

ANNUAL REPORT 1984



NETHERLANDS INSTITUTE FOR SEA RESEARCH

NETHERLANDS INSTITUTE FOR SEA RESEARCH
PUBLICATION SERIES

⁷¹
No. ~~10~~ - 1985

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.

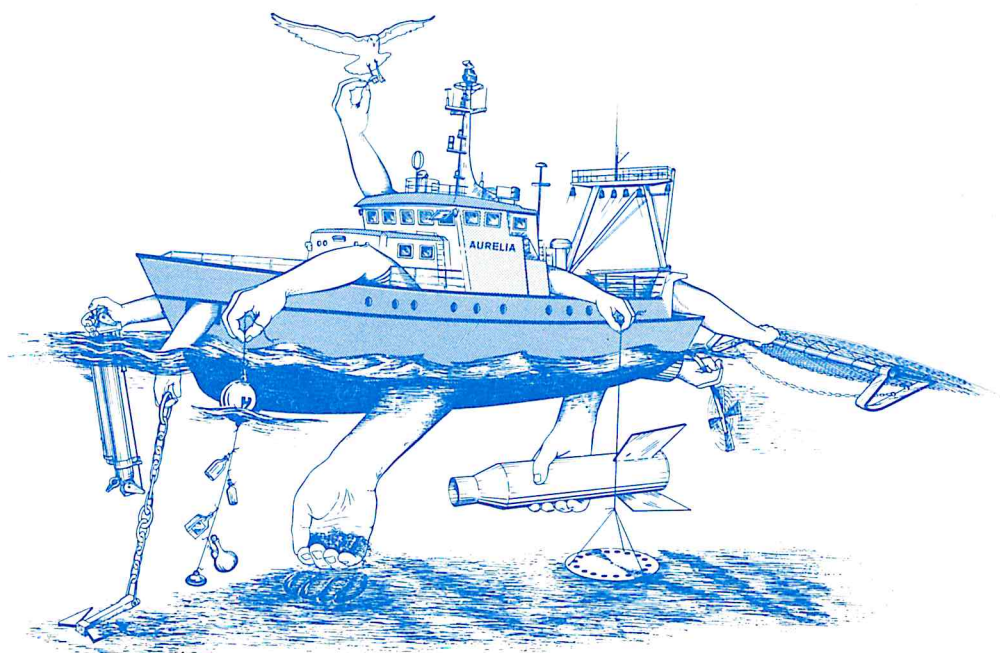
This Annual Report was produced under the responsibility of the directors:
H. POSTMA and J.J. ZIJLSTRA

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

Read for English by: R.B. WHITLATCH

and formatted and printed by the Institute's departments of reprography and publication: R.P.D. AGGENBACH, H. HOBBELINK, A.C. RIJK and G.E. DE SCHIPPER

ANNUAL REPORT 1984



NETHERLANDS INSTITUTE FOR SEA RESEARCH



CONTENTS

1. Scientific activity	3
1.1. Introduction	3
1.2. Estuarine Research	6
1.2.1. Physical and chemical research	6
1.2.1.1. Marine optics	6
1.2.1.2. Contaminants	6
1.2.1.3. Sublethal effects of heavy metals on marine organisms ..	7
1.2.1.4. Production and transport of organic matter	8
1.2.2. Sedimentological research	9
1.2.2.1. Aggregation, disaggregation, flocculation, and formation of particles	9
1.2.2.2. Sedimentation in the Wadden Sea	9
1.2.2.3. Dating with Pb-210	10
1.2.3. Biological research	10
1.2.3.1. Production and dynamics of macrozoobenthos on tidal flats in the Dutch Wadden Sea	10
1.2.3.2. Density-dependent mortality of juvenile plaice	11
1.2.3.3. Energy budget and growth experiments	12
1.2.3.4. Population dynamics of sea birds	13
1.2.3.5. Chemical composition of marine organisms and the abiotic environment	14
1.3. North Sea Research	16
1.3.1. Transport processes	16
1.3.1.1. Large-scale transport processes	16
1.3.1.2. Small-scale turbulence, mixing layers, and thermocline studies	17
1.3.1.3. Theoretical dynamical oceanography	17
1.3.2. Sediment and Foraminifera	18
1.3.2.1. Mud accumulation	18
1.3.2.2. Foraminiferal assemblages	19
1.3.3. Oxygen and nitrogen cycles in the sediment	19
1.3.4. The "REFLEX" programme	20
1.3.4.1. The pelagic system	20
1.3.4.2. Heterotrophic activities and bacterial biomass in marine environments	21
1.3.5. The southern North Sea	22
1.3.5.1. The pelagic system	22
1.3.5.2. Pelagic predators	24
1.3.5.3. Experimental investigations on zooplankton	26
1.3.5.4. The benthic fauna	26
1.3.5.5. Secondary producers	27
1.3.5.6. The role of carnivores in the benthic system	29
1.4. Ocean Research	30
1.4.1. Angola Basin	30
1.4.1.1. Sedimentology and palaeoceanography	30
1.4.1.2. The influence of aluminium on the silica cycle	33
1.4.2. North Atlantic Ocean and Norwegian Sea	34
1.4.2.1. Sedimentation and climatic change	34
1.4.2.2. Water transport and the silica cycle	34
1.4.2.3. Apparent copper complexation capacity and conditional stability constants	35

1.4.3. Indonesia. The SNELLIUS II expedition	41
1.4.3.1. Geology of the southern basins	41
1.4.3.2. The pelagic system of the eastern Banda Sea and the Western Arafura Sea	42
1.4.3.3. Input of Solo and Brantas Rivers into the sea	46
1.4.3.4. Coral reefs	49
1.4.4. Coral reefs in Curaçao, southern Caribbean Sea	50
1.4.5. Remanent magnetism in sediments	50
1.4.6. Conversion of clay minerals	51
1.4.7. Quantitative microzooplankton research	52
1.5. Special Projects	53
1.5.1. Biological Research Ems-Dollard Estuary (BOEDE)	53
1.5.2. Research at radioactive waste disposal site (DORA)	54
1.5.3. India project	55
1.5.4. Dutch Joint Monitoring Programme on chlorinated hydrocarbons	56
1.5.5. Continuous liquid-liquid extractor	57
1.5.6. OPEX, oil pollution experiment	57
1.5.7. Benthos sampling programme in Zeeland coastal waters	58
1.6. Additional Research	59
1.6.1. Research at NIOZ by guests	59
1.6.2. Participation in national and international programmes	60
1.7. List of research projects and research workers	62
1.7.1. Hydrography (H)	62
1.7.2. Biology (B)	63
1.7.3. Special projects	64
2. Scientific outcome	65
2.1. Publication	65
2.1.1. Netherlands Journal of Sea Research and other series issued ..	65
2.1.2. Publications NIOZ 1984	65
2.1.3. Internal Reports NIOZ 1984	70
2.2. Lectures, etc.	71
2.2.1. Colloquia and lectures at the Institute	71
2.2.2. Lectures of NIOZ scientists given elsewhere	76
2.2.3. Advice offered	79
2.2.4. Visitors from abroad	80
3. Nederlandse samenvatting van de wetenschappelijke activiteiten	81
3.1. Inleiding	81
3.1.1. Waddenzee en andere estuaria	82
3.1.2. Noordzee	84
3.1.3. Oceaan	87
3.1.4. Speciale projecten	89
3.2. Bezochte congressen	91
3.3. Bestuursfuncties	93
3.4. Studentenonderzoek	96
3.5. Cursussen, vergaderingen en excursies	97
3.5.1. NIOZ cursussen	97
3.5.2. Andere cursussen gehouden op het NIOZ	97
3.5.3. Ontvangen gezelschappen van verwante instituten, overheids- diensten, e.d.	97
4. Hulpafdelingen	98
4.1. Bibliotheek	98
4.2. Rekencentrum	98
4.3. Reprografische afdeling	99
4.4. Biologisch studiemateriaal	99
4.5. Werkplaatsen	100
4.6. Haven en vaartuigen	102
4.7. Logeergebouwen	102
5. Sociaal jaarverslag 1984	103
6. Jaarverslag ondernemingsraad 1984	113

1. Scientific activity

1.1. INTRODUCTION

In this annual report the scientific activities of the institute are described separately for the three main regions of research: the Wadden Sea (and other estuaries), the North Sea and the oceans. This classification stresses regional distribution. In this introduction the main directions of investigations are discussed following the traditional disciplines of oceanography.

In physical oceanography there are two main areas of research. One is concerned with processes of water transport. Considerable progress was made in explaining tidal residual transport generated by bottom topography and aspects of turbulent water movements. Gradually, attention has been directed to the influence of stratification on water mass displacements and the boundaries between stratified and unstratified waters, including the generation of fronts. The second area is optical oceanography, which has primarily concentrated on remote sensing and the development of the relations between sea surface properties and sea colours. Both water movement and remote sensing studies are closely related to the activities of the other marine disciplines.

Chemical oceanography and marine pollution research were combined in one department in order to strengthen and co-ordinate these disciplines. Again, two main areas can be discerned, that of biological oceanography and that of geochemistry. In the former, studies of nutrient cycles and eutrophication of coastal waters were vigorously pursued. Plans are now made to study, in addition to the oxygen cycle, the carbon dioxide cycle. The latter has been greatly neglected in Dutch coastal waters and is also important for the problem of CO₂ increases in the atmosphere. The study of sublethal effects of metals and man-made organic compounds may also be classified in this category. Geochemistry is also concerned with metal and metal "species" behaviour and will be further developed under the new leadership of the department. Considering the whole area of chemical activities of the institute, it is evident that more attention is given to bottom-water exchange processes than in the past. Two of the special projects of the institute, that on modelling on Wadden Sea (EON, see below) and on deep-sea dumping of radioactive matter, provide considerable support to the chemical investigations.

Much of the marine geological work is closely connected to marine chemistry. This includes studies in the water column on the sea bottom.

The Minister of Education and Science Mr. W.J. Deetman during a speech at the departure of R.V. "Tyro".



The first category is concerned with the transport of particulate matter, its sources and behaviour in estuaries, and its final destination. Special mention should be made of an international (SCOPE-UNEP) project which investigates the behaviour of fine-grained particulates, including particulate and dissolved organic materials, in rivers and adjacent seas. A new development in marine sedimentology is the use of sediment traps to collect particulate matter sinking in the water column. This method gives insight in particle fractionation and changes of composition during settling. Similar traps are also being used by the marine biologists. The second area of geological research is concerned with distribution patterns of recent sediments and their genesis. These investigations are integrated with water transport studies, boundary layer chemistry and problems of benthic biology such as bioturbation and distribution patterns of benthic organisms.

Marine biological research covers a very wide range of investigations at the institute. A main area of interest is that of benthic and pelagic biological communities (ecosystems), both in eutrophic and in oligotrophic areas. Comparative community studies are very rewarding from a scientific point of view as well from the position of an applied ecologist who wants to understand polluted communities. A large number of projects are connected with this central theme, such as chemical methods for the determination of primary production, mineralization and the determination of phytoplankton species, laboratory studies of phytoplankton-copepod systems and the growth and mortality of copepods, the behaviour, growth and mortality of distinct species of fish and crustaceans, population interdependence, long-term variability etc.

In the course of time, more attention has also been given to community modelling and to integrated studies of the coupling of benthic and pelagic communities. Methods have been developed to measure energy requirements of benthic communities. Special attention is given to the distribution of macrobenthos in the North Sea and its food supply. A combined study with physical and chemical oceanographers promises to improve insight in the biology of fronts. Biochemical and ornithological studies complete the broad range of investigations.

The ocean-going activities of the institute, in the framework of the second SNELLIUS expedition, should be mentioned separately. As already described in the previous annual report, this expedition takes place in eastern Indonesia between May 1984 and June 1985. Altogether, about 40 scientists and technicians of the institute participated. In addition considerable time was devoted to this project by the institute's management, administration and other technical staff. The departure from Den Helder was honored with the presence of the Minister of Education and Science who performed the cast off of the research ship "Tyro" and subsequently visited the institute. In 1984 programmes on marine pollution research and on coral reefs were carried out, whereas half of the planned cruises for the themes pelagic systems and marine geology were completed. The other cruises of these themes will take place in 1985. Moreover, a cruise will be devoted to the study of ventilation of the deep-sea basins.

It should also be mentioned that the institute made a contract (through the branch "Rijkswaterstaat" of the Ministry of Traffic and Waterways) with a number of government departments charged with the management of the Dutch sections of the North Sea and the Wadden Sea. This contract supports a project under the name of EON (Ecological Research of the North Sea and Wadden Sea). It is described in this annual report under



Mr. W.J. Deetman, Minister of Education and Science, and Mr. Waloejo Soegito, Indonesian Ambassador in The Netherlands, during "cables away" at the departure of R.V. "Tyro" for the Snellius II expedition.

"special projects" and will strengthen research on the field of the ecosystem modelling. To carry out the project, fifteen scientists and assistants have been appointed to the institute over a period of four years. This group was already active in the institute during several years under another name. Its start brings the number of participants in projects to about 20% of the total personnel.

The above description of activities of the institute stresses the multidisciplinary approach which is to a large extent its "raison d'être". The scientists of the institute have always strongly sought co-operation with relevant university departments and with other marine institutes, because of the considerable additional know-how from outside sources required for such an approach. This type of co-operation is to be further developed in future years. In 1984 a more formal co-operation was developed with the Delta Institute for Hydrobiological Research in Yerseke and connections with the department of marine biology of the University of Groningen were strengthened.

We are especially grateful for the continuing support of the Ministry of Education and Science,

H. Postma
J.J. Zijlstra



1.2. ESTUARINE RESEARCH

In addition to the Wadden Sea, workers at the NIOZ have been studying a variety of other estuarine environments.

1.2.1. Physical and chemical research

1.2.1.1. Marine optics

H2-02

Research has focused on extensive analysis and interpretation of in- and above-water optical spectra. Turbulent and highly variable coastal areas require specific approaches with respect to the absorption and scattering properties of seawater, resulting in the pursued relationships (algorithms) between the optical properties ("water colour") and the concentration of suspended and dissolved materials (sea truth). The amount of "water-colour" and sometimes intercorrelated components, were used to characterize the coastal watertype and determine the number and positions of the specific spectral bands suitable for (remote) optical sea water analysis.

Optical and water composition data, previously collected in the western Wadden Sea, were analysed in terms of their spectral absorption and scattering signatures using the components: algal pigments, particulate material, and dissolved organic matter ("yellow substance"). Correlations between total suspended matter, mineral suspended matter, pigment concentrations, "yellow substance" absorption and fluorescence, and particulate and dissolved organic carbon were also investigated.

In turbid coastal water effects, concerning the relationship of fluorescence of the natural chlorophyllous and dissolved organic materials were described and presented for publication.

1.2.1.2. Contaminants

H3-03

The western Wadden Sea was sampled in January, during a period of strong easterly and south-easterly winds and a high fresh water run off ($2897 \cdot 10^6 \text{ m}^3$ January) by the sluices of the "Afsluitdijk". This gave us the opportunity to collect samples covering the whole salinity regime (0-30‰ S). Plots of dissolved copper (Cu), nickel (Ni), and zinc (Zn) concentrations in relation to salinity show a conservative mixing of these elements, while lead (Pb) and cadmium (Cd) plots are rather confusing. Concentrations of dissolved Cu ($18 \text{ nmol} \cdot \text{l}^{-1}$), Ni ($22 \text{ nmol} \cdot \text{l}^{-1}$) and Zn ($83 \text{ nmol} \cdot \text{l}^{-1}$) at a salinity 30‰, reflect concentrations found in the coastal area while concentrations of these elements in the Rhine estuary are 2 to 3 times higher.

