

Ichnofossils

T.C.E. van Weering, J.H.F. Jansen

Ichnofossils, or trace fossils, sedimentary structures produced by the boring and trailing activity of living organisms, were studied in relation to palaeo environmental data and the presence of turbidites by O.P. Werver and P.J. Pestman. The abundance of ichnofossils was compared with water depth, sediment accumulation rates, and content of calcium carbonate and organic carbon for 25 cores. Water depth has a limited influence on the distribution of ichnofossils. The shallower cores have a more regular zonation of ichnofossils and contain more genera.

Teichichnus is found in shelf and slope deposits; *Chondrites*, *Lophoctenium* and *Scolicia* disappear at greater depths. *Thalassionides* is only present in hemipelagic and pelagic deposits. It occurs especially in interglacial intervals with high carbonate content, whereas *Planolites* and *Chondrites* occur in glacial, low carbonate intervals. This difference is related to low and high accumulation rates respectively, and may be caused by the attendant variation in mineralization rate of organic matter, and consequently of the amounts of food available.

Recolonization after the deposition of a turbidite shows rapid inhabitation by *Mycelium*, a pioneer, followed by *Chondrites*. This happened within ~500 years. Complete recolonization is reached ~1000 years after the deposition of a turbidite, which must be at least ~8 cm thick to kill all borrowing organisms. In the upper 80 cm of the cores zonations of ichnofossil associations occur which are controlled by environmental factors, succession of colonization and depth of burrowing of the organisms.

Authigenic carbonate

J.H.F. Jansen, S.J. van der Gaast

Calcite crystals found in 4 cores of the fan and reported in the previous annual report appear to have been composed most probably of ikaite, a hydrated calcium carbonate. Small crystal fragments still present in the cool-stored cores were measured with X-ray diffraction at 2°C and 100% humidity and showed frayed peaks which merged into calcite peaks after warming up to room temperature. Ikaite is only stable at near-zero temperatures. Other properties pointing to ikaite are the chemical composition, the friability, the alteration from an amber translucent to a white cloudy appearance and the attendant loss of H₂O, the chemical composition, and the amount of H₂O initially present. Since the external crystallographic habit corresponds to carbonate and not to ikaite, it is concluded that the crystals originally consisted of authigenic carbonate, probably calcium carbonate. They were subsequently transformed into ikaite and finally into calcite as an artefact.

This study is done in cooperation with Dr. C.F. Woensdregt, Department of Petrology, Utrecht State University, and Dr. M.J. Kooistra, Netherlands Soil Survey Institute (Stiboka), Wageningen.

Organic carbon measurements

J. van Iperen, W. Helder

A method has been developed to perfect the determination of organic carbon in calcareous marine sediments. Several procedures were tested to remove inorganic carbon without losing organic carbon. The best results were gained after acidification of the sediment with 1 N hydrochloric acid and drying at 70°C overnight. A correction factor is applied for weight increase after acidification, due to conversion of carbonate into chloride and to hydration. The remaining organic carbon is measured by microcumbustion at 1000°C. The coefficient of variation of the method is ~1.7%.

1.4.2. North Equatorial Current, North Atlantic Ocean

1.4.2.1. Plankton research

B4-03

W.W.C. Gieskes, M.A. Baars
and J.J. Zijlstra

The study of gut fluorescence and digestive enzyme activity in zooplankton samples of the NECTAR programme (North Equatorial Current Trans Atlantic Research) was completed. Respiration experiments in the oligotrophic water of the North Equatorial Current indicated a contribution to the community respiration by zooplankton of about 30%, which is much higher than measured earlier in the North Sea with the same technique. High-Performance Liquid Chromatography (HPLC) analysis of phytoplankton pigments of the deep chlorophyll maximum pointed to great differences in algal species composition between this maximum layer and the overlying mixed zone.

1.4.3. Southern Ocean

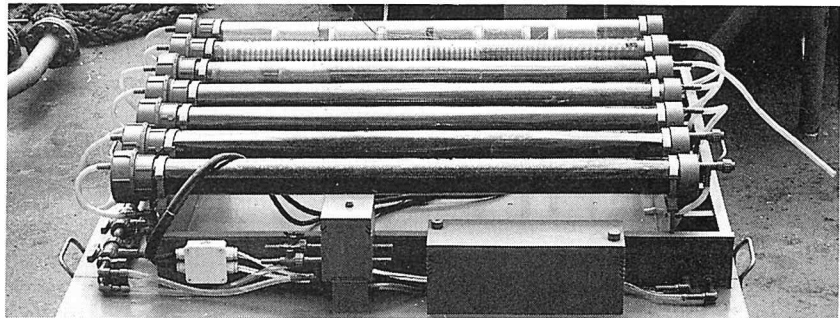
1.4.3.1. Chlorophyll *a* and phytoplankton

B4-02

W.W.C. Gieskes

In surface samples taken during a cruise to the western Atlantic sector of the Southern Ocean in October and November 1983, between 10 and 80% of chlorophyll *a*-containing particles were found to be smaller than 8 μm . This is surprising because large-celled diatoms are assumed to dominate the phytoplankton in these waters. Microscopic observations revealed that more than 50% of the nanoplankton-size fluorescent particles were free-floating chloroplasts. The major source of these particles is probably diatom cell disruption caused by wave action during storms and by grazing of krill.

Incubator for simulated *in situ* measurements of primary production at seven different depths and at different temperatures. The filters that cover the glass tubes have maximum transmittance in the blue part of the spectrum.



1.4.4. Indonesia. The SNELLIUS II expedition

1.4.4.1. Ventilation of deep-sea basins

H3-02

A.J. van Bennekom



Marine silica and phosphorus cycle

In various basins in East Indonesian waters, dissolved silica was measured in pore waters and in the water column in order to estimate the residence time of water in these basins. Interstitial water concentrations were quite variable (~ 400 to $700 \mu\text{m}$), but always much higher than the concentrations in bottom water (130 to $170 \mu\text{m}$). Hence, there is a relatively large flux of dissolved silica from the sediments into the bottom water. This flux is difficult to quantify because of the very large gradients in the upper cm of the sediment and because of the possible disturbance in the upper cm of the box-cores sampled. A preliminary estimate of the residence time for the main route of the deep water from the Lifamatola Strait through the Buru Basin and the north and south Banda Sea, is less than 10 years. The water in the basins off the main route have longer residence times (~ 40 years for the Weber Deep and 10-15 years for the Savu Sea). This means that the major outlet of the deep water from the Banda Sea cannot be the Savu Sea, but is likelier to be the passage between Timor and Leti.

Deep-water orthophosphate data were worked out together with M. Muchtar (LON, Jakarta). Over the entire region covered, the differences were very small. Only the bottom waters of the Savu Basin, and to a lesser extent, the deep bottom waters of the Weber Deep and the Aru Basin showed a detectable increase in $\text{PO}_4\text{-P}$, relative to the inflowing deep water. This distribution pattern of "excess $\text{PO}_4\text{-P}$ " is consistent with that of excess dissolved silica and with a decrease of dissolved oxygen in the same basins.

Radon-222

H3-10

G.W. Berger

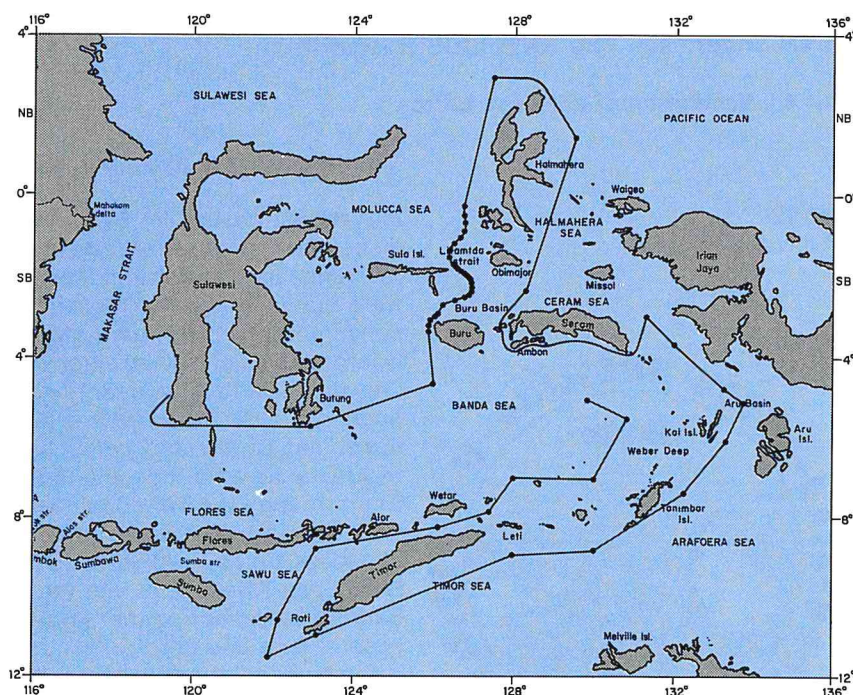
During the ventilation programme, about 30 stations were analysed for Radium-226 and Radon-222 in near-bottom water samples. Radon-222 concentrations were corrected for Radium-226 background values so that K-values could be calculated. In the Halmahera Basin unexpectedly high Radon concentrations were found. This may be due to a submarine earthquake that occurred 3 days later, but sedimentation rate calculations have to be carried out to prove this.

Measurements of temperature, salinity and aluminium content

H3-02

A.J. van Bennekom

Temperature and salinity.—The processing of CTD data was severely hampered by the bad quality of the Guildline deep-water CTD. Previous expeditions had already shown that the conductivity cell constant of this instrument decreased with increasing pressure. Correction formulas were calculated, and with these formulas, CTD salinities measured during previous cruises could be converted into real salinities with an accuracy of about 0.01, which hardly meets the requirements of modern deep-water oceanography. During Snellius II the temperature sensor of the CTD was sometimes malfunctioning too, which gives a much larger inaccuracy in the CTD salinities.



Aluminium.—A start was made with the adaptation of the lumogallion fluorometric method for dissolved aluminium to continuous flow analysis. This technique is especially suitable for interstitial water samples because of the low volume (about 2 ml). Preliminary results show that the manual method still has a higher precision and a lower detection limit. In interstitial water of sediments from the Indonesian basins, concentrations of $2.5 \mu\text{g} \cdot \text{l}^{-1}$ were found with generally the highest values near the sediment-water interface.

Oxygen cycle

Measurements of biomass and oxygen demand of the water show that the consumption rates in the deep sea are extremely low. Therefore, a highly sensitive enzymatic method (ETS method) was used. Biomass in the deep sea was measured by the ATP method. The vertical profiles of respiration rate and biomass reflect the import of organic matter from the euphotic zone. The oxygen uptake rate and the oxygen content of inflowing and outflowing water were measured to calculate the age of the water and the ventilation rate of the basin. The calculations, however, do not take into account the advection and diffusion of oxygen and, therefore, easily give rise to serious underestimates of the age of the watermass. Unfortunately, other independent methods involve similar problems.

B1-02

1.4.4.2. Input of rivers into the sea

H1-08
R. Nolting

Discharge of metals

Water and suspended particulate matter samples from the rivers Solo and Brantas in Java were collected in November-December 1984 in the rain season. During a stay in Bandung (DPMA), these samples were analysed for dissolved Cu, Zn, Pb, Cd, and Ni and for particulate Fe, Mn, Cu, Zn, Pb, Cd, Ni and Cr.

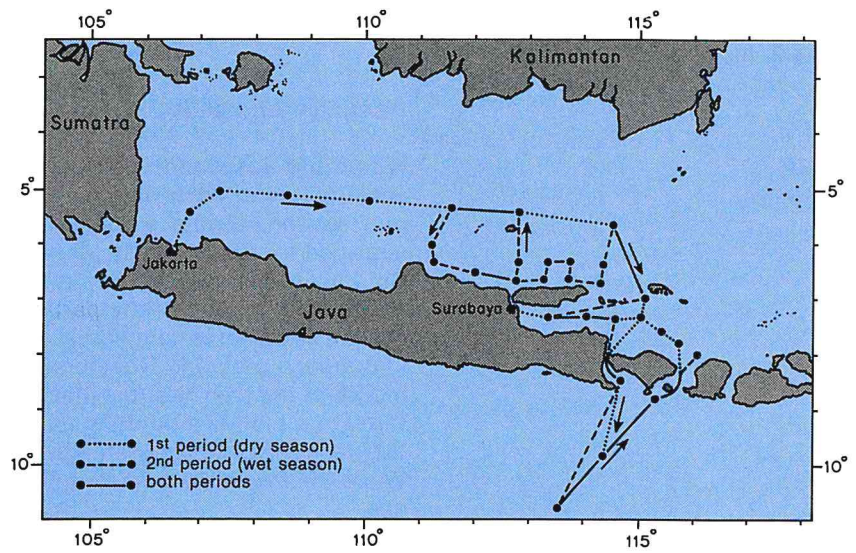
The composition of the particulate matter in suspension in the rivers Porong and Solo is completely different, probably because of differences in drainage area and weathering processes. The river Porong, being the mouth of the river Brantas, has a relatively small drainage area and runs through a mainly mountainous region. The river Solo has a much larger drainage area and runs through agricultural land before reaching the sea. While the Porong is dammed, the Solo has an open connection with the sea.

The compositional differences are demonstrated clearly by the total Fe content, which is 6.38% for the Porong and 2.6% for the Solo. It seems that the high Fe content in the Porong is caused by the so-called desilication process, which takes place in tropical regions where high rainfall and high temperatures exist. This means that there is a relative increase in the content of Fe and other metals in the soil owing to the preferential dissolution of amorphous silicate and the subsequent removal of this silicate from the soil. This process takes place mainly in the subsurface layer of the soil, which is subsequently transported to the river. High concentrations of silicic acid of $700\text{--}780\text{ }\mu\text{g}\cdot\text{l}^{-1}$ measured previously agree with this desilication process.

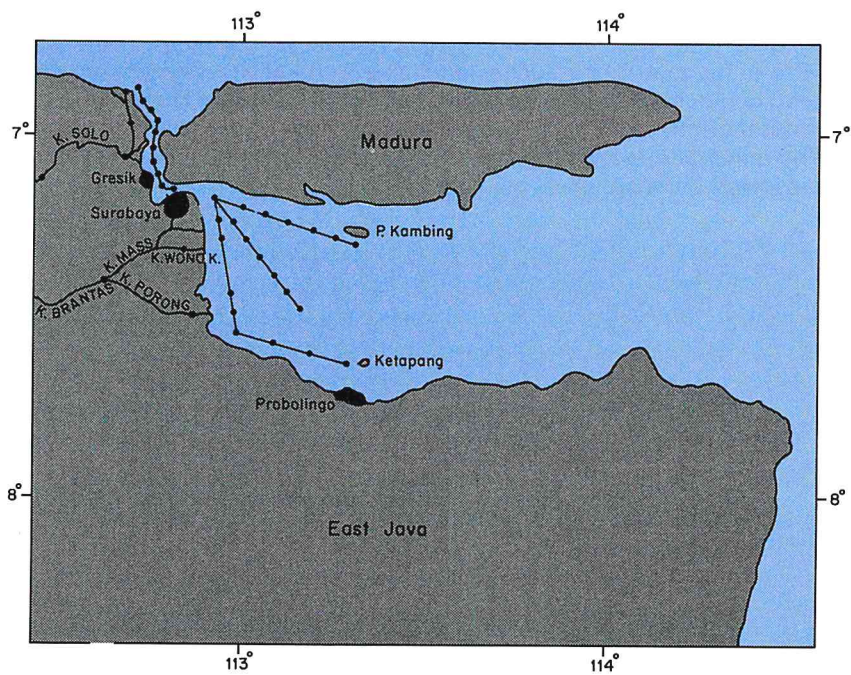
With the exception of Zn, all other metals determined were higher in the suspended matter from the Porong than from the Solo. The total Zn content in the suspended matter from the Solo is exceptionally high, ranging from 2362 to $19\,000\text{ }\mu\text{g}\cdot\text{g}^{-1}$. While in European rivers almost 70% of the total Zn content is leachable by 0.1 N HCl, none of the Zn content could be leached from the suspended matter from the Solo. A natural origin is the most acceptable explanation for this high Zn value. The minimal effect of any antropogenic influences is shown by the low dissolved Zn value of $\pm 1.3\text{ }\mu\text{g}\cdot\text{l}^{-1}$.

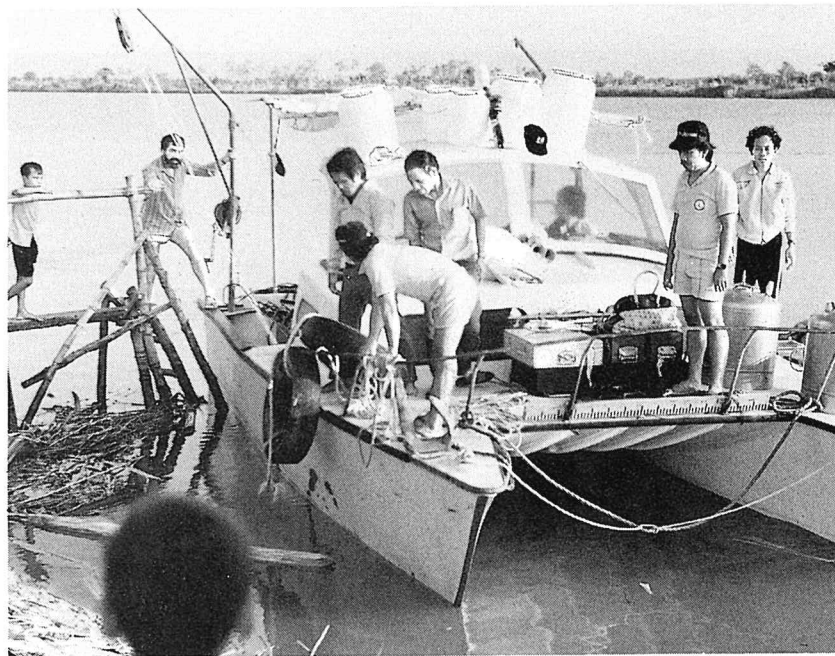


R.V. "Tyro"



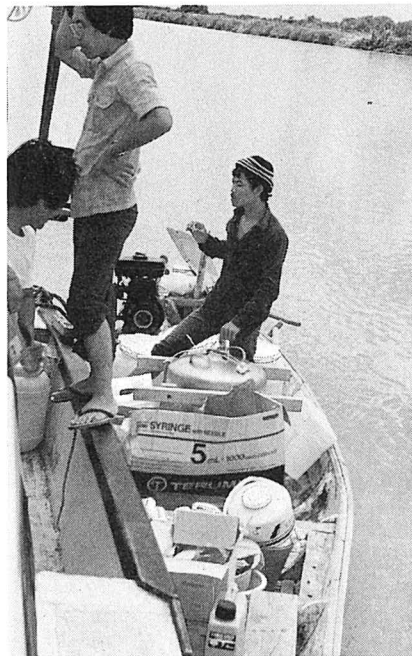
Sampling stations for the study of river input to the sea.



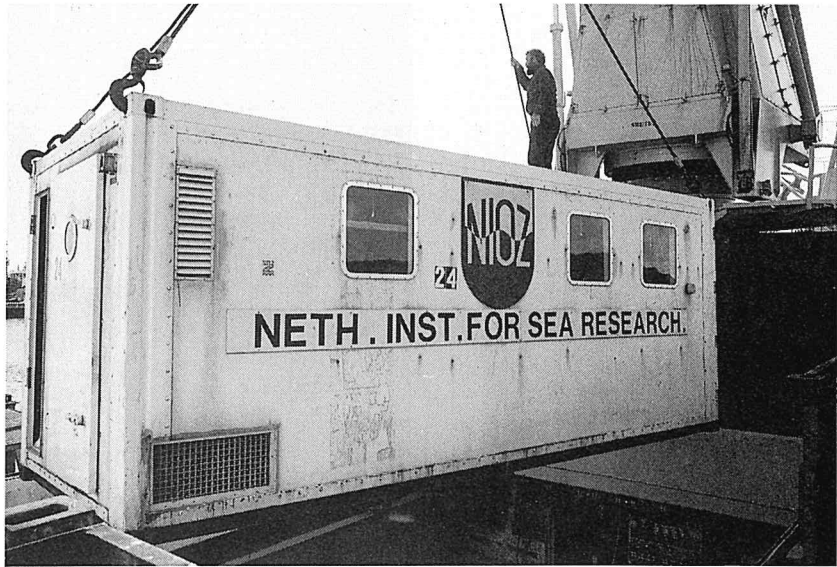


Preparing the katamaran at an anchor station in the river Solo. (under)

A typical sample location in an Indonesian river (above).



Transport of samples from the katamaran by a proa. *



Arrival of R.V. 'Tyro' at Den Helder, 2 August 1985. From left to right: Mr. Salim Abdullah, head of the Information Service of the Indonesian Embassy, Drs. J.C. Gmelich-Meijling, Burgomaster of Den Helder, L.J. Blok, Captain of the 'Tyro', Mrs. N. Blok-de Jong, Rear Admiral (ret.) J.C. Kreffer, Chairman of the Netherlands Council of Sea Research.



Remote sensing of coastal waters

H2-02
D. Spitzer

The research focussed on extensive processing and interpretation of in-water and above-water optical spectra in terms of water composition parameters. For turbid and highly variable coastal waters, specific approaches to the absorption and scattering processes in sea water are required to establish the pursued relationships (algorithms) between the optical properties ("water colour") and the concentration of suspended and dissolved materials (sea truth).

The amounts of components that determine water colour characterize the coastal water type. The components are sometimes intercorrelated. Optical *in situ* and remote airborne measurements were carried out in combination with extensive sampling in the Indonesian coastal waters north-east of Java. All data, both airborne and shipborne, have been preprocessed and reveal relationship with the particulate material distribution patterns.

In addition to the existing underwater (Advanced Spectral Irradiance Meter, ASIR) and airborne (Coastal Optical Remote Sensing Airborne Radiometer, CORSAIR) instruments, a new Portable Four Channel Radiometer (PFC) was developed, calibrated and tested. It was applied for numerous upwelling radiance measurements in Indonesian and Dutch coastal waters. Its spectral characteristics were adjusted to the Landsat MSS and TM bands.

A radiative transfer model study was performed, which demonstrates that optical remote sensing techniques can be applied for the determination of bottom depth and the composition of shallow waters.

The objectives of the marine optical research with respect to remote sensing applications are the same for Indonesian and Dutch coastal waters. In both areas, the aim is to use the specific instruments aboard the existing (Landsat) and planned European (ERS II) and Dutch-Indonesian (TERS) satellites. The choice of the spectral bands and the establishment of the specific algorithms in relation to the design and development of the instruments and methods for remote coastal observations are the final goals.

Remote sensing in the euphotic zone of ocean waters

H2-01
D. Spitzer

A study on the radiative transfer, including the fluorescence and stratification effects, was continued, the two-flow model developed previously being employed. The striking phenomena related to the fluorescence of chlorophyll pigments in the red part of the spectra were revealed, both from the theoretical study and from the optical measurements in Indonesian waters, confirming the calculated prediction. Shifts in the chlorophyll fluorescence maximum around 685 nm appear to be inherent to the abundance of pigments. Contrary to the blue part of the spectra, the currently assumed depth independence of the reflectance and of the upwelling irradiance attenuation coefficient in the red part appears not to hold at even low concentrations of chlorophyll pigments. This is to be ascribed to the fluorescence effects. Further theoretical treatment, in combination with the data collected during the Snellius II expedition, provides an explanation of the observed fluorescence and stratification effects. This may provide tools for investigations of the water-column structure.

Fig. 1 Airborne optical remote sensing of tidal flats.



Fig. 3 Spectral measurements by means of the CORSAIR
Downwelling irradiance (pag. 50)

Upwelling radiance (pag. 51)

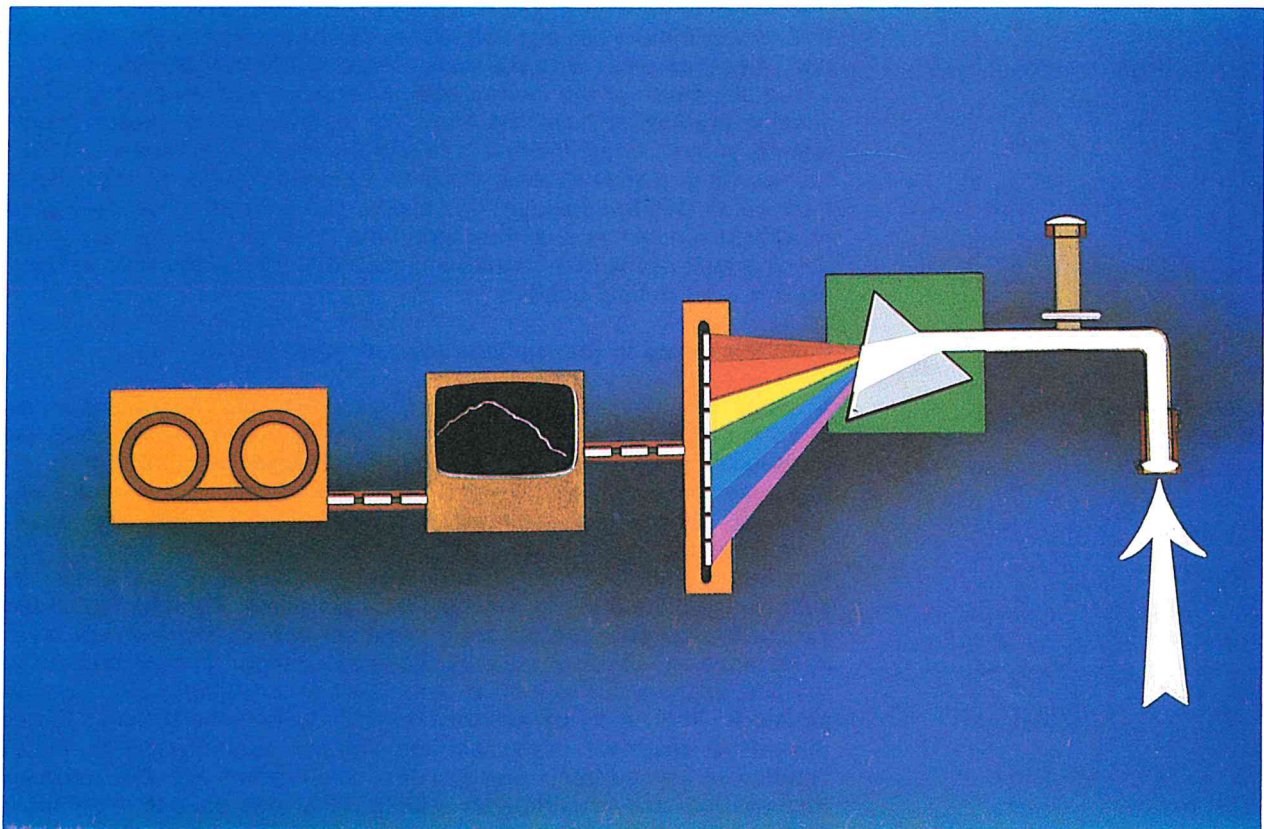
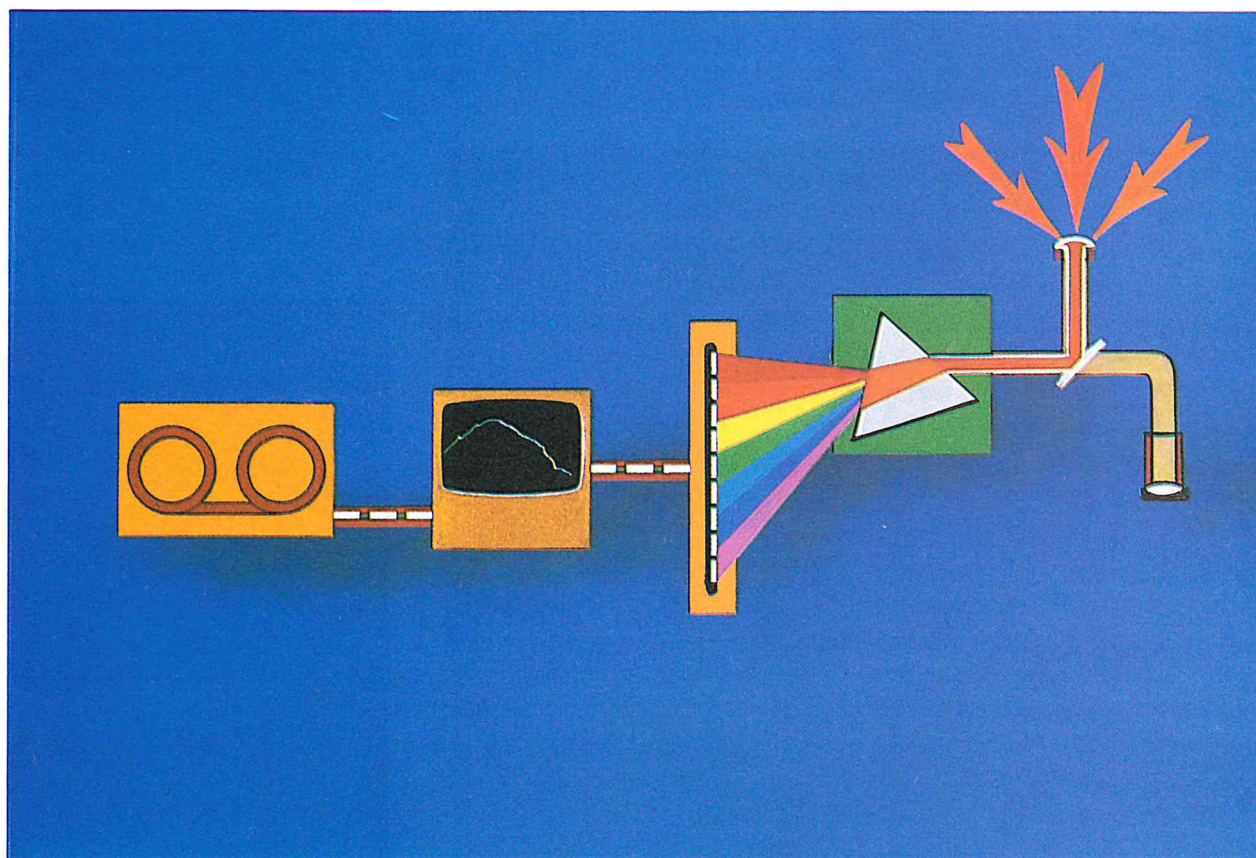
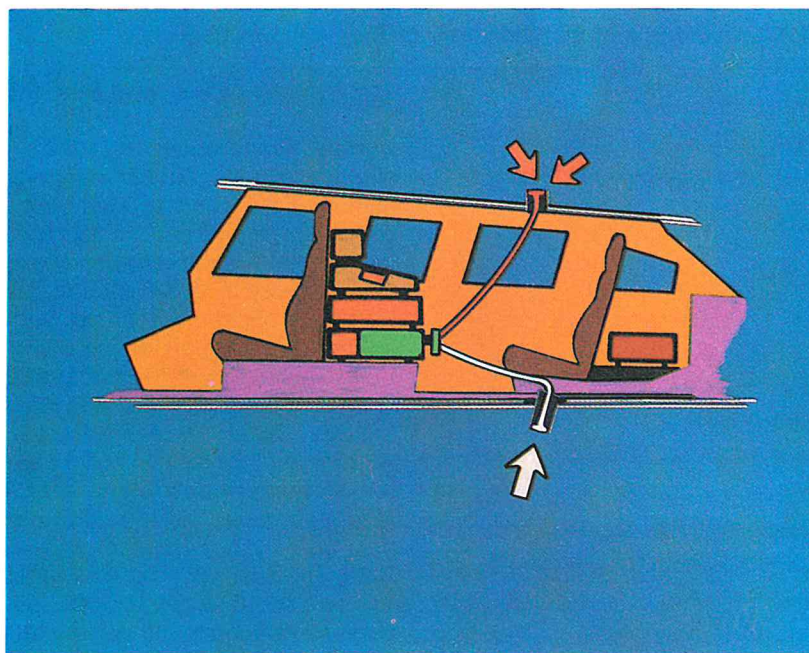


Fig. 2 Coastal Optical Remote Sensing Airborne Radiometer (CORSAIR) installed in a survey aircraft.



1.4.4.3. Geology and geochemistry of the southern basins

The geology of the Savu Sea and adjacent Indian Ocean

H3-08

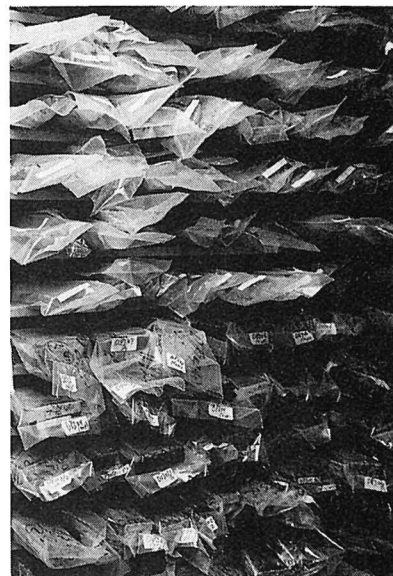
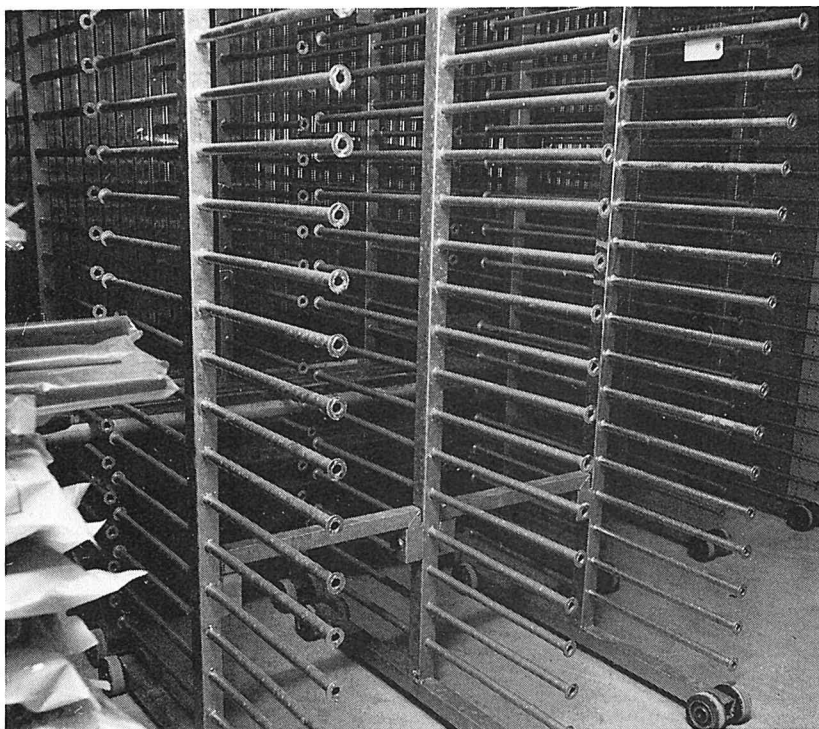
T.C.E. van Weering, J.H.F. Jansen

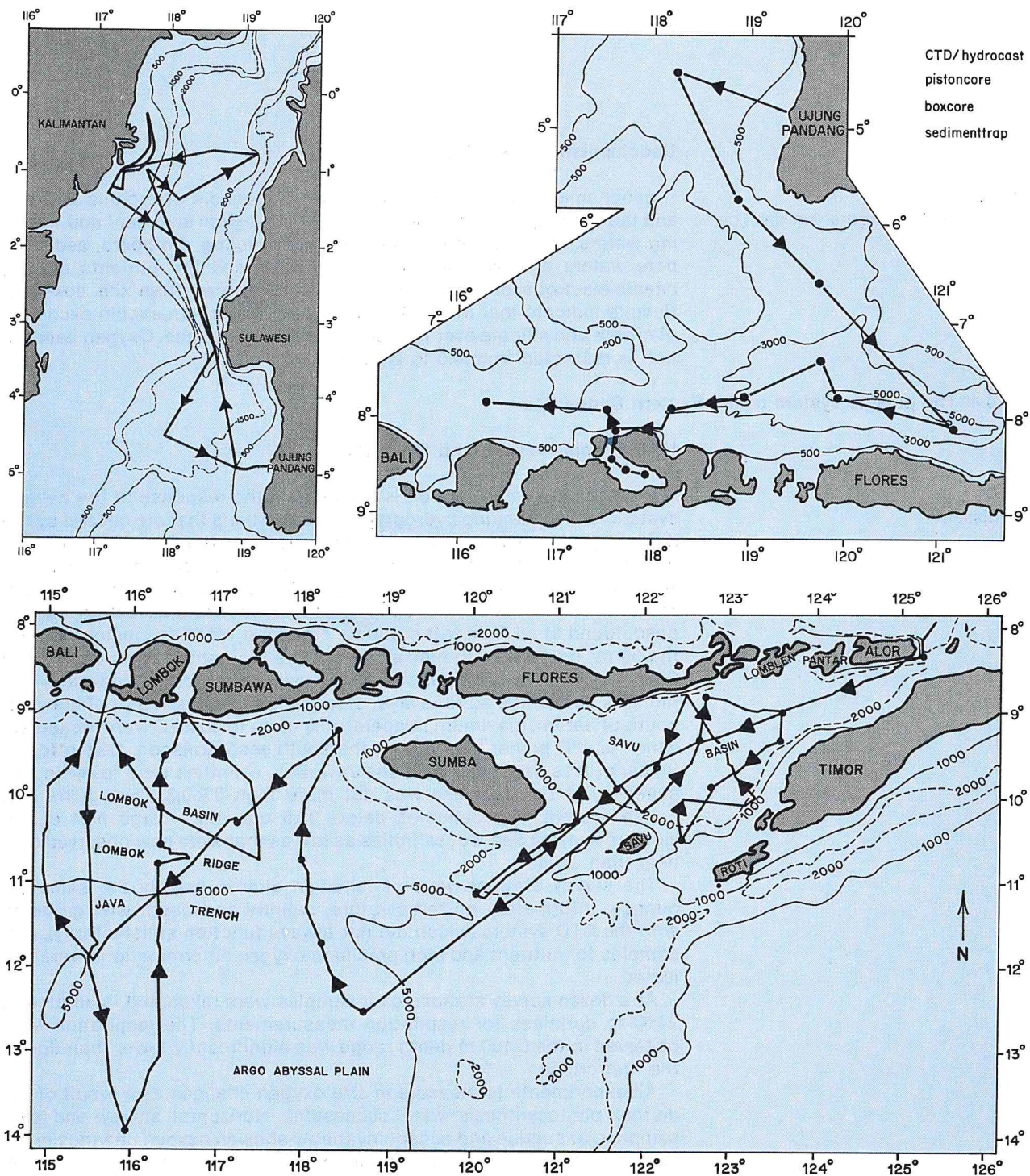
During two cruises in March and May-June 1985 high resolution shallow seismic and acoustic profiles were recorded which indicate that sediment transport by slumping is of major importance in the Savu Sea owing to the uplift of the Sumba-Savu-Roti ridge and the island of Timor. In the recent sediments on the continental slopes of Timor the slumps are indicated by growth faults. Slided blocks and soft sediment deformation were observed near the Sumba-Savu-Roti ridge.

The northern part of the Savu Basin is covered with fine-grained turbidites which form the distal end members of the slump deposits. This is confirmed by the study of 9 box-cores and piston-cores obtained from the Savu Basin and the adjacent part of the Java Trench, as well as by bottom photographs. At all 12 stations in the basin and on the sills of the northern entrance and southern exits, water samples and CTD profiles were taken for the determination of sediment-water interrelations.

In May-June, a transect was made to the Argo Abyssal Plain near the Deep-Sea Drilling Program site 261, where a piston-core was also taken for palaeoceanographic studies. This transect was continued with sampling stations and seismic and acoustic profiling in the eastern Lombok Basin. Preliminary results indicate that the Lombok Ridge forms part of the accretionary prism and at its crest consists of a number of tension basins. Locally, clay diapirs pierce through the sediment column. Volcanic intrusions of Late Tertiary age have been discovered near Sumba.

Storage of core samples at 4°C in the catacombs of the institute.





Geological and geochemical cruises.

Geochemistry of the Savu Basin

H1-02

W. Helder, M. Rutgers van der Loeff

A geochemical study aims at the early diagenesis of organic material and the exchange of dissolved compounds between sediment and overlying waters, with the emphasis on nitrogen cycling. On board, sediment pore waters and overlying water were analysed for nutrients and O₂ needle-electrode profiles were made in sub-cores from the box-core. Results indicate that in the Savu Basin there is a remarkable exchange of nitrate and silicate over the sediment-water interface. Oxygen penetration is restricted from 0.5 to 2.5 cm.

1.4.4.4. The pelagic system of the Eastern Banda Sea

Hydrography, oxygen and nutrients

H1-01

B. Tijssen

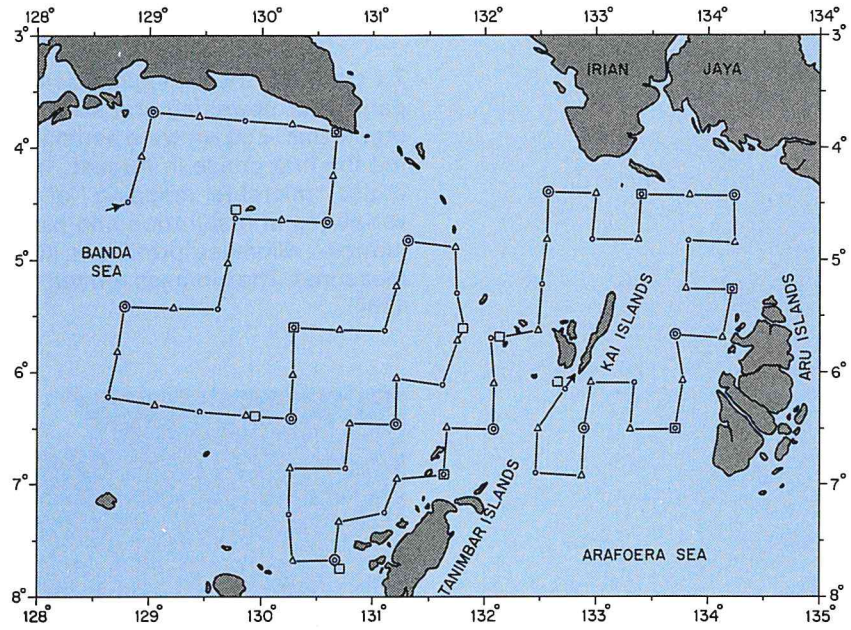
The aim of this investigation is to measure the response of the pelagic system to the changing hydrographical conditions that are caused by the different monsoonal regimes. A second cruise to the Eastern Banda Sea took place in February-March 1985. This cruise was centred in the north-west monsoon period with, according to Wyrtky, downwelling conditions. The expected surface-water circulation with eastward advection was, indeed, found at all four drift stations. Transport velocities measured with the 30 m² drogues in the mixed layer were high and ranged from 0.2 to 0.4 m·s⁻¹ over two-day periods. This means a complete renewal in one month's time of the surface layer studied. In the eastern part of the area, south of Seram, maximum temperatures of up to 30.2° C were measured, which is 4°C higher than during the south-east monsoon. Owing to the inflow of less salt water from the Java Sea, salinities were lower in this season, but the decrease was not more than 0.2-0.3. During the first cruise, waters with salinities below 33.5 covered a large part of the western Arafura Sea, but salinities as low as that were now observed only near Irian Jaya.

The survey stations were revisited in almost exactly the same sequence. Information on temperature, salinity and depth was gathered with the CTD system (which did not always function satisfactorily), and samples for nutrient and high-precision oxygen determinations were collected.

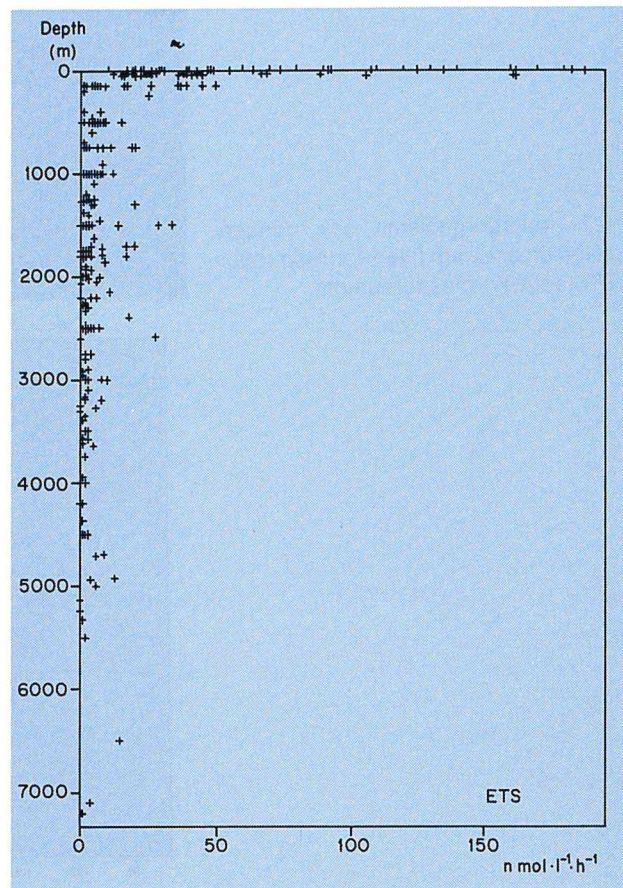
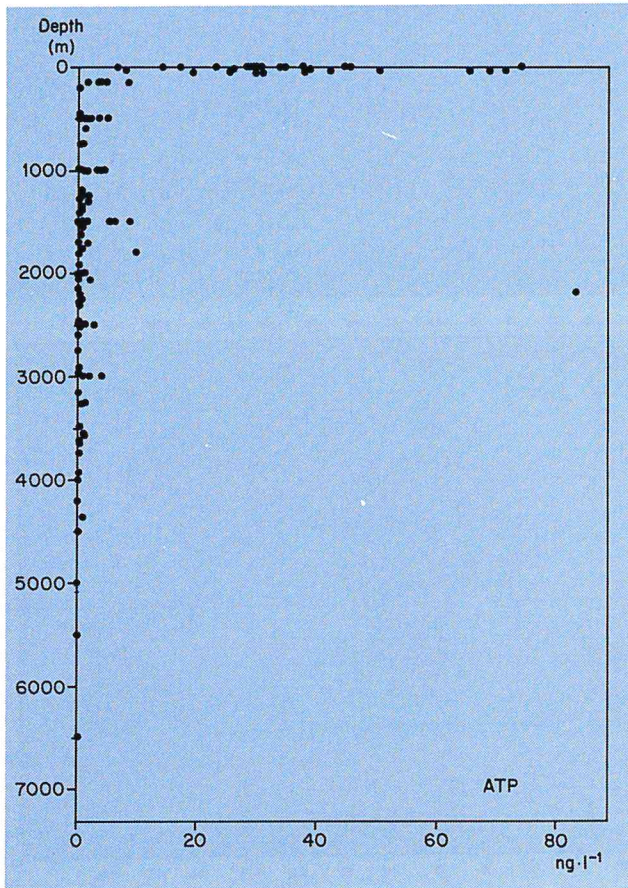
At a dozen survey stations cast samples were taken and incubated at 24°C in darkness for respiration measurements. The respiration level observed in the 0-100 m depth range was significantly lower than during the first cruise.

All experiments to measure *in situ* oxygen changes as a result of the diurnal photosynthesis were successful. Horizontal survey and cast sampling at sunrise and sunset invariably showed oxygen changes in the expected direction and with amplitudes in a narrow range. This shows both horizontal and vertical low-level oxygen variation; a level much lower than during the first cruise. Nutrient concentrations in the mixed layer were 2-3 times lower than during the first cruise.

Cruise tracks for the study of the pelagic system in the Eastern Banda Sea.



Biomass (as $\text{ng ATP} \cdot \text{l}^{-1}$) and relative respiration activity (as $\text{nmol} \cdot \text{l}^{-1} \cdot \text{h}^{-1}$ ETS activity) in deep-sea basins of east Indonesian waters



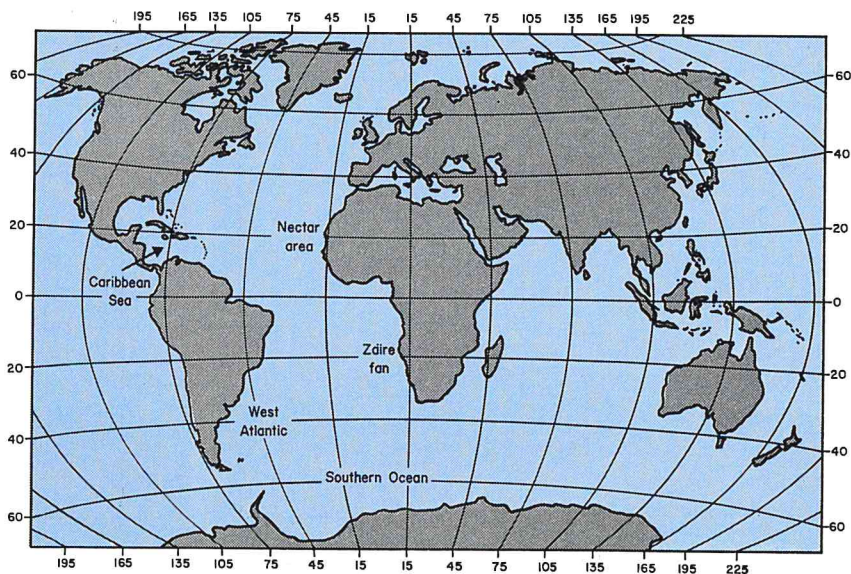
Microbiology

B1-02
J.H. Vosjan

To compare the biological activity in the upper 300 m water layer in periods of upwelling and downwelling, respiration rate and biomass of organisms $< 50 \mu\text{m}$ were estimated by the ETS and ATP methods, as during the first cruise in August, 1984. During the first part of the February cruise "microbial mapping" of the Banda Sea was carried out. Diurnal variations in respiration and biomass were studied later at four drogue stations. Biomass profiles in the upper cm of the sediment were also measured. The biomass formed in the sediment was lower than in August 1984.



Here microorganisms are concentrated on a $0.2 \mu\text{m}$ filter, for respiration (ETS-activity) measurements.



B4-03

M. Baars, W.W.C. Gieskes
P. Schalk, W. Zevenboom

Plankton research

As in February-March the prevailing wind direction is north-west (NW monsoon), the water is stratified and consequently the upper part must be nutrient-depleted. The chlorophyll concentration and the phytoplankton species composition observed during the cruise in the Banda Sea are typical of oligotrophic tropical waters: a very low concentration of phytoplankton (*viz.* coccoid blue-green algae) and a chlorophyll maximum layer located as deep as 80 m in the westernmost part of the area investigated. To the east, most phytoplankton appeared to be present in the upper 30 m, where diatoms were important contributors to the phytoplankton standing crop.

Mean zooplankton biomass in the Banda Sea was 2 to 3 times lower in February-March 1985 than during the SE monsoon in August 1984, *viz.* 9 and 23 ml·m⁻² displacement volume (over a 150 m water column) corresponding with 0.46 and 1.0 g C·m⁻², respectively. The highest biomass occurred again north-east of the Kai Islands, in the region probably influenced by river runoff from Irian Jaya. Later measurements, during the visits to long stations, revealed 1.5 to 2 times higher displacement volumes. It may be assumed that after the first survey week with little wind, the increase in average wind force deepened the mixed layer, supplying the photic zone with more nutrients, which rapidly led to higher secondary production.

Macrozooplankton catches with the Rectangular Midwater Trawl were also 2-3 times lower than in 1984 with much fewer crustaceans and jellyfish. Echo-patches recorded by the fish-finder type echo-sounder on board the R.V. "Tyro" showed the highest concentrations south-east of Seram and west of the Aru Islands. The region around the Kai Islands, richest in echo-patches in 1984, was now poorer than adjacent areas. Estimates by the R.V. "Tenggiri" of total fish stocks in the eastern Banda Sea were about 800 000 tons for August 1984 and only 80 000 for March 1985.

All preliminary results of this paragraph (1.4.4.4.) together (see also 1.4.4.7.) indicate that the pelagic system in the Banda Sea is much poorer in biomass stocks during the NW monsoon than during the SE monsoon, but not necessarily less active. The dissimilarities between large parts of the maps made for phytoplankton, chlorophyll, ATP and ETS, zooplankton and echo-patches imply a highly active ecosystem, though with a different structure, during the NW monsoon as well. We presume that the high production by the predominantly very small algae during the NW monsoon is consumed by bacteria and protozoa and that the economically more important food chain via zooplankton to fish is hampered by lack of suitable algae.

During the second cruise, in February-March, the Indonesian ships the R.Vs. "Samudera" and "Tenggiri" again participated in this programme of the Snellius II expedition. Five Indonesian scientists joined parts of the cruise of the R.V. "Tyro", and afterwards decisions were made regarding post-expedition stays in the Netherlands for collaboration in processing and publication. Four of these fellowships (two of them concerning Ph.D. candidates), on the subjects zooplankton, fish larvae and echo-sounding, started in the autumn of 1985. Another four, on phytoplankton, nutrients and hydrography, are to start in 1986.

Open-sided, towed zooplankton sampler equipped with CTD and *in situ* fluorometer, used during the pelagic programme in the Banda Sea.



Sedimentation of organic matter

B3-01
G.C. Cadée

In the Banda Sea sediment traps were used successfully to collect organic matter sinking from the euphotic zone to deeper water layers. Moreover, samples were collected to measure the amount of organic carbon (dissolved and particulate) present in the upper water layers. The sediment trap samples of February contained fewer recognizable faecal pellets than those of August 1984. Living zooplankton collected and killed in the traps forms a problem, as it is difficult to separate from the rest of the material collected. In August, 20 to 60 mg C·m⁻²·d⁻¹ sank out of the euphotic zone, which is little compared with the primary production material.

Open-sized, towed zooplankton sampler with opening and closing device in front and sensors for depth, temperature, fluorescence, and turbidity protected in a cage on the back.



1.4.4.5. Metabolism and production by benthic fauna

B1-04
P.A.W.J.de Wilde

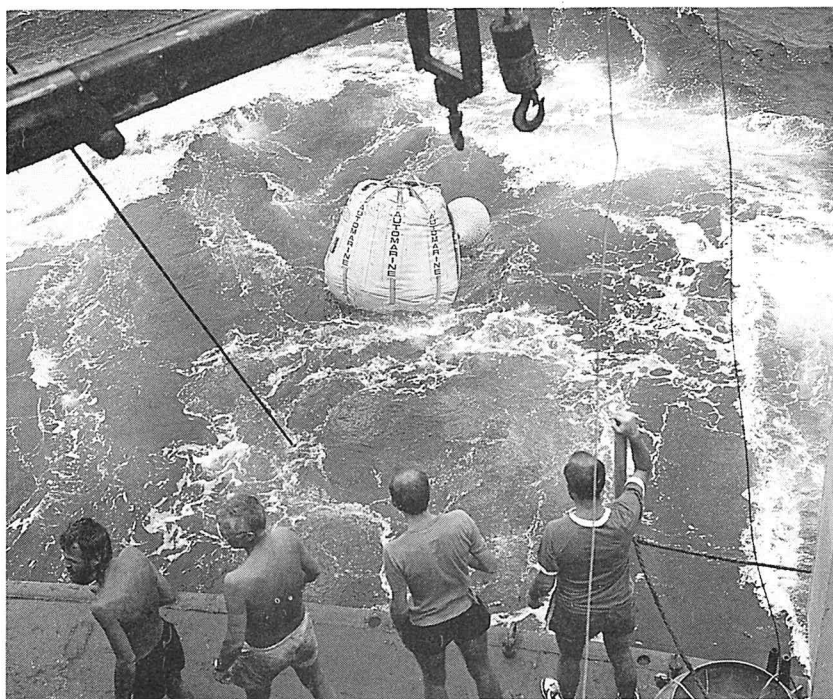
At 11 shallow-water stations (~ 100 m depth) in the Eastern Banda Sea, 49 box-cores were collected. Aboard the R.V. "Tyro" the sediment was sieved and the retained material preserved and stored for later analysis. At 8 stations, 31 undisturbed bottom cores were subsampled from the box-core samples and placed in a laboratory incubator at simulated bottom conditions (temperature, bottom water). From these experiments the sediment oxygen demand was estimated and related to the detailed fauna composition of the incubated cores. The annual carbon demand, calculated from the oxygen uptake data, ranged from 35 to 250 g C·m⁻²·y⁻¹. Meiofauna densities in the Java Sea and shallow areas of the Banda Sea (< 100 m depth) amounted to 0.2-0.3 x 10⁶ individuals per m².

At 3 selected stations, bell-jar systems were lowered on to the seabed to measure the *in situ* oxygen demand of the enclosed sediment. One of the bell-jar systems was lost east of Seram, due to pirates who robbed the marker buoys. The ETS activity of the upper sediment layer was also determined at all benthic stations.

1.4.4.6. Sea-birds

G.C. Cadée

Quantitative sea-bird observations in February-March indicated that the same areas were rich in sea-birds as during the August 1984 cruise, viz. around the breeding island of Manuk (Great Frigatebirds, Brown-footed and Red-footed Boobies) and south of Irian Jaya. Migratory Wilson's Storm Petrels abounded here in August; in February-March migrating Streaked Shearwaters did so.



Underwater lifting-bags and winches on the quarterdeck of the Tyro are used for picking up heavy benthic bell-jars. The success of such an operation is, however, above all dependent on good team-work.

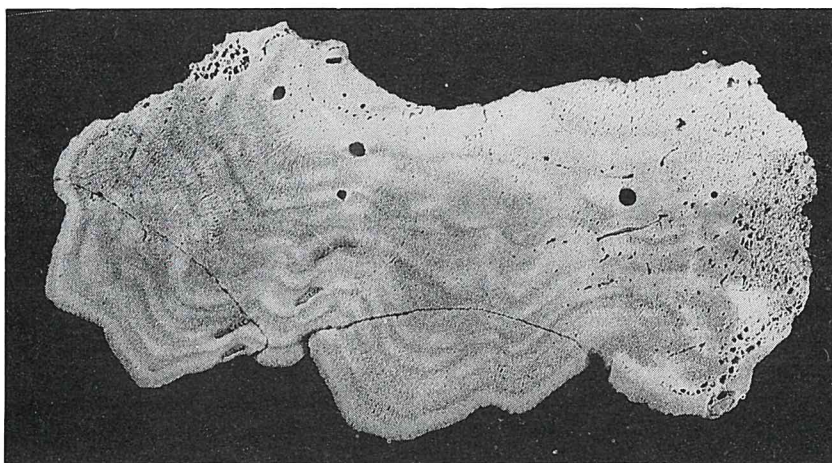
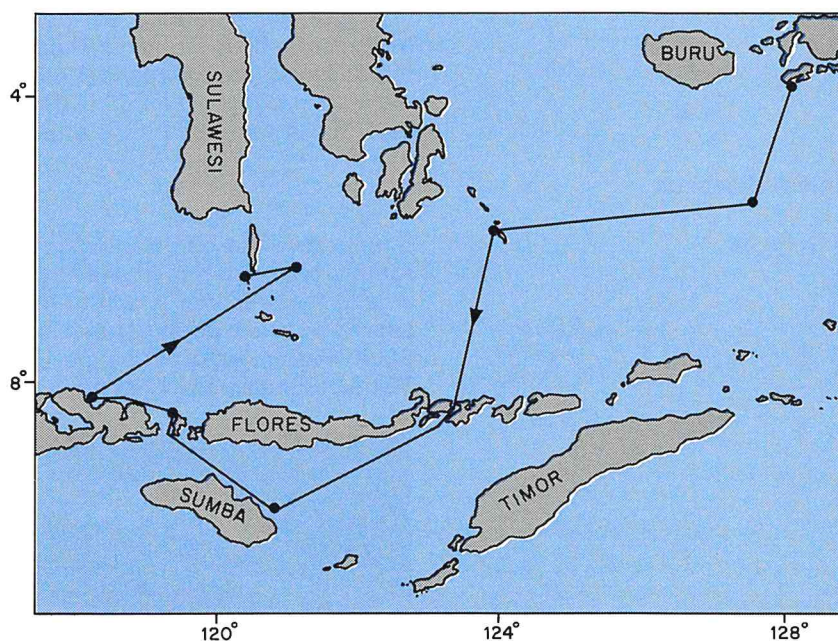
1.4.4.7. Coral reefs

B1-05

R.P.M. Bak

Data of 42 transects around 8 islands in the Eastern Banda Sea are analysed with multi-variate techniques. Preliminary results show ordination of the transects along various gradients, such as from exposed to sheltered conditions. Parallel to this gradient there are gradients in ecological characteristics, e.g. from the presence of hard bottom and crustose coralline algae, to a large quantity of foliaceous branching corals and large colony sizes.