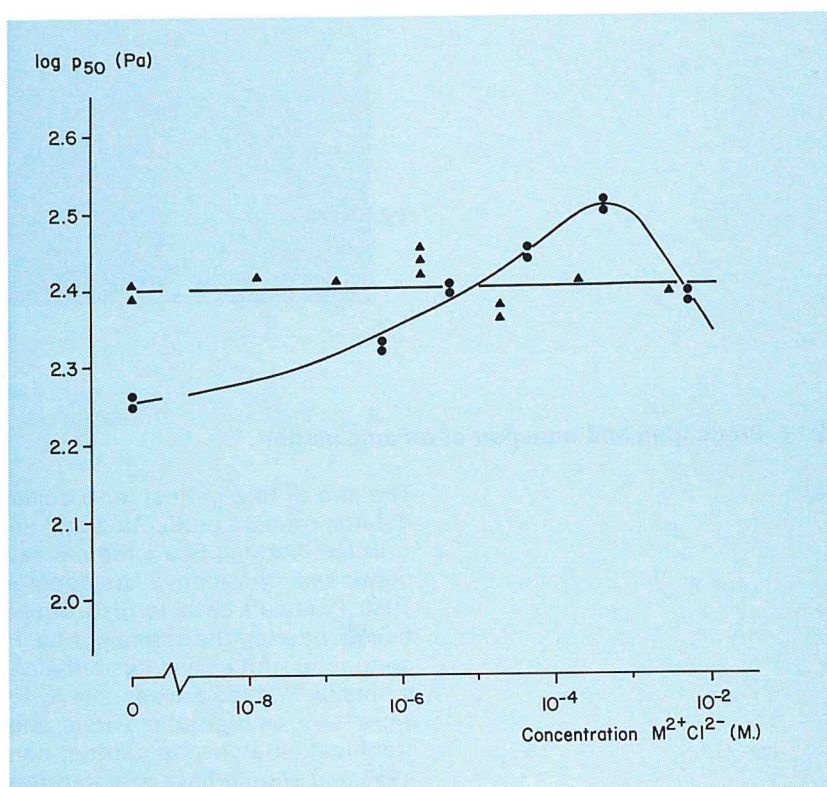
1.2.1.3. Sublethal effects of heavy metals on marine organisms

H3-04

Research on sublethal effects of some heavy metals on some marine organisms was continued and includes a number of aspects:

a) The chemical form of Zn, Cd, Pb, and Cu in the blood of the lugworm (*Arenicola marina*) and the flatfish flounder (*Plathichthys flesus*) under *in vitro* conditions: extracellular haemoglobin with high molecular weight in the lugworm and the intracellular tetrameric haemoglobin concentrations in the flounder possess a high complexation capacity for Zn, Cd, Pb, and Cu. In both species complexation is dependent on time and haemoglobin. Adenosine-tri-phosphate, being the organic co-factor inside flounder erythrocytes, appears to possess no complexation capacity. Due to complexation, the ionic concentrations of Zn, Cd, Pb, and Cu have been reduced to 95% of the original ones. The measured absolute concentrations of Cd and Cu complex bound to flounder haemoglobin are $6.2 \text{ mg}\cdot\text{ml}^{-1}$ and $88.3 \text{ mg}\cdot\text{ml}^{-1}$, respectively.

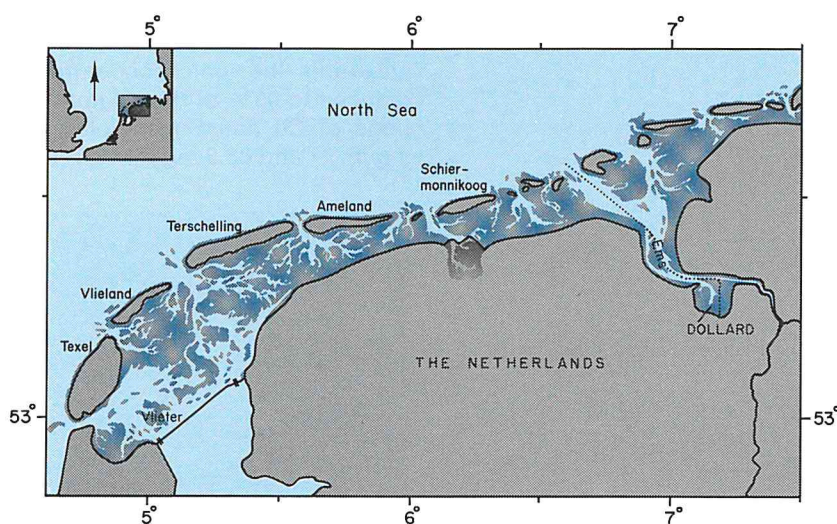
Effect of copperchloride at pH 7.50 (●) and cadmiumchloride at pH 7.60 (○) on the oxygen affinity (expressed as the half-saturation oxygen tension, p_{50} in Pascal) of *Arenicola* haemoglobin solutions, measured at 15°C in tris-HCl, i 0.05; haemoglobin concentration $47 \text{ mg}\cdot\text{ml}^{-1}$



b) The influence of Cd on some respiratory properties of haemoglobin in the lugworm (*Arenicola marina*): at pH values of 7.3, 7.6, and 7.85, Cd exerts minor influence on oxygen affinity, but however, exerts a distinct effect on the subunit-cooperativity of the haemoglobin, and this influence is pH dependent. These results contrast with data on the influence of Cu on the respiratory properties of *Arenicola* haemoglobin, because Cu affects oxygen affinity, but does not influence the subunit co-operativity.

c) Experimental studies on the uptake of Cd and its distribution in *Arenicola marina*, with special emphasis on the correlation between the presence of Cd in sediment, water, and different body compartments of the lugworm: by means of bioturbation the lugworm influences the absorption of Cd to the sediment, 60-92% of the absorbed Cd can be extracted from the sediment with 0.1 N HCl. The uptake of Cd by the lugworm is independent of the concentration of Cd in the interstitial water. The concentrations in the blood seem to reflect, most directly, fluctuations of Cd concentrations in the environment.

Wadden Sea with geographical names mentioned in this report.



1.2.1.4. Production and transport of organic matter

B3-01

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

In the Wadden Sea a regular sampling of the Marsdiep tidal inlet was continued. Chlorophyll has apparently remained relatively constant from 1950 (Postma's data) to 1976, but has suddenly increased since 1978, particularly during the spring period. Phytoplankton production, though less continuous data exist, has remained constant since the earliest measurements by Postma & Rommets in 1965. However data collected in 1981/82 were twice as high as previous values. This increase cannot be due to eutrophication alone, as nutrient concentrations increased regularly since 1950 and should have affected this increased phytoplankton production much earlier. Climatic factors may also be involved, causing less turbidity. Direct data on long-term changes in turbidity, however, are not available and are difficult to collect due to the large tidal variation in turbidity values.

The Ems estuary was revisited in May 1984. Special attention was paid to the amount and fate of organic carbon imported to the Wadden Sea in spring. During this period the Ems has a larger phytoplankton population than it has in winter months. (All our earlier cruises to this estuary have been in winter to exclude this phytoplankton influence).

1.2.2. Sedimentological research

1.2.2.1. Aggregation, disaggregation, flocculation, and formation of particles

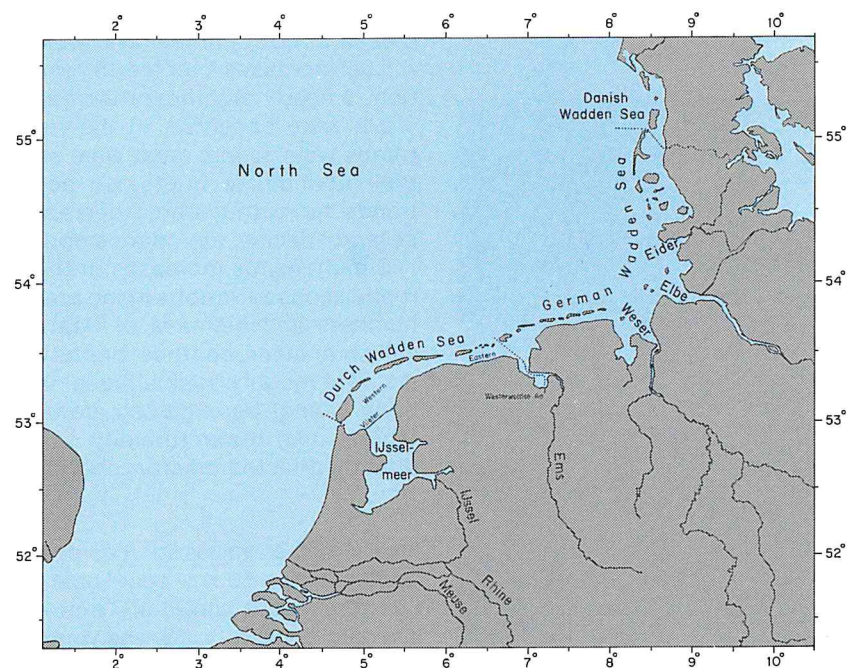
H4-08

To study aggregation and disaggregation of suspended matter in relation to organic matter composition, samples were collected in the Gironde River (in January), the Ems River estuary (in May), and the mouth of the Rhône River (in September-October). The sampling was a continuation of the work initiated in 1982-1983, and involved comparing the three river mouths under conditions of high (May) and low (January-February) organic productivity. Work in the Rhône examined a river mouth without tidal action. This study is being carried out in co-operation with P. Bernard (Antwerpen), J.J. Boon (Amsterdam), V. Ittekkot (Hamburg), J.-M. Martin (Paris), and W.G. Mook (Groningen). The research in the French river mouths was financed by the French GRECO-ICO programme.

1.2.2.2. Sedimentation in the Wadden Sea

H4-01

In the Wadden Sea, boxcores and vibrocores were collected in the "Vlieter", the Dollard, on the tidal watersheds of Terschelling, Ameland and Schiermonnikoog, on the tidal watersheds in the German Wadden Sea from Borkum to Wangeroog and Mellum, and in the Jade. A start has been made with the study of sediment structure (X-ray and visual description), additional grainsize analysis, and sedimentation rate (with Pb-210). Attention is focused on the influence of bacteria, bottom flora and bottom fauna on aggregation and sedimentation of finegrained material. A comparison will be made between the sediment structure in the different mud-deposition areas related to the mechanisms of deposition and the sedimentation rate.



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

1.2.2.3. Dating with Pb-210

H4-11

For the interpretation of sediment data from the "Vlieter" (Wadden Sea) the absolute ages below the bioturbated zone had to be determined for comparison with the marker date caused by the closure of the "Afsluitdijk" in 1932. The signal due to supported Pb-210 was determined at Woods Hole Oceanographic Institute (U.S.A.). With this method sedimentation rates of $5-7 \text{ cm}\cdot\text{y}^{-1}$ were found in the "Vlieter" gully.

1.2.3. Biological research

1.2.3.1. Production and dynamics of macrozoobenthos on tidal flats in the Dutch Wadden Sea

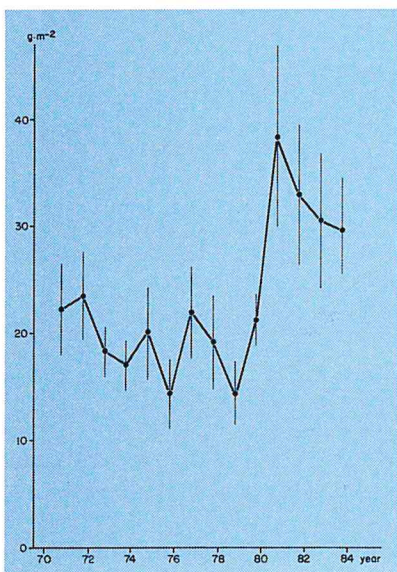
B3-02a

Long-term (1969-1984) 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 spatial and temporal variations.

Total macrozoobenthic biomass in this area has been significantly higher in the last 4 years than during the seventies (see Fig.). Mean biomass values increased from a low level of $30 \text{ g}\cdot\text{m}^{-2}$ ash-free dry weight during the seventies to about $50 \text{ g}\cdot\text{m}^{-2}$ during the early eighties. Biomass increased rapidly, particularly during the summer of 1980, when members of abundant year classes born in 1979 grew to near-adult size. Particularly molluscan reproduction had been highly successful in 1979 after the severe winter of 1978-1979.

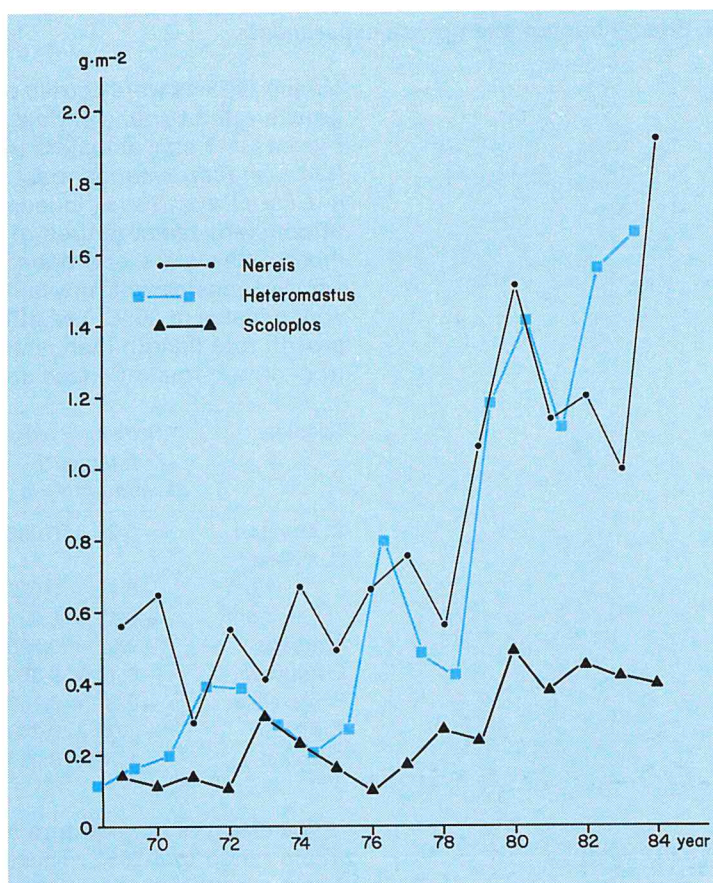
Data on numbers and weights collected during the 15 year sampling at the same 15 sites at Balgzand, revealed that the higher level of macrobenthic biomass was not exclusively caused by abundant year classes born in 1979. In nearly half of the 27 species that were found in sufficiently high numbers to enable a statistical study of trends in their densities, an increase in both number and weight per m^2 was observed. Significant ($p < 0.05$) increases over the 15 year period were found in 10 species. In addition, 3 nearly significant increases and 1 nearly significant decrease ($p < 0.1$) were observed. In the remaining 13 species no clear long-term trends were found; most were sensitive to low winter temperatures, and their abundance fluctuated accordingly. Thus, increasing abundance trends far outnumbered decreasing ones during the past 15 years. In several species, abundance doubled or tripled during this period.

Simultaneous increases of the rate of primary production and of chlorophyll concentrations in the area may underlie the observed increases of numbers and biomass of tidal flat macrobenthos. As in the biomass values of macrobenthos, primary production estimates in the early eighties were roughly double those observed in the early seventies. The possibility cannot be excluded, however, that trends in other environmental factors, like lower turbidity or lower concentrations of contaminants, directly affected macrozoobenthos densities.



Mean biomass values for macrobenthic animals living at 15 sampling places at Balgzand, a 50 km^2 tidal flat area in the westernmost part of the Wadden Sea. The values shown are expressed in $\text{g}\cdot\text{m}^{-2}$ ash-free dry weight with 1 standard error ($n = 15$) and were observed in late winter of each of the 14 years indicated.

Mean biomass values for 3 polychaete species (.) *Nereis diversicolor*, (O) *Heteromastus filiformis* and (Δ) *Scoloplos armiger* observed at annual sampling in late winter during a 15 year period at Balgzand. Means of 15 tidal flat stations, expressed in $\text{g}\cdot\text{m}^{-2}$ ash-free dry weight. In all 3 species the increases are highly significant ($p < 0.01$).



1.2.3.2. Density-dependent mortality of juvenile plaice

Previous studies suggest the existence of a period of high and density-dependent mortality occurring during and shortly after the settlement of O-group plaice on Wadden Sea tidal flats. We studied mortality factors responsible for the sharp reduction in numbers and found a period of high mortality coinciding with tidal migration between tidal flats and gullies. In the gullies the crustaceans (*Crangon crangon* and to a lesser extent *Carcinus maenas*) are abundant. In the laboratory both species prey on small plaice. The shrimp *C. crangon* consumes plaice up to 30 mm and *C. maenas* consume plaice up to 40-50 mm. The period of high plaice mortality on the tidal flats appears to end when the population has reached a mean size of about 30 mm, suggesting that *C. crangon* is the most important predator. Predation of plaice by shrimp in the field is being investigated by examining shrimps stomach contents. Predation intensity appears to be dependent on plaice density.