In the skeletons of the massive coral *Porites*, a pattern of dark bands is observed superimposed on the high-low density growth-band pattern. These dark bands are of organic origin.



Section through skeleton of *Porites* (Banda Sea) showing dark banding pattern.

1.4.5. Coral reefs in Curaçao, southern Caribbean Sea

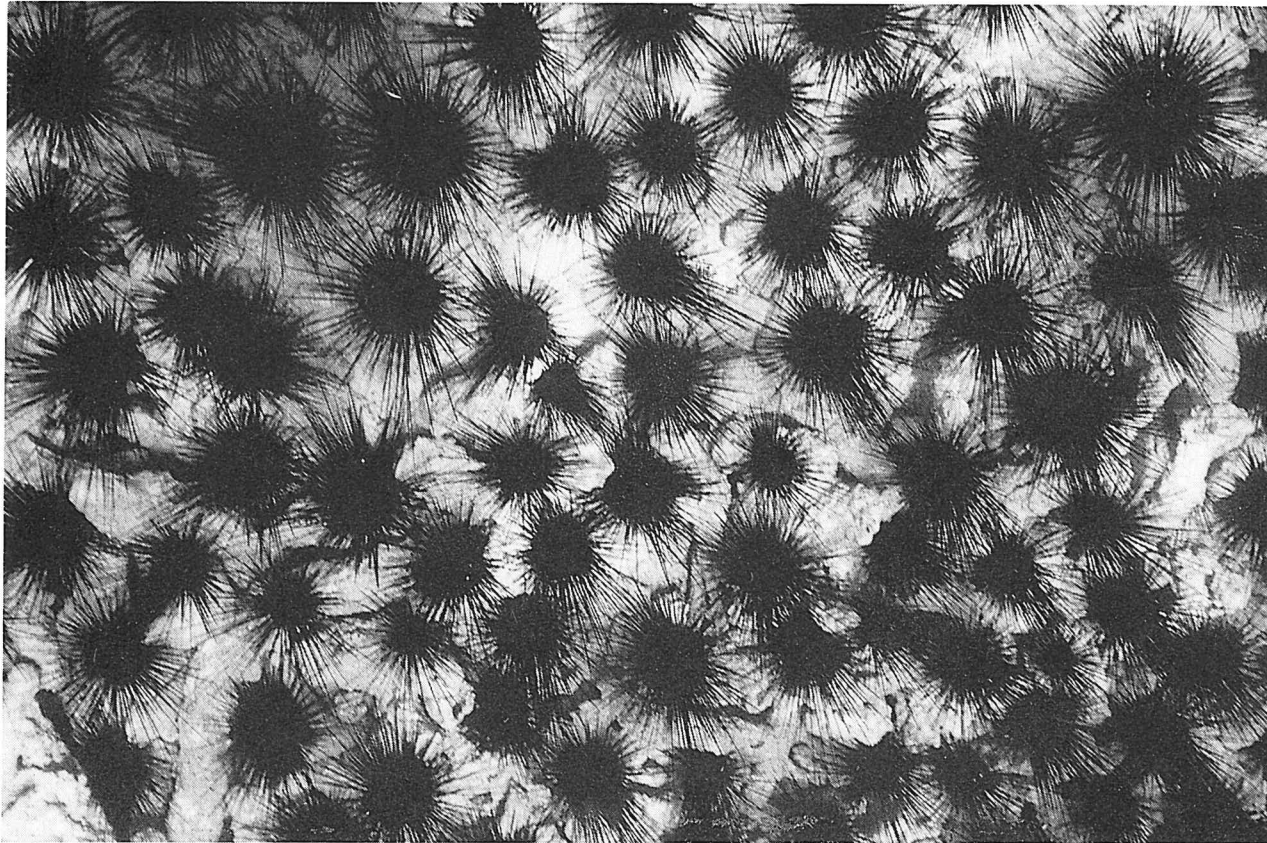
B1-05

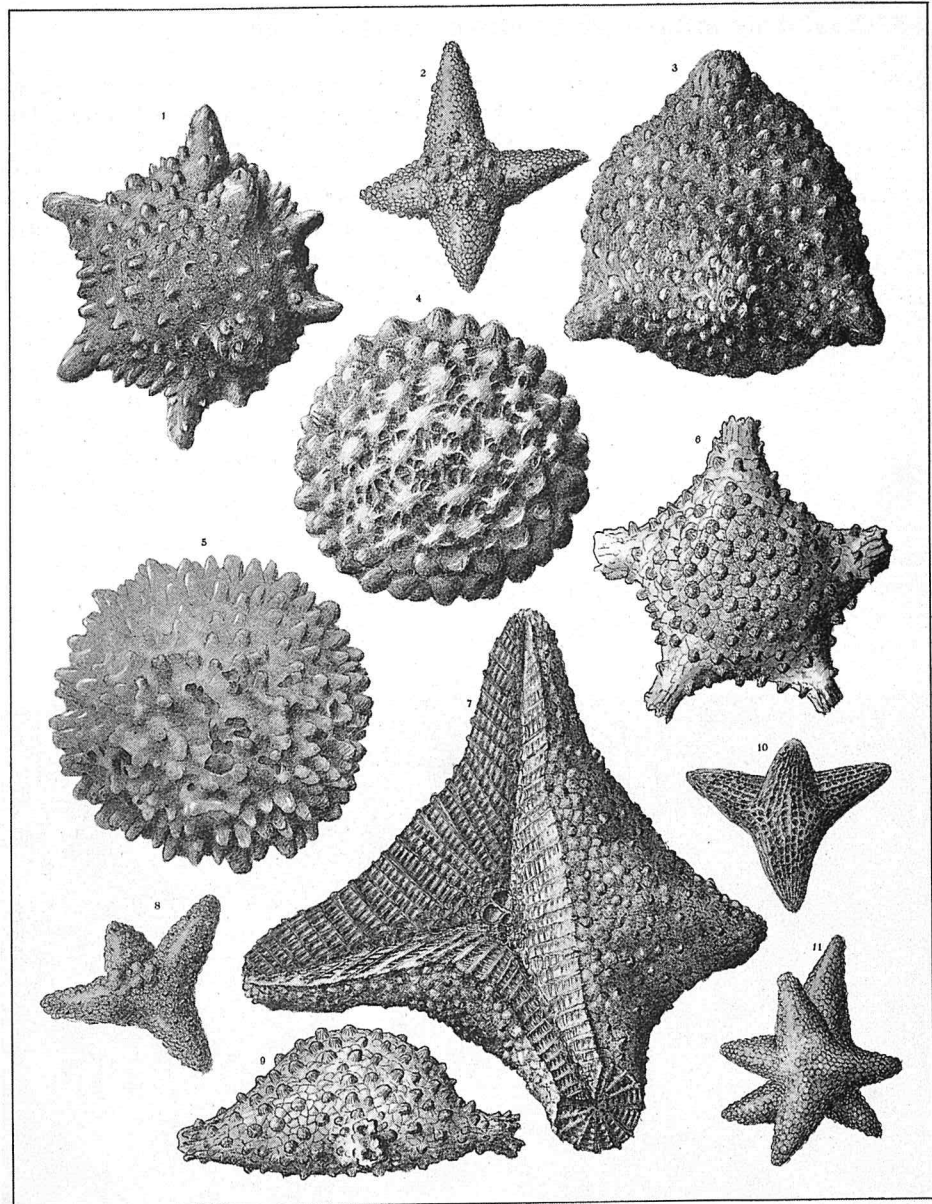
R.P.M. Bak

The enormous reduction in the densities of the mainly herbivorous sea urchin *Diadema antillarum* (see Annual Report 1984, p. 50) resulted in significant changes in bottom cover components on the reef in Curaçao (depths 3, 15, 27 m). The cover of fleshy and filamentous algae increased at all depths by 32-118% of the original cover. This paralleled a decreasing cover of crustose coralline algae, corals and sand. Corals such as *Agaricia agaricites* appeared to be more susceptible to overgrowth of algae than other coral species.

It is predicted that the effect of the mass mortality of *Diadema* will be negligible in some reef areas. The rate of settlement of pelagic larvae of *Diadema* varied significantly in space and time; on one reef the numbers of settlers recorded were always higher than on another reef at a distance of 24 km along the coast. These differences reflected higher and lower abundances of *Diadema*. Settlement was influenced by the degree of fouling of substrata: relatively clean surfaces attracted more larvae. The pattern of recruitment through time was similar on those reefs: continuous, though sparse, settlement throughout the year with, superimposed, two pronounced peaks and two less pronounced peaks in settlement, equally spaced over the year.

High density of the sea urchin *Diadema antillarum* before mass mortalities reduced population size to less than 95% of former conditions. Depth 2 m. (Curaçao)

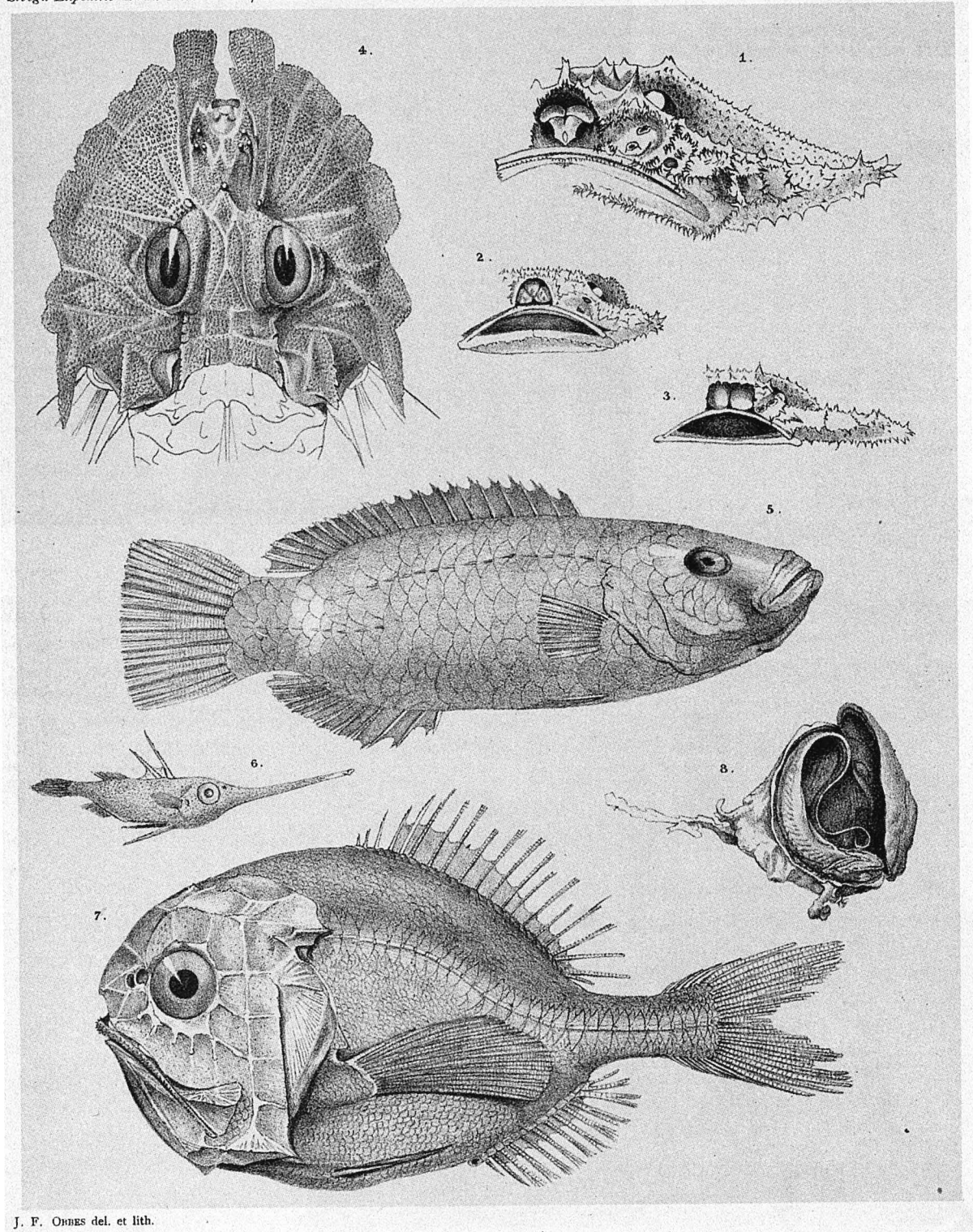




The SIBOGA expedition (1899-1900) was the first large Dutch expedition that studied the East-Indonesian waters, i.e. roughly the same area visited again in 1929-1930 by the SNELLIUS expedition and in 1984-1985 by the Joint Indonesian-Dutch SNELLIUS II expedition.

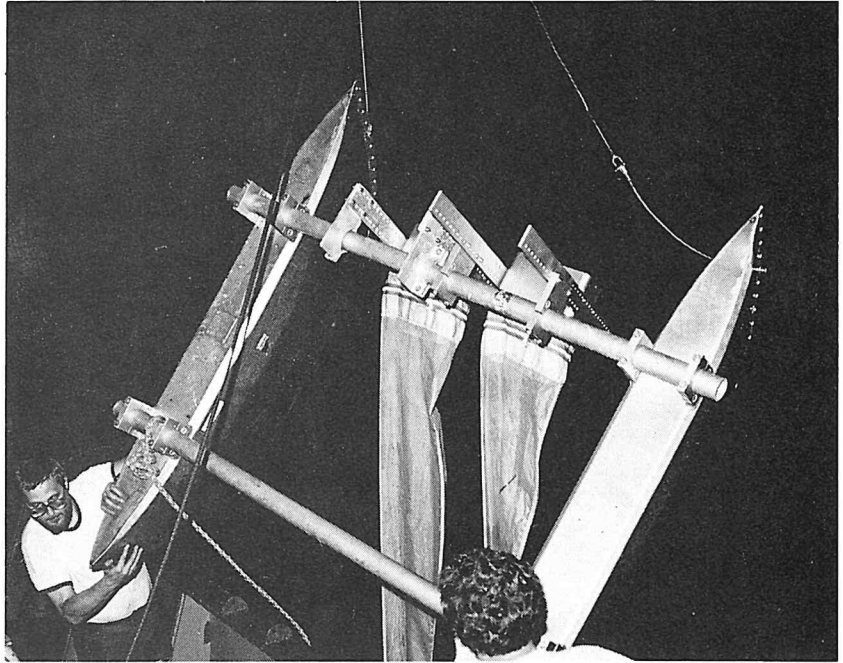
Many observations were made with sophisticated sounding equipment, temperature measurements gave indications for the provenance of bottom water in the deep basins, later to be studied more *in extenso* by the SNELLIUS I and II expeditions.

A large part of the time was devoted to the collection of biological specimens with dredges and pelagic nets and very rich collections have been obtained. Publications of the results started already in 1901 and 147 monographs have now been published, many of them with beautiful illustrations, some examples of which are here presented. (with permission of the editor E.J. Brill, Leyden).



J. F. OHRES del. et lith.

Launch of the neuston net during Snellius II, for sampling the waterstrider *Halobates* and the typical plankton just beneath the surface.



1.5. SPECIAL PROJECTS

1.5.1. Ecological Research North Sea and Wadden Sea (EON)

The EON group was set up in March 1984 and is to end its work in December 1987. EON works on 4 research projects under a contract between NIOZ and a number of Government agencies. The EON projects are executed in close co-operation with members of the NIOZ staff and of the biological department of the State University of Groningen. The projects are:

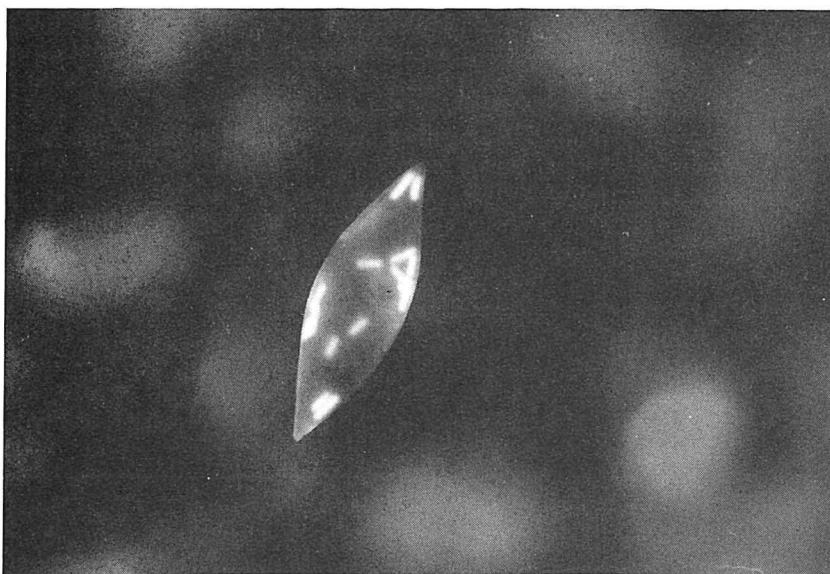
a) DEDMOD: This project aims at the documentation and publication of the BOEDE (Biological research group Ems-Dollard Estuary) -model of the ecosystem of the Ems-estuary. This mathematical simulation model of the ecosystem of the Ems estuary was mainly constructed in earlier years, but after a number of revisions and extensions it reached its final form this year.

The Ems estuary is divided into 5 compartments. The transport between these compartments is modelled with a one-dimensional transport model. In each compartment, three biological systems can be distinguished: a pelagic, a benthic and an epibenthic system. In these biological systems a large number of different species are grouped together into highly aggregated functional groups. For instance, phytoplankton is divided into two groups: flagellates and diatoms; macrobenthos is subdivided into suspension feeders and deposit feeders. Biological processes such as production, growth, excretion and mortality of the different groups of organisms are given by mathematical equations. The only forcing functions in the model are time series for freshwater discharge, light and temperature. The boundary conditions of the different state variables at the seaward boundary in the river Ems and the Westerwoldsche Aa are also given. The results of the model are validated and verified with field data. A special validation programme to express the concordance between independent field data and model output was developed.

To test the general applicability of the ecosystem model of the Ems estuary for other temperate estuaries, the Ems model was compared with GEMBASE (General Ecosystem Model for the Bristol Channel and Severn Estuary), which was developed in IMER, Plymouth, Great Britain. It appears that the ecosystem model of the Ems estuary works well with the boundary conditions of the Bristol Channel and the Severn estuary. However, the inverse, GEMBASE with the boundary conditions of the Ems estuary, was not very successful, because GEMBASE strongly focusses on the pelagic system and less on the benthic system.

The documentation and publication of the ecosystem model of the Ems estuary is part of the EON project and is in progress.

Bacteria mineralizing a dead diatom (~ 20 μm length) collected in the water column of the Wadden Sea.



b) EMOWAD: The development of a mathematical simulation model and the description of the ecosystem of the western part of the Dutch Wadden Sea.

The aim of this project is to transfer the ecosystem model of the Ems estuary to the western Wadden Sea. During this exercise, available data are to be used as much as possible and little supplementary research is to be done.

After the western Wadden Sea had been divided into different compartments, an inventory was made of the published and unpublished data necessary for the ecosystem model of the western Wadden Sea. It appears that there are considerable gaps in the data sets. For instance, little is known about pelagic and benthic bacteria. The nutrient limitation of algae and nutrient regeneration in the western Wadden Sea have not been described in detail. Nothing is known about the nutritive value of dissolved and particulate organic matter produced and entering the western Wadden Sea. It also appears that the available data are often too old or insufficient to be used in the model.

To obtain the missing data, a proposal will be written for limited field research in the western Wadden Sea.

The project EMOWAD also includes a special project WAWAMO. This encompasses a hydrographical model that simulates in detail the water exchange between the western Wadden Sea and the adjacent North Sea.

c) VONZEE: Preliminary investigations for research regarding the ecology of the North Sea.

A special group has been established to start this project at the end of 1985.

d) TECON: Direct help and advice for different Government agencies concerned with the management of the North Sea and the Wadden Sea. At the moment, this project consists of investigations of the macrobenthic fauna in a discharge area for TiO_2 waste in the North Sea and of an investigation of the macrobenthic fauna around drilling platforms in the North Sea.

The research on the effects of TiO_2 waste on the bottom fauna was started in 1980 and finished in 1984. Sorting and analysing of the samples have almost been completed. A report is in progress, and the general conclusions are that there is a considerable variation in the fauna, which may largely be attributed to unstable environmental conditions. Therefore, it was difficult to establish immediate effects of the waste discharges on the fauna in the dumping area.

Another project within TECON comprises the effects of discharged cuttings covered with oil based mud on the bottom fauna near drilling platforms. This programme is executed in close co-operation with TNO, Den Helder. Samples collected during one survey near three different platforms will be analysed in the near future.

1.5.2. Research at the dumpsite for low-level radioactive waste (DORA)

M.M. Rutger v.d. Loeff,
M. Lavalys

The DORA (Deep sea Research on Radioactive Waste) project, started in 1982, investigates geochemical and biological characteristics of the NEA (Nuclear Energy Agency) dumpsite for low-level radioactive waste, located in the NE Atlantic Ocean around 46°N , 17°W . The purpose is to describe geochemical and biological pathways along which radioisotopes can be transported once they are eventually released from the waste containers. In spring 1984, a second cruise was made to the dumpsite with Hr. Ms. "Tydeman".

1.5.2.1. Geochemistry

As an approach to predicting the mobility of radionuclides in sediments we have investigated the distribution of trace metals in cores collected in 1982 and in 1984.

Pore water.—All pore water samples, were squeezed on board ship at in situ temperature and, where necessary, in an inert atmosphere, and analysed for Mn, Fe, Cu, Zn, Cd, Co and Ni. Cu and Ni occurred in maximum concentrations at the sediment surface and decreased with depth in the aerobic sediment. This is the result of decomposition of organic material at the surface and adsorption of the released metals below. In two gravity cores, the transition from aerobic to suboxic conditions could be followed. Below the depth of oxygen depletion, at about 1 m depth, the dissolved concentrations of Mn, Fe, Co rose abruptly; Ni, Cu and Cd increased more gradually.

Sediment.—A selective extraction technique was used to investigate the distribution of trace metals between various phases in the sediment. With this technique we distinguish a carbonate-bound phase, a Mn-oxyhydroxide phase, and a HCl-leachable phase. Since the separation between these phases is only operationally defined, interpretation of the results must be done with caution. Nevertheless, the combination of the change with depth of the phase distributions and the pore water data allows the following conclusions to be drawn:

In the aerobic sediment nearly all Mn, Co and Ni and a part of Fe, Cu and Zn occur in the Mn-oxyhydroxide phase. This phase has disappeared completely in the suboxic sediment.

When oxygen becomes depleted, at a depth of about 1 meter in the sediments from the valleys in the dumpsite, oxyhydroxides of Mn and Fe dissolve. Since in the aerobic sediment many trace elements are bound to oxyhydroxide surfaces, these elements are set free in the suboxic sediment. Whereas sulfide and organic matter form an efficient next trap for most trace elements (including e.g. U and Pu) in coastal and shelf sediments, they are absent or rare in the suboxic dumpsite sediments. Here clay mineral surfaces can be expected to form the next best adsorption sites. As a result, the mobility of many trace elements (Fe, Mn, Co, and to a lesser extent Ni, Cu, Cd) increases significantly.

Carbonate-¹⁴C determinations have shown age reversals in two out of three gravity cores. From Ca and Mg contents in the selective extracts it was shown that appreciable amounts of dolomite were present in the samples. If this was all fossil dolomite, the estimated ages would be up to 2200 yrs too old. The age reversals remain, however, after these corrections, and the likeliest explanation is that they result from slumping.

1.5.2.2. Biology

In order to obtain a better description of the faunal composition we set up a faunal density, biomass and distribution research programme that focussed on the following subjects:

Horizontal distribution of the meiofauna. - From data of 4 box-core samples, with 5 subcores of 10 cm² each, it is concluded that the density of Nematoda is rather constant. Their biomass varies considerably, however. This shows that it is inaccurate to use mean individual body weight for the calculation of Nematoda in a sediment sample. Comparison of data from two expeditions did not show a clear resemblance between samples from approximately the same place (less than 2 km apart).

Composition of the Nematoda fauna. - As Nematoda may be good indicators for the benthic environment (high density, many species), 3 months of research were spent on describing this fauna. The diversity proved to be high, which is a characteristic of the deep sea, and an indication that no great disturbance of the benthos has taken place, for example by dumping. 60 % of the Nematoda are juveniles, and 50% are non-selective deposit feeders.

Vertical distribution of macrofauna. - For this research, whole box-core samples were cut horizontally in 1-5 cm thick slices and sieved over 1mm and 0.5 mm screens. The first results show that most animals live in the upper cm, and that below 10 cm hardly any animals are found.

1.5.3. Dutch Joint Monitoring Programme on polychlorinated hydrocarbons

S-03
T. Hillebrand

According to an agreement with RIZA, water samples from the Marsdiep were collected and analysed for chlorinated hydrocarbons four times during 1985. The programme was expanded to include two other sampling locations, one 50 miles off the coast near IJmuiden and the other in the river Rhine near the 990 km mark. Two sampling trips have been completed. Because of ice-conditions, one sampling trip had to be postponed till January 1986.

Since the continuous liquid-liquid extractor makes it possible to handle larger sample sizes than before, we are trying to develop a more efficient method for the clean-up of the extracts. This is necessary because of a disturbing matrix effect. The composition of the matrix is not yet known, but it will be investigated with GC-MS. The commonly used adsorption chromatographic separation of chlorinated hydrocarbons from the matrix is not always successful, and we plan to investigate the use of gel permeation chromatography as an alternative.

1.5.4. Continuous liquid-liquid extraction

H1-06
T. Hillebrand

In 1985 the liquid-liquid extractor was baptized and is now known under the name of ISABELLE (Instrument Suitable for Aqueous Bulk Exposure to Liquid-Liquid Extraction). Although designed for the extraction of low concentrations of PCBs and other chlorinated compounds in water, the application has been expanded through successful experiments with other substances in a different concentration range. A licensing agreement has been made with the firm Lenz-Labor Instruments to produce and market small and medium-sized versions of ISABELLE, and the extractor has been presented at several scientific exhibitions.

In collaboration with Cinda Chemicals B.V. in Uithoorn, a tar-product manufacturer, a number of experiments were carried out to test ISABELLE for its suitability in industrial waste-water treatment, and to find a solution to the waste-water problems of this company. The goal was to decrease the concentration of polycyclic aromatic hydrocarbons (PAHs) from more than $10 \mu\text{g}\cdot\text{l}^{-1}$ to a maximum of $2 \mu\text{g}\cdot\text{l}^{-1}$ and, ultimately to less than $0.2 \mu\text{g}\cdot\text{l}^{-1}$. Initial experiments carried out at NIOZ were not successful because of the heterogeneous composition of the waste-water. A subsequent on-site experiment was successful for the analytical version of ISABELLE, but revealed an extraction efficiency problem with the up-scaled version ($360 \text{ l}\cdot\text{h}^{-1}$ capacity). The problems are related to the solvent to water ratio that is used. The future prospects for the use of ISABELLE in industrial waste-water treatment look promising.

In collaboration with Provinciale Waterstaat voor Zuid-Holland in Haarlem and Uitwaterende Sluizen voor Kennemerland and Westfriesland in Edam, an experiment was carried out in the Volgermeer polder in Broek in Waterland. This well-known dump-site is heavily polluted with chemical waste, and a successful procedure for clean-up would be of great economic value. This waste-water represented a formidable challenge in that it contained emulsifying agents and dissolved iron, which caused a large increase in the rate of solvent consumption. This problem was solved. Another problem was the presence of volatile components, such as monochloro benzene, and water soluble compounds, notably chlorinated phenols. This problem is still being worked on.

1.5.5. Opex, oil pollution experiment

B1-01

P.A.W.J. de Wilde, G.v. Moorsel

1985

OPEX is an applied research project aimed at the study of fate and effects of oil and dispersants in Model Tidal Flat ecosystems (MOTIFs). Besides NIOZ, TNO and RIN participate in this project. Macrofauna in het MOTIFs is studied by NIOZ. A large-scale experiment, in which relatively high concentrations of North Sea Forties oil ($0.5 \text{ l} \cdot \text{m}^{-2}$) and the dispersant Finasol OSR 5 were used, ended in March 1985. In May 1985 the present experiment started with lower concentrations of oil dispersant ($0.1 \text{ l} \cdot \text{m}^{-2}$) and shorter exposure times (1 and 3 days as opposed to 5 days in 1984). Duplicate tests were carried out with oil, dispersed oil and controls.