Experimental observations show that unsuccessful shrimp attacks induce characteristic scars on plaice, which are also frequently seen in the field population. In the laboratory, these scars disappear in about 50 days. In the field, all scars have disappeared 1.5 months after the period of high mortality.

1.2.3.3. Energy budget and growth experiments

Measurements were carried out on the effect of temperature on maximum growth rate of young shrimp (*Crangon crangon*, 2-4 cm), crabs (*Carcinus maenas*, 1-3 cm), sea stars (*Asterias rubens*, 4-7 cm diam.), O-group flatfish (*Limanda limanda* (dab), 4-6 cm, *Pleuronectes platessa* (plaice), 4-6 cm, *Platichthys flesus* (flounder), 5-6 cm, and *Solea solea* (sole), 4-6 cm kept at constant temperatures of 6°, 10°, 14°, 18°, 22°, 26°C for about one month. Sea stars and dabs did not survive at 26°C, and both species showed considerable mortality and a reduced growth rate at 22°C, like the young plaice at 26°C. The effect of temperature in the range of 6-14°C on growth rate (length (fish, shrimp) or carapace width (crabs), or diameter from armtip-to-armtip (sea stars)) has been computed.

Species	Growth in length i.r.t. temp. (T, °C) $dL_{cm}/month = a + bT$	Temp. (°C) where $dL = 0$	Maximum dL cm/month	Temp. (°C) with max. growth
<i>C. crangon</i>	$-0.26 + 0.082T$	3.2	1.3	22-26
<i>C. maenas</i>				
1 cm	$-0.13 + 0.029T$	4.4	1.9	22-26
3 cm	$-0.19 + 0.072T$	2.6	0.8	14-22
<i>A. rubens</i>	$-0.62 + 0.020T$	2.1	2.2	14
<i>L. limanda</i>	$-0.10 + 0.020T$	0.5	2.4	14
<i>P. platessa</i>	$-0.32 + 0.162T$	2.0	3.2	22
<i>P. flesus</i>	$-1.09 + 0.249T$	4.4	3.6	22
<i>S. solea</i>	$-1.73 + 0.289T$	6.0	5.7	26

The effect of temperature on growth rate is certainly not linear over the whole range of 6-26°C. Therefore, to be able to estimate the lower limit where growth will stop, a linear temperature relationship has been calculated for each species only for the lower temperature range.

Sea stars and dabs appear to be cold water species with a comparable maximum growth rate at about 14°C. At temperatures higher than 18°C, these species showed little survival and hardly any growth. Shrimps and shore crabs showed also a comparable temperature effect on growth. The low growth rate of larger crabs (3 cm) at temperatures higher than 14°C may have been due to reproduction. Plaice, flounder, and sole showed interesting differences in their temperature relationships; the plaice appears to be a cold water species, while flounder and sole appear to be warm water species with much higher temperature coefficients for growth. Particularly, young O-group sole showed extremely high growth rates of about 5 cm per month (190% increase in ash-free dry weight).



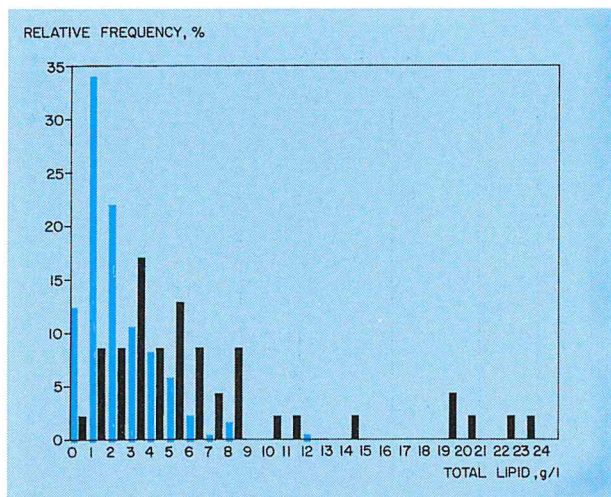
1.2.3.4. Population dynamics of sea birds

B3-04a

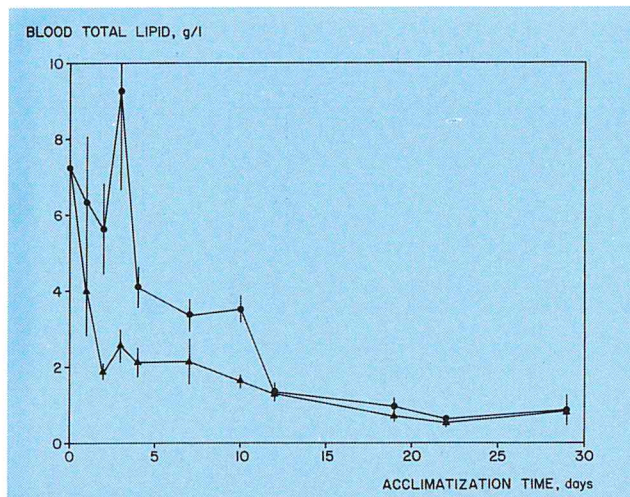


During the nesting season, a large number of Eiders was found dead on or near their nests in the breeding colony on the island of Vlieland. In contrast to what had happened during the pollution incident in the early sixties when mortality in other Eider breeding colonies in the Wadden Sea had been high, in 1984 dead birds were found only in a restricted area in the Vlieland colony. There is evidence that all dead birds had used the same fresh-water pool in the dunes. In and around that pool, a number of dead birds were also found. Autopsy by the Centraal Dierkundig Instituut (CDI, Lelystad) indicated that Eiders had died from an infectious disease. Indeed, the mortality stopped after the birds no longer had access to the pool.

Fledging success in 1984 was relatively good in the Eider colonies located on the islands of Texel, Vlieland and Terschelling. A concentration of moulting Eiders was sampled in July, yielding 300 birds. Besides Dutch breeding birds identified by their rings, 3 adult females were caught that had been ringed in colonies in the Baltic Sea area, 2 as breeding birds and 1 as a duckling. So far, adult females ringed elsewhere were never found among the several thousand of birds inspected for rings during the breeding season (i.e. in May). The July sample showed that at least one percent of the females moulting in the Wadden Sea was of Baltic origin. This confirms that birds from that area are indeed migrating to the Wadden Sea to moult as expected from the increase in Eider numbers in the western Wadden Sea.



Frequency distribution of blood lipid concentrations in male (solid bars, $n = 167$) and female (dashed bars, $n = 47$) *Carcinus maenas*.



Decrease in blood total lipid concentration after transfer to experimental conditions. Temperature 4-5°C (O) and 17-21°C (Δ); vertical bars represent the standard errors of the means.

1.2.3.5. Chemical composition of marine organisms and the abiotic environment

B3-05

Experiments were carried out to analyse the effect on osmotic conditions of lipid levels in shore crabs (*Carcinus maenas*). Total concentrations of lipids, lipoproteins, triglycerides and free fatty acids were measured in animals exposed to various salinities at high (17-20°C) and low (4-5°C) temperatures. The result may be summarized as follows:

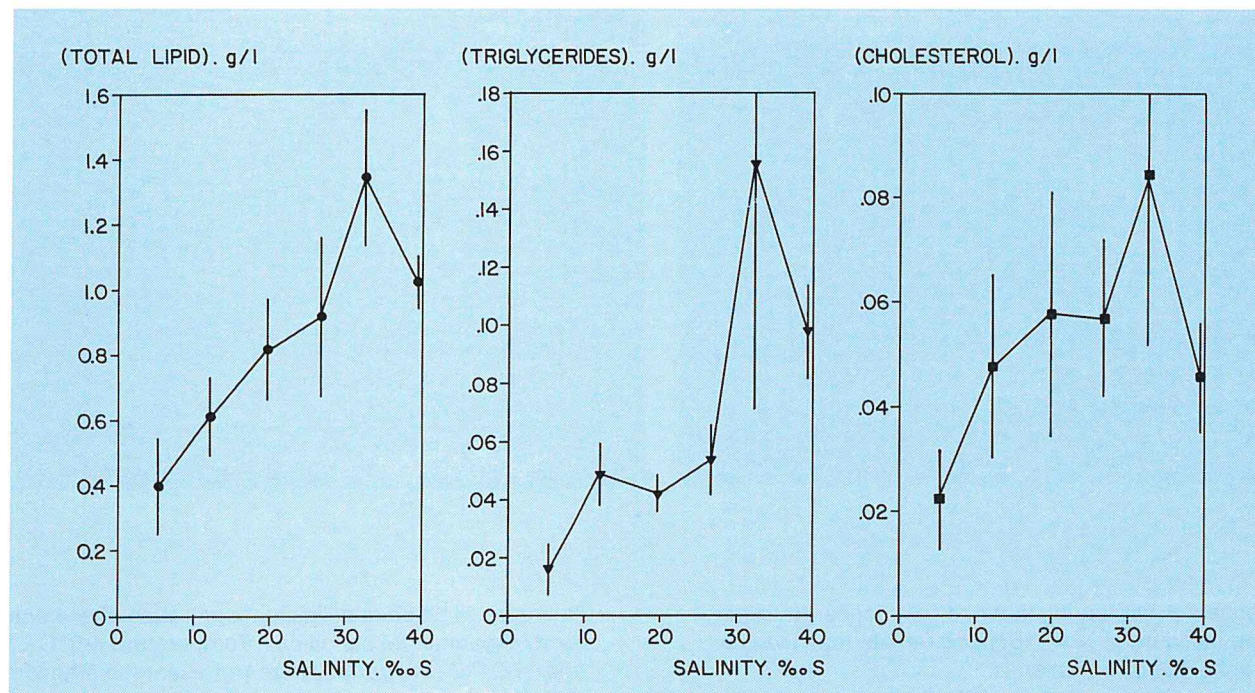
Generally, total blood-lipid concentration is considerably higher in females than in males and reduces with increasing weight in both sexes. Large changes in concentration (~7% per day) occur during acclimatization of the crabs, and are mainly associated with a loss of lipoproteins. This is ascribed to increased (locomotory) activity at animal densities higher than those occurring in nature.

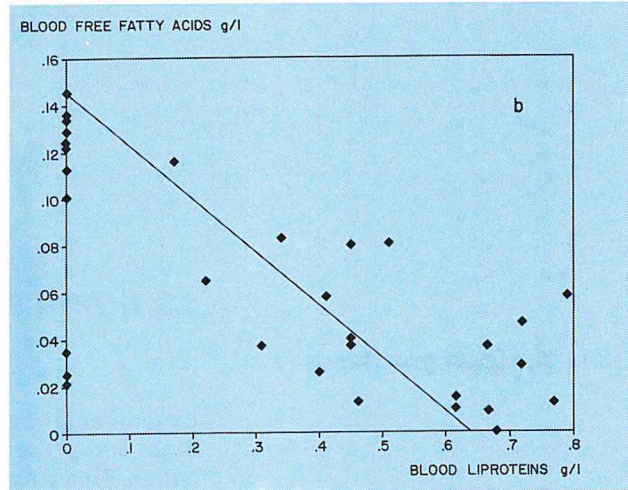
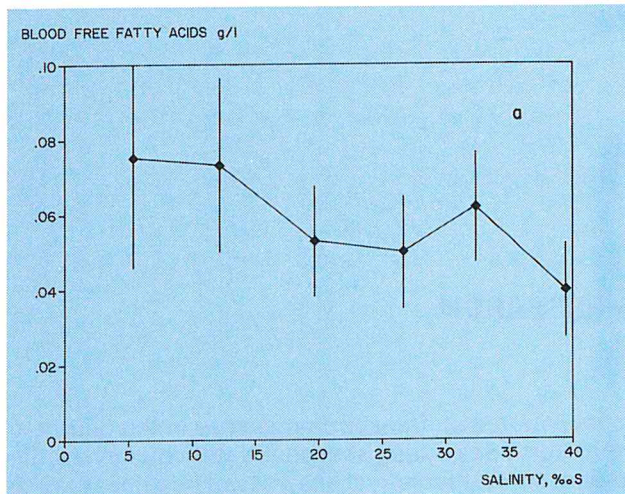
Total concentrations of lipids, triglycerides and cholesterol attain maximal values around normal seawater salinities (33). This response may relate to the function of these substances in membrane permeability regulation.

(BETA)-lipoprotein concentrations are more or less stable between 20 and 30‰ S. Beyond this range, concentrations increase toward higher salinities and decrease toward lower salinities. This response may indicate that these substances are involved in blood-ion regulation.

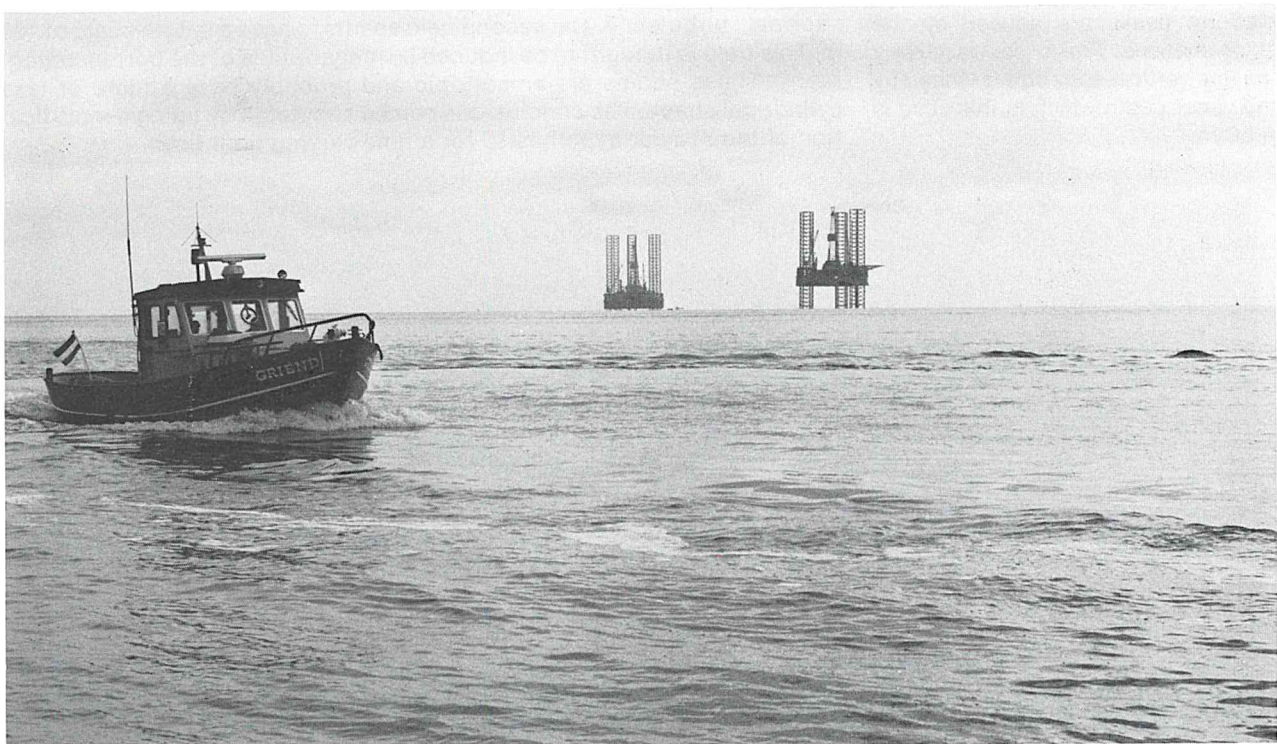
Fatty-acid concentrations are inversely related to blood (BETA)-lipoprotein concentrations. Outside the regulation range, between 20 and 30‰ S, blood levels of free fatty acids are negatively related to environmental salinity. This third type of response may contribute to the regulation of the blood osmotic concentration.

Blood total lipid-, triglyceride- and cholesterol concentrations as a function of external salinity. Acclimatization period > 12 days.





The fatty acid concentration in the blood of *Carcinus maenas* acclimated to various conditions in relation to the external salinity (a) and the concurrent β -lipoprotein concentrations (b).



1.3. NORTH SEA RESEARCH

1.3.1. Transport processes

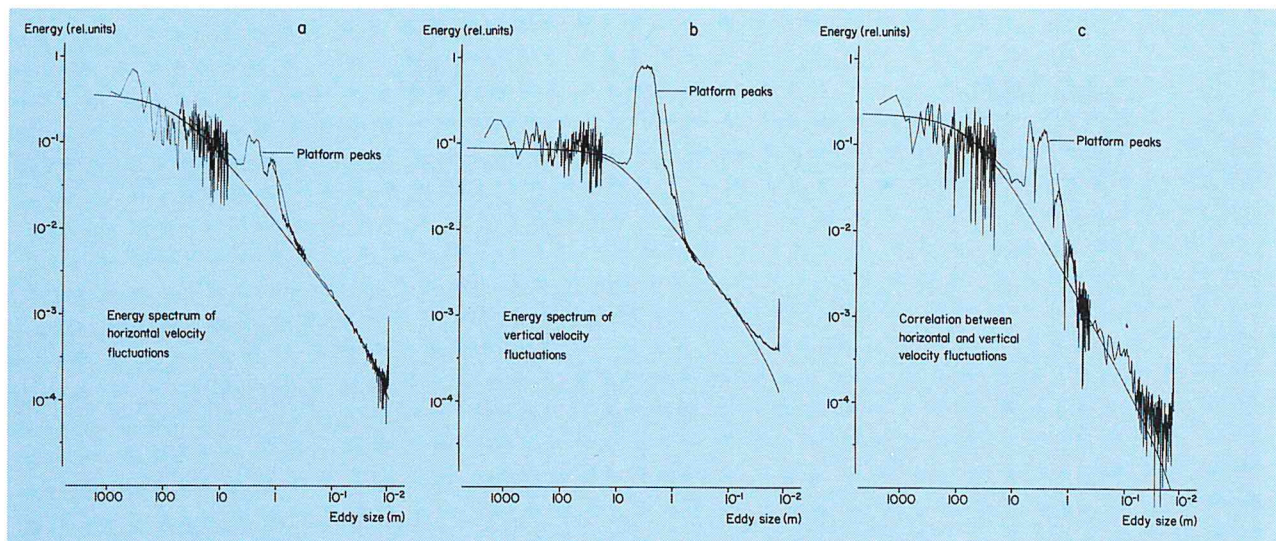
Experimental work concentrated on transport processes in the Southern Bight and in the central North Sea during seasonal water column stratification. This was completed with theoretical analyses of non-linear, wind-driven circulation, two dimensional tidal rectification and three dimensional structure of residual flow.

1.3.1.1. Large-scale transport processes

H2-06

Turbulent energy spectra determined with the NIOZ laser-doppler velocimeter system during the "Bree-14" project. The drawn lines are the theoretical curves fitting the data. The platform peaks are caused by the ships motions. Fig. b shows clearly that the vertical eddy size is limited by the water depth which in this case is ~ 20 m.

The analysis of current velocity measurements collected during the project "Breeveertien" in a "small" horizontal array (max. distance 2 km) was finished. There are strong indications that turbulence at the site can be decomposed into two stochastically independent fields. The length scale of the eddies in one of these fields is equal to waterdepth (30 m). Horizontally the eddies are nearly isotropic and are thought to constitute "normal" turbulence. The second field seems to have a length scale of 100 m. This field is thought to be induced by megaripples of the bottom topography. These eddies are anisotropic and probably have a more or less cylindrical shape. The conclusions can be simulated by using a modification of the "Taylor-hypothesis" for a time-varying tidal flow.



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

H2-07

The analysis of observational data collected during the joint project "Stratified North Sea 81/82" has been continued in 1984. The model, which describes the turbulence in the wind-mixed layer, has been extended to include terms accounting for the growth of wind-waves. It is based on a variant of Ekman's work on wind-driven ocean currents.

From small-scale turbulence measurements performed during the project "Breeveertien" (1982), a coherent picture can be obtained of the turbulent structure of the watercolumn in a tidally-mixed region of the Southern Bight of the North Sea. The model, which is verified by laser-doppler turbulence measurements, is based on a balance equation of turbulent kinetic energy and the "Van Veen"-velocity profile. It is also apparent that one can expect a surface stratification in periods of low wind velocity and high solar radiation, especially close to the turn of the tide. When the tidal velocity increases after slack water, stratification will disappear in most cases. This stratification has a large influence on the horizontal diffusion properties in the surface layers of this area an aspect which was clearly visible in dye releases on different days during the "Breeveertien" experiment. If the water column is well mixed, a simple relationship is obtained between turbulence properties determined by the laser-doppler system and horizontal diffusion in its initial phase.

Support has been given to a project of the K.N.M.I. (Royal Netherlands Meteorological Institute) concerning the influence of underwater dunes on changes in the properties of surface waves in different phases of the tidal cycle. A few turbulence measurements have been done at different positions relative to the crests of the underwater dunes. It is, however, almost impossible to position the ship within a small distance compared to the "wavelength" of the dunes making interpretation of the measurements difficult.

1.3.1.3. Theoretical dynamical oceanography

H2-08

Theoretical analysis of non-linear, wind-driven circulation was continued by looking for a suitable global renormalization method. It appears possible to define a renormalized Ekman number so that for boundary layer flow, the non-linear problem can be reduced to a quasi-linear one, the solution of which has the same characteristics as the results from numerical simulation. This method also applies, in an even simpler form, to the symmetry breaking of the topographic beta-effect in wind-driven circulation of shallow seas like the North Sea. Two studies on two-dimensional tidal rectification were finished both in collaboration with the Centre of Mathematics and Computer Sciences (Amsterdam).

The first one deals with the generation of residual circulation by side-wall frictional boundary layers. By means of a global renormalization procedure, residual circulation grows exponentially for large Strouhal numbers. The second study deals with the generation of residual circulation by a step-like topography. It could be proven, that for a sharp step the residual velocity field extends only over an area of two times the tidal excursion amplitudes on both sides of the step. Only when lateral friction is introduced, the profile extends to infinity with an exponential decay. Moreover it was shown that the method of "harmonic truncation", sometimes used to mathematically attack this problem can give wrong results if applied to sharp steps.

A start was made with a study of the three dimensional structure of residual flow with the assistance of ZWO (Organization for the Advancement of Pure Research). This study attempts to determine under which circumstances the cross-isobath circulation near a tidal sand ridge gives a convergence of the bottom currents to the ridge crest. A first analysis, using a weakly non-linear approach, suggests that in the regime no such convergence can be found. Consequently one must look at the strongly non-linear situation, a much more difficult problem. The first area of study has centered on the limit of small amplitude topography. As a first result, analysis showed that three-dimensional effects have a bearing on the quasi two-dimensional structure of the residual circulation, since tilting of horizontal vortex lines adds to the generation of residual flow in the horizontal plane.

1.3.2. Sediment and Foraminifera

1.3.2.1. Mud accumulation

H4-01

Studies were mainly carried out in some mud accumulation areas in the southern North Sea. In the German Bight, southeast of Helgoland, current velocity and suspended matter concentration were measured at half hour intervals during a full tidal cycle at various points near the surface and bottom measurements were carried out partly with the R.V. "Aurelia" and partly with the R.V. "Senckenberg" of the Senckenberg Institute in Wilhelmshaven in co-operation with Dr. Georg Irion of that institute. Preliminary analyses clearly indicate that on the west side of the mud deposition area transport of suspended matter is larger during the flood-tide (directed inward into the German Bight) than during the ebb-tide (directed outward). This is related to the asymmetry of tidal movement. Further inward, the difference between flood-tide and ebb-tide is smaller. Although only a few samples have been taken, this indicates an accumulation mechanism which may explain the presence of a mud deposit in this area. Bottom cores, collected with a vibrocorer in 1983, were X-rayed and profiles were made. Compared to other mud accumulation areas (e.g. Vlieter, Dollard, tidal watersheds in the Dutch Wadden Sea), the sediment structure is more irregular: alternating sandy and muddy layers, erosion surfaces and strongly bioturbated zones. ^{210}Pb measurements on some cores showed sedimentation rates in the order of $0.7\text{--}1.0\text{ cm}\cdot\text{y}^{-1}$. This was also found at the edge of the deposit, where it thins out, indicating that the mud has been transgrading over the (older) sand deposits during the past 100-200 years.



1.3.2.2. Foraminiferal assemblages

H4-01

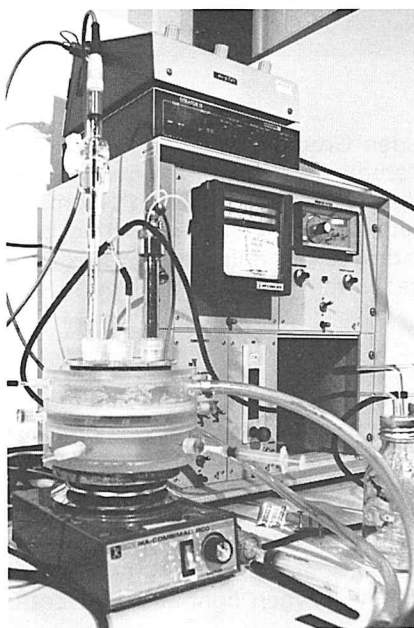
In the Skagerrak, 28 boxcores were collected with the R.V. "Aurelia" during a joint cruise with Dr. B. Corliss (Woods Hole Oceanographic Institution, U.S.A.). Funding for this programme was received from the National Science Foundation, U.S.A. and the aim of the research was to determine the relationship between assemblages of living benthic Foraminifera and hydrographic and sedimentologic variables. Specifically, the amount of organic carbon used as an indicator of food availability, together with dissolved oxygen, nitrate and phosphate in the pore water and sedimentation rate (^{210}Pb) are being studied in co-operation with the department of chemical oceanography (Section 1.3.3).

A study of benthic Foraminifera in surface sediments of the Norwegian Channel, carried out in co-operation with Dr. G.B. Quale (University of Oslo), showed that eight species dominated the fauna. Five assemblages could be discerned; four of which were related to hydrographic characteristics of the overlying watermasses. The distribution of certain species seems to be related to bottom sediment conditions such as silt, clay and organic matter content.

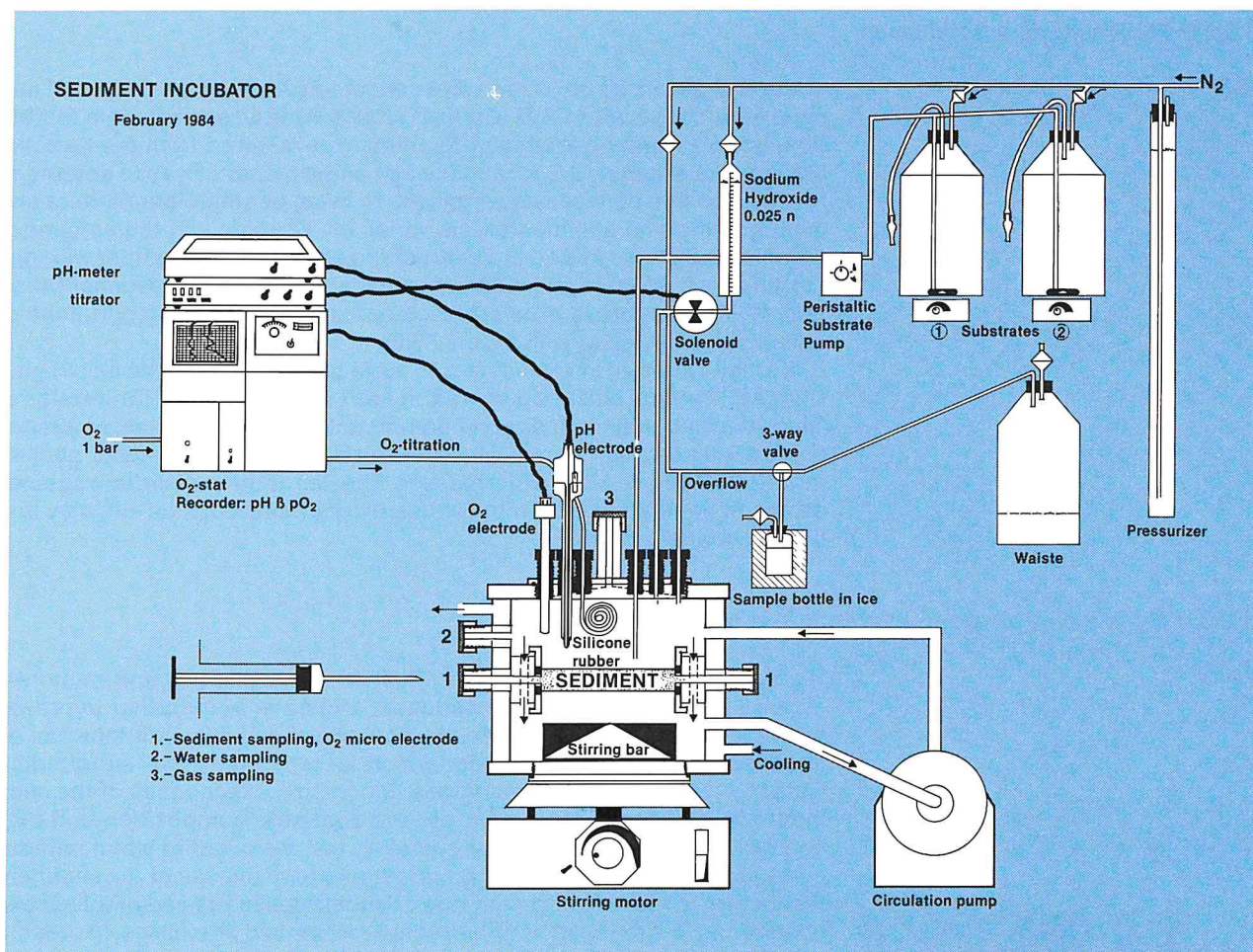
1.3.3. Oxygen and nitrogen cycles in the sediment

H1-03

During the course of studies on nitrification, denitrification and ammonification in marine sediments a sediment incubator was further improved and made operational. Selected physical and chemical conditions can be imposed on a slice of sediment which is separated from surrounding water by two permeable membranes. Biochemical responses of the sediment slice to temperature, pO_2 , pH and substrate composition and concentration can be evaluated by sampling the surrounding water without disturbing of the sediment slice. A prerequisite to the use of the sediment incubators is that the diffusion rate of substrates in the sediment slice is not limiting *in situ* reaction rates of biogeochemical processes. In order to establish diffusion rates in the sediment incubator system experiments with chlorine as a conservative tracer were conducted. This led to the development of the present design of the incubator in which a diffusion coefficient for chlorine through the sediments/membrane system is determined. The diffusion coefficient is ten times higher than diffusion under natural conditions. Extrapolation to diffusion coefficients of nitrate, nitrite and ammonia makes it plausible that reaction rates of biogeochemical processes in the sediment of the incubator are not controlled by diffusion. To determine O_2 -gradients in sediments in the laboratory and in field, construction of O_2 -micro-electrodes was continued. At present, O_2 -micro-electrodes constructed according to Revsbech's method are operational. During a cruise in the Skagerrak these micro-electrodes were tested, and a comparison was made with commercially available larger mini-needle electrodes. Both types of electrodes performed satisfactorily on sediments from the Norwegian Channel and yielded comparable results. However, the rugged construction and non-disposable character of the mini-needle electrode makes it advantageous for shipboard use.



The sediment-incubator, an apparatus for the study of early diagenetic processes in sediments under controlled conditions of temperature, oxygen, pH and substrate concentrations.



1.3.4. The "REFLEX" programme

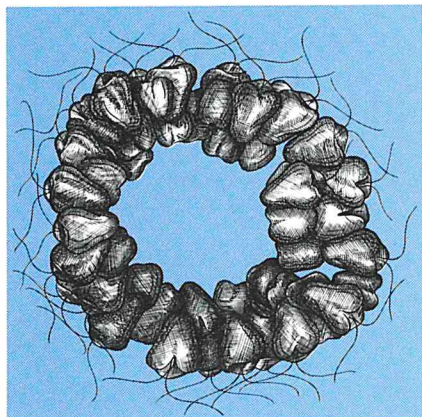
During the "REFLEX" (Repeated Fladen Ground Experiment) cruise of April-May 1983 plankton ecology was studied, especially the dynamics of *Calanus finmarchicus* in relation to the spring phytoplankton bloom.

For about one month samples were collected near a drifting buoy launched at 58°42'N and 0°30'E which drifted 45 n.miles northward during this period. Some results were reported in the 1983 Annual Report.