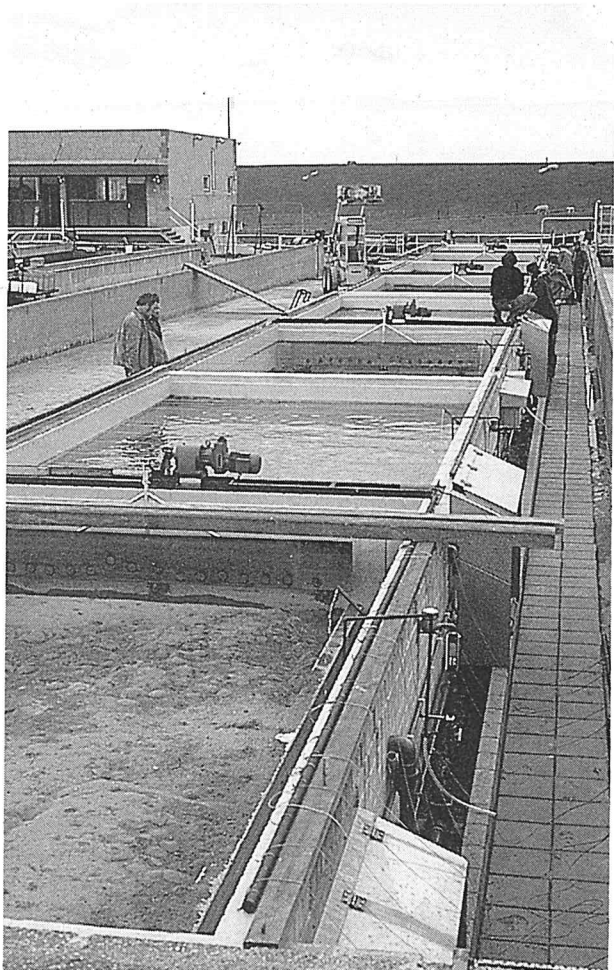
Dispersed oil and exposure to untreated oil during 5 days caused high acute mortality in various organisms living near the sediment surface e.g. the bivalve *Cerastoderma edule* and the small crustacean *Corophium volutator*. With dispersed oil the lugworm (*Arenicola marina*) suffered an acute mortality of 20-30%. Normal bioturbation activity in the remaining population was resumed after 2 weeks. Both treatment with oil and dispersed oil caused bivalves to crawl temporarily at the sediment surface. As a result of the simulated oil spills in the previous year a striking long-term effect was observed during the winter of 1985, viz. a sudden increase in mortality of adult *Cerastoderma*.

Long-lasting ecotoxicological research projects as initiated by OPEX offer interesting facilities for the study of long-term effects caused by harmful substances in ecosystems.



Addition of oil during one of the experiments.

The outdoor model tidal-flat ecosystem (MOTIF).



Oil slick on a "MOTIF".



1.6. ADDITIONAL RESEARCH

1.6.1. Research at NIOZ by guests

Frede O. Andersen (University of Odense, Denmark) worked on sediment-water exchange and its mediation by bioturbation in shallow tidal sediments, from 15 June to 15 August.

Prof. Wang Bao-can (East China Normal University, Shanghai) worked on tidal flat sediments from January to December 1985.

Drs. Hans Bos (Municipal University, Amsterdam), assisted by a group of co-workers, collected bottom samples near the beach from Texel to Zeeland with the *Navicula* and worked on these in the laboratory in June-July 1985.

Drs. Beate Buch (Hamburg University), in August and September 1985, worked on sediment cores collected near Sumbawa and the Mahakam delta during the Snellius-II programme (Leg 1b).

Prof. Dr. W. Ebenhöh (University of Oldenburg, F.R.G.) participated in the construction of the ecosystem model of the Ems-Dollard estuary.

Dr. H. Etcheber (University of Bordeaux, France) cooperated with R. Laane (EON) in the study of the nutritive value of organic matter in the sediments of the Western Wadden Sea.

Leo Goeyens (Free University, Brussels, Belgium) cooperated on ^{15}N -application in marine sediments, during April and May.

Dr. P.A. Haefner jr. (Biology Department, Rochester Institute for Technology, New York, USA) worked on problems concerning carbohydrate metabolisms in common shrimps. Experiments were done in which blood, cellular and whole animal glycoside concentrations were determined fluorometrically in animals adapted to high and low temperatures and to a range of 6 different salinities. The results revealed differences in glucose concentrations associated with environmental circumstances, sex, size and reproduction development.

Sha Li-pin (East China Normal University, Shanghai; temporarily at Utrecht State University) worked on sediments in the Texel inlet, using the *Navicula* and the *Aurelia*, during summer and autumn 1985.

Dr. R.J. Miller (Bedford Institute of Oceanography, Canada) spent part of his sabbatical year (from 1 March to 1 October 1985) working at NIOZ on experiments aimed at measuring copepod mortality due to predation.

Dr. P. Radford (IMER, Plymouth, G.B.) participated in the modelling of the EON group.

A. Rajendran (National Institute of Oceanography, Goa, India) as a Unesco research fellow, worked on chemistry of sediments in the Skagerrak from January to December 1985.

Drs. Karin Ree (Municipal University, Amsterdam) worked on sediment size distributions and organic content of sediment samples from the Rhine and the Rhine mouth in relation to the distribution of organic pollutants, in October-November 1985.

Dr. Norman Silverberg, Department of Oceanography, University of Quebec at Rimouski worked on the biochemistry of the benthic boundary layer, from 29 April to 10 May and from 21 October to 1 November.

Dr. C.G.N. de Vooy made a literature review on behalf of the Rijkswaterstaat Department of Environmental Management (DDMI, Middelburg). The review concerns the effect of macrobenthos on the exchange of nutrients between sea bottom and water column. This work is connected with the management of Lake Grevelingen and the Eastern Scheldt Estuary in the near future.

An inventory was made of all NIOZ publications concerned with the bottom of the Dutch Wadden Sea and the near coastal zone of the North Sea, published between 1970 and 1984, for RIN (State Institute for Nature Management) and TNO.

On behalf of TNO (CIVO-Technologie, afd. Instituut voor Visserijproducten, IJmuiden) mussels (*Mytilus edulis*) were prepared containing a cadmium concentration of 120 mg Cd/kg flesh dry weight.

Dr. R.B. Whitlatch (associate professor on sabbatical leave from the University of Connecticut, Groton, U.S.A.) finished his work on bioturbation and feeding biology of deposit feeders on tidal flats in the Wadden Sea.

H. Yasuda (Governmental Industrial Research Institute, Kure, Japan) stayed at NIOZ till April 1985, studying the vertical structure of topographically rectified tidal currents.

In connection with the Snellius-II expedition, the following scientists did research at NIOZ in 1985:

Drs. Horas Hutagalung (LON, Jakarta, Indonesia)

Mr Deddi Moelyadi Moelyo B.Sc. (D.P.M.A., Bandung, Indonesia)

Drs. Hamidah Razak (LON, Jakarta, Indonesia)

Mr Ibrahim Sumanta (D.P.M.A., Bandung, Indonesia)

Drs. Sumarno (Gadjah Madah University, Yogyakarta, Indonesia)

They all participated in analyses of heavy metals and chlorinated hydrocarbons in samples (water, suspended matter, sediment, and organisms) taken during TYRO cruises for theme V of the Snellius-II expedition.

Mr Suhendro Budiharjo (B.P.P.I., Semarang, Indonesia)

Mr Duto Nugroho (B.P.P.I., Semarang, Indonesia)

Mr Soewito (B.P.P.I., Semarang, Indonesia)

arrived in October as post-expedition trainees of the Snellius- II expedition, to work on Theme 3: Pelagic System data.

1.6.2. Participation in national and international programmes

During July and August 1985, research and training programmes on the use of remote sensing for coastal management were implemented at the Pattimura University within the framework of the Maluku regional development project LTA 72, a cooperation between ITC Enchede and the Regional Planning Board BAP-PEDA (see 1.4.4.2./H1-08).

The Environmental Institute in Ambon is one of the institutes selected for a special task in the field of marine ecosystem monitoring, management and protection. A close cooperation has been established between this Environmental Institute and the Fisheries Faculty of the Pattimura University and the local branch of the National Oceanographic Institute LONLIPI.

The establishment of relationships between physical parameters and imageries (satellite or aerial photographs), mapping etc. were carried out separately under the guidance of expert advisors. For the group of coastal management specialists the following major themes were elaborated on:

1. The use of remote sensing techniques for the mapping and monitoring of marine dispersion patterns (pollution, silt, chlorophyll etc.). For this theme use could be made of the experiences gained during the Shellius II expedition.

2. The use of remote sensing techniques for the mapping and monitoring of coral reefs. This major theme was guided by drs. J.C. Post (Euroconsult).

3. The use of remote sensing techniques for the mapping and monitoring of mangroves. This major theme was guided by ir. H.H. de Jongh (Haskoning).

In February samples of suspended matter were collected in the mouth of the river Rhône as part of the French GRECO-ICO programme.

In June D. Eisma participated in a Canadian research programme on suspended matter organized at B.I.O., Dartmouth, by K. Kranck. Use was made of the submersible PISCES IV.

In August a cooperation programme was set up with the Institute of Estuarine and Coastal Research (Prof. Chen), East China Normal University, Shanghai, China, for research at the Chang Jiang river mouth and adjacent parts of Hangzhou Bay. A preliminary agreement was made in May during a visit by D. Eisma to Shanghai. This project has been submitted to the respective governments for financing.

The consequences of the dumping of low-level radioactive waste in the N.E. Atlantic Ocean are investigated by the International Coordinated Research and Surveillance Programme (CRESP) of the Nuclear Energy Agency (NEA). The DORA project at NIOZ is the Dutch contribution to this programme.

During a workshop organized by UNESCO and the National Science Foundation (U.S.A.) NIOZ contributed to the development of a research programme for the study of factors influencing the productivity in the Caribbean coastal zone (Discovery Bay, Jamaica, 3-9 November 1985).

Dr. F. Colijn cooperated with the University of Hamburg during a survey (29 May - 8 June) in the German Bight. The relation between phytoplankton (bloom), species, primary production and nutrient concentrations was studied.

During 1985 a limited Dutch-Antarctic Programme, based on close cooperation with the German Polar Institute at Bremerhaven, took shape. A project, "Sediment-water interaction (nutrients, Al, Radon) in the Atlantic sector of the Antarctic Ocean", is to be carried out on board F.S. "Polarstern" in March and April 1986 in close cooperation with Dr. Gersonde and Dr. Westall (AWI). This project has been approved.

In cooperation with RIVO, research was done on food conditions of herring larvae and recruitment of herring populations in the North Sea (see 1.7.2. project B4-02).

As in 1984, work on the use of intertidal flats by coastal birds could be carried out by the participation in the project INTERWADER for S-E Asia. Studies were done on the foods and feeding behaviour of a number of bird species in Thailand, and the biomass of invertebrates was determined in a number of muddy intertidal flats (See 1.7.2. project B3-03b).

Part of the work on production and dynamics of macrobenthos in Wadden Sea and North Sea incorporated in the EC-project COST-47 (See 1.2.2.3.).

In cooperation with a number of Dutch Governmental Institutes (RIJP, RIN, RIZA and RWS-ADH) a study of the macrobenthic fauna in relation to sediment composition in the subtidal part of the western Wadden Sea, was continued. Results of a survey, including 454 sampling stations, will be published soon (See 1.2.2.2.).

1.7. LIST OF RESEARCH PROJECTS AND RESEARCH WORKERS

1.7.1. Hydrography (H)

- Chemical Oceanography and Marine Pollution department (B. Sundby)
- H1-01 Nutrient, oxygen and carbon investigations in Wadden Sea, North Sea and open ocean (S.B. Tijssen, W. Helder, H. Postma, C. Westra, assistants F. Wetsteyn, J.W. Rommets)
 - H1-02 Nitrogen cycle in the marine environment (W. Helder, J. Bakker, P. Kieskamp, assistant R.P.T. de Vries)
 - H1-03 Diagenetic processes of N-compounds in marine sediment under conditioned circumstances (J.F. Bakker, W. Helder, P. Kieskamp, assistant R.T.P. de Vries)
 - H1-04 Carbondioxide research (H. Postma, M. Hoppema, assistant J.W. Rommets)
 - H1-06 The early diagenesis of trace metals in coastal marine sediments (B. Sundby, L. Gerringa, assistant R.F. Nolting)
 - H1-07 North Sea research (B. Sundby, L. Gerringa, assistant R.F. Nolting)
 - H1-08 Snellius-II expedition (M.T.J. Hillebrand, R.F. Nolting)
 - H1-09 Trace metal geochemistry in sediments of the Skagerrak (B. Sundby, assistant R.F. Nolting)
 - H1-10 Identification of organochlorines and their fate in the marine environment (J.M. Everaarts, K. Booij, assistant M.T.J. Hillebrand)
 - H1-12 Estuarine research (J.M. Everaarts, assistant M.T.J. Hillebrand)
 - H1-13 Contaminants (J.M. Everaarts, assistant M.T.J. Hillebrand)
- Physical Oceanography department (C. Veth)
- H2-01 Marine optics 1: the euphotic zone of oceanic waters (D. Spitzer, assistants M.R. Wernand, M.W. Manuela)
 - H2-02 Marine optics 2: remote sensing of coastal waters (D. Spitzer, assistants M.R. Wernand, M.W. Manuela)
 - H2-03 Experimental dynamical oceanography (J.T.F. Zimmerman, C. Veth, J.J.M. van Haren, assistants M.W. Manuela, W.M.L. Lambrechts)
 - H2-04 Small-scale turbulence, mixing layers and thermocline studies (C. Veth, assistant W.M.L. Lambrechts)
 - H2-05 Theoretical dynamical oceanography (J.T.F. Zimmerman)
- Marine Geology and Geochemistry department (D. Eisma)
- H3-01 Sediment transport and sedimentation in the North Sea area (D. Eisma, T.C.E. van Weering, assistants G.W. Berger, S.J. van der Gaast, J. Kalf, J. van Iperen)
 - H3-02 Marine silica cycle (A.J. van Bennekom, J.H.F. Jansen, assistants G.W. Berger, S.J. van der Gaast, J. van Iperen)

- H3-03 Sedimentology and palaeoceanography of the Angola Basin and Zaire deep-sea fan (J.H.F. Jansen, T.C.E. van Weering, A.J. van Bennekom, assistants G.W. Berger, S.J. van der Gaast, J. van Iperen, J. Kalf)
- H3-04 Palaeomagnetism of sediment cores and sedimentological experiments of remanent magnetism (M.J. van Vreumingen, assistants: students)
- H3-05 Conversion of clay minerals in the sea (S.J. van der Gaast,)
- H3-06 Transport and sedimentation of suspended matter under the influence of the Scotland-Greenland Ridge flow system (D. Eisma, assistants S.J. van der Gaast, J. van Iperen, J. Kalf)
- H3-07 Sedimentation processes along continental margins (T.C.E. van Weering, assistants S.J. van der Gaast, J. van Iperen)
- H3-08 Geology and geochemistry of the floor of southern Indonesian deep-sea basins (J.H.F. Jansen, T.C.E. van Weering, W. Helder, assistants G.W. Berger, S.J. van der Gaast, J. van Iperen, J. Kalf)
- H3-09 Transport and deposition of suspended matter in some eastern Indonesian basins (D. Eisma, assistants J. Kalf, J. van Iperen)
- H3-10 Dating with naturally occurring isotopes (A.J. van Bennekom, D. Eisma, assistant G.W. Berger)

1.7.2. Biology (B)

Experimental systems (P.A.W.J. de Wilde)

- B1-01 Experimental systems (J.H. Vosjan, P.A.W.J. de Wilde, assistants E.M. Berghuis, A. Kok, E. Pauptit, G. Nieuwland)
- B1-02 The activity of micro-organisms (J.H. Vosjan, E. Pauptit, G. Nieuwland)
- B1-03 Bioturbation as environmental factor (J.H. Vosjan, P.A.W.J. de Wilde, assistants E. Pauptit, G. Nieuwland)
- B1-04 Energy consumption and production in dominant benthic faunal elements; community respiration (P.A.W.J. de Wilde, J.H. Vosjan, R. Dekker, assistant E.M. Berghuis, A. Kok, E. Pauptit, G. Nieuwland)
- B1-05 Coral research (R.P.M. Bak)
- B1-06 Microzooplankton (R.P.M. Bak, assistant G. Nieuwland)

Autecology (F. Creutzberg)

- B2-01 The role of carnivores in the tidal area (B. R. Kuipers, M. Fonds, H. van der Veer, J.J. Zijlstra, assistants P. van der Puyl, R. Dapper, J.I.J. Witte)
 - a Density-dependent mortality in juvenile plaice (J.J. Zijlstra, H.W. van der Veer)
 - b Food intake and growth (B.R. Kuipers)
 - c Energy budget and growth experiments (M. Fonds)
- B2-02 The role of the benthic fauna in the ecosystem of the southern North Sea (F. Creutzberg, M. Fonds, G.C.A. Duineveld, A.D.G. Dral, assistants G.J. van Noort, P. van der Puyl,)
 - a, b, c The role of carnivores in the benthic system (F. Creutzberg, G.J. van Noort)
 - d The energy budget of benthic carnivores (M. Fonds, P.P. v.d. Puyl)
 - e The role of secondary producers in the benthic system (G.C.A. Duineveld)
- B2-03 Carnivores in the pelagic system (B.R. Kuipers, R. Daan, assistant H.J. Witte)
- B2-04 Vision in Odontocetes (A.D.G. Dral)
- B2-05 Quantitative investigation of microzooplankton (A.D.G. Dral)
- B2-06 Mariculture (M. Fonds, assistant P. van der Puyl)
- B2-07 Benthos sampling programme in Zeeland coastal waters (P. Seip, assistant R. Brand)

Benthic systems (J.J. Beukema)

- B3-01 *In situ* production and input of organic matter (G.C. Cadée, assistant J. Hegeman)

- B3-02 a Secondary production and population dynamics in bivalves and other bottom fauna in the Wadden Sea (J.J. Beukema, assistants W. de Bruin, J. Zuidewind)
- b Ecology of bottom fauna in sediments along the coasts of western Europe (J.J. Beukema, assistants W. de Bruin, J. Zuidewind)
- B3-03 a The role of sea-birds in the food chain and population dynamics in the Wadden Sea and adjacent North Sea (C. Swennen, assistants P. Duiven, J. Zuidewind)
- b Comparison of the food system of sea-birds in tropical tidal areas and the Wadden Sea (C. Swennen, assistants P. Duiven, J. Zuidewind)
- B3-04 The chemical composition of marine organisms in relation to abiotic environmental circumstances (D.H. Spaargaren)
- B3-05 Variability in annual recruitment of benthic invertebrates living on tidal flats in the Dutch Wadden Sea (R. Dekker)
- Pelagic systems (H.G. Fransz)
- B4-01 The pelagic system of the non-stratified shelf area (H.G. Fransz, W.W.C. Gieskes, R. Daan, M.J.W. Veldhuis, F.A.C. Kouwets, assistants G.W. Kraay, S.R. Gonzalez)
- B4-02 The pelagic system of the semi-permanently stratified sea (H.G. Fransz, W.W.C. Gieskes, M.A. Baars, M.J.M. Reichert, assistants G.W. Kraay, S.R. Gonzalez, S.S. Oosterhuis, N. Schogt)
- B4-03 The pelagic system of the permanently stratified sea (M.A. Baars, W.W.C. Gieskes, J.J. Zijlstra, assistants G.W. Kraay, S.S. Oosterhuis, J.I.J. Witte, N. Schogt, W. Zevenboom (WOTRO), P. Schalk (WOTRO))
- B4-04 Population dynamics and bioenergetics in experimental pelagic ecosystems (W.C.M. Klein Breteler, M.J.M. Reichert, assistant S.R. Gonzalez)

1.7.3. Special projects

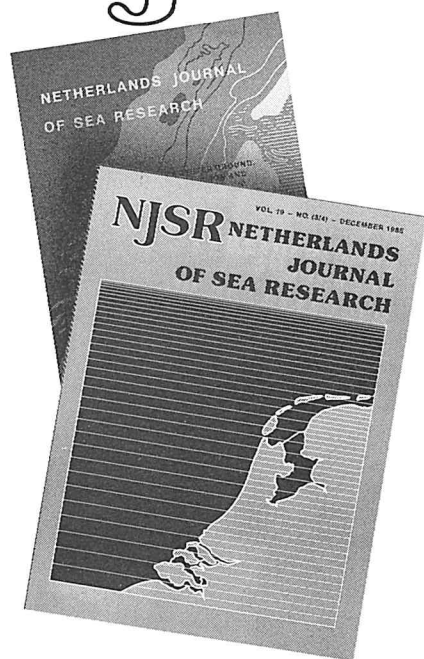
- S-01 Ecological Research North Sea and Wadden Sea (EON). M.A. van Arkel, J.W. Baretta, R.W.P.M. Laane, P. Ruardij, H.G.J. Schröder (died 16 September 1985), H.W. van der Veer, H. Ridderinkhof, W. Admiraal (stationed at University of Groningen), F. Colijn (allied scientist, University of Groningen), assistants A. Kop, J.P.F. Malschaert, M. Mulder, A. Stam, R. Kloosterhuis, L. Venekamp (stationed at University of Groningen), A.C. Bol-den Heijer.
- S-02 Biological and geochemical investigations in relation to the deep-sea disposal of low-level radioactive waste (DORA). M. Lavaleye, M.M. Rutgers van der Loeff, assistants D. Wayers (until 15 September), C.M. Oomens-Meeuwse (from 1 September), G.J. Zigterman (Energie Onderzoek Centrum Nederland, ministeries VROM en EZ, EC Brussels)
- S-03 Dutch joint monitoring programme on polychlorinated hydrocarbon. (M.T.J. Hillebrand).
- S-04 Oil Pollution Experiments (OPEX). (G.W.N.M. van Moorsel, P.A.W.J. de Wilde, assistants E.M. Berghuis, A. Kok (EC Brussels, Rijkswaterstaat Directie Noordzee, Nederlandse Aardolie Maatschappij, Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, afdeling Den Helder, Rijksinstituut voor Zuivering van Afvalwater, Rijksinstituut voor Natuurbeheer, afdeling Texel, Nederlands Instituut voor Onderzoek der Zee).
- S-05 Continuous liquid-liquid extractor. (M.T.J. Hillebrand.)

2. Scientific outcome

2.1. PUBLICATION

2.1.1. Netherlands Journal of Sea Research and other series issued

NJSR



During 1985, vol. 18 (1984) was completed as a special combined issue edited by R.H.D. Lambeck, H.J. Lindeboom and P.H. Nienhuis, under the title of "Lake Grevelingen: From an estuary to a saline lake. Structure and functioning of an evolving marine ecosystem." It contains 18 papers on research in the saline lake Grevelingen.

With vol. 19, the appearance of the Netherlands Journal of Sea Research has been changed. A larger page size rendered it possible to print in 2 columns. By the more efficient use of the space, the contents per page could be increased by 75%. A new cover in bright colours was designed by H. Hobbelink.

Number (1) of vol. 19 appeared in August with 9 papers, number (2) in November with 10 papers. Number (3/4), containing 11 papers, will appear in early 1986 as a special issue edited by W. Helder and F. Colijn, under the title of "Nutrients in estuaries: Eutrophication and other aspects."

Out of the 30 papers published in vol. 19, 13 are on marine biology, 14 on marine chemistry and 3 on other marine research topics. Among the first authors, 14 are from outside the Netherlands.

The only issue in the series Special Publications was the Annual Report 1984. It was erroneously numbered 10; this should have been 11. The number of Internal Reports completed in 1985 was only 2.

Miss A.C. Rijk left the editorial staff and was succeeded by Mrs J. Mulder and Mrs B. Bak.

2.1.2. Publications NIOZ 1985

- ARBOUW, G.J. Over de broedbiologie van de Stormmeeuw *Larus canus* op Texel.—*Limosa* **58**: 109-112.
- ARBOUW, G.J. & C. SWENNEN. Het voedsel van de stormmeeuw *Larus canus* op Texel.—*Limosa* **58**: 7-16.
- BAARS, M.A. & G.R. HELLING. Methodical problems in the measurement of phytoplankton ingestion rate by gut fluorescence.—*Hydrobiol. Bull.* **19**: 81-88.
- BAARS, M.A. & S.S. OOSTERHUIS. Zooplankton grazing in natural water with high concentration of ^{14}C bicarbonate: variable live controls and gut passage time.—*Hydrobiol. Bull.* **19**: 71-80.
- BAK, R.P.M. Recruitment patterns and mass mortalities in the sea urchin *Diadema antillarum*. Proc. 5th International Coral Reef Congress, Tahiti, 5: 267-272.
- BAKKER, J. & W. HELDER. Technical description of manufacturing and application of needle- and micro-oxygen electrodes in sediments. Addition to *Limnol. Oceanogr.* **30**: 1106-1109 (in mimeo).
- BARETTA, J.W. & J.F.P. MALSCHAERT. Experimental problems using electronic particle counters.—*Hydrobiol. Bull.* **19**: 21-27.
- BENNEKOM, A.J. VAN. Dissolved silica as an indicator of Antarctic Bottom Water penetration, and the variability in the bottom layers of the Norwegian and Iceland Basins.—*Rit Fiskideildar* **9**: 101-109.
- BENNEKOM, A.J. VAN, F. EIJGENRAAM & R.L. GROENEWEGEN. Deep CTD calibrations: pressure effects on conductivity and *in situ* accuracy of temperature. Hydrography Committee, ICES C.M. 1985/C: 4.
- BEUKEMA, J.J. Energie in oecosystemen. In: J.A.G. DAVIDS. Energie uit biologische systemen. Biologische Raad Reeks. PUDOC, Wageningen: 39-63.
- , Growth and dynamics in populations of *Echinocardium cordatum* living in the North Sea off the Dutch north coast.—*Neth. J. Sea Res.* **19**: 129-134.
- BEUKEMA, J.J., E. KNOL & G.C. CADÉE. Effects of temperature on the length of the annual growing season in the tellinid bivalve *Macoma balthica* (L.) living on tidal flats in the Dutch Wadden Sea.—*J. exp. mar. Biol. Ecol.* **90**: 129-144.
- BEUKEMA, J.J. & B.W. MEEHAN. Latitudinal variation in linear growth and other shell characteristics of *Macoma balthica*.—*Mar. Biol.* **90**: 27-33.
- BEUKEMA, J.J. & P.H. NIENHUIS. Processen in oecosystemen. In: K. BAKKER *et al.* Inleiding tot de oecologie. Bohn, Scheltema & Holkema, Utrecht: 323-348.
- BEWERS, J.M., P.A. YEATS, S. WESTERLUND, B. MAGNUSSON, D. SCHMIDT, H. ZEHLE, S.S. BERMAN, A. MYKYTINK, J.C. DUINKER, R.F. NOLTING, R.G. SMITH & H.L. WINDOM. An intercomparison of seawater filtration procedures.—*Mar. Pollut. Bull.* **16**: 277-281.
- BOON, J.P., Uptake, distribution and elimination of selected PCB components in juvenile sole (*Solea solea*) and effects on growth. In: Marine biology of polar regions and effects of stress on marine organisms, J.S. GRAY and M.E. CHRISTIANSEN. John Wiley and Sons, Chichester, UK: 493-512.
- BOON, J.P., J.C. DUINKER. Kinetics of individual polychlorinated biphenyl (PCB) components in juvenile sole (*Solea solea*) in relation to concentrations in water and to lipid metabolism under conditions of starvation. —*Aquat. Toxicol.* **7**: 119-134.
- BOON, J.P., M.B. VAN ZANTVOORT, M.J.M.A. GOVAERT & J.C. DUINKER. Organochlorines in benthic polychaetes (*Nephtys* spp.) and sediments from the southern North Sea. Identification of individual PCB components.—*Neth. J. Sea Res.* **19**: 93-109.
- BOUWMAN, L.A., K. ROMEYN & W. ADMIRAAL. On the ecology of meiofauna in an organically polluted estuarine mudflat.—*Estuar. coast. Shelf Sci.* **19**: 633-653.
- CADÉE, G.C. Macroaggregates of *Emiliana huxleyi* in sediment traps.—*Mar. Ecol. Prog. Ser.* **24**: 193-196.
- , Some data on seabird abundance in Indonesian waters, July/August 1984.—*Ardea* **73**: 183-188.

- CREUTZBERG, F. A persistent chlorophyll a maximum coinciding with an enriched benthic zone. In: P.E. GIBBS. Proc. 19th European Marine Biology Symposium. Cambridge Univ. Press, Cambridge: 97-108.
- DAAN, N. & J.J. ZIJLSTRA. Visserijbiologie. In: K. BAKKER *et al.* Inleiding tot de oecologie. Bohn, Scheltema & Holkema, Utrecht: 422-464.
- DEKKER, R. Een opmerkelijke korvangst.—Zeepaard 45: 33-35.
- . *Cuthona amoena* (Gastropoda: Opisthobranchia), een nieuwe naaktslak voor de Nederlandse fauna.—Zeepaard 45: 71-74.
- . Over de fauna op en rond scheepswrakken.—Zeepaard 45: 104-105.
- . The sudden appearance of *Aeolidiella glauca* (Gastropoda: Opisthobranchia) in Lake Grevelingen (S.W. Netherlands) in 1983 and 1984.—Zool. Bijdr. 30: 1-6.
- DRAI, A.D.G. Amphibious vision in dolphins. In: H.R. DUNCKER & F. FLEISCHER. Functional morphology in vertebrates. Fortschritte der Zoologie 30, Gustav Fischer Verlag, Stuttgart, New York: 707-709.
- DUINKER, J.C., M.T.J. HILLEBRAND, R.F. NOLTING & S. WELLERSHAUS. The river Ems: Processes affecting the behaviour of metals and organochlorines during estuarine mixing.—Neth. J. Sea Res. 19: 19-29.
- EISMA, D. Vietnam. In: E.C.F. BIRD & M.L. SCHWARTZ. The world's coastline. Van Nostrand Reinhold, New York: 805-811.
- . Het Waddengebied bij Mont St. Michel.—Waddenbull. 20: 76-78.
- EISMA, D., P. BERNARD, J.J. BOON, R. VAN GRIEKEN, J. KALF & W.G. MOOK (1984). Loss of particulate organic matter in estuaries as exemplified by the Ems and the Gironde estuaries.—Mitt. Geol.-Paläont. Inst. Univ. Hamburg, SCOPE/UNEP (Sonderb.) 58: 397-412.
- EISMA, D. & D.W. PARK. North Korea and South Korea. In: E.C.F. BIRD & M.L. SCHWARTZ. The world's coastline. Van Nostrand Reinhold, New York: 833-841.
- FONDS, M. Tongkweek.—Visserij 38: 113-118.
- FONDS, M., R. CRONIE, D. VETHAAK & P. VAN DER PUYL. Laboratory measurements of maximum daily food intake, growth and oxygen consumption of plaice (*Pleuronectes platessa*) and flounder (*Platichthys flesus*), in relation to water temperature and the size of the fish. Demersal Fish Committee, ICES C.M. 1985/G: 54: 1-7.
- FRANSZ, H.G. & S. DIEI. Secondary production of *Calanus finmarchicus* (Copepoda: Calanoidea) in a transitional system of the Fladen Ground area (northern North Sea) during the spring of 1983. In: P.E. GIBBS. Proc. 19th European Marine Biology Symposium. Cambridge Univ. Press, Cambridge: 123-133.
- FRANSZ, H.G. & J.H.G. VERHAGEN. Modelling research on the production cycle of phytoplankton in the Southern Bight of the North Sea in relation to riverborne nutrient loads.—Neth. J. Sea Res. 19: 241-250.
- GAAST, S.J. VAN DER & J.H.F. JANSEN. Apparent long spacings from clay-water gels, glasses, and crystalline materials due to total reflection of X-rays: a comment.—Clays Clay Miner. 33: 471-472.
- GAAST, S.J. VAN DER, K. WADA, S.I. WADA & Y. KAKUTO. Small-angle X-ray powder diffraction, morphology, and structure of allophane and imogolite.—Clays Clay Miner. 33: 237-243.
- HELDER, W. & J. BAKKER. Shipboard comparison of micro- and mini-O₂-electrodes for measuring O₂-distribution in marine sediments.—Limnol. Oceanogr. 30: 1106-1109.
- HELLING, G.R. & M.A. BAARS. Changes of the concentrations of chlorophyll and phaeopigment in grazing experiments.—Hydrobiol. Bull. 19: 41-48.
- HUMMEL, H. Food intake of *Macoma baltica* (Mollusca) in relation to seasonal changes in its potential food on a tidal flat in the Dutch Wadden Sea.—Neth. J. Sea Res. 19: 52-76.
- . Food intake and growth in *Macoma baltica* (Mollusca) in the laboratory.—Neth. J. Sea Res. 19: 77-83.
- . An energy budget for a *Macoma baltica* (Mollusca) population living on a tidal flat in the Dutch Wadden Sea.—Neth. J. Sea Res. 19: 84-92.