1.3.4.1. The pelagic system

B4-02

Analysis of samples collected in the second half of May revealed that up to 85% of the phytoplankton consisted of the colonial Prymnesiophycean *Corymbellus aureus*. This species was described for the first time about 10 years ago and has never been reported from the North Sea. Degradation products of algal pigments found during the rise and fall of this exceptional algal bloom indicate that copepod grazing on *Corymbellus* was much less intensive than on other algal species. Primary production, measured both with the ¹⁴C and with the oxygen light-and-dark bottle method, was up to 3 g C·m⁻²·d⁻¹.



Corymbellus aureus

Zooplankton samples and copepod growth data show that carbon biomass of the dominant herbivore, the copepod *Calanus finmarchicus*, ranged from 0.2 to 1.7 g·m⁻², with peaks at 9 and 21 May. Chlorophyll content of these animals in the upper 100 m was highest during the night indicating diurnal vertical migration. The activity of the digestive enzymes amylase and laminarinase did not show such a diurnal rhythm. Trypsin activity for the digestion of animal food was not detected. Chlorophyll ingestion rates were estimated *in situ* for copepodite stages III, IV, V and female VI, according to digestion rates (22, 46, 78 and 53 ng·d⁻¹ respectively) and measured with the Coulter counter in grazing experiments (—, 40, 75 and 135 ng·d⁻¹ respectively, not measured for Copepodite stage III). The *Calanus* population grazed less than 1% of the phytoplankton stock per day. Development and growth rates of incubated *Calanus* stages decreased after the first week in May presumably due to changes in phytoplankton composition. Carbon production of the population was only about 1.2 g·m⁻² in 27 days. This low production and the residual transport observed from south to north suggest that most of the *Calanus* biomass found in the Fladen Ground area is not produced there. Possible sources of *Calanus* are frontal systems east of Orkney and Scotland which are located upstream in the Faroer Isle residual current running west and south of the Fladen Ground area.

B3-01

Daily measurements with sediment traps indicated that 1% of the primary production (~20 mg C·m⁻²·d⁻¹) sank from the euphotic layer. This material was primarily deposited in the form of large euphausiid faecal pellets.

1.3.4.2. Heterotrophic activities and bacterial biomass in marine environments

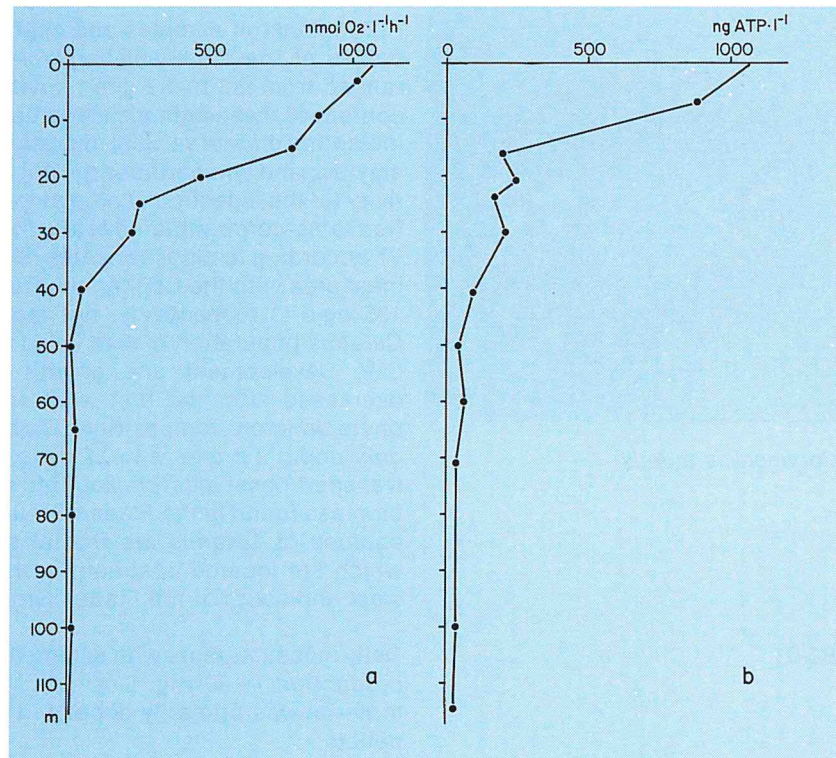
B1-03

Measurements of mineralization (ETS) and biomass (ATP) during the REFLEX expedition in May 1983 in the northern North Sea gave the following results. Biomass and respiration in the water column are predominantly found in the upper 50 m layer. The ATP concentration in the entire water column amounted to 20.4 ± 6 mg·m⁻², which corresponds to about 5 g C·m⁻² (assuming a C biomass/ATP ratio of 250). As the respiration rate at the same time was 1.5 g C·m⁻²·d⁻¹, a respiration/biomass ratio of 0.3 was calculated. Then, assuming a steady state situation, a doubling time of the biomass of 3 days was found.

In addition, ATP concentration of the bottom sediment was measured. From a sediment core of 13 cm, a mean biomass of 4.5 mg·m⁻² (expressed in ATP) was calculated. The major part was concentrated in the upper 5-7 cm layer. The ratio of ATP in water column to ATP in sediment amounts to 20.4/4.5 = 4.5. This high biomass value in the sediment points to a considerable import of organic matter by sedimentation.

Electron transport system (ETS) activity is highly affected by temperature. Therefore, experiments were carried out to determine the conversion factor needed to translate ETS values, obtained by a standard incubation temperature of 20°C, into *in situ* respiration values. The natural logarithm of ETS values was plotted against the reciprocal of the absolute temperature (Arrhenius curve), which gave the activation energy (E_a). From 9 simultaneous observations on oxygen uptake and ETS activity an ETS/respiration ratio of 4.3 ± 1.9 was calculated.

a. ETS-activity at *in situ* temperature plotted against depth. Fladen Ground, 18 May 1983. Recalculated to real respiration and integrated over the whole water column gives a respiration of $1.7 \text{ g C} \cdot \text{m}^{-2} \cdot \text{d}^{-1}$. b. ATP content per liter plotted against depth. Fladen Ground, 18 May 1983. Integrated over the whole water column and multiplied by 250 gives a biomass of $4.95 \text{ g C} \cdot \text{m}^{-2}$.

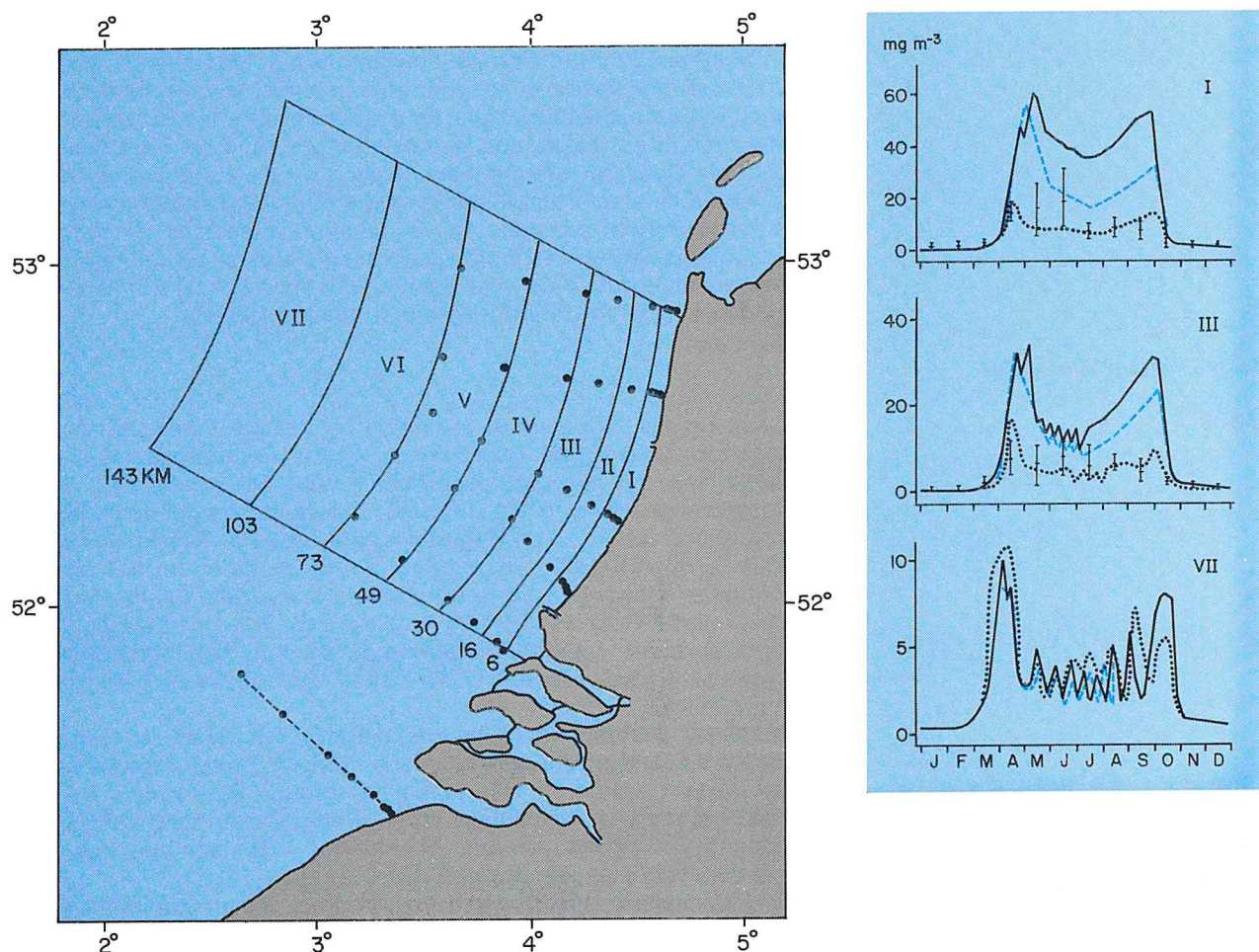


1.3.5. The southern North Sea

1.3.5.1. The pelagic system

B4-01

Modelling the ecosystem to study plankton dynamics in the eutrophic Southern Bight was continued in co-operation with the Delft Hydraulics Laboratory (DHL). The earlier model SEASIM was combined with the DHL programme DELWAQ for computing horizontal water transport. The resulting model SEAWAQ simulates seasonal variation in diatom and other phytoplankton carbon and concentrations of the nutrients P, N, and Si at different distances from the Dutch coast. The model suggests that eutrophication caused an increase of flagellate summer biomass by a factor of 2 to 4 within 30 km from the coast since 1930. This caused an important shift in composition from diatoms to other phytoplankton species. Nutrient influx from the south seems to be as important as river discharge for water quality. In the model, phytoplankton growth within 16 km from the coast is not limited by nutrient depletion or light conditions. Here summer biomass seems to be regulated by density-dependent dispersive transport to offshore waters. Beyond 16 km, diatoms are limited by Si depletion, while other phytoplankton are limited by P depletion.



Compartments used for the model SEAWACK with locations of the WAKWON monitoring programme. Chlorophyll a contents in the compartments I, III, and IV, as estimated by the model SEAWACK for 3 different scenarios, compared with measured values. 1. Continuous lines: river nutrient discharge and nutrient influx across the southern border both of 1980, 2. interrupted lines: the same estimates of 1930 and 1980 respectively, and 3. dotted lines: river nutrient discharge of 1930 and southern influx reduced to influx from the Straits.

B2-03

To evaluate the effect of predation on the summer development of copepod populations in the Southern Bight, zooplankton samples collected at the Rijkswaterstaat (RWS) measuring platform 7 miles off Noordwijk were analysed. Copepod growth experiments were carried out to estimate total mortality rate of the most abundant species. Rates of development of *Temora longicornis* stages kept in shipboard containers during the period of highest phytoplankton level in July and August, equalled rates at intermediate food levels in the laboratory (section 1.3.5.3.). Mortality rates can be estimated from observed changes of stage densities and estimated rates of development. By comparing total mortality and predation mortality it may be possible to quantify the significance of predation for the summer decline of copepod populations.

A series of cruises was made with the R.V. "Aurelia" in the eastern part of the Southern Bight to observe changes in the *Phaeocystis pouchetii* population during March-June when this colonial prymnesiophycean is common in Dutch coastal waters. Peak abundance was registered in the coastal zone in April-May, and further offshore numbers were generally much lower. Considerable numbers, however, were still found in the offshore region in June. From measurements of lipids, carbohydrates, proteins and excretion products, the suggestion arises that *Phaeocystis* forms proteins during the night using assimilates accumulated during day time inside the mucoid envelope of the colony. Cultures of *Phaeocystis* are now kept in the laboratory to test this hypothesis.

1.3.5.2. Pelagic predators

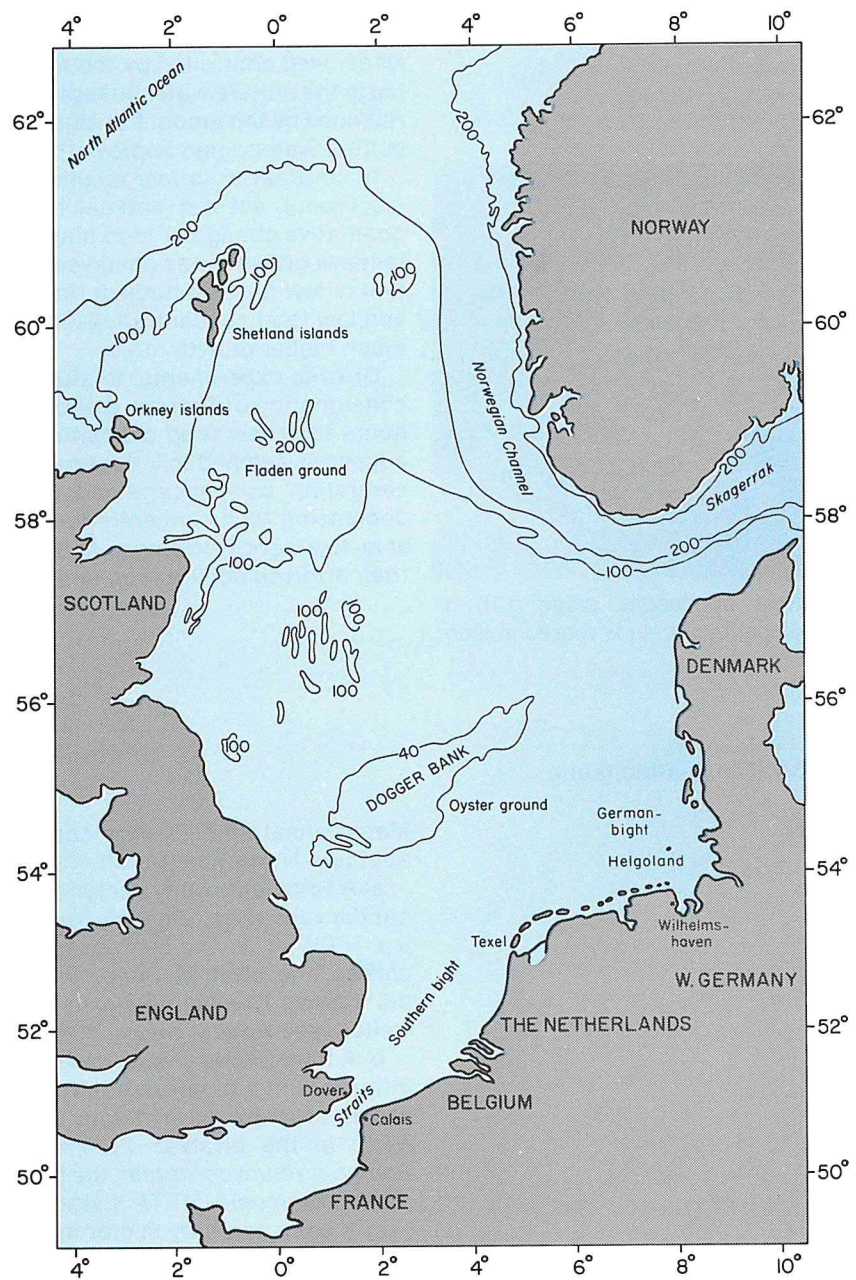
B2-03

Research on the influence of predation by pelagic carnivores on herbivorous zooplankton has focused on the role of Hydromedusae in North Sea coastal waters. Feeding experiments were carried out with *Sarsia tubulosa* which was offered different densities of copepods (mainly *Temora*). Food intake of 10 different size classes of *Sarsia* was determined at 12°C, the mean temperature during the bloom of this species (April-June). There appeared to be a nearly linear relationship between umbrella diameter and maximum feeding rate. Growth rates in *Sarsia* were measured in non-limiting feeding conditions: size increase was 2 mm per week in small specimens (5 mm) and 1 mm per week in larger ones (9 mm).

Preliminary experiments on feeding behaviour in the mysid (*Euproxus flexuosus*) showed a strong dependence of feeding rate on prey density. Further experiments with macroplankton groups like mysids and euphausiids require more knowledge of their vertical distribution and actual prey density at different depths. A 200-liter water sampler has been designed for this purpose and was tested at sea.

During the summer of 1984, field work was focused on development and interaction of populations of copepods, hydromedusae and *Noctiluca*. During 6 weeks in July and August, daily plankton samples were taken from the Rijkswaterstaat (RWS) measuring platform 7 miles off Noordwijk. Vertical hauls with a 50 μ net over the 20 m water column and simultaneous Nansen water samples gave information on chlorophyll *a* concentration and water temperature. In the beginning of August the population of the dominant copepod *Temora longicornis* showed a rapid decline together with the chlorophyll *a* content of the water. The copepod decline, however, was due to a decrease of numbers of the juvenile stages only (from 50 000 m^{-3} to less than 1000 m^{-3}); the adults of *Temora* and adults and juveniles of less abundant species remained at more or less constant levels. An explanation for the phenomenon was ascertained by studying the stomach contents of the hydromedusa *Phialidium hemisphaericum* and the zooflagellate *Noctiluca*, which appeared to feed almost entirely on copepod eggs. *Noctiluca* with densities of up to 35 000 per m^3 , could influence copepod population levels in summer.

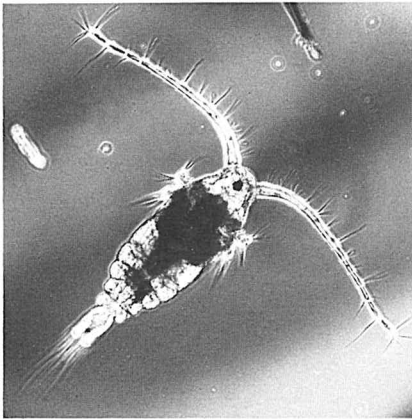
In April, July and September, cruises with the R.V. "Aurelia" were made in the surrounding water of the RWS-measuring platform in order to study horizontal distribution of zooplankton in the area which might affect catches at the RWS-platform. In spring there appeared to be little horizontal variation, while the two summer trips showed a variation in copepod density up to a factor 6 between stations.



North Sea with geographical names mentioned in this report.

1.3.5.3. Experimental investigations on zooplankton

B4-04



Juvenile copepodite stage (CII) of *Centropagus hamatus* reared in laboratory culture.

Population-dynamics and bioenergetics of a dominant copepod from the North Sea were investigated in experiments in which generations of the copepod *Temora longicornis* were cultivated continuously. A long-term experiment was carried out at 16 different temperature and food combinations. It appeared that concentrations of algae fed to the copepods were rather well controlled by the heterotrophic flagellate *Oxyrrhis marina* living in the culture water. In turn, the concentration of this flagellate was influenced by the amount of algae fed. Automatic control of particles in the culture water could improve this balanced culture system.

In contrast to former results, development of *Temora* was not always isochronal, even at optimal food concentrations. It is possible that a qualitative change of food played a role. Experiments indicate that constant low growth rates observed in the sea can be explained by a combination of low temperatures during spring when food is abundantly present, and low food concentrations in summer when temperatures would allow much higher growth rates.

Grazing experiments, to study the influences of methodology on food consumption of *Temora*, demonstrated an adaptation time of about 3 to 4 hours to a new food concentration. Container volume and crowding of copepods seemed to influence food consumption. The effect of food concentration was ascertained. Filtering rates appeared to increase at decreasing food concentration, and no plateau was reached, not even at very low concentrations. Apparently, copepods continuously increase their effort to collect food until they starve.

1.3.5.4. The benthic fauna

B2-02

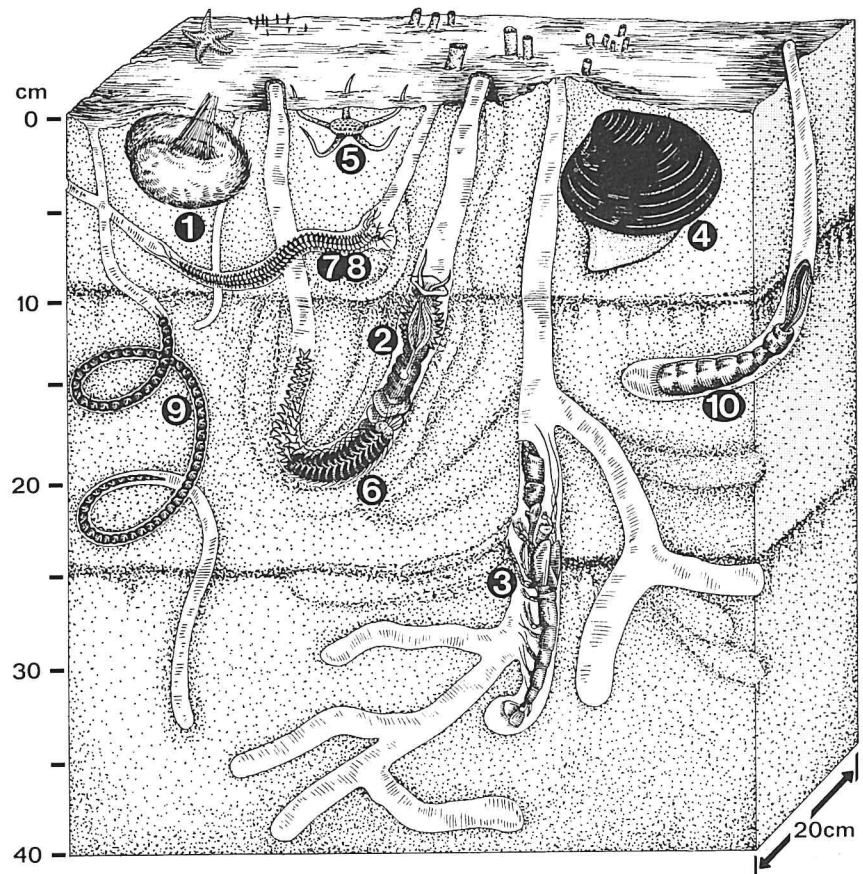
Macrofaunal studies were continued in three ecological sectors in the southern North Sea (Dutch offshore waters).

a) A turbulent sandy sector in the south with well-mixed water throughout the year and a relatively poor fauna. Infauna biomass is in the order of 3 g AFDW·m⁻². The benthos is characterized by the polychaete *Nephtys cirrosa*, the bivalves *Donax vittatus*, *Ensis* sp. and *Spisula* sp. and the crustacean *Thia scutellata*. In this zone the META I station was regularly visited (see Annual Report 1983).

b) A transitional area with very muddy sediments and an extremely rich infauna with a biomass of about 25 g AFDW·m⁻². In this area the fauna shows an apparent zonation with maxima in abundance from south to north in the bivalves *Tellina fabula*, *Nucula turgida*, the sea-urchin *Echinocardium cordatum*, the bivalve *Abra alba*, and the prosobranch *Turritella communis* (META II station).

c) A calm and silty sector in the north (Oyster Ground) with a summer water column stratification and a rich fauna. The biomass of the benthos amounts, on the average, to 12.5 g AFDW·m⁻². The infauna is characterized by the polychaete *Chaetopterus variopedatus*, the bivalves *Thracia convexa*, and *Cyprina islandica*, the brittle star *Amphiura filiformis*, and the crustacean *Callinassa subterranea* (META III station).

Block diagram showing spatial arrangements of dominant macrofauna organisms in a muddy sediment (META station 2) in the Oyster Ground. 1. *Echinocardium cordatum*, 2. *Chaetopterus variopedatus*, 3. *Callianassa subterranea*, 4. *Arctica islandica*, 5. *Amphiura filiformis*, 6. *Gatteana cirrosa*, 7. *Glycera rouxii*, 8. *Nereis* sp., 9. *Notomastus latericeus*, 10. *Echiurus echiurus*.

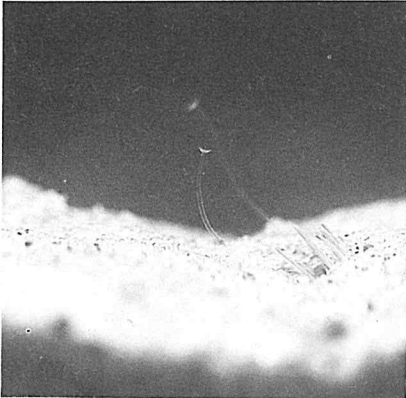


1.3.5.5. Secondary producers

B2-02e

In 1984 in order to measure growth and numerical changes of several selected species four cruises were made for regular sampling of macrobenthos at the three META stations. For *Mysella bidentata* (Mollusca) and *Amphiura filiformis* (Echinodermata), the most abundant species at site META II, growth rates, recruitment and mortality have also been estimated.

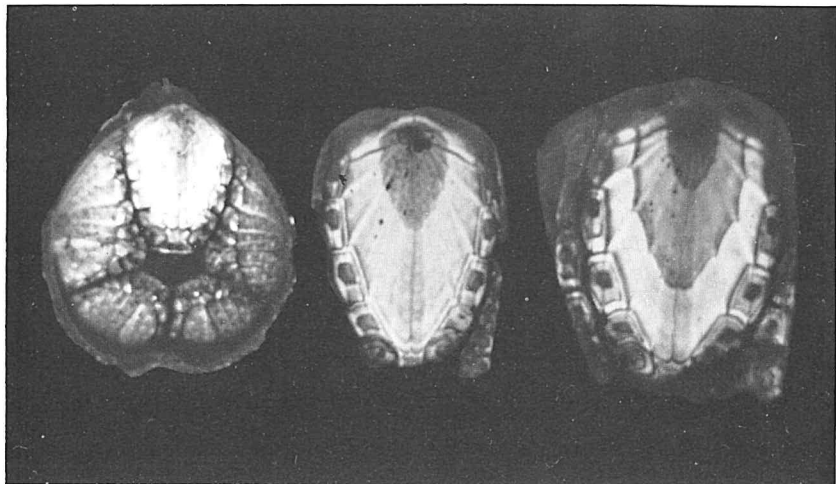
In the population of the latter species the adult fraction remained stationary in size and numbers and dominated the population during the period of observation. The large number of recruits during summer did not lead to pronounced year classes in subsequent years due to unexplained mortality. Growth rate of these small stages was low ($0.9 \text{ mm} \cdot \text{y}^{-1}$ disk size). Consequently, annual production of this population must be attributed to the (stationary) adult fraction. It is argued that grazing of the arm tips (which causes reduction in disk size) and their subsequent regeneration explains the lack of distinct year classes and difficulties in measuring production. While predation by the dab (*Limanda limanda*) on *Amphiura* has been calculated, it apparently does not have an appreciable effect on the population.



Surface activity of dorsal tube feet of the sea urchin *Echinocardium cordatum*. These tube feet are used for constructing a respiratory funnel and for collection of food particles.

In co-operation with Dr. M.I. Jenness (Davis & Elkins College, USA) growth rates of the sea urchin *Echinocardium cordatum* along a transect in the southern North Sea were studied. For this purpose a method of age determination by growth rings was used. Growth estimates yielded unexpected results; growth rate in the turbulent sandy sector was highest and showed a gradual decrease in northward direction. The observed gradient in growth rate correlated well with temperature in the area, but is there enough food available at the southern sites?

A study on the fate of chlorophyll *a* in the water column at META I station, showed that during periods of slack tide chlorophyll *a* levels increased at the sediment surface and chlorophyll *a* became buried in the top 5 cm. This burial may be explained by current ripples action. Laboratory experiments in a circular flow tank yielded similar results. Observations on the feeding mechanism of *E. cordatum* showed this species to be an efficient surface deposit-feeder, well capable of utilizing the intermittent food supply found in the turbulent southern sandy sector.



Skeletal rings in foot-plate of *Echinocardium cordatum*. Three successive year classes.

B1-05

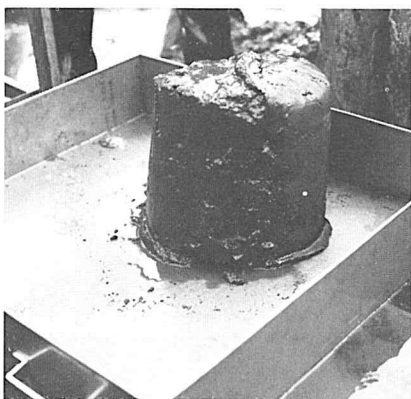
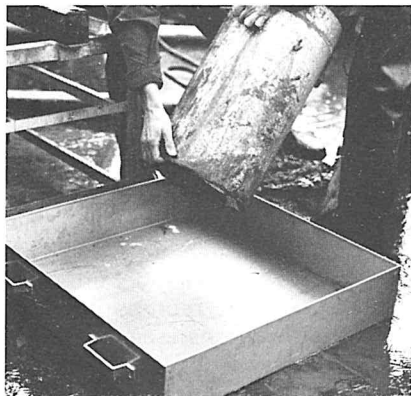
Metabolism of *Echinocardium cordatum* in relation to temperature and body size was measured in the laboratory. While this species attains high numerical densities and biomass its energy demand is less than 2% of the total carbon flow to the benthos, due to its sluggish behaviour.

B2-02e

The study of the feeding mechanism of *Callinassa subterranea*, a burrowing shrimp occurring in high densities in the muddy parts of the southern North Sea (Oyster Ground), was continued. During this work it was observed that large sized food particles seemed to be excluded from ingested sediment. Organic carbon values of the faeces were significantly higher than those of the sediment offered as food suggesting the animals are selective deposit feeders. Small particles with a relatively high organic carbon content are probably preferred over larger sand particles. Additional morphological examination of the mouth parts of *C. subterranea* showed that the chaetae on the mouthparts form a series of sieves.

1.3.5.6. The role of carnivores in the benthic system

B2-02a-c



Studies on the trophic relationships between benthos and demersal fish on two common fish species, the lesser weever *Trachinus vipera* and the dab *Limanda limanda*, showed the lesser weever occurs in high densities in areas with medium and coarse sand (in the Southern Bight). Its yearly production is $0.02-0.08 \text{ g AFDW} \cdot \text{m}^{-2}$. If a gross growth efficiency of 0.2 is accepted (most probably the efficiency is lower), the food required for such a production amounts to $0.1-0.4 \text{ g AFDW} \cdot \text{m}^{-2} \cdot \text{y}^{-1}$. The diet of the lesser weever mainly consists of fish (85% especially gobies *Pomatoschistus* sp.) which in turn feed on shrimp. With the assumed gross efficiency of 0.2, we arrive at an indirect predatory pressure on the secondary producers of at least $0.5-2.0 \text{ g AFDW} \cdot \text{m}^{-2} \cdot \text{y}^{-1}$. The impact of *T. vipera* on sandy benthic systems with a benthic biomass in the order of $3 \text{ g AFDW} \cdot \text{m}^{-2}$ is significant.

The effect of the dab *Limanda limanda* on the bottom fauna has been studied at a site where the ophiuroid *Amphiura filiformis* is the most abundant macrobenthic species. Arm tips of *A. filiformis* cropped by the dab account for 60% of the diet of this species. Data on density and size-frequency of the dab and temperature during four successive seasons have been implemented in existing consumption models for the dab. Annual uptake of *Amphiura* arms amounts to $0.75 \text{ g} \cdot \text{m}^{-2}$ (wet weight) or approximately 400 arms. With *Amphiura* densities of 800 m^{-2} this implies that one out of two animals will lose an arm each year. Considering regeneration capabilities of *Amphiura*, grazing of the dab would have a negligible effect on the population. The number of regenerating arms of *Amphiura*, however, suggests that either this food source must also be exploited by other carnivores or consumption by the dab is grossly underestimated.