- IERLAND, E.T. VAN. Use of the flow cytometer in grazing studies.—Hydrobiol. Bull. **19**: 37-39.
- IPEREN, J. VAN & W. HELDER. A method for the determination of organic carbon in calcareous marine sediments.—Mar. Geol. **64**: 179-187.
- JANSEN, J.H.F. Middle and Late Quaternary carbonate production and dissolution, and paleoceanography of the eastern Angola Basin, South Atlantic Ocean. In: K.J. Hsü & H.J. WEISSERT. South Atlantic paleoceanography. Cambridge Univ. Press, Cambridge: 25-46.
- . Hiatuses in Mesozoic and Cenozoic sediments of the Zaire (Congo) continental shelf, slope, and deep-sea fan. In: K.J. Hsü & H.J. WEISSERT. South Atlantic paleoceanography. Cambridge Univ. Press, Cambridge: 197-204.
- JANSEN, J.H.F., A. KUIJPERS & S.R. TROELSTRA. N-S hemisphere climatic asymmetry: evidence from a major circulation shift 300,000 yrs BP.—Terra cognita **5**: 69.
- JENNESS, M.I. & G.C.A. DUINEVELD. Effects of tidal currents on chlorophyll a content of sandy sediments in the southern North Sea.—Mar. Ecol. Prog. Ser. **21**: 283-287.
- KLEIN BRETELER, W.C.M. Fixation artifacts of phytoplankton in zooplankton grazing experiments.—Hydrobiol. Bull. **19**: 13-19.
- KLEIN BRETELER, W.C.M. & S.R. GONZALEZ. Culture and development of *Temora longicornis* (Copepoda, Calanoida) at different conditions of temperature and food.—Syllogeus **58**: 71-84.
- KRAMER, C.J.M., J.P. BOON, J.C. DUINKER, J.M. EVERAARTS, M.T.J. HILLEBRAND, R.F. NOLTING & E.M. VAN DER VLIES. Contaminanten in de Wadden Zee en een vergelijking met de omliggende gebieden. Rapport Ministerie van Volksgezondheid en milieuhygiëne Project M 201: 1-127.
- KUIPER, J., N. ADMIRAAL, P. DE WILDE, R. DEKKER, W. WOLFF & C. BROUWER. The influence of dispersants on the fate and effects of oil in model tidal flat ecosystems. TNO Report R85/067: 1-11.
- KUIPER, J., P.A.W.J. DE WILDE & W.J. WOLFF (1984). Oil pollution experiment (OPEX). I. Fate of oil mousse and effects on macrofauna in a model ecosystem representing a Wadden Sea tidal mudflat. In: G. PERSOONE, E. JASPERS & C. CLAUS. Ecotoxicological testing for the marine environment, Vol. 2. State Univ. Ghent and Inst. Mar. Sci. Res., Bredene: 331-359.
- LAANE, R.W.P.M., W.W.C. GIESKES, G.W. KRAAY & A. EVERSDIJK. Oxygen consumption from natural waters by photo-oxidizing processes.—Neth. J. Sea Res. **19**: 125-128.
- LAANE, R.W.P.M. & V. ITTEKKOT. Dissolved and particulate carbohydrates in the Ems-Dollart estuary.—Mitt. Geol.-Paläont. Inst. Univ. Hamburg SCOPE/UNEP (Sonderb.) **58**: 385-395.
- LAVALEYE, M.S.S. & M.M. RUTGERS VAN DER LOEFF. Sediment biological properties. In: R.R. DICKSON, P.A. GURBUTT & P.J. KERSHAW. Interim oceanographic description of the North-East Atlantic site for the disposal of low-level radioactive waste, II. NEA/OECD, Paris: 56-62.
- LESTER, R.T. & R.P.M. BAK. Effects of environment on regeneration rate of tissue lesions in the reef coral *Montastrea annularis* (Scleractinia).—Mar. Ecol. Prog. Ser. **24**: 183-185.
- LEOPOLD, M.F., E.C.L. MARTEIJN & C. SWENNEN. Long-distance transport of prey from the intertidal zone to high-tide roosts by the Oystercatcher.—Ardea **73**: 76-82.
- LUDDEN, E., W. ADMIRAAL & F. COLIJN. Cycling of carbon and oxygen in layers of marine microphytes: A simulation model and its ecological implications.—Oecologia **66**: 50-59.
- MARTEIJN, E.C.L. & C. SWENNEN. Overwinterende grutto's *Limosa limosa* in ZW-Nederland.—Limosa **57**: 125-128.

- MOORSEL, G.W.N.M. VAN. Disturbance and growth of juvenile corals (*Agaricia humilis* and *Agaricia agaricites*, Scleractinia) in natural habitats on the reef of Curaçao.—Mar. Ecol. Prog. Ser. **24**: 99-112.
- . A simple device for simultaneously focusing and determining field size in underwater photography. In: J.D. GEORGE, G.I. LYTHGOE & J.N. LYTHGOE. Underwater photography and television for scientists. Oxford Univ. Press, Oxford: 48-55.
- NOORT, G.J. VAN & J.P.H.M. ADEMA. The genus *Macropodia* Leach, 1814 in the North Sea and adjacent waters, with the description of a new species.—Zool. Meded., Leiden **59** (28): 363-379.
- OOSTERHUIS, S.S. & M.A. BAARS. On the usefulness of digestive enzyme activity as index for feeding activity in copepods.—Hydrobiol. Bull. **19**: 89-100.
- POSTMA, H. Kooldioxyde en klimaatverandering.—Lucht en Omgeving **2**: 9-12.
- . Eutrophication of Dutch coastal waters.—Neth. J. Zool. **35**: 348-359.
- REDDINGIUS, J. & H.G. FRANSZ. Modellen. In: K. BAKKER *et al.* Inleiding tot de oecologie. Bohn, Scheltema & Holkema, Rotterdam: 349-375.
- RIJNSDORP, A.D., M. VAN STRALEN & H.W. VAN DER VEER. Selective tidal transport of North Sea plaice larvae *Pleuronectes platessa* in coastal nursery areas.—Trans. Am. Fish. Soc. **114**: 461-470.
- RUITER, R.S.C. DE & J.H.F. JANSEN. Two Pleistocene silicoflagellate biohorizons from the Angola Basin (SE Atlantic).—Mar. Micropal. **9**: 365-368.
- RUTGERS VAN DER LOEFF, M.M., J.-M. JACQUET, P. RUCH & A. WYTTEBACH. Sediment chemical and physical properties. In: R.R. DICKSON, P.A. GURBUTT & P.J. KERSHAW. Interim oceanographic description of the North-East Atlantic site for the disposal of low-level radioactive waste, II. NEA/OECD, Paris: 37-50.
- QVALE, G. & T.C.E. VAN WEERING. Relationship of surface sediments and benthic foraminifera distribution patterns in the Norwegian Channel (northern North Sea).—Mar. Micropal. **9**: 469-488.
- SINGH, S.M., A.P. CRACKNELL & D. SPITZER. Evaluation of sensitivity decay of Coastal Zone Colour Scanner (CZCS) detectors by comparison with *in situ* near-surface radiance measurements.—Int. J. Remote Sensing **6**: 749-758.
- SLOOT, H.A. VAN DER, D. HOEDE, J. WIJKSTRA, J.C. DUINKER & R.F. NOLTING. Anionic species of V, As, Se, Mo, Sb, Te and W in the Scheldt and Rhine estuaries and the Southern Bight (North Sea).—Estuar. coast. Shelf Sci. **21**: 633-651.
- SPAARGAREN, D.H. Origin of life: Oceanic genesis, panspermia or Darwin's "warm little pond"?—Experientia **41**: 719-727.
- . Elemental composition and interrelations between element concentrations in marine finfish, molluscs and crustaceans.—Neth. J. Sea Res. **19**: 30-37.
- . The significance of nitrate in the nitrogenous excretion of *Carcinus maenas*.—Neth. J. Sea Res. **19**: 119-124.
- SPAARGAREN, D.H. & A.D.G. DRAL. Overleven in de Waddenzee. Panda **21**: 118-120.
- SPAARGAREN, D.H. & R. MORS. The effect of environmental osmotic conditions on blood lipid levels of the shore crab, *Carcinus maenas*.—Comp. Biochem. Physiol. **80A**: 579-585.
- SPITZER, D. Indonesian marine environment remote sensing experiments (IMERSE) in het kader van de Snellius II expeditie.—Remote Sensing Nieuwsbrief **22**: 13-15.
- SPITZER, D. & R.W.J. DIRKS. Contamination of the reflectance of natural waters by solar-induced fluorescence of dissolved organic matter.—Appl. Optics **24**: 444-445.
- SUNDBY, B. & N. SILVERBERG. Manganese fluxes in the benthic boundary layer.—Limnol. Oceanogr. **30**: 372-381.
- SWENNEN, C. Iets over de vogels van het open water van IJsselmeer, Waddenzee en Noordzee.—Vogeljaar **33**: 208-214.
- . Steltlopers in Zuidoost Azië.—Vogels **29**: 174-177.
- SWENNEN, C., M.F. LEOPOLD & M. STOCK. Notes on growth and behaviour of the American razor clam *Ensis directus* in the Wadden Sea and the predation on it by birds.—Helgoländer Meeresunters. **39**: 255-261.

- TEMME, N.M. & J.T.F. ZIMMERMAN. On the theory of topographic vorticity production by tidal currents. Report AM-R 8506, CWI, Dept. Appl. Math.: 1-20.
- VEER, H.W. VAN DER. Impact of coelenterate predation on larval plaice *Pleuronectes platessa* and flounder *Platichthys flesus* stock in the western Wadden Sea.—Mar. Ecol. Prog. Ser. **25**: 229-238.
- VEER, H.W. VAN DER, M.J.N. BERGMAN & J.J. BEUKEMA. Dredging activities in the Dutch Wadden Sea: effects on macrobenthic infauna.—Neth. J. Sea Res. **19**: 183-190.
- VEER, H.W. VAN DER & W. OORTHUYSEN. Abundance, growth and food demand of the scyphomedusa *Aurelia aurita* in the western Dutch Wadden Sea.—Neth. J. Sea Res. **19**: 38-44.
- VELDHUIS, M.J.W. & W. ADMIRAAL. Transfer of photosynthetic products in gelatinous colonies of *Phaeocystis pouchetti* (Haptophyceae) and its effects on the measurements of excretion rate.—Mar. Ecol. Prog. Ser. **26**: 301-304.
- VLAS, J. DE. Secondary production by siphon regeneration in a tidal flat population of *Macoma balthica*.—Neth. J. Sea Res. **19**: 147-164.
- . Weide van vlees. Thesis University of Groningen: 1-131.
- VOOYS, C.G.N. DE. De biologie van de mossel.—Waddenbull. **20**: 60-63.
- VUGHTS, H.F. & J.T.F. ZIMMERMAN. The heat balance of a tidal flat area.—Neth. J. Sea Res. **19**: 1-14.
- WOLDENDORP, J.W. & J.J. ZIJLSTRA. Het milieu. In: K. BAKKER *et al.* Inleiding tot de oecologie. Bohn, Scheltema & Holkema, Utrecht: 25-68.
- WEERING, T.C.E. VAN & G.T. KLAVER. Trace element fractionation and distribution in turbidites, homogeneous and pelagic deposits; the Zaire Fan. Southeast Atlantic Ocean.—Geo-mar. Lett. **5**: 165-170.
- ZIJLSTRA, J.J. De Snellius II-expeditie.—Vakbl. Biol. **65**: 216-220.
- ZIJLSTRA, J.J. & J.IJ. WITTE. On the recruitment of O-group plaice in the North Sea.—Neth. J. Zool. **35**: 360-376.
- ZIMMERMAN, J.T.F. Radar images of the sea bed.—Nature, Lond. **314**: 224-226.

2.1.3. Internal Reports NIOZ 1985

- BAARS, M.A. Indonesian-Dutch Snellius II Expedition, Theme 3 "Pelagic Systems": Shipboard Report RV Tyro 9 February-10 March: 1-44.
- BAARS, M.C., T.C.J. BUISMAN, T.C.E. VAN WEERING, C. VAN ZWIETEN & J.J. ZIJLSTRA. Een nieuw onderzoekingsvaartuig voor de Noordzee: 1-32.
- CREUTZBERG, F., G.C.A. DUINEVELD & G.J. VAN NOORT. The effect of different numbers of tickler chains on beam-trawl catches. "Aurelia"-cruise reports on the benthic fauna of the southern North Sea. No. 1985-1.
- DAAN, R., B. KUIPERS, H. WITTE, S. GONZALEZ, H. WITTE & F. VAN DER ENDE. Zoöplankton ontwikkelingen in het kustgebied van de zuidelijke Noordzee. Resultaten van het veldwerk-project Meetpost Noordwijk 1984. No. 1985-2.
- EBENHÖH, W.A. A dynamic model of the redistribution of suspended silt in an estuary. BOEDE Publicaties en Verslagen, 1985-2: 1-21.
- EVERAARTS, J.M. Indonesian-Dutch Snellius II Expedition, Theme 5 "River inputs into ocean systems": Shipboard Report RV Tyro 10 December 26 December 1984:1-12.
- MULDER, M. Onderzoek naar de mogelijke effecten van lozen van TiO₂ afvalzuur op de macrobenthische fauna in de Noordzee. I. Survey.
- NOLTING, R.F. & DEDDI MOELYADI MOELYO. Improvement of trace metal determinations by studying water samples from the rivers Porong and Solo and the coastal area of Surabaya-Indonesia.
- NOLTING, R.F., IBRAHAM SUMANTA & DEDDI MOELYADI MOELYO. Preliminary survey: Study on dissolved trace metals in the Bay of Jakarta area.

- POSTMA, H. Indonesian-Dutch Snellius II Expedition, Theme 2 "Ventilation of deep sea basins": Shipboard Report RV Tyro 3 January-6 February 1985: 1-60.
- SPANJE, L.E.M. VAN. Problemen bij het quantitative gebruik van multispectrale luchtfotografie voor benthische diatomeeënpopulaties in getijdegebieden. BOEDE Studentenverslagen, 1985-1: 1-27.
- WEERING, T.C.E. VAN. Indonesian-Dutch Snellius II Expedition, Theme 1 "Geology and geophysics of the Banda Area and adjacent areas": Shipboard Report RV Tyro 13 March-24 March 1985: 1-18.
- WEERING, T.C.E. VAN. Indonesian-Dutch Snellius II Expedition, Theme 1 "Geology and geophysics of the Banda Area and adjacent areas": Shipboard Report RV Tyro 29 May-June 1985: 1-18.
- ZIJLSTRA, J.J. Indonesian-Dutch Snellius II Expedition, Theme 3 "Pelagic Systems": Progress Report of Cruise 1, July-August 1984: 1-39.

2.2. LECTURES, etc.

2.2.1. Colloquia and lectures at the institute

(titles translated)

- | | |
|-------------|--|
| 4 January | F. Creutzberg (NIOZ): (Development, growth and food uptake by the lesser weever population.) |
| 18 January | Preliminary results from REFLEX:
J.H. Vosjan (NIOZ): (Biomass (ATP) and respiration (ETS-activity).)
S.B. Tijssen (NIOZ): (Oxygen profiles.)
W.W.C. Gieskes (NIOZ): (Analysis of algae pigments by HPLC before, during and after a bloom of <i>Corymbellus aureus</i> .)
G.C. Cadée (NIOZ): (Sediment trap results.) |
| 25 January | J. Regtien (University of Groningen): (Interpretation of optical measurements in the western Wadden Sea.)
D. Eisma (NIOZ): (Aggregation and de-aggregation of silt in estuaries.) |
| 27 February | Investigations in the Voordelta:
A. Smaal (DDMI): (Marine environmental research by RWS.)
L. Kohsiek (DDMI): (Geomorphological developments in the Voordelta.)
P. Seip (NIOZ): (An account of bottom-fauna investigation in the Voordelta.) |
| 1 March | A. Rajendran (National Institute of Oceanography, Goa, India): Property-property relations and discontinuity layers in the Arabian Sea.
D. Spitzer (NIOZ): (Fluorescence in natural waters.) |
| 8 March | P.A. Haefner (Rochester Institute of Biology): The soft shell blue crab fishing industry.
J.J. Beukema (NIOZ): (The possible reaction of the bottom-fauna in the Wadden Sea to eutrophication.) |
| 29 March | M. Fonds (NIOZ): (Influence of water temperature on the growth of shrimp, shore crab, common starfish and young flatfish from the Wadden Sea.) |
| 19 April | J. Boere (L.H. Wageningen): (Uptake of cadmium by the lugworm <i>Arenicola marina</i> L.) |

M. Reichert (University of Amsterdam): (The effect of cadmium on certain oxygen binding properties of the blood of *Arenicola marina* L.)
 J.M. Everaarts (NIOZ): (In which chemical form do zinc, cadmium, lead and copper occur in the blood of the lugworm *Arenicola marina* L. and the flounder *Plathichtys flesus*?)

- 26 April F. Creutzberg (NIOZ): (A mortality estimate in the lesser weever.)
 H.G. Fransz (NIOZ): (A mortality estimate in the exponential phase of development in copepod populations with a continuous production.)
 B.R. Kuipers (NIOZ): (A mortality estimate in juvenile shrimps.)
 R. Daan (NIOZ): (A comparison of methods for the estimation of mortality in copepod populations.)
- 3 May N. Silverberg (University of Quebec at Rimouski, Canada): Variations of the input of organic matter from the water column to the sediment surface, and early diagenesis in the Laurentian Trough.
 R. Witlatch (University of Connecticut, USA): *In situ* experiments on animal-sediment relations in the deep sea.
 G. Duineveld (NIOZ): *Amphiura filiformis* in the southern North Sea.
- 10 May Recent geological and geochemical investigations in the Skagerrak:
 T.C.E. van Weering (NIOZ): (The Skagerrak: an introduction).
 W. Helder (NIOZ): (Why oxygen measurements in the sediment?)
 J.F. Bakker (NIOZ): (Construction and application of oxygen micro-electrodes).
- 23 May J.E. Cloern (Geological Survey of California, USA): Phytoplankton ecology in San Francisco Bay.
- 31 May H. de Baar (Cambridge University, U.K.): Rare earth elements in the Pacific and the Atlantic Ocean.
 H. Walbrinck (KNMI): First determinations of sea-water temperature in the North Sea with "High Resolution Picture Transmission".
- 25 June R. Reuther (Universität Oldenburg): Lidar remote sensing of the Sea.
- 5 July I.A. Mendelssohn (Louisiana State University, USA): Coastal erosion and land-loss in Louisiana.
- 30 August R.J. Miller (Halifax Fisheries Research Laboratory, Canada): Sea urchin disease and benthic communities in Nova Scotia, Canada.
- 13 September D.D. Adams (State University of New York at Plattsburg, USA): Geochemistry of gases in recent sediments with special reference to interfacial processes.
- 19 September P.J. Radford (Institute for Marine Environmental Research, Plymouth, UK): The validation and x-validation of ecosystem models.
- 25 September R. Tatsukawa (Ehime University, Matsuyama, Japan): Organochlorine and heavy metal pollution in the marine environment.

1 October	R.P. Brandli (Cape Fear Technical Institute, North Carolina, USA): Use of natural fluorescence to describe water type mixing in Cape Fear Estuary.
15 November	J.C. Relaxans (Université de Bordeaux I, France): Measurement of the electron transport system (ETS): methodology and application to the estuarine environment.
29 November	D. Eisma (NIOZ): (<i>In situ</i> observations of suspended particulate matter using a deep-sea submersible).
6 December	G. Billen (Université libre de Bruxelles, Belgium): A biochemical approach to the processes of organic matter utilization by planktonic bacteria in natural waters.
20 December	W. Schlager (Free University of Amsterdam): Carbonate platforms.

2.2.2. Lectures of NIOZ scientists given elsewhere

- Admiraal, W.: Bacterial activity during *Phaeocystis pouchetii* blooms in the North Sea. Groningen, 21 February.
- Baars, M.A.: Theme 3 "Pelagic Systems" of the Snellius-II Expedition. BPPL/LON, Jakarta, Indonesia, 5 February.
- Bak, R.P.M.: Community organization on coral reefs. University of Essen, BRD, 23 May .
- : Recruitment patterns and mass mortalities in the sea urchin *Diadema antillarum*. 5th International Coral Reef Congress, Tahiti, French Polynesia, 27 May - 1 June.
- : How do coral reefs respond to gradients in factors limiting primary productivity? Research planning workshop UNESCO/National Science Foundation USA, Jamaica, 4 November.
- Baretta, J.W.: Ecological implications of ecosystem modelling. IMER, Plymouth, U.K., 28 June.
- Bennekom, A.J. van: Estimates of residence times in deep Indonesian Basins, based on silicate measurements, LON, Jakarta, Indonesia, 8 February.
- : Deep CTD calibrations: Pressure effects on conductivity and *in situ* accuracy of temperature. ICES, London, U.K., 8 October.
- : (Dutch contribution to Antarctic research). Antarctisch Weekend, Leiden, 10 November.
- Beukema, J.J.: Recruitment, migration and growth of *Macoma balthica* in the Dutch Wadden Sea. Meeting Finnish Macoma workers, Tvärminne, Finland, 29 July.
- : Benthos responses to eutrophication of the Dutch Wadden Sea. European Marine Biology Symposium, Hirtshals, Denmark, 9-13 September.
- : Common patterns in the fluctuations of macrobenthic animal species living at different places in the Wadden Sea. Symposium COST- 647, Brussels, Belgium, 9-12 December.
- Cadée, G.C.: Transport of organic carbon by the river Ems. 4th workshop on transport of carbon and minerals in major world rivers, Tianjin, China, 15 May.
- : (Phytoplankton variation in time and space in the Dutch Wadden Sea). Nederlands-Vlaamse Kring van Diatomisten, Haarlem, 20 September.

- Eisma, D.: Transport and deposition of suspended matter in the North Sea. Geological Society, London, U.K., 9 January.
- : Study of individual marine and estuarine suspended particles by automated electron-probe X-ray microanalysis (P. Bernard, D. Eisma, R. van Grieken). Studiedagen Oceanologie, Brussels, Belgium, 4 March.
- : (Suspended matter flocculation in estuaries). Ned. Oceanografen Club, Den Haag, 18 April.
- : Suspended matter in the North Sea. Colloquia Geologisch-Paläontologisch Institut Univ. Hamburg, BDR, 23 April.
- : Flocculation of suspended matter in estuaries. Colloquia Institute of Estuarine and Coastal Research, Shanghai, China, 23 May.
- : Mud flat deposition along the Wenzhou coastal plain in southern Zhejiang, China (Wang Bao-can and D. Eisma). Symposium Clastic Tidal Deposits, Utrecht, 27 August.
- : Sediment transport and deposition in estuaries and the coastal sea. NATO-ASI Meeting, Aussois, France, 6 September.
- : Preliminary results Snellius-II programme legs 1a and 1b (Strait Makassar and the Flores Basin). Royal Neth. Acad. Sc., Amsterdam, 6 November.
- : Scientific research in the North Sea. North Sea Symposium, Goethe Institute, Rotterdam, 15 November.
- Everaarts, J.M.: (The uptake and distribution of cadmium in the lugworm *Arenicola marina*; the chemical form in which cadmium occurs in its blood and some effects on the respiratory properties of the haemoglobin). R.U. Utrecht, 7 June.
- Fonds, M.: (Breeding of soles). Eerste Aqua Cultuurdag Nederland, Ede, 12 January.
- : Laboratory measurements of maximum daily food intake, growth and oxygen consumption of plaice and flounder. Demersal Fish Committee, ICES, London, U.K., 7-12 October.
- Fonds, M. & A.D. Rijnsdorp: (Feeding and Growth). Symposium Biologische Raad "Als een vis in het water", Amsterdam, 16 November.
- Fransz, H.G.: The effect of *Phaeocystis* blooms on the development of copepod populations in Dutch coastal waters of the North Sea. Phaeocystis Workshop, University of Groningen, 21 February.
- : Effects of fresh water inflow on the plankton distribution, composition and production in the Dutch coastal waters of the North Sea. NATO Workshop on fresh water runoff, Bodø, Norway, 22 May.
- Gaast, S.J. van der: Small angle X-ray powder diffraction, morphology, and structure of allophane and imogolite. Congress of the Japanese Clay Mineral Society, Sendai, Japan, 16 October.
- Gieskes, W.W.C.: Phytoplankton and primary production in the oligotrophic North Atlantic. CSIRO Marine Laboratories, Hobart, Tasmania, Australia, 20 March.
- : Use of HPLC analysis in phytoplankton ecology. Institut für Meereskunde, University of Kiel, BRD, 14 June.
- Iperen, J. van: (Diatom research at NIOZ). RIN, Leersum, 9 February.
- Jansen, J.H.F.: (Series of lectures, Marine Geology). Hogere Zeevaartschool, Amsterdam, April-May.
- : Carbonate sedimentation and palaeoceanography during the Quaternary. Marine Geological Institute, Bandung, Indonesia, 23 May.
- : Palaeoceanography of the Angola Basin and palaeoclimate in west equatorial Africa during the Quaternary. Colloque du Comité Français de l'Union Internationale pour l'Etude du Quaternaire (INQUA), Paris, France, 23 November.

- Jansen, J.H.F., A. Kuipers, S.R. Troelstra: (A Northern-Southern hemisphere contrast in long-term changes of ocean and atmosphere circulation during the Quaternary). Institute for Meteorology and Oceanography (IMOU), Utrecht State University, 14 February.
- : N-S hemisphere climatic asymmetry: evidence from a major circulation shift 300 000 yrs BP. 75th Annual Meeting of the Geologische Vereinigung, Kiel, BRD, 2 March.
- Laane, R.W.P.M.: The nutritional value of organic matter in estuaries and its ecological implications. SCOPE/UNEP meeting, Tianjin, China, 20 May
- Lavaleye, M.S.S.: Abyssal meio- and macrofauna of the N.E. Atlantic dumpsite for low-level radioactive waste. Fourth Deep-Sea Biology Symposium, Hamburg, BRD, 25 June.
- : (Biological research of the NEA dumpsite area for low-level radioactive waste). Nederlandse Oceanografen Club, KNMI, De Bilt, 14 November.
- Nolting, R.F.: Difficulties occurring during sampling and analysis of natural waters for trace metals. DPMA, Bandung, Indonesia, 6 May.
- Postma, H.: Ventilation in deep-sea basins. LON, Jakarta, Indonesia, 8 February.
- : Lectures on estuarine research. University of New York, Stony Brook, U.S.A., 25-27 March.
- : Estuarine and coastal processes. University of Rhode Island, U.S.A., 28 March.
- : Coastal oceanography; Colloquium "Bordomer". Bordeaux, France, 9 October.
- : (The Snellius-II Expedition). Genootschap "Physica", Alkmaar, 4 November.
- : (The Snellius-II Expedition). Geologisch Museum, Leiden, 19 November.
- Rutgers van der Loeff: Methods for the study of sediment-water exchange. Instituto Nacional de Investigacao das Pescas, Lisbon, Portugal, 10 May.
- : Chemical fluxes through the sediment-water interface. Marine Geological Institute, Bandung, Indonesia, 23 May.
- : (Geochemical research of the dumpsite for low-level radioactive waste - implications for the dispersion of radionuclides). Nederlandse Oceanografen Club, KNMI, De Bilt, 14 November.
- Spitzer, D.: Remote sensing of the coastal marine environment. Pattimura University, Ambon, Indonesia, 2 August.
- Sundby, B.: L'effet de l'oxygène sur l'échange des métaux à travers l'interface eau/sédiment. Centre Champlain des Sciences de la Mer, Quebec, Canada, 28 May.
- : Echange des métaux de trace entre l'eau et le sédiment. Centre des Faibles Radioactives (CNRS/CEA), Gif-sur-Yvette, France, 5 September.
- : An *in situ* study of the release and uptake of trace metals at the sediment-water interface. Delta Institute for Hydrobiological Research, Yerseke, 11 September.
- : An *in situ* study of the release and uptake of trace metals at the sediment-water interface. Department of Analytical Chemistry, Free University of Brussel, Belgium, 24 September.
- : A short course of chemical oceanography; series of lectures. Department of Earth Sciences at the Free University of Amsterdam, November.
- Swennen, C.: Feeding strategies in the oystercatcher. 97. Jahresversammlung der Deutschen Ornithologen-Gesellschaft, Osnabrück, BRD, 2 October.
- : The ecology of waders in Pattani Bay. Prince of Songkla University, Pattani, Thailand, 15 November.
- : (Results of research on feeding ecology in oystercatchers in captivity). Workshop Scholeksteronderzoek, Haren, 27 November.
- Tijssen, S.B.: Hydrography and oxygen regime during the first cruise of Snellius-II, Theme 3, August 1984. LON-BPPL, Jakarta, Indonesia, 5 February.
- Veth, C.: (Turbulence measurements in the stratified and unstratified North Sea with a laser-doppler velocimeter). Inst. Meteorol. and Oceanogr., Utrecht, 14 March.

- Vosjan, J.H.: Biomass and respiratory activity of micro-organisms in the pelagic system of the Eastern Banda Sea and the Western Arafura Sea during south-east monsoon. Jakarta, Indonesia, 4 February.
- : (Microbiological research in east Indonesian seas, during the Snellius-II expedition). Wageningen, 9 May.
- : A sketchy outline of the fate of organic matter in the Dutch Wadden Sea, with special emphasis on sulfate in the sediment-water interface. Tvärminne, Finland, 18 October.
- Weering, T.C.E. van: Principles and practice of high resolution seismic profiling. Marine Geological Institute, Bandung, Indonesia, 7 March.
- : Deep-sea fan sediments and sedimentation. Marine Geological Institute, Bandung, Indonesia, 23 May.
- : (Geology of eastern Indonesia; an introduction to the Snellius- II expedition, theme 1). State Museum Geology and Mineralogy, Leiden, 29 November.
- : (Course in sedimentary geology). Hogere Zeevaartschool, Amsterdam, April.
- Wilde, P.A.W.J. de: General introduction to the biology of the Wadden Sea, with special reference to the bioturbative activities of benthic organisms. Int. Symposium on modern and ancient clastic tidal sediments, State University Utrecht, 30 August.
- Zijlstra, J.J.: First results of pelagic studies in the eastern Banda Sea, D. Nega University, Semarang, Indonesia, 18 June.
- : (Marine ecosystems; 18 lectures). Vakgroep Marine Biologie, R.U. Gronigen, (18 lectures) 24-28 June.
- : ("Introductory Lecture" of Symposium on Fishes), Biologische Raad. Amsterdam, 1 November.
- Zimmerman, J.T.F.: Non-linear winddriven ocean circulation: oscillatory forcing and rectification. IAPSO/IAMAP Assembly, Honolulu, U.S.A., 13 August.
- : (Physical oceanography), Lecture series International Institute for Hydraulic Environmental Engineering. Delft, January.
- : (Lecture series windwaves). University Utrecht, January - June.
- : (Lecture series long waves and tides). University Utrecht, September - December.

Posters

- Kuipers, B.R. & F. Creutzberg: (The Wadden Sea as a nursery for plaice). BION-Lustrum 1970-1985, Vrije Universiteit, Amsterdam, 31 May.
- Seip, P. e.a.: (Benthic fauna in Zeeland offshore waters). COST 647 Symposium "Long-term changes in coastal benthic communities", Brussels, Belgium, 9-12 December.

2.2.3. Advice offered

- Advice was given to private entrepreneurs and advisory agencies van Loon, Bakker, Birnbaum, Vleeschager, van der Meer, von Unruh, and others, about mariculture of sea bait organisms, particularly *Nereis virens* and lugworm species.
- Advice to Breegenbout Dredging and Reclamation B.V. on marine organisms potentially suited to accumulate toxic substances, April.
- Advice to Geosite Surveys (U.K.) about environmental studies near Qatar, Persian Gulf, July.
- Advice to Smaal (DDMI) and de Vries (W.L.) about deposit feeding organisms in coastal areas.
- On behalf of the Ministry of Foreign Affairs and Development Aid, advice was given on some computerized applications of technique and the updating of computer-orientated knowledge, during the final stage of the building and deployment of two vessels for marine geological research in India by the Geological Survey of India.

- Advice was given to Dr. Schaafsma, Waterbouwkundig Laboratorium, Delft, concerning disturbances by detritus in acoustic measurements of current velocity.
- Advice was given to the marine geology department of the Alfred Wegener Institut (AWI), Bremerhaven, BRD, on analysis of clay minerals from Antarctic sediments. Some technical adaptations were carried out on the X-ray diffraction equipment of the AWI.
- Advice was given to the National Science Foundation, Washington, D.C., U.S.A., on a regulatory biology programme.
- Advice was given to the Société Franco-Japonais on the need for a translating bureau for Japanese oceanographic literature.
- Advice was given to Nederlandse Brandwonden Stichting on the problems of ice-formation at very low temperatures.
- Within the scope of the project Satellite Remote Sensing of the Sea Bottom Reflection for the Location of Sandbanks advice was given to Volker Stevin Dredging B.V. and Ears B.V. regarding the radiative transfer model calculations.
- Participation in international press conference on the Snellius-II expedition, 22 October.
- Advice was given to a delegation of the Swedish Natural Science Research Council about oceanographic research in the Netherlands.
- Advice on suspended matter research was given to Bedford Institute of Oceanography, Dartmouth, Canada.

2.2.4. Visitors from abroad

Dr. H. de Baar, Cambridge, U.K.
 Drs. P. Bernard, Antwerpen, Belgium.
 Dr. G. Billen, Free University of Brussels, Belgium.
 Prof. K. Boström, Dep. of Geology, University of Stockholm, Sweden.
 Dr. Brandt, Cape Fear Technical Institute, U.S.A.
 Dr. J.C. Cloern, Geology Survey, California, U.S.A.
 Drs. K. van Craenenbroeck, Ghent, Belgium.
 Dr. J. Ehlers, Geologisches Landesamt, Hamburg, B.R.D.
 Dr. L. Granar, Geological Survey of Sweden.
 Dr. S. Grünig, Alfred Wegener Institut für Polarforschung, Bremerhaven, B.R.D.
 Dr. D. Hedberg, Swedish Natural Science Research Council, Sweden.
 Dr. P. Herman, University of Ghent, Belgium.
 Dr. H.J. Hirche, Alfred Wegener Institut für Polarforschung, Bremerhaven, B.R.D.
 Dr. G. Irion, Wilhelmshaven, B.R.D.
 Dr. Abdul Gani-Ilahude, Lembaga Oseanologi Nasional, Jakarta, Indonesia.
 Dr. G. Jacks, The Royal Institute of Technology, Stockholm, Sweden.
 Prof. Chen Jiyu, Shanghai, China.
 Young Won Jo, Institute of Marine Sciences, University of Pusan, South Korea.
 Dr. Issam Krouma, Agric. Secr. Syria.
 Dr. C. Lancelot, Free University of Brussels, Belgium.
 Prof. Dr. J. Lenz, University of Kiel, B.R.D.
 Ir. Badruddin Mahbub, DPMA, Bandung, Indonesia.
 Dr. J.M. Martin, Paris, France.
 Prof. Dr. L. Mayer, Dalhousie University, Halifax, Canada.
 Dr. U. Miller, Depart. of Quaternary Geology, University of Stockholm, Sweden.
 Dr. C. Mizota, Kyushu University, Fukuoka, Japan.
 Dr. He Qixiang, Qingdao, China.
 Dr. K. Reise, Biologische Anstalt Helgoland Litoralstation List of Sylt, D.B.R.
 Prof. R. Reymont, University of Uppsala, Sweden.
 Prof. O. Stephanson, Luleå Institute of Technology, Sweden.
 Dr. Sumantri Tahrir, Marine Geological Institute, Bandung, Indonesia.
 Ir. Syamsuddin, DPMA, Bandung, Indonesia.
 Dr. P. von Unruh, Académie de Montpellier, Centre régional universitaire, France.
 Dr. F. Westall, Alfred Wegener Institut für Polarforschung, Bremerhaven, D.B.R.
 Prof. Dr. E.M. van Zinderen Bakker, Dept. of Botany, Palynological Research, University of the Orange Free State, Bloemfontein, South Africa.

3. Nederlandse samenvatting van de wetenschappelijke resultaten

3.1. INLEIDING

Deze samenvatting is, evenals in vorige verslagen, ingedeeld in onderzoek betreffende de Waddenzee en andere estuaria, de Noordzee en de oceaan. Er wordt een kort overzicht gegeven van de resultaten van het onderzoek, dat in meer detail in het Engelse gedeelte van het verslag wordt besproken. Aansluitend experimenteel onderzoek wordt onder de meest in aanmerking komende van de bovengenoemde drie regionale rubrieken vermeld. In een vierde paragraaf wordt een kort overzicht gegeven van het onderzoek in speciale projecten.

Aangezien het werk in Indonesië halverwege het jaar was afgelopen kon weer meer aandacht aan onderzoek dichterbij huis worden besteed. Niettemin werd ook in de tweede helft van het jaar nog veel aandacht aan de uitvoering van resultaten van Snellius-II gegeven en aan het eind van het jaar kwamen de eerste Indonesische medewerkers naar het instituut.

3.1.1. Waddenzee en andere estuaria

Evenals in vorige jaren werd onderzoek uitgevoerd zowel in de voor het instituut van oudsher belangrijke Waddenzee als in andere estuaria en kustgebieden. Onderzoek in Indonesische kustwateren is onder Oceaan-onderzoek vermeld.

In de Waddenzee werd de stikstofcyclus bestudeerd, die sterk wordt beïnvloed door de zuurstofconcentratie. In experimenten met Waddenzeesediment, waaraan $^{15}\text{NO}_3^-$ was toegevoegd, werd vastgesteld dat bij lage O_2 -concentraties een relatief groter deel van het nitraat in moleculair stikstof (N_2) wordt omgezet (denitrificatie) dan in ammoniak (NH_4^+) (ammonificatie). In de stikstofcyclus speelt N_2O een belangrijke rol, omdat het een tussenproduct vormt bij zowel de nitrificatie als de denitrificatie, een reden waarom aandacht werd besteed aan een accurate en snelle bepalingmethode. In verband met het belang van de O_2 -gradient voor de stikstofcyclus in sedimenten werd het gebruik van micro- en naaldelectroden voor de O_2 -bepaling getest. Die O_2 -gradient wordt evenals de uitwisseling tussen sediment en bovenliggend water sterk beïnvloed door bioturbatie, hetgeen in experimenten werd aangetoond.

In de Golf van St. Lawrence (Canada) werd de vroege diagenese van sporen metalen in mariene sedimenten bestudeerd. Ten aanzien van mangaan (Mn) werd geconstateerd dat de uitwisseling tussen het gereduceerde en geoxideerde deel van het sediment kwantitatief veel belangrijker is dan tussen sediment en water, hetgeen tot ophoping van Mn in sedimenten leidt. Daarnaast werd het gedrag van cadmium en kobalt

bestudeerd, waarbij cadmium, dat sterk geassocieerd blijkt met deeltjes van biogene oorsprong en precipiteert onder anaerobe omstandigheden, zich blijkt op te hopen in het gereduceerde deel van het sediment. Kobalt daarentegen komt grotendeels voor in deeltjes van lithogene oorsprong en blijkt zich in het sediment vooral in het geoxideerde deel te bevinden.

In de Gullmarsfjord (Zweden) werden met behulp van op het sediment geplaatste klokken ("flux-chambers") experimenten verricht met betrekking tot het transport van metalen tussen water en sediment. Sommige metalen (Fe, Mn, Co) werden door het sediment opgenomen, maar andere (Cd, Cu, Ni, Zn) werden juist afgegeven, waarbij echter de O_2 concentratie in het sediment de transportrichting sterk beïnvloedde. Tijdens deze experimenten werd bovendien onderzoek gedaan naar de bruikbaarheid van de carbonaat productie als maat voor het totale benthische metabolisme (anaeroob en aeroob).

Onderzoek naar het voorkomen van zink, cadmium, lood en koper in diverse polychaeten, tweekleppigen en de garnaal in de Nederlandse Waddenzee liet geen afnemende concentraties van west naar oost zien. Hoge concentraties van Cd en Zn werden gevonden in organismen op het Balgzand, maar ook in de Dollard in het oosten.

Met behulp van lood-210 werd in de Waddenzee (Dollard en waterscheidingen) onderzoek verricht naar de verticale ouderdomsverdeling van het sediment. Hoewel vele verticale verstoringen het patroon beïnvloedden, kon een gemiddelde sedimentatiesnelheid van 10-20 cm per 100 jaar worden vastgesteld.

In verband met de onzekerheid over de relatieve betekenis van de mineralisatie van organisch materiaal in het water en de bodem van de Waddenzee werd zowel de ETS-activiteit (maat voor metabolisme) als het ATP-gehalte (maat voor biomassa) van diverse bodem- en watermonsters bepaald. De indruk bestaat dat zowel activiteit als biomassa in de bodem hoger waren dan in het water, maar aan de tweede interpretatie kleven voor beide grootheden nog bezwaren. Daarnaast werd getracht de intensiteit van de sulfaat reductie in monsters uit de wadbodem te bepalen, zowel *in situ* als in experimenten, waarbij relatief hoge snelheden werden gemeten die wijzen op het belang van de wadbodem bij mineralisatie.

Uit tellingen van fytoplankton organismen in de westelijke Waddenzee blijkt een geleidelijke toename in de periode 1973-1985, die vooral de flagellaten en in het bijzonder *Phaeocystis* betreft. Deze toename is in overeenstemming met de in 1984 gemelde toename in chlorofyllgehalten en primaire produktie in dit gebied, en met soortgelijke resultaten verkregen uit waarnemingen door anderen nabij Helgoland. Een nadere analyse van gegevens over het macrobenthos van de westelijke Waddenzee (Balgzand) betreffende een periode van ca. 15 jaar laten eveneens een duidelijke toename zien, zowel in aantallen dieren als in biomassa en productie. Waarschijnlijk zijn zowel het fytoplankton als het macrobenthos beïnvloed door eutrofiëring van het kustgebied.

Naast een geleidelijke toename vertoonden de meeste soorten van het macrobenthos in de getijdengebieden van de Waddenzee van Denemarken, Duitsland en Nederland grote variaties, die voor enkele soorten synchroon bleken te verlopen.

Er werd een begin gemaakt met onderzoek naar de recrutering van de macrofauna van de Waddenzee en met onderzoek aan protozoën.

3.1.2. Noordzee

In samenwerking met KNMI en Rijkswaterstaat werden metingen verricht aan kleinschalige turbulentie nabij onderwaterduinen, teneinde na te gaan in hoeverre deze turbulentie verantwoordelijk kan zijn voor oppervlaktepatronen zichtbaar gemaakt met "microwave" radar. Uit het onderzoek bleek dat turbulentieverschillen nabij duintoppen en -dalen niet optreden, waardoor het onwaarschijnlijk is dat verschillen in turbulentie verantwoordelijk zijn voor de waargenomen oppervlakteverschijnselen.

Ter bepaling van het verband tussen bodemafstand en de lengteschaal van door bodemfunctie gegenereerde eddies werden turbulentiemetingen verricht nabij het amphidromisch punt in de zuidelijke Noordzee, waar de stroomsnelheden in de loop van een getij nauwelijks variëren, en de waterkolom in een min of meer stationaire staat van turbulentie verkeert.

Voorbereidingen werden getroffen voor uitvoering van het Friese Front Project in 1986, een gecombineerd fysisch-chemisch-biologisch programma, waaraan verschillende Nederlandse en minstens één buitenlandse instituut zullen deelnemen.

Een theoretische analyse over niet-lineaire, windgedreven circulatie samen met het Mathematisch Centrum te Amsterdam, werd uitgebreid. Voorts werd een studie gemaakt van radarbeelden van het oppervlak van de Noordzee, welke de topografie van de zeebodem laten zien als gevolg van de interactie tussen getijstroomrichtingen en het windveld.

Uit resultaten verkregen over het transport van gesuspendeerd materiaal in de Noordzee, in voorafgaande jaren verzameld, blijkt dat gesuspendeerd materiaal geconcentreerd wordt in kustgebieden. Hiervoor zijn diverse factoren verantwoordelijk, zoals een quasi-estuariene circulatie nabij de kust, aanlandige golven, afluende wind en evenwijdig aan de kust verloopende stromingen. Dicht bij de kust wordt dit nog versterkt door een asymmetrisch getij.

Uit met boxcores in het Skagerrak genomen monsters werd in het oostelijk deel met behulp van het verval van ^{210}Pb een sedimentatiesnelheid van 40 cm per 100 jaar afgeleid, terwijl de snelheden in het centrale deel veel lager waren. De bovenste 2-4 mm van het sediment was goed gemengd door bioturbatie en daardoor aanmerkelijk ouder dan vers materiaal uit de water-sediment grenslaag. De goede menging van de bovenste laag bemoeilijkte de interpretatie van geochemische processen, waarbij in het bijzonder de stikstofcyclus werd bestudeerd. Nitraatmaxima corresponderen met hogere zuurstofconcentraties, waarbij nitraat wordt gevormd in de oppervlaktelaag. Ook Fe en Mn lieten een fraaie samenhang met het O_2 -profiel zien. Aan de hand van 3 monsters werd een gedetailleerde analyse gemaakt van de verticale verdeling van een 7-tal metalen.

In het Deltagebied en in de zuidelijke bocht van de Noordzee werd van enkele metalen de concentratie in de waterkolom nagegaan, in opgeloste en in particuliere vorm. De concentraties van alle metalen waren hoger in het Nederlandse en het Engelse kustgebied, waarbij zowel aanvoer door rivieren als het vrijkomen uit sediment en gedumpt slib een rol zal spelen. Cd, Ni en Zn kwamen vooral voor in opgeloste vorm, terwijl Fe en Mn vooral in deeltjes waren geconcentreerd.

Het modelleren van het planktonsysteem in de Zuidelijke Bocht in samenwerking met het Waterloopkundig Laboratorium werd voortgezet, waarbij een moeilijkheid blijft dat het model het maximum van de planktonbloei in juli-september geeft, terwijl in werkelijkheid de voorjaarsbloei het belangrijkste is. Een begin werd gemaakt met onderzoek naar beperkende factoren tijdens de zomer die niet in het model zijn opgenomen. Verrassend was dat de hoogste planktonbiomassa zuidelijk van de Rijn-Maas monding werd aangetroffen, in een gebied met hogere zomertemperaturen en Fe-concentraties en niet in het gebied noordoostelijk van de monding, in de pluim van rivierwater met lage zoutgehalten en hoge concentraties aan N, P en Si.

Het experimentele werk aan copepoden werd voortgezet, waarbij voor *Temora longicornis* gewerkt wordt met een populatie die reeds 50 generaties in cultuur is.

Tijdens een ten dele door BION gesteund onderzoek wordt het effect bestudeerd van predatie op de ontwikkeling van copepoden gedurende de zomer wanneer meestal een plotselinge afname in het bestand plaats vindt. Dit jaar werd bevestigd dat twee soorten - de zoöflagellaat *Noctiluca* en de hydromeduse *Phialidium* - de voornaamste predatoren vertegenwoordigen. Beide hebben het voornamelijk op copepodeeieren voorzien. Uit het onderzoek blijkt nu dat de eipredatie reeds geruime tijd voor de sterke afname in het copepodenbestand optreedt, maar dan ineens leidt tot een afname van de eiproductie van de copepoden, vermoedelijk samenhangend met een afnemend fytoplanktonbestand. Het effect van de predatie wordt mogelijk versterkt door het optreden van kannibalisme op nauplii onder deze omstandigheden.

Onderzoek met behulp van netten aan het macroplankton van de zuidelijke Noordzee gaf in voorgaande jaren aan dat dit plankton vooral talrijker is in kustgebieden. Dit jaar echter werden met behulp van acoustische methoden aanwijzingen verkregen dat concentraties kunnen voorkomen in frontsystemen.

De bemonsteringsmethoden, in gebruik bij het onderzoek naar de benthische fauna, werden vergeleken tijdens een bijeenkomst op het instituut van specialisten uit aan de Noordzee grenzende landen. Vooral de bemonstering van een zandige bodem leverde in kwalitatieve en kwantitatieve zin grote verschillen op, op een modderige bodem waren de verschillen geringer. De bijeenkomst was een voorbereiding van een internationaal gecoördineerd bemonsteringsprogramma voor Noordzee bodemfauna. Een vergelijking van de bodemfauna op drie stations met verschillende gehalte aan organisch materiaal in het sediment gaf aan dat de meiofauna minder snel toeneemt bij toenemend organisch gehalte dan de macrofauna. Uit onderzoek over de verspreiding van Echinodermen-larven rond een frontzone ten noorden van Texel bleek dat deze sterk gebonden is aan watermassa's, waarbij het front een scheidingslijn vormt.

In verband met het voorkomen van grotere epifauna-organismen, die bemonsterd worden met een fijnmazige trawl, werd het effect van kettingen

op de vangst nagegaan. Dit bleek gering op een modderige bodem, maar sterk op een zandbodem, waarbij het effect per soort verschilde.

Van diverse benthische carnivoren werd een energiebudget opgesteld, met als voornaamste variabelen temperatuur en voedselaanbod. De resultaten van dergelijk onderzoek aan schol en bot werden samengevat.

3.1.3. Oceaanonderzoek

De Snellius II-expeditie, een Indonesisch-Nederlands onderzoeksproject in de Oost-Indonesische wateren in de jaren 1984-1985, gecoördineerd door de Nederlandse Raad voor Zeeonderzoek, heeft ook in 1985 een grote invloed gehad op de activiteiten van het instituut. Tot 14 juni, de dag waarop het onderzoeksschip "Tyro" na een verblijf van bijna een jaar in Indonesische wateren naar Nederland vertrok, werden nog een aantal tochten uitgevoerd, waarbij vrijwel steeds personeel van het NIOZ betrokken was. Het onderzoek tussen januari en juni 1985 betrof de ventilatie van diepzeebekkens (1 tocht), pelagische systemen (1 tocht) en geologie (5 tochten). Na de deels stormachtige terugtocht, waarbij onderweg nog diverse waarnemingen werden verricht, arriveerde de "Tyro" op 2 augustus in Den Helder. Er kan worden teruggezien op een zeer geslaagde expeditie met verhoudingsgewijs zeer weinig oponthoud en technische storingen.

Er is een begin gemaakt met de uitwerking van het verzamelde materiaal, waarover volgens plan in november 1987 gerapporteerd zal worden op een symposium in Jakarta.

In de loop van het jaar namen de reeds enige jaren bestaande plannen voor Nederlandse deelname aan Antarctisch onderzoek vastere vormen aan. Die deelname wordt evenals de Snellius-II expeditie gecoördineerd door de Nederlandse Raad voor Zeeonderzoek. Voor de jaren 1985-1987 zal de uitvoering voornamelijk plaats vinden in samenwerking met het Alfred Wegener Instituut in Bremerhaven (B.R.D.), waarbij opgestapt wordt op het nieuwe zeer goed geoutilleerde onderzoekingsvaartuig R.V. "Polarstern". Voorlopig nemen een viertal instituten deel aan het onderzoek, nl. het IMOU, het RIN, de RGD en het NIOZ, waarbij volgens plan in 1986 van NIOZ-zijde 8-9 personeelsleden naar het Antarctisch zeegebied zullen gaan.

Voorts bereidt het instituut zich voor op een versterking van het Noordzee-onderzoek in de komende jaren. In verband hiermee werd onder meer op Texel, een onder auspiciën van de ICES georganiseerde bijeenkomst belegd, waarbij intercalibratie plaatsvond van bemonsteringsapparatuur voor bodemonderzoek in gebruik bij diverse instituten rond de Noordzee.

Daarnaast wordt, eveneens ten dele in internationaal verband, een onderzoek aan frontensystemen in de Noordzee (het Friese Front) voor het jaar 1986 voorbereid.

Tenslotte vindt in EON-verband beraad plaats over op het beheer van de Noordzee gericht onderzoek in de jaren 1987-1991.

3.1.4. Speciale projecten

Het project Ecologisch Onderzoek Noordzee en Waddenzee (EON) zette in het verslagjaar het werk aan het Eems-Dollard estuarium (DEMOD) voort. Een ecologisch simulatiemodel van dit estuarium werd voltooid en er werd een vergelijking gemaakt tussen dit model en dat voor het estuarium van de Severn en het Kanaal van Bristol. Het laatste geschiedde in samenwerking met onderzoekers van het IMER te Plymouth. De definitieve documentatie en publicatie van het model nadert zijn voltooiing.

Inmiddels werd een begin gemaakt met een soortgelijk model voor de westelijke Waddenzee, genaamd EMOWAD, onder andere door het verzamelen van ontbrekende gegevens over het gebied. Voorts werd in een aanvullend project gewerkt aan een hydrografisch model dat de wateruitwisseling tussen de Noordzee en de Waddenzee simuleert. In voorbereiding was verder onderzoek naar de oecologie van het Noordzeegebied. Een en ander wordt door interdepartementale gelden gefinancierd.

Een tweede project, genaamd DORA (Diepzee Onderzoek i.v.m. Radioactief Afval), eveneens interdepartementaal gefinancierd en tevens gesteund door de EEG, behelst onderzoek in een dumpingsgebied voor laag-radioactief materiaal in de noordoostelijke Atlantische Oceaan. Dit onderzoek had een geochemische en een biologische component. Deze studie zal in 1986 in hoofdzaak worden voltooid. Gestreefd wordt naar een voortzetting van het biologische programma.

In een overeenkomst met het RIZA werden watermonsters uit het Marsdiep, de Rijn en de Noordzee geanalyseerd op het voorkomen van gechlorideerde koolwaterstoffen.

Een vloeistof-vloeistof extractor genaamd ISABELLE (Instrument Suitable for Aqueous Bulk Exposure to Liquid-Liquid Extraction) en ontwikkeld op het NIOZ werd ingezet voor studie van de mogelijke reiniging van afvalwater van Cindu, een bedrijf voor verwerking van olie-afval te Uithoorn. Verder werd het instrument, in samenwerking met diensten in de provincie Noord-Holland, ingezet in het afvalgebied van de Volgermeer.

Een laatste project betreft OPEX ("Oil Pollution Experiment") dat de gevolgen bestudeert van de belasting met olie en oliedispersgentia van kunstwadden (MOTIFS of "model tidal flat ecosystems"). Dit is een samenwerkingsverband van het NIOZ, met het RIN en TNO. De experimenten worden uitgevoerd in bakken bij het RIN, Texel.

3.2. BEZOCHTE CONGRESSEN

Coastal Margins as Sediment Traps, Geological Society, Londen, Engeland, 9 januari: D. Eisma.

Expert Panel Meeting Radioactive Waste IAEA/IMO, Wenen, Oostenrijk, 14-18 januari: J.J. Zijlstra.

Workshop "Oecologie en Fysiologie van *Phaeocystis pouchetii*", Groningen, Nederland, 21 februari: W. Admiraal, F. Colijn, H.G. Fransz, R. Laane, M.J.W. Veldhuis.

75th Annual Meeting Geologische Vereinigung, Kiel, West-Duitsland, 27 februari - 2 maart: J.H.F. Jansen.

Geotagung, Kiel, West-Duitsland, 27 februari - 1 maart: A. J. van Bennekom.

IOC vergadering, Parijs, Frankrijk, 18-22 maart: J.J. Zijlstra.

ICES Meeting Benthos Working Group, Bremerhaven, West-Duitsland, 26-29 maart: F. Creutzberg, G.C.A. Duineveld, P.A.W.J. de Wilde.

Earsel/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors and Application, Straatsburg, Frankrijk, 31 maart - 3 april: D. Spitzer.

Seminar "Speciation of Fission and Activation Products in the Environment", Oxford, Engeland, 22-26 april: M.M. Rutgers van der Loeff.

Canadian Meteorological and Oceanographic Society Annual Meeting, Montreal, Canada, 11-12 May: B. Sundby.

SCOPE-UNEP, 4th workshop on transport of carbon and minerals in major world rivers, Tianjin University, Tianjin, China, 13-22 mei: G.C. Cadée, D. Eisma, R. Laane.

17th International Liège Colloquium on Ocean Hydrodynamics, Dynamical biological processes at marine physical interfaces, Luik, België, 13-17 mei: S.B. Tijssen, C. Veth.

CRESP-meeting (Coordinated Research and Surveillance Programme) georganiseerd door de Nuclear Energy Agency (NEA), Lissabon, Portugal, 13-17 mei: M.S.S. Lavaleye, M.M. Rutgers van der Loeff.

SCOR-COPE workshop, Luik, België, 17-19 mei: C. Veth.

NATO Freshwater/Sea Workshop, Bodø, Noorwegen, 29-25 mei: H.G. Fransz.

5th International Coral Reef Congress, Tahiti, Frans Polynesië, 27 mei - 1 juni: R.P.M. Bak.

International Conference on Pelagic Biogeography, Noordwijkerhout, Nederland, 29 mei - 5 juni: M.A. Baars, P.H. Schalk, J.J. Zijlstra.

BION-symposium "Biologisch Onderzoek als Levensvoorwaarde", Amsterdam, Nederland, 31 mei: D.H. Spaargaren.

Expanded Expert Panel Radioactive Waste, IMO, Londen, Engeland, 3-6 juni: J.J. Zijlstra.

Indonesisch-Nederlands Planning Commissie vergadering, afscheidsceremonie Tyro, Jakarta, Indonesië, 12-20 juni: H. Postma, J.J. Zijlstra.

4th Deep-Sea Biology Symposium, Hamburg, West-Duitsland, 23-29 juni, M.S.S. Lavaleye.

Symposium "Milieubeheer en Technologische Ontwikkeling", Eindhoven, Nederland, 4 juli: J.M. Everaarts.

Estuarine and Coastal Pollution, Plymouth, Engeland, 12-17 juni: J. Baretta, P. Ruardij.

Workshop Duits-Nederlandse samenwerking antarctisch onderzoek, Bremerhaven, West-Duitsland, 23-24 juli: J.J. Zijlstra.

Meeting Finnish Macoma workers, Twärminne, Finland, 29 juli: J.J. Beukema.

2nd International Phycological Congress, Kopenhagen, Denemarken, 4-10 augustus: W. Admiraal, F. Colijn.

Joint Assembly IAMAP/IAPSO, Honolulu, U.S.A., 4-17 augustus: J.T.F. Zimmerman.

Congress European Society for Comparative Physiology and Biochemistry, Barcelona, Spanje, 25-29 augustus: D.H. Spaargaren.