1.4. OCEAN RESEARCH

1.4.1. Angola Basin

1.4.1.1. Sedimentology and palaeoceanography

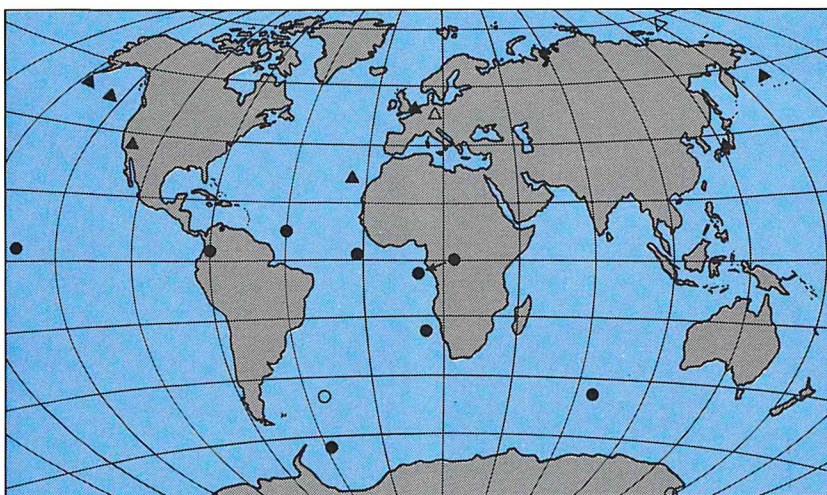
H4-03

Palaeoceanography and palaeoclimatology

In the Zaire deep-sea fan, NE Angola Basin, sediment accumulation rates decreased considerably, and clay-mineral composition switched from a smectite-dominated to a kaolinite-dominated association around ~350 000 yBP. Both changes indicate a transition from a more arid to a more humid climate in western tropical Africa: that is, to a more interglacial situation. Long-term climatic and oceanographic records in other areas also indicate major changes at that time. The changes, however, have been different in the northern and southern hemispheres, indicating an asymmetric climatic and oceanic shift with a transition to more glacial conditions in the northern hemisphere and to more interglacial conditions in the southern hemisphere.

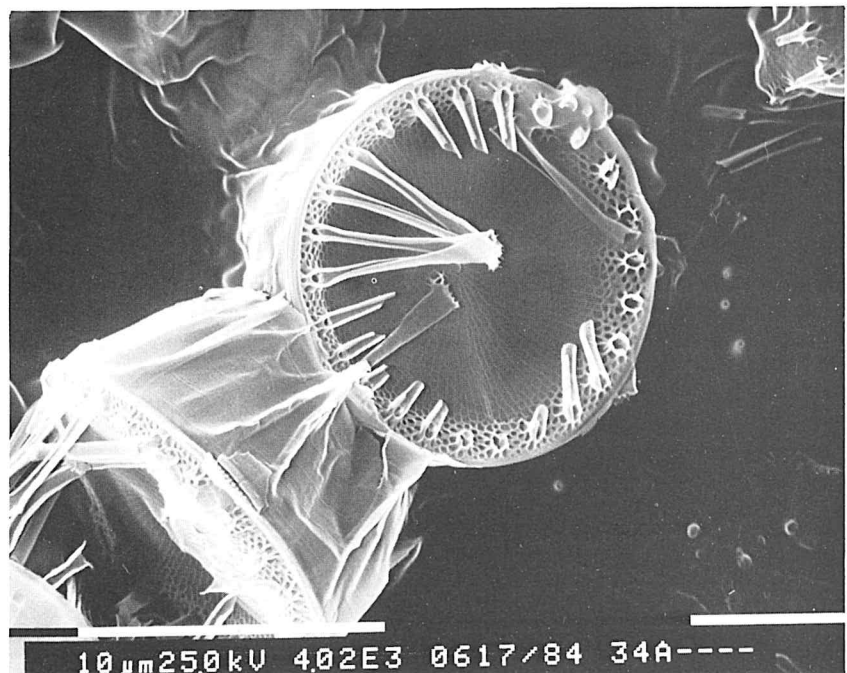
The asymmetry of the shift suggests a more zonal, weaker Northern hemispheric circulation combined with more intensive glacial/winter-type southern hemispheric circulation before ~350 000 yBP, while in the northern hemisphere glacial patterns became more intense after ~350 000 yBP. The shift has possibly been forced by the 413 000 y orbital eccentricity cycle.

Locations of climatic records showing a long-term change at 400-300 ka BP. ▲ and △ : changes towards more "glacial" conditions; ● and ○: towards more "interglacial" conditions; ○ and △ less well dated changes.



In surface samples from the deep-sea fan, 7 assemblages of diatoms can be distinguished. Two assemblages occur exclusively in shelf and upper slope deposits, four are found in lower slope and abyssal plain deposits, and one is present over the entire area. The first six assemblages are related to specific hydrographic phenomena, *i.e.* the presence of Zaire River plume water, the influence of the South Equatorial Counter Current, the local effect of upwelling colder water masses (Angola Dome) or the occurrence of low salinity and/or nearshore highly productive waters. In the northern part of the fan area (2-8°S) low diversity assemblages occur, dominated by *Thalassionema nitzschioides* which tolerates relatively low salinities. In the southern part (8-11°S) highly diverse oceanic assemblages occur. This high diversity is attributed to the regular occurrence of stratified surface and subsurface waters of different origin, containing markedly different diatom assemblages. The distribution of phytoliths indicates an air-dominated transport by southeasterly trade winds, probably originating from the savannah belts of southern Africa. Displaced freshwater diatoms, found in the area of recent fan turbidites, are mainly transported by turbidity currents guided by the Zaire Canyon and by low-density currents across the continental slope.

The relative abundance of the radiolarian *Cycladophora davisiana* is high in glacial sediments of the fan area with values comparable to those in recent sediments at the upper continental slope of the upwelling area off Namibia. This suggests increased fertility of the glacial ocean, caused by intensified coastal and oceanic upwelling. Downcore distributions of this radiolarian show opposite patterns in pelagic and hemipelagic sediments. The *C. davisiana* signal, therefore, is not synchronous, even not within the equatorial Atlantic, and cannot be used for ocean-wide stratigraphic correlation.

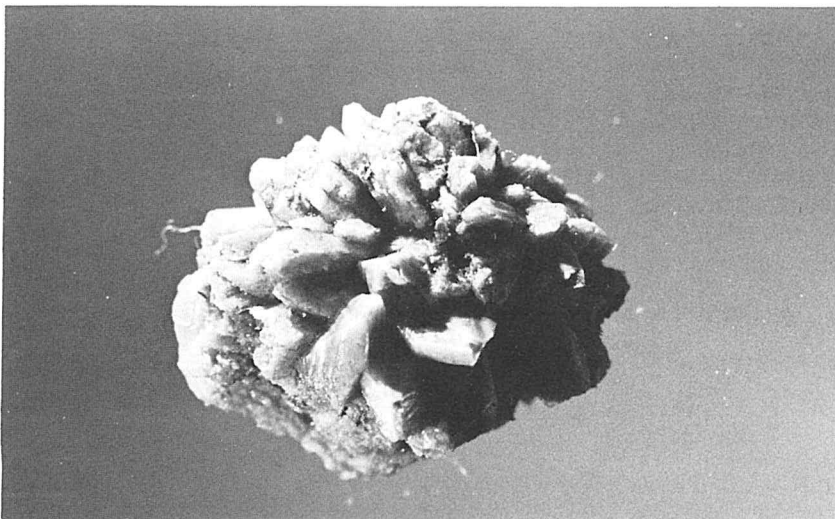


Sedimentology

Bulksamples of sediments were studied by neutron- activation analysis together with G. Klaver (University of Amsterdam). The rare-earth element (REE) distribution pattern shows constant La/Th, Sm/Th, Yb/Th, Rb/Th, and Ta/Th ratios, indicating a common source for all elements, Ce shows anomalous patterns which presumably can be linked to the presence of poorly crystallized smectite. Within the turbidites the silt fractions show relatively high values of Hf and Zr indicating mineral separation due to fractionation by hydrodynamic processes.

In 4 cores of the fan large calcite crystals occur. At first sight they resemble the well known desert roses of gypsum, and for this reason they were interpreted as pseudomorphs after gypsum, gypsum crystals having been eroded from the Zaire canyon walls from Upper Cretaceous cap rocks of salt domes in the continental slope and transported by turbidity currents. The crystals are composed of numerous small crystals consisting of thin layers of massive calcite forming an envelope around porous aggregates of poorly cemented calcite crystals. Stable carbon isotope composition shows that the carbon of the carbonate originates from organic matter of the surrounding sediment, and crystallographic measurements neither correspond to the habit of gypsum, nor of hydrated carbonates, but corresponds to that of calcite. It is concluded that the crystals are authigenic calcite crystals, being pseudomorphs after a previous carbonate phase, which is partly dissolved and subsequently transformed into calcite. This study is done in co-operation with C.F. Woensdrecht, Department of Petrology, University of Utrecht.

Suspended matter samples, collected in 1980, were analyzed in collaboration with P. Bernard (Antwerpen University) with scanning-microprobe analysis, a technique unavailable in 1980. Of 300 particles per sample elemental composition was determined by energy-dispersive X-ray fluorescence, and size and shape were also measured. Preliminary results show these data are related to water masses and are an indication of the source of suspended matter.



Authigenic calcite crystal from core T78-34 from the Zaire deep-sea fan.

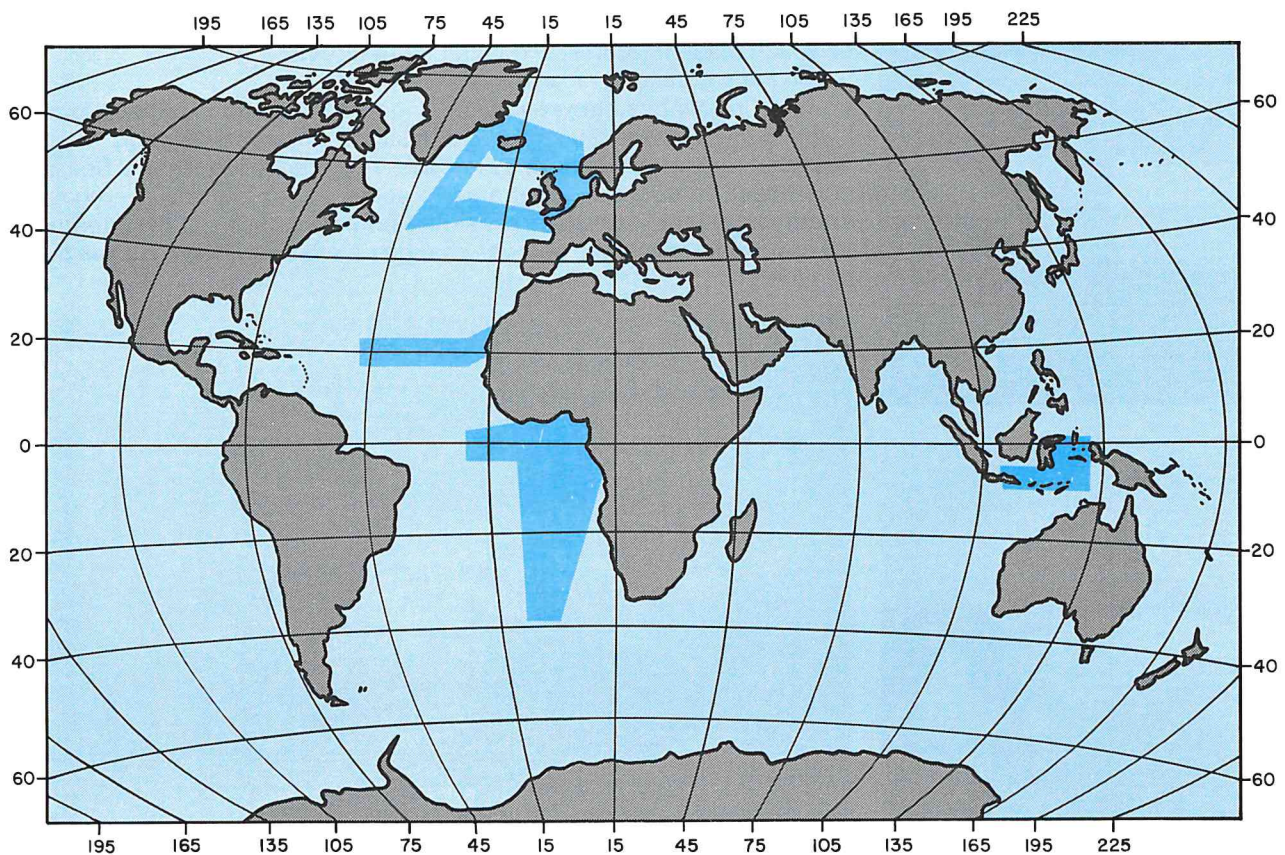
1.4.1.2. The influence of aluminium on the silica cycle

H4-02

The accumulation of biogenic amorphous silica (opal) in the Zaire fan greatly depends on the incorporation of aluminium in its lattice. Because of unusually high aluminium content, coupled with low solubility (aluminium is able to decrease the solubility of opal 100 times) and spongy ultrastructure, this silica was called opal-B (see Annual Report 1982).

Solubility experiments, however, give information about bulk opal, while aluminium enrichment was demonstrated only for single opaline particles that were recognized as frustules or their fragments and represent only a few percent of the biogenic opal. New comparative SEM and X-ray diffraction studies of fractionated samples show evidence of aluminium enrichment of opal in all size fractions down to $0.1\ \mu\text{m}$, with higher Al contents in finer fractions. The shape of particles $<0.1\ \mu\text{m}$ is comparable to the shape of larger particles which suggests that Al is also present in this finest fraction. Consequently, both decreased solubility and Al enrichment takes place in all size fractions of opal in the Zaire fan (see also H4-03 and H4-05). This work was done in co-operation with J. Pieters (Utrecht University) with SEM equipped with an EDAX electron diffraction system for chemical analyses.

Areas of NIOZ ocean expeditions.



1.4.2. North Atlantic Ocean and Norwegian Sea

1.4.2.1. Sedimentation and climatic change

H4-07

Cores from the Faroe Shetland Channel, obtained in 1981, were studied for their vertical changes in clay-mineral distribution as possible indicators of climatic change. In one core the last glacial period is marked by low content of vermiculite and high content of smectite. In the Holocene interval these values are opposite. The same pattern can be observed in concentrations of kaolinite, chlorite and illite/mica. Foraminiferal assemblages and oxygen-isotope composition are studied in co-operation with Drs S.R. Troelstra and G. Ganssen (Free University, Amsterdam). Preliminary results show that previously obtained ^{14}C ages are too old, because of mixing with other carbonates.

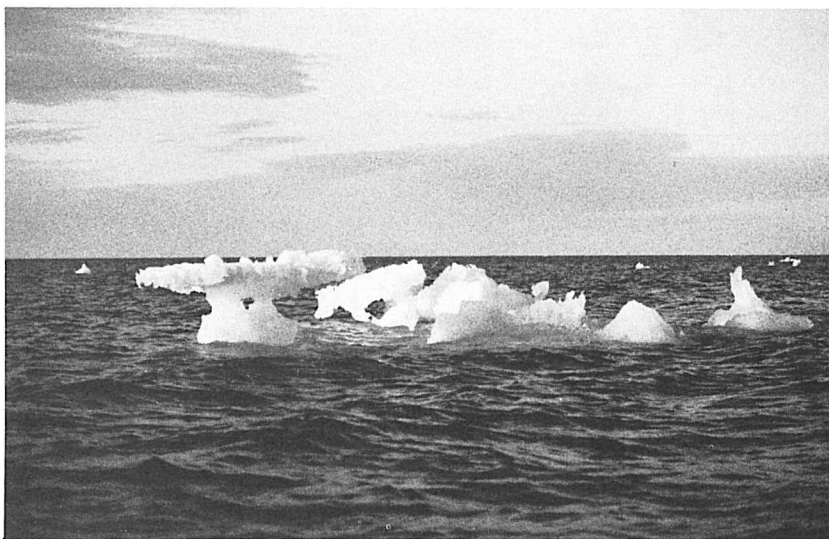
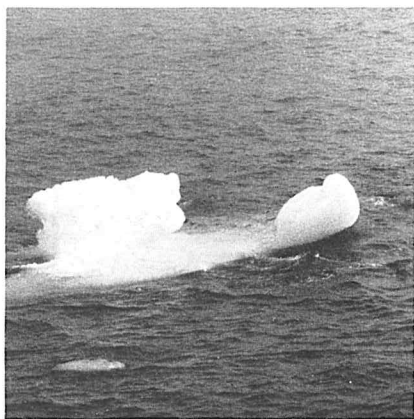
1.4.2.2. Water transport and the silica cycle

H4-02

Using temperature, salinity, dissolved silicic acid, and tritium (measured by the Department of Isotope Physics, Groningen University) as tracers, water masses in North Atlantic, the Norwegian Sea, and Iceland Sea were characterized. In a qualitative sense the movement of water masses could be derived from the gradual change of these parameters, and data obtained during cruises in 1981 and 1983 do fit into the classical pattern. In a quantitative sense, at most depth levels salinity and temperature were lower compared to the classical definitions of characteristic water masses which made interpretation much more difficult.