Modern and Ancient Clastic Tidal Deposits symposium, Utrecht, Nederland, 26-28 augustus: D. Eisma.

Foreland Basins, Freiburg, Zwitserland, 1-4 september: T.C.E. van Weering.

NATO-ASI Meeting on Physical and Chemical Weathering in Geochemical Cycles, Aussois, Frankrijk, 4-15 september: D. Eisma.

SCOPE General Assembly, Washington D.C., U.S.A., 9-13 september: H. Postma.

European Marine Biology Symposium, Hirtshals, Denemarken, 9-13 september: J.J. Beukema.

10th Symposium on Earth Tides, Madrid, Spanje, 23-27 september: J.T.F. Zimmerman.

97. Jahresversammlung Deutschen Ornithologen-Gesellschaft, Osnabruck, West-Duitsland, 1-6 oktober: C. Swennen.

"Bordomer", Colloquium Universiteit en K.v.K. Bordeaux, Bordeaux, Frankrijk, 7-11 oktober: H. Postma.

Scientific seminar on the application of distribution coefficients to radiological assessment models, CEC, Louvain-la-Neuve, Belgie, 7-11 oktober: M.M. Rutgers van der Loeff.

ICES Statutory Meeting, Londen, Engeland, 7-11 oktober: A.J. van Bennekom, B. Sundby, S.B. Tijssen, J.J. Zijlstra.

ICES, Demersal Fish Committee, Londen, Engeland, 7-12 oktober: M. Fonds.

Congress of the Japanese Clay Mineral Society, Sendai, Japan, 16-18 oktober: S.J. van der Gaast.

International seminar on Ecology of Photosynthetic Prokaryotes with special reference to Meromictic Lakes and Coastal Lagoons, Tvärminne, Finland, 17-20 oktober: J.H. Vosjan.

Symposium oliebestrijding op zee, op de kust en op binnenwateren, Delft, Nederland, 30 oktober: G. van Moorsel, P.A.W.J. de Wilde.

Workshop "Factors influencing organic productivity in Caribbean coastal zones", National Science Foundation/Unesco, Montego Bay, Jamaica, 3-9 november: R.P.M. Bak.

Colloque du Comité Français de l'Union Internationale pour l'Etude du Quaternaire (INQUA), Parijs, Frankrijk, 22-23 november: J.H.F. Jansen.

ESF-workshop over poolonderzoek, Oslo, Noorwegen, 27-29 november: J.J. Zijlstra.

COST 647 Symposium "Long-term changes in coastal benthic communities", Brussel, België, 9-12 december: J.J. Beukema, F. Creutzberg, R. Dekker, G.C.A. Duineveld, P. Seip, P.A.W.J. de Wilde.

Congres Raad van Europa en EAMST (European Association of Marine Science and Technology), Lissabon, Portugal, 16-19 december: H. Postma.

Annual Conference Paleontological Association, Aberystwyth, Wales (U.K.), 18-21 december: G.C. Cadée.

3.3. BESTUURSFUNCTIES

- M.A. Baars
 - lid Technische subcommissie Snellius-II, Nederlandse Raad voor Zeeonderzoek
 - assistent coördinator Pelagische Systemen Snellius-II
- R.P.M. Bak
 - lid redactieraad Marine Ecology Progress Series
 - lid redactieraad Coral Reefs
 - adviseur wetenschappelijke studiekring Nederlandse Antillen
 - adviseur Biological Oceanography Program, National Science Foundation, USA
 - lid Council International Society for Reef Studies
 - docent (ad-Honorem) University of Puerto Rico
 - lid Committee Scientific Reference Assessment Caribbean
- A.J. van Bennekom
 - lid werkgroep Antarctica van IUCN-ledencontact
 - lid planningsgroep klimaatgericht oceaanonderzoek
- J.J. Beukema
 - coördinator van de sectie "Intertidal soft bottoms" van het EG-project COST-47 (Coastal marine benthos)
 - hoofdredacteur van het Netherlands Journal of Sea Research
- G.C. Cadée
 - lid commissie voor buitenlandse marien-biologische stations KNAW
 - lid DORA commissie (diepzee opberging radioactief afval)
 - bestuurslid BION werkgemeenschap aquatische oecologie
- F. Creutzberg
 - lid ICES Benthos Working Group
- G.C.A. Duineveld
 - lid ICES Benthos Working Group
- D. Eisma
 - lid ICES working group on marine sediments in relation to pollution
 - lid adviesgroep marien aardwetenschappelijk onderzoek van de Koninklijke Nederlandse Akademie (NRZ)
 - lid SCOR working group 46, river input into the ocean systems
 - lid projectgroep slibeigenschappen en coördinatiecommissie slib van de Raad van Overleg fysisch oceanografisch onderzoek Noordzee
 - voorzitter AWON werkgroep mariene geologie
 - lid commissie geologische wetenschappen van de KNAW
 - lid beheerscommissie ZWO laboratorium Isotopengeologie
 - lid werkgroep Afvalgips en Vliegass Gezondheidsraad
 - lid gebruikerscommissie Laser-korrelgrootte bepalingen
 - adviserend hoogleraar East China Normal University
 - docent oceanografie Rijksuniversiteit Utrecht
- J.M. Everaarts
 - lid commissie biologische problemen koelwater
 - lid contactgroep water van de commissie TNO/CNB voor onderzoek inzake nevenwerkingen van bestrijdingsmiddelen
 - lid begeleidingscommissie VROM, project contaminantenonderzoek Waddenzee
 - lid projectgroep Biologische Toxicologie; BION werkgemeenschap Stofwisselingsfysiologie

- lid werkgemeenschap mariene monitoring (W-MM)
M. Fonds
- lid ICES Mariculture Committee
H.G. Fransz
- lid beoordelingscommissie werkgemeenschap theoretische biologie (BION)
- lid commissie mariene biologie van de Nederlandse Raad voor Zeeonderzoek
W.W.C. Gieskes
- lid werkgroep remote sensing van de Nederlandse Raad voor Zeeonderzoek
- lid SCOR-UNESCO werkgroep 78 bepaling pigmenten voor fotosynthese in zee-
water
J.H.F. Jansen
- penningmeester Sedimentologische Kring, Koninklijk Nederlands Geologisch
Mijnbouwkundig Genootschap
R.W.P.M. Laane
- lid begeleidingscommissie Balans Seston kwaliteit (DGW)
M.S.S. Lavaleye
- lid taakgroep biologie van het Coordinated Research and Surveillance Programme
(CRESP) van de Nuclear Energy Agency (NEA)
H. Postma
- lid Nederlandse Raad voor Zeeonderzoek
- lid Scientific Committee on Oceanic Research (ICSU)
- lid Raad van Overleg fysisch oceanografisch onderzoek van de Noordzee
- lid Nederlandse UNESCO-commissie
- lid Koninklijke Akademie van Wetenschappen
- voorzitter Nederlandse Commissie voor SCOPE (Scientific Committee on Prob-
lems of the Environment)
- lid deskundigencommissie BOEDE
- lid "Comité de perfectionnement" van het Institute Océanographique, Parijs en
Monaco
- voorzitter bestuur Beyerinck-Popping fonds
- lid Waddenzee-adviesraad
- lid CO₂-commissie van de gezondheidsraad
- voorzitter wetenschappelijke commissie Biologische Anstalt Helgoland,
Hamburg
J.W. Rommets
- secretaris van de technische commissie van het Nederlands Centrum van Ocea-
nografische gegevens
M.M. Rutgers van der Loeff
- lid taakgroep Geochemie en fysische oceanografie van het Coordinated Re-
search and Surveillance Programme (CRESP) van de Nuclear Energy Agency (NEA)
H.G.J. Schröder
- lid begeleidingscommissie BALANS (DIHO en DDMI)
D.H. Spaargaren
- secretaris van de commissie voor buitenlandse marien-biologische stations van
de Koninklijke Akademie van Wetenschappen
- lid Crustacean Society, Washington, U.S.A.
- lid Society for Experimental Biology, London, U.K.
- lid groupement pour l'avancement de la Biochimie marine, Gif/Yvette, Frankrijk
D. Spitzer
- lid werkgroep remote sensing van de Nederlandse Raad voor Zeeonderzoek
- lid werkgroep zichtbaar licht in open water van Rijkswaterstaat
- lid gebruikerswerkgroep CAESAR-project van het Nationaal Lucht- en Ruimte-
vaart Laboratorium
- lid SCOR working group 70: remote sensing of the oceans from satellites van de
scientific committee for oceanic research
- lid ocean colour working group van de European Space Agency
- lid taakgroep ERS-1 programma voor Nederland, Ministerie van Verkeer en Wa-
terstaat.

- B. Sundby
 - Adjunkt professor, Université du Québec à Rimouski (Canada)
 - lid Commissie voor Chemische oceanografie (NRZ)
 - lid ICES Working Group on Sediments in relation to Marine Pollution
 - lid ICES Marine Environmental Quality Committee
- C. Swennen
 - lid werkgroep bijlage VEG-vogelrichtlijn
 - lid Nederlandse sectie International Council of Birds Preservation (ICBP)
 - nationaal kontaktpersoon sea duck branch van het International Waterfowl Research Bureau (IWRB)
- S.B. Tijssen
 - lid hydrography committee van de ICES
 - lid commissie oceanografische informatie-uitwisseling van de Nederlandse Raad voor Zeeonderzoek
 - lid subcommissie Data en Informatiezaken, planningscommissie Snellius-II, Nederlandse Raad voor Zeeonderzoek
- C. Veth
 - lid coördinatiegroep WST van de Raad van Overleg voor het fysisch oceanografisch onderzoek van de Noordzee
 - corresponding member of SCOR working group 69 (small scale oceanic/turbulence)
 - lid programmaraad van de werkgemeenschap meteorologie en fysische oceanografie van ZWO
 - lid van de gebruikersgroep van laser-doppler snelheidsmeettechniek
- T.C.E. van Weering
 - lid werkgroep Noordzee van de samenwerkende milieu-organisaties
 - Nederlands correspondent voor de International Association of Sedimentologists
 - lid Technische subcommissie Snellius-II, Nederlandse Raad voor Zeeonderzoek
 - assistent coördinator mariene geologie, Snellius-II
 - lid werkgroep Bodem van de Raad van Overleg voor het Fysisch en Oceanografisch Onderzoek van de Noordzee
 - secretaris van de Nederlandse Oceanografen Club
- P.A.W.J. de Wilde
 - lid commissie van beheer Delta Instituut
 - adviseur wetenschappelijke studiering Nederlandse Antillen
 - lid Nederlandse commissie voor internationale natuurbescherming
 - lid stuurgroep OPEX
 - lid projectgroep OPEX
 - lid natuurbeschermingsraad, Ministerie voor Landbouw en Visserij
 - lid coördinatorenoverleg internationaal Waddenonderzoek
 - lid ICES North Sea Benthos Working Group
 - lid begeleidingsgroep macrobenthos, Oosterschelde
- P. de Wolf
 - lid voorlopige commissie voor de milieueffectrapportage
- J.T.F. Zimmerman
 - voorzitter a.i. commissie fysische oceanografie van de Nederlandse Raad voor Zeeonderzoek
 - lid dagelijks bestuur werkgemeenschap MFO-ZWO
 - lid programmaraad werkgemeenschap MFO-ZWO
 - lid redaktieraad Continental shelf research
 - IAPSO vertegenwoordiger nationaal UGGI comité
 - lid van de Rijkscommissie voor Geologie
 - lid van de subcommissie mariene geologie van de RCG
 - lid van de begeleidingscommissie voor het STW project: "Mathematische methoden voor een analyse van speciale atmosferische modellen", Centrum voor Wetenschap en Informatica, Amsterdam
 - lid planningscommissie "Klimaatgericht oceaanonderzoek" van de CFO-NRZ
 - correspondent van Natuur en Techniek

J.J. Zijlstra

- lid bestuur Nederlandse Raad voor Zeeonderzoek
- voorzitter commissie mariene biologie van de Nederlandse Raad voor Zeeonderzoek
- lid planningscommissie Snellius-II
- lid Koninklijke Nederlandse Akademie van Wetenschappen
- vice-voorzitter van de Biologische Raad
- lid Commissie van Beheer van het Limnologisch Instituut
- lid wetenschappelijke commissie van het Rijksinstituut voor Natuurbeheer (RIN)
- lid biological oceanography committee ICES
- voorzitter SCOR-UNESCO werkgroep 65: coastal-offshore interactions
- lid Raad van Overleg Biologisch-Chemisch onderzoek Noordzee

3.4 STUDENTENONDERZOEK

Als onderdeel van hun doctoraalstudie of als stagiaire namen de volgende personen deel aan het onderzoek (nummers verwijzen naar project, zie sectie 1.7).

R. Bakker	R.U. Utrecht	H1-08
G.J. v.d. Berg	R.U. Utrecht	H3-08
H. Bos	G.U. Amsterdam	H3-01
B. Bouwmeester	G.U. Amsterdam	B2-01c
P. Breed	R.U. Groningen	EON
C. van den Brink	L.H. Wageningen	B1-02
A. de Buck	T.H. Eindhoven	H1-09
C.C.M. de Cocq van Delwijnen	SOL Utrecht	B3-04
M.J.E. Carpay	G.U. Amsterdam	B1-05
R.W.J. Dirks	R.U. Utrecht	H2-02/H2-05
F.M. Ellenbroek	L.H. Wageningen	Opex
H. Elzinga	G.U. Amsterdam	H2-02
F. van de Ende	V.U. Amsterdam	B4-01
M. Engelkes	R.U. Groningen	B4-01/02/EON
A. van Ginkel	SOL Utrecht	B3-04
S. Hartman	L.H. Wageningen	B4-04
M.M.J. Haver	V. d. Broek Instituut Amsterdam	B3-04
T. Ietswaard	R.U. Groningen	EON
Z. Jager	L.H. Wageningen	B4-02
P. Lock	R.U. Utrecht	H1-02,03
A.M. van der Niet	R.U. Leiden	B3-04
P. Nonhebel	T.H. Eindhoven	EON
A. Oost	R.U. Utrecht	H3-08
P.J. Pestman	R.U. Utrecht	H3-03
K. Phillipart	L.H. Wageningen	H2-02
M. Rebers	L.H. Wageningen	H3-01
M. van Rijssel	R.U. Groningen	H1-02,03
I. Sprong	G.U. Amsterdam	H3-06
M. Starink	G.U. Amsterdam	EON
A. Stolk	R.U. Utrecht	H3-01
M. de Vries	R.U. Utrecht	EON
O. Weaver	R.U. Utrecht	H3-03
A. Wijnkoop	Laboratoriumschool Rijnland	H3-02
H. Wortelboer	G.U. Amsterdam	H1-09

3.5. CURSUSSEN, VERGADERINGEN EN EXCURSIES

3.5.1. NIOZ cursussen

De cursus "Mariene Ecosystemen" werd gegeven van 10 tot 22 juni. Er namen 34 studenten aan deel, waarvan 19 de opleiding Mariene Biologie in Groningen volgen. Ook dit jaar had de cursus als thema de stofkringloop in het bentische en het pelagische systeem van de Waddenzee.

De cursus "Inleiding in de oceanologie" werd gegeven van 11 februari tot 8 maart. Er waren 28 deelnemers, van wie de helft afkomstig was van de R.U., Groningen. Deze cursus is een onderdeel van het tweedejaars curriculum mariene biologie in Groningen. De studenten verbleven voor het praktische gedeelte van de cursus van 11 tot 15 februari en van 25 februari tot 1 maart op het NIOZ. De geplande vaardagen konden ten gevolge van ijsgang geen doorgang vinden.

Van 19 tot 23 augustus werd de oude stijl cursus "Oceanografie" gegeven voor 12 studenten. In deze cursus lag de nadruk voornamelijk op de fysische en chemische aspecten van zeeonderzoek. Studenten van de opleiding fysische oceanografie aan het Instituut voor Meteorologie en Oceanografie van de R.U. vormden een belangrijke component van het aantal deelnemers. Er werd goed en enthousiast gewerkt.

3.5.2. Ontvangen gezelschappen van verwante instituten, overheidsdiensten, e.d.

21 februari	excursie biologie studenten Laboratorium voor Experimentele Entomologie (UVA). Inleiding: J. Everaarts
7 maart	excursie 2e klas MTS-IJmond 50 personen
19 maart	excursie Prof. D. Stoddart uit Cambridge + 17 studenten contactpersoon: R. Bak
20 maart	Stichting Opleiding Leraren (20). Inleiding: Joop Bakker
27 maart	Hoger Rijksinstituut voor Tuinbouw (België) 25 personen. Inleiding: M. Rutgers v.d. Loeff
15 april	excursie 5e klas HAVO (Aardrijkskunde)
24 april	excursie Hogere Laboratorium Opleiding te Leeuwarden (30 personen). Inleiding: J. Everaarts
7 mei	Vrouwenvereniging De Waal (8 personen)
9 mei	Mavo Hilversum
14 mei	C.F. Gauss Gymnasium Hockenheim. Inleiding: B. Kuipers
15 mei	Fryske Academie (60 personen).
16 mei-19 mei	Groninger Biologen Duikvereniging
21 mei	J. de Wit Gymnasium.
22 mei	Stichting Opleiding Leraren (20 personen) Inleiding: W. Gieskes.
28 mei	3e klas MAVO uit Voorschoten (50 personen)

30 mei	Bakhuis Rozeboom Instituut uit Beverwijk HLO-chemie (16 personen)
10 juni	Lagere school uit Alkmaar
24-25 juni	Dr. R. Reuter uit Oldenburg met 20 studenten.
25 juni	Sportcomplex Groenendaal uit Heemstede (50 tot 60 personen)
16 augustus	Instituut voor Pre-en Protohistorie (IPP) uit Amsterdam (10 personen). D. Eisma en F. Jansen
21 augustus	International Institute for Hydraulic and Environmental Engineering (30 personen). B. Sundby.
28 augustus	Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer (40 tot 50 personen) J. Everaarts
5 september	TH-delft (15 tot 25 personen) Spreker: H. Postma
25 september	Haagse Katholieke PABO uit Den Haag (10 personen) o.l.v. A. Cost Budde
26 september	Zeevaartschool Den Helder (20-25 personen)
26-29 september	Bijeenkomst van de IBAC (International BIO Acoustics Committee). (36 personen)
4 oktober	4e klas HAVO Maurix college uit Vught (20 personen) contactpersoon: K. Margry
8 oktober	PABO uit Sittard (14 personen)
10 oktober	PABO uit Ede (30 personen)
16 oktober	Universiteit van Hamburg (20 personen)
5 november	LEAO Den Helder
28 november	Landmeetkundig Gezelschap "SNELLIUS" (48 personen) Inleiding: J. Zimmerman.
12-13 december	BION werkgemeenschap Ethologie.
26-29 september	Bijeenkomst van de IBAC (International BIO Acoustics Committee). (36 personen)

4. HULPAFDELINGEN

4.1. Bibliotheek

In 1985 werden 62 boeken en 2 atlassen aangeschaft. 8 lopende series van boeken bleven gehandhaafd.

Met ingang van 1985 heeft de bibliotheek abonnementen op de volgende tijdschriften:

- Marine Environmental Research (vol. 15, 1985)
- Continental Shelf Research (vol. 4, 1985)

Via het RIN ontvangen we het volgende tijdschrift:

- Wetlands, Journal of the Society of Wetlands Scientists (vol. 1, 1981)
- Journal of Coastal Research ontvangen we gratis van CERF, Florida. (no. 1, 1985)

Uitbreiding door ruil met Neth. J. Sea Res.:

- Japanse Antarctic Research Data Reports, Expedition, National Institute of Polar Research, Tokyo. Marine Biology & Oceanography (1984)
- Galaxea, Publication of Sesoko Marine Science Center, Univ. Ryukyus, Japan (vol. 2, 1983)
- Indian Journal of Marine Sciences (13 (3), 1983)
- Technical Report Series, Univ. George Skiaway Island (no. 1, 1984)
- Bothnian Bay Reports, Perameri Research Station, Oulu (no. 2, 1980)
- Meddelande Huso Biologiska Station, Abo Akademi, Aland Finland (no. 14, 1969)
- Berichte aus dem Institut für Meereskunde, Christian Albrechts Univ., Kiel (48, 1978)
- Berichte zur Polarforschung (no. 1, 1982)

4.2 Rekencentrum

In 1985 werd het bestaande NORD-100 computersysteem uitgebreid door de plaatsing van een NORD-530 (een 32-bits minicomputer), een schijfgeheugen van 450 MB, een magneetbandeenheid; een intelligente AO-plotter met een tekenbreedte van maximaal 90 centimeter en een digitizer van 1 bij 1 meter. De NORD-530 heeft ervoor gezorgd dat de steeds toeneemende vraag naar rekentijd opgevangen kon worden. De intelligente plotter maakt kwalitatief zeer goede tekeningen en zou in de toekomst gebruikt kunnen worden voor publicaties.

Gezien de ontwikkeling van de laatste paar jaar mag verwacht worden dat de vraag naar beeldscherm aansluitingen nog iets zal toenemen, zeker met de komst van 10 assistenten in opleiding (AIO) in 1985.

4.3. Reprografische afdeling

Binnen de reprografische afdeling is tijdens het verslagjaar meer aandacht besteed aan het tekenwerk ten behoeve van het Netherlands Journal of Sea Research, maar ook is de hoeveelheid tekenwerk toegenomen door het vaker verschijnen van dit tijdschrift.

In het kader van de herbezettingsoperatie werd de plaats van een tijdelijke tekenaar omgezet in een vaste aanstelling.

Tijdens de Snellius-II expeditie heeft een fotograaf aan een gedeelte van de reis (thema II en III) deelgenomen om verschillende werkzaamheden aan boord van de "Tyro" fotografisch vast te leggen.

4.4. Biologisch studiemateriaal

De afdeling, gevestigd aan de Buitenhaven in Den Helder, leverde evenals voorgaande jaren, levend en gefixeerd biologisch studie- materiaal aan universitaire laboratoria, scholen, buitenlandse instituten en educatieve instellingen. In verband met de strenge winter en de slechte zomer konden niet voldoende dieren worden ingekocht en moesten enige aanvragen worden afgewezen. Circa 79.000 levende en/of gefixeerde dieren werden verkocht, alsmede 59.000 liter zeewater.

4.5. Werkplaatsen

Het eerste halfjaar stond voor de werkplaatsen in het teken van de Snellius-II expeditie. Daar het verlenen van technische assistentie tijdens de vaartochten en het lassen van de "TYRO" zeer veel tijd in beslag heeft genomen zijn de werkzaamheden op het instituut beperkt gebleven tot reparaties en enige kleine aanpassingen. Wel is in deze tijd assistentie verleend bij het vernieuwen van het dak van het Aquariumgebouw en bij de onderhoudswerkzaamheden in de woningen en kamers van het logeergebouw. Enige kleine verbouwingen in het instituut werden uitbesteed aan derden. Voor de persluchtinstallatie werd een nieuwe compressor aangesloten. In de nettenschuur werd een nieuwe zolder aangebracht en werd de CV-installatie aangepast.

Voor het onderzoek op het voormalige R.E.M. eiland werd een speciale lier geplaatst.

Voor het vaarplan 1986 van de NRZ werd een begin gemaakt met het onderhoud van de apparatuur die gebruikt was op de Snellius expeditie. Tevens werden voor het Friese Front Projekt vijf speciale boeien ontwikkeld, en werd een oude vislier opgeknapt en omgebouwd van drie naar 4 trommels.

Voor de Antarctica expedities in 1986 werd een speciale lier ontworpen; de fabricage hiervan werd uitbesteed.

In opdracht van het International Centre of Water Studies werden twee speciale meetvissen gebouwd voor metingen in de Rijn. Het I.C.V.S. heeft inmiddels laten weten dat beide systemen zeer goed voldoen.

Electronische afdeling.—Het verwerken van de opgedane ervaringen en het onderhoud van de apparatuur bepaalde de werkzaamheden na de Snellius-II expeditie. Vooral de CTD en de monsternameapparatuur werden goed onderhouden genomen.

Met geld uit het IAS is voor de "Aurelia" een CTD-systeem met computerverwerking aangeschaft en een algemene ijkfaciliteit voor het iken van temperatuur en conductiviteit. We verwachten dat, met steun van het ijkwezen, dit systeem straks ook ten dienste van andere instituten (KNMI, RWS) kan staan.

De nieuwe "*in situ*" meetklokken van exp. biologie zijn vrijwel voltooid. Voor chemische oceanografie kwam een N2-destructeur gereed. Een aanvang is gemaakt met de automatisering van de seismische apparatuur.

Er liggen plannen gereed voor het automatiseren en standaardiseren van data-inname aan boord van onderzoekingsvaartuigen. Met name in de automatiseringssfeer is behoefte aan personeelsuitbreiding. Hierin zal in 1986 worden voorzien.

De afdeling is dit jaar verhuisd naar een grotere ruimte; een deel van het instrumentarium is vernieuwd.

Energie.—Begin 1986 werd naast het hoofdgebouw een 75 kW windturbine geplaatst van het fabriekaat Bouma (Heerhugowaard). Deze turbine zou volgens berekeningen van het E.C.N. Petten 125.000 kWh per jaar moeten kunnen leveren. Op 17 maart werden de kWh meters geplaatst en de turbine leverde tot 31 december 153.500 kWh, wat aanmerkelijk hoger is dan geraamd. Hiermee is deze turbine de meest rendabele van Nederland en in termen van opbrengst per windoppervlak voor zover bekend ook van Europa. Het door windenergie opgewekte vermogen is ~ 15% van het totaal benodigde. Met het P.E.N. is voor de turbine een contract afgesloten, waarbij teruglevering mogelijk is. Dit komt echter in de praktijk nauwelijks voor.

Eind 1985 zijn op het logeergebouw de zonnecollectoren geplaatst. Deze dienen als bijkomende verwarmingsbron voor huishoudelijk warm water.

4.6. Haven en vaartuigen

Na de pensionering in juni van havenmeester H. Beumkes heeft er een reorganisatie plaats gevonden en is C. van Zwieten hoofd van de Haven en Vaartuigendienst geworden. E. Adriaans, schipper van de "Griend", is bij de N.I.O.Z. haven gaan wonen en heeft het toezicht daarop overgenomen. De nieuwe reparatiezolder voor fuiken en netten is betrokken door W. Jongejan.

De "Aurelia" vaart nu met gezagvoerder C. Gerssen, 1e stuurman A. Souwer, 2e stuurman J.C. Groot, en heeft er een nieuwe man bij aan dek, matroos R. Rebel. Het schip heeft 165 vaardagen gemaakt en 320 opstappers vervoerd. Onder de hoofdmotor zijn nieuwe rubberblokken geplaatst. De 4 reddingsvloten zijn geheel vervangen en van het actief-roer is de onderwater-electromotor geheel gereviseerd.

De "Navicula" onder schipper C. Wisse heeft 149 vaardagen gemaakt met 310 opstappers.

De "Griend" met schipper E. Adriaans heeft 106 vaardagen gemaakt met 355 opstappers. Bovendien is in het najaar door de werkplaats een klein hydraulisch A-frame aan boord gemonteerd, en een liertje met 60 m draad voor licht viswerk en het nemen van water- en grondmonsters. Het drijfvlot voor het aanmeren van de "Griend" is vervangen door een nieuw AZOBE vlot, afm. 20 x 4 m, met 3 luiken ten behoeve van onderzoek van de biologische werkgroepen en scholen.

4.7. Logeergebouw "In den Potvis"

Het logeergebouw is vanaf 1 mei ondergebracht bij de afdeling huishoudelijke dienst. G. Steenhuizen is naast hoofd van deze afdeling tevens beheerder van "In den Potvis" en heeft een van de huisjes betrokken als dienstwoning, zodat nu van een 24-uurs service sprake is.

In 1985 is een begin gemaakt met het opknappen van het logeergebouw. Verschillende woningen werden geveerd. Voor 6 woningen is er nieuw meubilair aangeschaft. Alle woningen zijn opnieuw gestoffeerd. De douchecellen zijn betegeld en in de keukens is een afzuiger gemaakt. Bijna de helft van de 16 slaapzalen en gangen kreeg ook een opknapbeurt: deuren, muren, plafonds, kasten en gangen werden geveerd; het dak werd gerepareerd en de douchecellen werden betegeld. In het hoofdgebouw zijn zonnecollectoren geplaatst en aangesloten. In de kelder werd een werkplaats gemaakt en ingericht. In de keuken kwam een nieuwe schrapmachine, een frituur- en een koffiezetapparaat.

De bezettingsgraad bedroeg in 1985 voor de huisjes (10 woningen) 77,9% en voor de 25 eenpersoonskamers 83,4%. Het aantal losse overnachtingen bedroeg 3000, waaronder 1432 voor de groep Indonesische onderzoekers en 608 voor een zestal mensen van Prov. Waterstaat uit Haarlem. Voor 6 gasten werden de verblijfkosten door het NIOZ vergoed, deze mensen verbleven in totaal 134 nachten in "de Potvis".



Installatie zonnepanelen.

5. SOCIAAL JAARVERSLAG

5.1. Algemeen

In de rechtspositie van het instituut, zoals beschreven in het vorige jaarverslag, kwam in 1985 geen verandering. Van de zijde van het Ministerie van Onderwijs en Wetenschappen wordt er echter naar gestreefd om para-universitaire instituten zoals het NIOZ onder een beperkt aantal "koepe-organisaties" onder te brengen. Hiertoe zijn de universiteiten, de KNAW en ZWO aangewezen. Bij de laatste twee instanties werd informatie ingewonnen over de beleidsstructuur. Dit onderwerp zal ook het komende jaar veel aandacht van directie en ondernemingsraad vergen. Onder meer moet worden nagegaan wat de rol van de NDV in de nieuwe opzet zou kunnen zijn.

Er werd een nieuwe interne organisatiestructuur voor het NIOZ opgesteld en ter goedkeuring voorgelegd aan het Bestuur van de Vereniging en het ministerie.

5.2. Beheer

Het beheer van het instituut berust nog steeds bij de NDV. De Commissie van Toezicht werd met twee leden versterkt en bestaat nu uit vijf personen, de NDV-commissaris, de NDV-penningmeester, de voorzitter van de Wetenschappelijke Commissie en de twee leden. Deze versterking werd noodzakelijk geacht in verband met de onder algemeen genoemde problematiek. Wat de Wetenschappelijke Commissie betreft droeg de Minister, in het kader van zijn dereguleringsbeleid, de benoemingsbevoegdheid voor nieuwe leden over aan de NDV.

Het NIOZ voerde verder, evenals in voorafgaande jaren, het beheer over de zogenaamde "instrumentenpool" van de Nederlandse Raad voor Zeeonderzoek en verzorgde de wetenschappelijke uitrusting van de oceaanschepen "Tyro" en "Tydeman".

Bestuur (per 1-12-1985)

Commissaris:	Prof. Dr. W. Scharloo
Commissie van toezicht:	Prof. Dr. W. Scharloo Dr. J.G.D. Lambert (penningmeester NDV) Prof. Dr. J. Lever Prof. Dr. W. Mook Dr. E.K. Duursma
Financiële commissie:	Prof. Dr. W. Scharloo Dr. J.G.D. Lambert Prof. Dr. J. Lever Drs J. Bezemer (Ministerie van O en W)

Wetenschappelijke commissie

Prof. Dr. J. Lever (voorzitter) Biologisch Laboratorium van de Vrije Universiteit van Amsterdam	vertegenwoordigt: Vrije Universiteit Amsterdam	vakgebied: mariene biologie
Dr. P.J. Roos (secretaris) Vakgroep Aquatische Oecologie	Vrije Universiteit Amsterdam	aquatische ecologie
Prof. Dr. N. Daan Rijksinstituut voor Visserijonderzoek IJmuiden	Rijksinstituut voor Visserij- onderzoek	visserij- biologie
Dr. E.K.M. Duursma Delta Instituut voor Hydrobiologisch Onderzoek	Delta Instituut voor Hydro- biologisch onderzoek	chemische ocean- grafie
Prof. Dr. C. van den Hoek Laboratorium voor Plantensystematiek, Haren (Gr.)	Rijksinstituut Groningen	plantensys- tematiek
Prof. Dr. J. Joosse Biologisch Laboratorium van de Vrije Universiteit van Amsterdam	Vrije Universiteit Amsterdam	endicrino- logie
Dr. J. van der Land Rijksmuseum van Natuurlijke Historie Leiden	Rijksmuseum van Natuur- lijke Historie	mariene biologie
Dr. Ir. L. Otto Afd. Oceanografie, KNMI, De Bilt	KNMI, De Bilt	fysische ocean- grafie
Dr. R.C. Peters Laboratorium voor Vergelijkende fysiologie	Rijksuniversiteit Utrecht	aquatische fysiologie
Prof. Dr. R.A. Prins Rijksinstituut voor Natuurbeheer	Rijksinstituut voor Natuur- beheer	micro- biologie
Prof. Dr. W. Scharloo Lab. voor Populatie- en Evolutie- biologie, Utrecht	Nederlandse Dierkundige Vereniging	biologie

5.3. werkoverleg

Met de Ondernemingsraad werden regelmatig besprekingen gehouden over reeds genoemde en andere instituutzaken. Het overleg verliep steeds in goede harmonie (zie verder het jaarverslag van de Ondernemingsraad). Het werkoverleg tussen directie en hoofden van dienst en in de afdelingen vond op de gebruikelijke manier plaats.

5.4. personeelsbeleid

Bevorderingen

In 1985 werden onderstaande personen bevorderd:

G. W. Berger	H.H. de Porto
J. van Heerwaarden	I. Wernand-Godée
G.W. Kraay	M.R. Wernand
G. Nieuwland	F.J. Wetsteyn

Mutaties

Onderstaande mutaties vonden plaats in 1984:

In dienst	C. Leverington	01-02	
	T. Steenhuizen-		
	Borkulo	01-05	
	M. Reichert	01-06	
	R. Rebel	01-06	
	R. Dekker	01-06	
	K. Booy	01-07	
	H. Spigt	01-09	
	L. Gerringa	01-09	
	F.A.C. Kouwets	15-08	
	R. Nichols	01-10	
	F. Hovenkamp	01-10	
	J.P. Mulder-		
	Starreveld	01-11	
	B. Bak-Gade	01-11	
	H. Franken	01-12	
	W.M. Kieskamp	01-12	
	J.M.J. Hoppema	01-12	
Uit dienst	L. Everhardus	09-02	ontslag
	A.C. Rijk	01-08	ontslag
	H. Beumkes	01-07	pensioen
	J.F. Bakker	01-12	ontslag
Overplaatsing	S.W. de Porto		magazijn-administratie
	C. van Zwieten		hoofd haven- en vaartuigen-
			dienst
	C. Gerssen		gezagvoerder Aurelia
	A.J. Souwer		1e stuurman Aurelia
	J.C. Groot		2e stuurman Aurelia

5.5 personeelslijst (per 31-12-85)

<i>Direktie:</i>	<i>Secretaresse:</i>	<i>Assistentie:</i>
Prof. Dr. H. Postma	J. Hart-Stam	J.W. Rommets
Dr. J.J. Zijlstra	J.W. Schröder-ter Avest	J.I.J. Witte
	C. Leverington	
<i>Beheerder:</i>		
Ing. E. van Abs		

Onderzoekafdelingen

afd. chemische oceanografie en
onderzoek zeeverontreiniging

Onderzoeker:

Dr. B. Sundby
Drs. K. Booy
Dr. J.M. Everaarts
Drs. L. Gerringa
Dr. W. Helder
Drs. J.M.J. Hoppema
Drs. W. Kieskamp
Drs. S.B. Tijssen

Assistentie:

M.T.J. Hillebrand
R.F. Nolting
R.T.P. de Vries
F.J. Wetsteyn

afd. fysische oceanografie

Drs. C. Veth
Prof. Dr. J.T.F. Zimmerman
Dr. D. Spitzer

M.R. Wernand
M.W. Manuels
W.M.L. Lambrechts

afd. mariene geologie en geochemie

Dr. D. Eisma
Dr. J.H.F. Jansen
Dr. T.C.E. van Weering
Drs. A.J. van Bennekom

G.W. Berger
S.J. van der Gaast
J. van Iperen
J. Kalf
J. Schilling

afd. experimentele systemen

Dr. P.A.W.J. de Wilde
Dr. J.H. Vosjan
Dr. R.P.M. Bak

E.M. Berghuis
A. Kok
G. Nieuwland
E. Pauptit

afd. autecologie

Dr. F. Creutzberg
A.D.G. Dral
Dr. M. Fonds
Drs. F. Hovenkamp
Dr. B.R. Kuipers
Drs. G. Duineveld

G. van Noort
P. van der Puy
H.J. Witte

afd. pelagische systemen

Dr. Ir. H.G. Fransz
Dr. W.W.C. Gieskes
Dr. M.A. Baars
Dr. W.C.M. Klein Breteler

S.R. Gonzalez
G.W. Kraay
S.S. Oosterhuis

afd. benthische systemen

Dr. J.J. Beukema
Dr. G.C. Cadée
Drs. R. Dekker
C. Swennen
Dr. D.H. Spaargaren

W. de Bruin
J. Hegeman

P. Duiven
J. Zuidewind

Hulpafdelingen

publikatie en bibliotheek

Dr. J.J. Beukema (redactie)
J. v.d. Wal-Doornekamp (bibliotheek)

B. Bak-Gade
J.P. Mulder-Starreveld
M. Bruining-du Porto

administratie

G. Goslinga

D.J. Bruin

E.C. Lanser
I. Wernand-Godée
G. Zonnenberg

reprografie

H. Hobbelink

B. Verschuur
R. Nichols

R.P.D. Aggenbach
G.E. de Schipper

rekencentrum

F. Eijgenraam
R. Dapper

onderhoudsafdeling	T. Verveer		
werktuigbouwkunde	T. Buisman	S.D. Groot F.J. Parlevliet H.H. de Porto	J. Visser S. Gieles
houtbewerking	L. Heerschap	R.M. Daalder	
electrotechniek	F.J. Schilling		
magazijn	A. Ran	S.W. de Porto	
instrumentmakerij/aquariumtechnische afdeling	H.J. Boekel	A. Vaars J. van Heerwaarden	R. Lakeman T. Kuip
elektronica	Ing. R.L. Groenewegen	G.M. Manshanden	Ing. J. Leijtens Ing. H. Franken
biologisch studiemateriaal (Den Helder)	J.M. Nieuwenhuizen		
huishoudelijke dienst en logeergebouw "de Potvis"	G.H. Steenhuizen T. Steenhuizen-Borkulo	G.C. Weijdt-Eelman H. Spigt	
haven en vaartuigen	C. van Zwieten C. Wisse C. Gerssen	W.P. Jongejan J.C. Tuntelder A.J. Souwer J.C. Groot	E. Adriaans R.J.R. Anthonijsz A. Boon G.L. de Vries E. Sebens C. Mozes W.J.M. Koomen R. Rebel

5.6. tijdelijke personele ondersteuning

C. Leverington	01-01 tot 01-02	vervanging secretaresse
N. Schogt	01-01 tot 01-05 en 01-09 tot 31-12	pelagische systemen
H. Kloosterhuis	11-01 tot 01-03	Snellius expeditie
R. Nichols	01-03 tot 01-03 en 01-04 tot 01-10	reprografie
C. Eriks	01-08 tot 01-10	electrotechniek
J. van der Gaast	01-08 tot 01-09	onderhoudsdienst
Ing. P. Boereboom	01-09 tot 31-12	magazijnadministratie
J.W. Schröder-ter Avest	01-11 tot 31-12	vervanging secretaresse

Onderzoekers met een ZWO-beurs:

Drs. R. Daan	pelagische systemen
Drs. L.R.M. Maas	fysische oceanografie
Drs. M. Veldhuis	pelagische systemen (i.s.m. R.U. Groningen)
Drs. H. Yasuda	fysische oceanografie

Onderzoekers met een WOTRO-beurs:

Dr. W. Zevenboom	pelagische systemen i.s.m. U. Amsterdam
Drs. P.H. Schalk	

Werken met behoud van uitkering

In 1985 hebben een aantal personen op het instituut gewerkt met behoud van een uitkering. Dit geschiedt na goedkeuring door de gemeente, de bedrijfsvereniging of het Ministerie van Binnenlandse Zaken.

P. Boereboom	documentatie
C. Fisher	zeewaterverontreiniging
M. Tijssen	elektronica
E. Bakker	autoecologie
A. de Graaf	reprografie
E. Okkels	DORA

Tevens is op verzoek van de Gemeenschappelijke Medische Dienst te Alkmaar sinds het begin van het verslagjaar een lichamelijk gehandicapte bij het instituut werkzaam.

Het NIOZ verleent zijn medewerking aan de uitvoering van speciale projecten, bijv. ter onderbouwing of uitvoering van het beleid van andere ministeries dan het Ministerie van Onderwijs en Wetenschappen en van het bedrijfsleven. Het stelt hiervoor ruimte en wetenschappelijke kennis ter beschikking. Het personeel voor deze projecten wordt op kosten van de opdrachtgever speciaal voor de duur van het project ingehuurd. Het NIOZ personeel, dat de eigenlijke taak van het instituut, fundamenteel onderzoek, uitvoert is hierbij slechts in een adviserende rol betrokken.

In principe worden slechts projecten aangenomen die samenhangen met of nauw aansluiten bij de taak van het instituut. De looptijd van de projecten kan sterk variëren, van enkele maanden tot vele jaren. Er waren de volgende speciale projecten (zie ook onder 1.5 en 1.7.3):

<i>Project</i>	<i>Medewerkers</i>	
BOVO/RWS	Drs. P. Seip	
	R. Brand	
DORA	A. Engelberts	01-06 tot 01-12
	Dr. M.M. Rutgers van der Loeff	
	Drs. M. Lavaleye	
	G.J. Zigterman	
	D. Waijers	01-01 tot 16-09
EON	C. Oomens-Meeuwsen	01-09 tot 31-12
	D. Speyer	01-03 tot 01-06
	Dr. W. Admiraal	
	Drs. M.A. van Arkel	
	Drs. J.W. Baretta	
	Dr. R.W.P.M. Laane	
	H. Malschaert	
	M. Mulder	
	Drs. P. Ruardij	
	L.A.H. Venekamp	
	A.C. Bol-den Heijer	
	Ir. H.T. Kloosterhuis	vanaf 01-04
	J.P. Mulder-Starreveld	01-01 tot 15-05
	Dr. P. de Wolf	gedetacheerd door TNO
	A.J. Kop	gedetacheerd door TNO
	H.G.J. Schröder	gedetacheerd door TNO
	A. Stam	gedetacheerd door TNO

Indiaproject	B. Koster	01-01 tot 01-03
	C. Oomens-Meeuwssen	01-01 tot 01-07
OPEX	Drs. R. Dekker	01-01 tot 01-07
	F. Ellenbroek	01-05 tot 31-12
	G. van Moorsel	01-05 tot 31-12
	A. de Gee	01-12 tot 31-12
Rijkswaterstaat	Drs. C.G.N. de Vooy	01-06 tot 15-08 en 01-12 tot 31-12
Boorspoeling	W. Lewis	01-08 tot 31-12
	A. Hillebrand-Kikkert	01-10 tot 31-12
WaWaMo	Drs. H. Ridderinkhof	vanaf 16-03
Vaarplan	P.R. Alkema	
	A.J. Asjes	
	A. Balk	
	Ing. H. Franken	tot 01-12
	A. Goes	01-06 tot 01-12
	H. van Veen	
	J. Wagenaar	01-01 tot 01-09
	R.J.C. Witte	
	C. Rutten	01-10 tot 31-12
N.R.Z.	Dr. C.J.M. Kramer	01-08 tot 31-12
Shell	Drs. C. Fisher	01-10 tot 31-12

Stagiaires

Aan een groot aantal studenten uit Hoger en Middelbaar Beroepsonderwijs werd gelegenheid gegeven een stage te volgen. Deze mogelijkheid staat open voor studenten aan Laboratoriumscholen uit het gehele land en voor studenten aan de Middelbare en Hogere Technische scholen in Noord-Holland. Gestreefd wordt naar stages van 6 maanden of langer.

Lijst van stagiaires in 1985:

B. Laurier	01-01 tot 01-02	MTS IJmond, electrotechniek
J. Stark	01-01 tot 01-03	MTS Hoorn, werktuigbouwkunde
E. Stikvoort	01-01 tot 01-06	v.d. Broek Inst., Amsterdam
C. Eriks	01-01 tot 01-08	MTS IJmond, electrotechniek
F. v.d. Maagdenburg	01-02 tot 01-07	
K. de Weerd	01-03 tot 01-07	MTS Alkmaar, electronica
N. Onderwater	04-03 tot 01-07	HTS Hilversum, instr. makerij
B. Koster	01-04 tot 01-08	Nautisch College, Den Helder
M. Haver	01-05 tot 31-12	v.d. Broek Inst., Amsterdam
M. Preng	01-06 tot 01-08	MEAO Alkmaar, secretariaat
J. Hayma	05-07 tot 31-12	Nautisch College, Den Helder
F. Tatenhove	01-08 tot 01-11	MTS Alkmaar, electrotechniek
E. Keijzer	01-08 tot 01-12	MTS West-Friesland, werktuigb.
E. Witte	01-08 tot 31-12	MTS Hoorn, electrotechniek
A. Wijnkoop	01-09 tot 31-12	HLO Leiderdorp, chem. oceanogr.
A. Hulsebos	01-12 tot 31-12	MTS West-Friesland, werktuigb.
J. Rozeboom	01-12 tot 31-12	MTS Alkmaar, electrotechniek

5.7. verdere personeelszaken

Deeltijd

De in 1985 aangetrokken Assistenten in Opleiding (AIO) zijn allen aangenomen op 32 uur basis in een vierjarig dienstverband.

Elk verzoek om deeltijdarbeid wordt door de directie van geval tot geval bekeken. Criteria, die hierbij gehanteerd worden zijn: 1e) de organisatie moet beheersbaar blijven, 2e) de kwaliteit en kwantiteit van de dienstverlening moet gegarandeerd blijven, 3e) de afspraken over deeltijd zijn bindend.

M. Bruining-du Porto	33.25 uur	bibliotheek-assistente
G.C. Eelman	9.97 uur	kantine-assistente
W. Klein Breteler	32 uur	bioloog
E.C. Lanser	26.6 uur	administratie-assistente
G.E. de Schipper	34.2 uur	reprografie-medewerkster
J. van der Wal- Dornekamp	33.25 uur	bibliothecaresse
I. Wernand-Godée	26.6 uur	administratie-assistente
J.T.F. Zimmerman	22.8 uur	fysicus
M. Zonnenberg	35.15 uur	telefoniste
T. Steenhuizen-Borkulo	19 uur	huishoudelijke dienst
R. Dekker	32 uur	AIO
L. Gerringa	32 uur	AIO
F.A.C. Kouwets	32 uur	AIO
F. Hovenkamp	32 uur	AIO
W.M. Kieskamp	32 uur	AIO
J.M.J. Hoppema	32 uur	AIO
H. Spigt	25 uur	huishoudelijke dienst
J.P. Mulder-Starreveld	19 uur	redactie
B. Bak-Gade	19 uur	redactie

Ziekte

Vervanging van langdurig zieken is en zal ook in de toekomst zoveel mogelijk worden opgevangen door eigen personeel. Slechts bij hoge uitzondering wordt door het Ministerie extra steun verleend.

5.8. Verslag van de personeelsvereniging

Activiteiten voor en door het personeel:

De toneelgroep "Comedia de la NIOZ" heeft op 27 april drie eenakters opgevoerd:

- "Karel" van Mrozek, 1969
- "De kale zangeres" van Ionesco, 1948
- "Over de schadelijkheid van tabak" van Tsjechov, 1902

Het damesvolleybalteam Retsina behaalde in de seizoenscompetitie een 4e plaats in de 3e klasse. De heren van DGM werden 7e in de 1e klasse.

De zaalvoetbalteams NIOZ I en II eindigden respectievelijk middenin en onderaan in de 4e klasse. Met de Fair-play-cup bereikten zij echter een 2e en 3e plaats. Daarnaast organiseerden zij het 16e Biologentoernooi dat op 24 mei plaats vond op de sportvelden van SV Texel.

Als vanouds werd de SPORTDAG - gehouden op 29 augustus - een groot succes. Autoecologie won hierbij de 1e prijs. Benthische systemen werd 3e.



6. JAARVERSLAG ONDERNEMINGSRAAD 1985

6.1 Algemeen

De relatie tussen de ondernemingsraad en de directie manifesteerde zich in 1985 conform de ontwikkeling in voorgaande jaren: volgens het harmoniemodel. De overlegvergaderingen tussen beide partijen werden gekenmerkt door een openhartige sfeer, waarbij ook meningsverschillen binnen de geleding directie/beheerder niet onder de tafel verborgen bleven. Voor de directie heeft het voordelen belangrijke zaken zonder geheimzinnigheid te bespreken: de notulen van OR- en Overlegvergaderingen vormden dit jaar een belangrijke informatiebron voor het personeel en ook de regelmatig gehouden werklunches of vergaderingen van OR-leden met hun achterban droegen er toe bij dat motieven, plannen en daden van de directie voor velen duidelijker werden dan via de normale informatiestroom volgens de hiërarchieke weg. Leefde de OR in voorgaande jaren vooral bij de niet-wetenschappers, dit jaar nam ook het contact tussen de wetenschappers en hun OR-vertegenwoordigers toe, mede doordat de laatsten zich actiever opstelden door o.a. de uitbreiding van hun achterban met de aanstelling van Assistenten-In-Opleiding.

De OR heeft het afgelopen jaar over tal van belangrijke zaken met name de reorganisatie en de daarmee verband houdende aanstellingen, mogen adviseren. Toch gevoelde hij bij tal van andere zaken de behoefte om in een eerder stadium te mogen meepraten dan nu vaak geschiedde. Mede door de belasting van reorganisaties en kwesties op landelijk niveau werd het directiebeleid bij veel interne aangelegenheden gekenmerkt door snelle besluitvorming in kleine kring, wat bij het personeel weleens frustrerend overkwam. Een aantal besluiten betreffende nieuwe organisatiesystemen of regelingen kwam tot stand zonder, of na onvoldoende raadpleging van de toekomstige gebruikers of betrokkenen. De OR heeft het gevoel dat de acceptatie door het personeel van dergelijke regelingen sterk bevorderd zou worden indien in de beleidsvormende procedure een grotere rol toebedeeld wordt aan personeelsvertegenwoordigers, hetzij direct betrokkenen hetzij een OR-lid. Zulke van geval tot geval wisselende personen kunnen naast het vervullen van hun "klankbordfunctie" en het aandrazen van details en feiten onbekend bij de beleidsbepalende personen, ook een grote rol spelen in het informele informatiecircuit binnen het Instituut, waardoor het uiteindelijke besluit een minder demotiverende invloed op het personeel heeft dan nu soms het geval is.

Mede gezien het voorafgaande is het verheugend dat de directie positief heeft gereageerd op het verzoek van de OR om ook in de werkgroepeliderversgadering "nieuwe stijl" een OR-vertegenwoordiger als waarnemer toe te laten. In de loop van 1986 zal de huidige werkgroepeliderversgadering omgevormd worden tot een vergadering van de dan 3-koppige directie met alleen de werkgroepelidervers, coördinator speciale projecten, personeelschef (tevens hoofd administratieve diensten) en hoofd technische diensten.

6.2. Punten van aandacht

Het afgelopen jaar werd gekenmerkt door de vele besprekingen die gewijd werden aan de reorganisatie. Werd nog maar enkele jaren geleden vanuit het Ministerie van Onderwijs en Wetenschappen te kennen gegeven dat de structuur van het NIOZ wat topzwaar gevonden werd door het grote aantal werkgroepvoerders (toen 8), de laatste tijd werd zowel vanuit datzelfde Ministerie als van andere zijden benadrukt dat het management op het NIOZ versterkt diende te worden. Plannen tot reorganisatie werden in 1984 ontwikkeld en omvatten enerzijds een beperking van het aantal werkgroepen tot 6 (te bereiken in 1987) en anderzijds uitbreiding van de technisch-administratieve staf. In 1985 rondde de directie een definitieve versie van het algemene schema af, met daarin verwerkt diverse aspecten van het OR-reorganisatievoorstel uit 1984. Het nieuwe reorganisatieschema werd in de loop van het jaar zowel door de OR (onder voorbehoud dat het financieel haalbaar of realiseerbaar zou zijn) als door de Commissie van Toezicht aanvaard, en ook het Ministerie van Onderwijs en Wetenschappen verleende zijn fiat. Bij de aanstelling van de 2 direct uit het schema voortvloeiende nieuwe functionarissen, de personeelschef en het hoofd technische diensten, namen OR-leden zitting in de sollicitatiecommissies.

Over de voorgenomen reorganisatie van de directionele top, gekoppeld aan het vertrek wegens het bereiken van de pensioengerechtigde leeftijd van Prof. Dr. H. Postma in juli 1986, is uitvoerig gediscussieerd en de voorgelegde constructie werd door de OR in principe aanvaard. Als punt van discussie resteert de wijze van inschaling en bijbehorende financiering van het toekomstige drietal directeuren (algemeen, wetenschappelijk en technisch-administratief directeur). De OR vreest dat indien het Ministerie toestemming verleent voor schaalverhoging van een of meer van deze functies zonder daarbij structureel de totale NIOZ-salarislasten aan te passen, de doorvoering van deze nieuwe schalen bevordering van het overige personeel en invulling van opengevallen formatieplaatsen kan belemmeren op financiële gronden. Meer duidelijkheid wordt in 1986 verwacht wanneer de aanstelling van de nieuwe wetenschappelijk directeur actueel wordt.

De voor de Snellius-II Expeditie ontworpen overwerkregeling bleek niet in alle voorkomende situaties toepasbaar en werd in de loop van 1985 in het overleg tussen OR en directie verder uitgewerkt. Ook voor de compensatie van weekenddagen door wetenschappers kwam een formele regeling tot stand. De OR verzocht de directie bij de NRZ aanhangig te maken dat de in 1984 en 1985 toegepaste overwerkregeling ook de komende jaren bij NRZ-vaartochten gebruikt zal gaan worden. Bij het opstellen van dit jaarverslag was nog niet duidelijk of deze wens gehonoreerd gaat worden. In 1986 worden voor het eerst NIOZ-programma's met "Tyro" en "Aurelia" gezamenlijk uitgevoerd en het ontbreken van een overwerkvergoeding voor opstappers op de "Aurelia" wordt als een vorm van ongelijke behandeling ervaren.

Vooruitlopend op de landelijke invoering van de 38-urige werkweek per 1 augustus 1985 werd door de OR een enquête onder het personeel gehouden over de vraag welke vorm van arbeidsduurverkorting het meest in trek zou zijn. Conform de latere resultaten van het Centraal Overleg koos een meerderheid voor extra vrije dagen. Rekening houdend met een kwartier langer werken op maandag t/m donderdag volgens de huidige werktijden werd voor de mensen in volledige dienst het aantal vrije dagen per jaar daardoor met 13,5 uitgebreid. In het overleg tussen OR en directie werd overeengekomen dat maximaal 5 van deze dagen verplicht door de directie aangewezen kunnen worden (algehele sluiting van het instituut rond kerst en nieuwjaar). De resterende vrije dagen mogen ook in de vorm van korter werken gedurende bepaalde perioden opgenomen worden. Een afwijkende werktijd geldt voor de in de loop van 1985 aangestelde AIO'ers, zij werken en krijgen betaald 32 uur per week (voor een periode van 4 jaar) volgens de richtlijnen van het Ministerie van Onderwijs en Wetenschappen.

De vertegenwoordigers van de wetenschappers in de OR stelden een notitie op over de leeftijdsstructuur en de te verwachten pensioneringen van de wetenschappelijke staf, met de daaruit voortvloeiende problemen betreffende de zeer beperkte mogelijkheden om tijdelijke medewerkers in vast verband aan te stellen en om vaste stafleden in schaal te bevorderen. Voorts was er bemoeienis met de plannen voor ruimtelijke integratie van een deel van de EON-medewerkers in de biologische laboratoria (deels vooruitlopend op de nieuwe structuur met 3 biologische werkgroepen zomer 1987) en met een nadere reglementering van de faciliteiten voor de publicatie van proefschriften.

Tijdens de overlegvergaderingen kwamen regelmatig landelijke ontwikkelingen ter sprake die een grote invloed op het NIOZ zullen kunnen hebben in de komende jaren. Op de wens van het Ministerie om alle onder hem vallende instituten onder te brengen bij universiteiten of onder koepelorganisaties als ZWO of KNAW heeft de NDV aansluiting bij een universiteit afgewezen en vooralsnog geen voorkeur voor een van beide andere mogelijkheden uitgesproken. Meer duidelijkheid wordt verwacht als de huidige reorganisaties bij zowel ZWO als NRZ (KNAW) in een verder stadium zijn. In deze problematiek spelen ook fusieplannen van de oecologische instituten een rol, waarbij als fusiepartner van het NIOZ (een deel van) het Delta Instituut voor Hydrobiologisch Onderzoek genoemd wordt hetwelk nu onder de KNAW ressorteert. Voorts bestaan er voorstellen van WUON en ICONA (Commissie Biesheuvel) om de inspanningen, faciliteiten en instellingen betrokken bij het onderzoek en het toezicht op de Noordzee te coördineren.

6.3. Verkiezingen en samenstelling OR

Tijdens de op 7 juni gehouden verkiezingen, georganiseerd door de verkiezingscommissie bestaande uit Rob Dapper en Eilke Berghuis, was voor alle in aanmerking komende groepen maar 1 kandidaat aangemeld zodat geen stemmingen plaatsvonden. Een nieuwe vertegenwoordiger voor de biologische onderzoekers werd pas op 20 juni bekend na een open verkiezing in die geleding. Een zelfde type verkiezing werd gehouden op 2 december om een vertegenwoordiger van het personeel werkzaam in apart gefinancierde projecten te kiezen.

Vanaf juli had de OR de volgende samenstelling:

Rob Dapper (voorzitter), voor het administratief personeel en personeel in algemene dienst

Kees Veth (secretaris), voor het "hydrografisch" wetenschappelijk personeel (geologen, chemici, fysici)

Rinus Manuels (ABVA), voor het hydrografisch laboratoriumpersoneel

Wim Jongejan (ABVA), voor het varend en havenpersoneel

Siem Groot voor het technisch personeel

Martien Baars voor het biologisch wetenschappelijk personeel

Eilke Berghuis voor het biologisch laboratoriumpersoneel

Per 2 december trad tevens Maarten van Arkel toe als afgevaardigde van het projectpersoneel.

6.4. Commissies

Voor personeelszaken en financiële zaken werden 2 commissies uit de ondernemingsraad gevormd. Zowel de Personele Commissie, bestaande uit Kees Veth en Rinus Manuels, als de Financiële Commissie, Eilke Berghuis en Martien Baars, hielden een aantal besprekingen met de beheerder. De veiligheidscommissie, bestaande uit Wim Jongejan en Siem Groot namens de OR en Joop Rommets en Jan Hegeman als toegevoegde niet-OR leden, was in 1985 niet actief. Alhoewel de ARBO-wet al in werking is getreden voor het bedrijfsleven, is dat nog niet het geval voor overheidsinstellingen en is het op dit moment onduidelijk hoe en wanneer het NIOZ formeel met deze wet rekening moet houden.

6.5. Vergaderingen

Er werden 10 vergaderingen van de OR belegd, en er werd 6 maal een overlegvergadering met directie en beheerder gehouden. Vanaf medio 1985 werd voorafgaande aan de overlegvergaderingen steeds een OR-werkluuch gehouden om het overleg beter voor te bereiden.

6.6. Scholing en financiën

Het door de OR uit te geven bedrag stond voor 1985 begroot op f 4000,- maar dit bedrag werd nauwelijks aangesproken omdat het volgen van een door sommige nieuwe OR-leden gewenste algemene ondernemingsraad-cursus niet eenvoudig bleek; deze cursussen zijn uit de standaardpakketten van scholings- en vormingsinstituten verdwenen en worden alleen nog op aanvraag en bij voldoende deelname gehouden. Aan het eind van 1985 was ca f 250,- besteed aan abonnementsgelden voor enkele vakbladen als het OR-blad en De Gids.