The main conclusions are:

- Overflow waters between Iceland and Scotland are markedly less saline and colder than in the past, while silicic acid concentration is about the same. Going north, these waters can be traced to the Iceland Sea, and going south, they have penetrated to some extent into the deep basins south of Iceland. The same trends were found previously in the equatorial Atlantic indicating that gradual changes have been going on for quite some time.



- Deep waters of the Norwegian Sea have less silicic acid than in the past; they contain some tritium and have become slightly more saline. Contrary to what was stated in the Annual Report 1983, the waters in the deep Norwegian Sea are apparently not in a stationary state.

- Waters at more than 4000 m depth in the northeastern Atlantic have much higher silicic acid concentrations than waters at the western side of the Mid-Atlantic Ridge while salinity and temperature are about the same. In this respect silicic acid is a very valuable tracer; based on its distribution in the equatorial and south Atlantic, the bottom waters in the north-east Atlantic contain about 25% Antarctic Bottom Water.

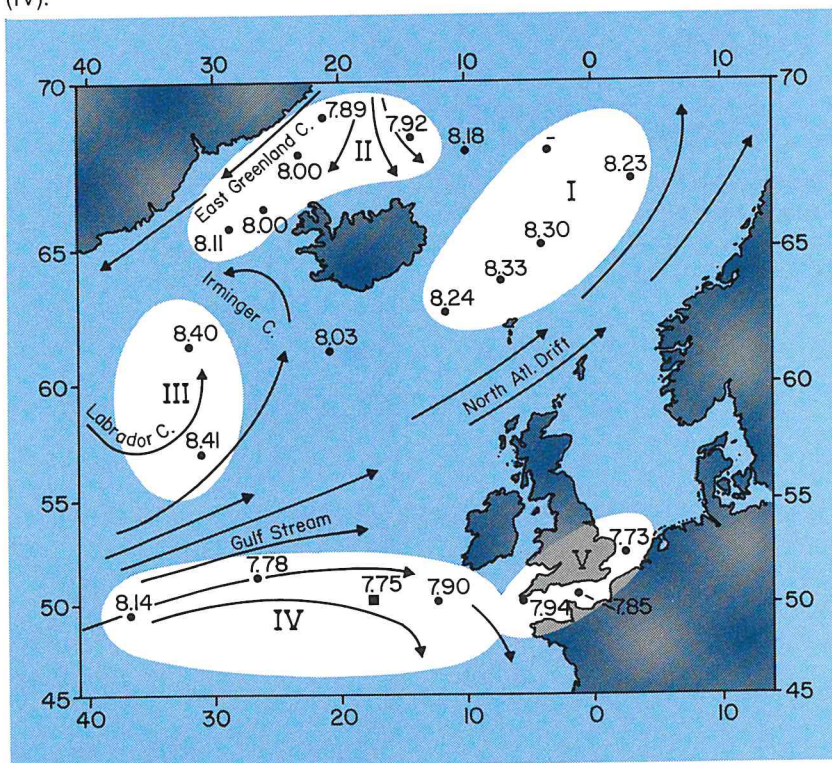
1.4.2.3. Apparent copper complexation capacity and conditional stability constants

H3-03

During a cruise with R.V. "Tyro" in July-August 1983, the apparent complexation for copper (CC Cu) was determined, using differential Pulse Anodic Stripping Voltammetry under clean room conditions. Measurements were carried out by direct titrations as well as after equilibration of copper spikes.

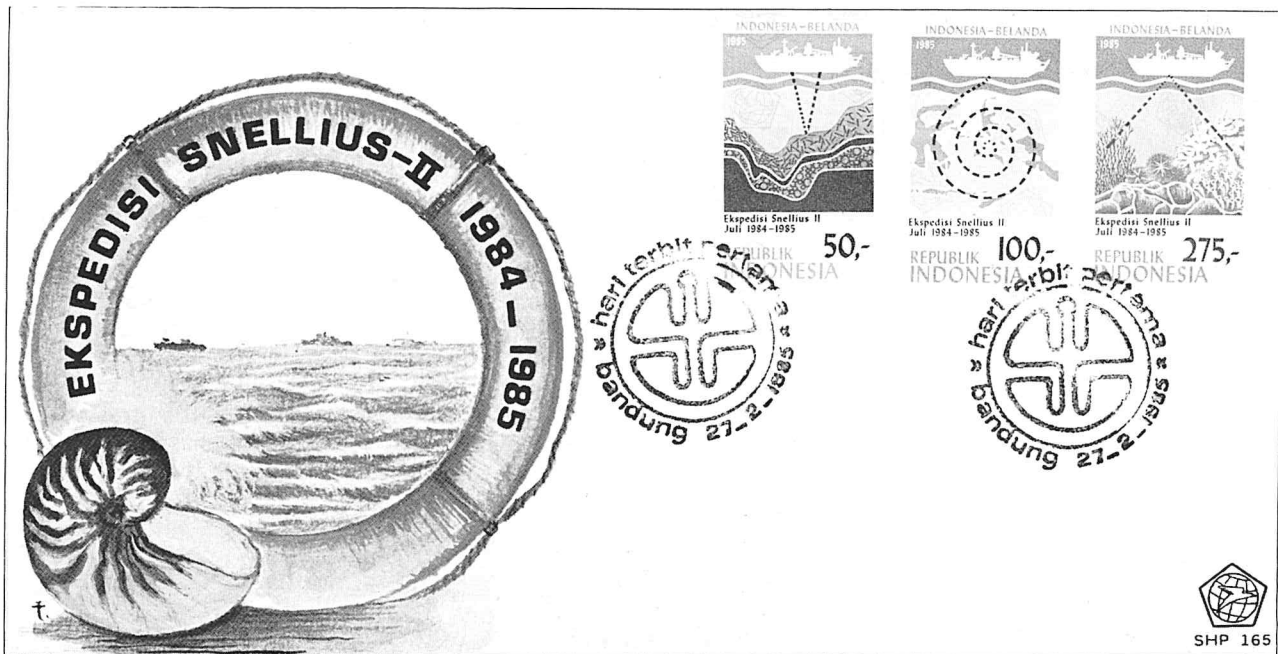
On the basis of salinity, temperature, silicate and phosphate concentrations the following surface waters could be distinguished: North Atlantic Drift (I), East Greenland Current (II), Labrador Current (III) and Gulf Stream waters (IV, V). The mean values for CC Cu are 59 (I), 55 (II), 45 (III) and 33 nM Cu. For log K' they are: 8.28 (I), 7.98 (II), 8.41 (III) and 8.06 (IV).

Information on complexation kinetics extracted from the titration curve revealed that also K_f' is area-specific. The complexation rate constant in the northern area (I) is about two times larger than in the southern area (IV).



Distribution of conditional stability constants (log K') of copper complexes formed with natural organic matter in surface waters.

Preliminary results for deep-water samples indicate smaller CC Cu and higher K' than for surface waters. A model is presented, in which the results are explained by biological activity in terms of plankton numbers obtained from Continuous Plankton Recorder data. Excretion products and intracellular matter derived from lysed cells appear to have different complexation behaviour. For open ocean plankton species the K' values of copper complexes with exudates seem to be smaller than of complexes with intracellular material.

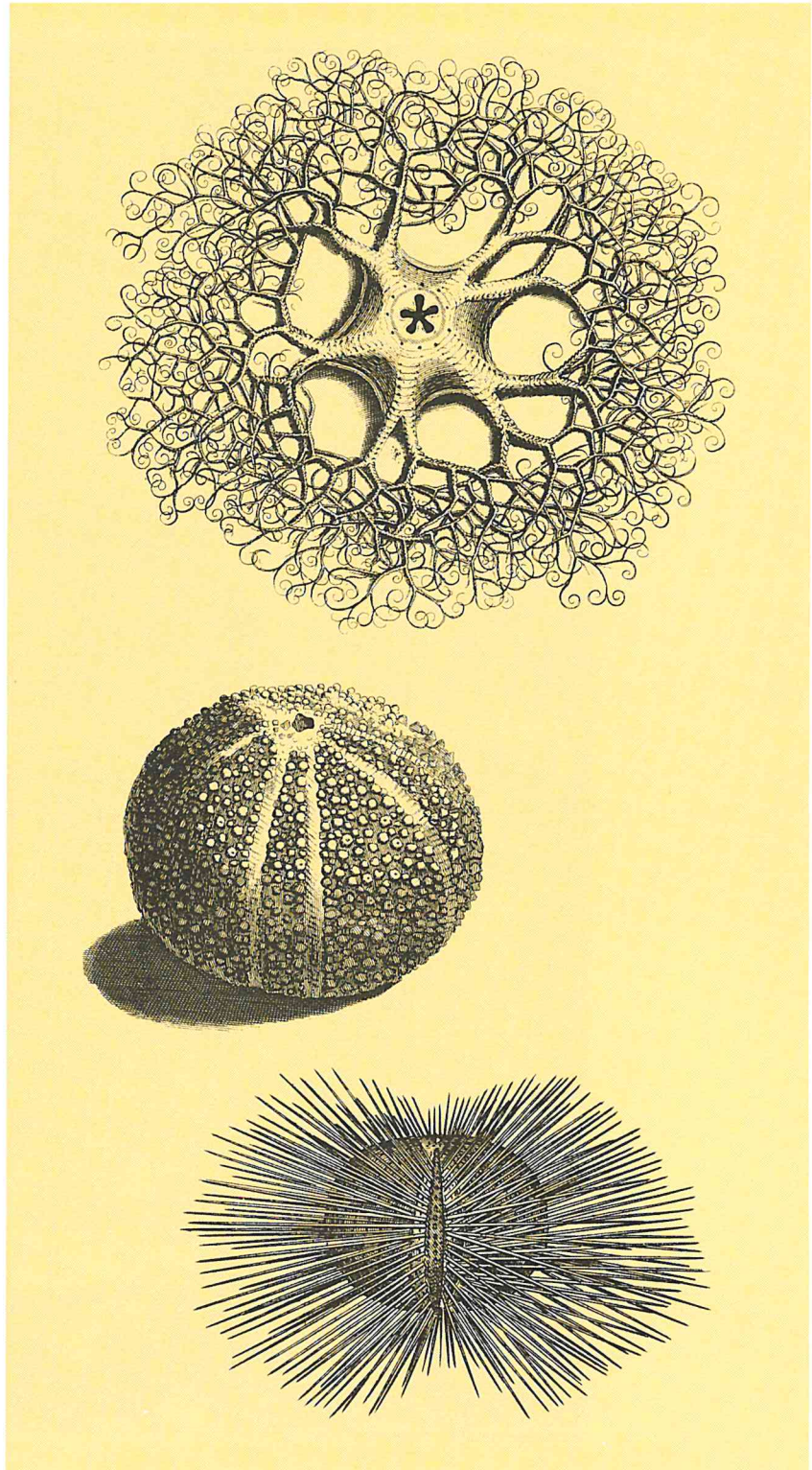
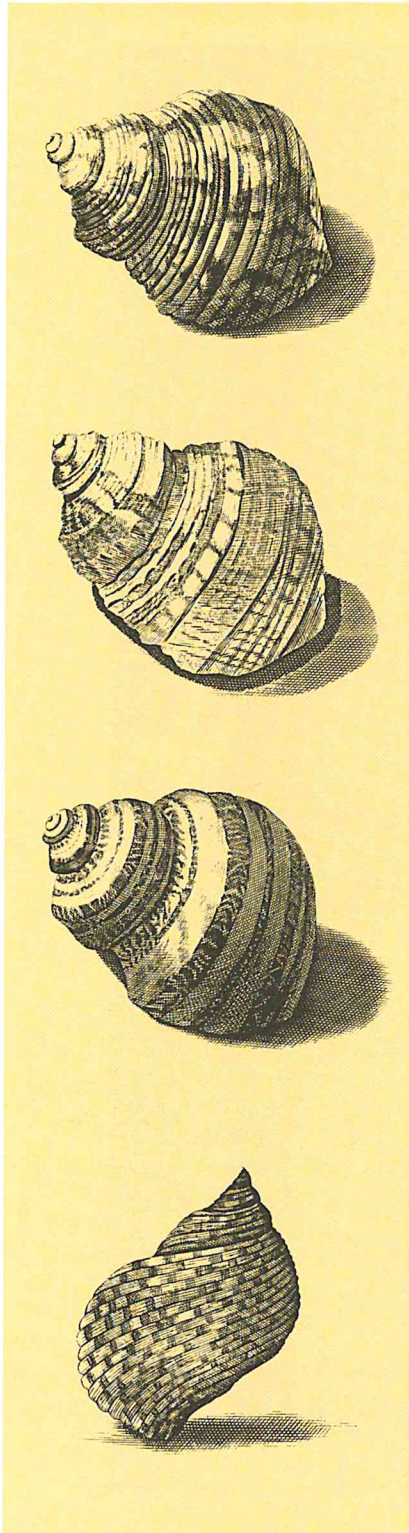


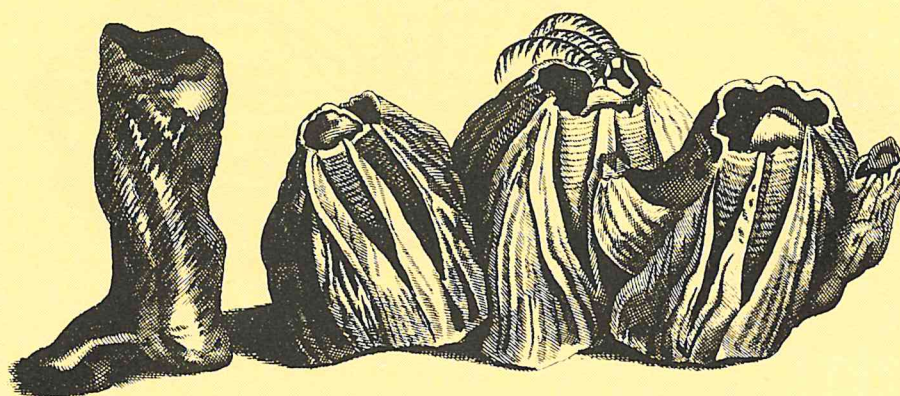
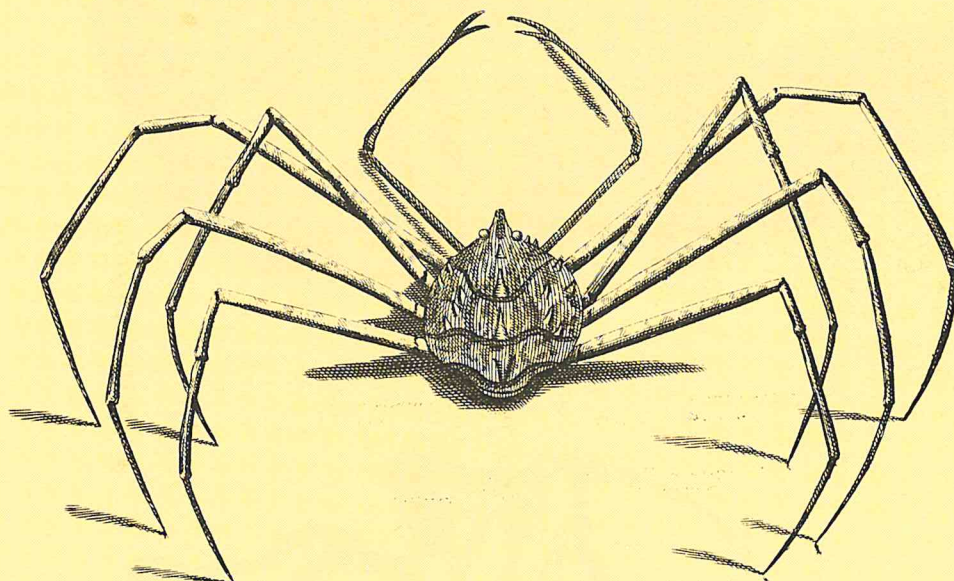
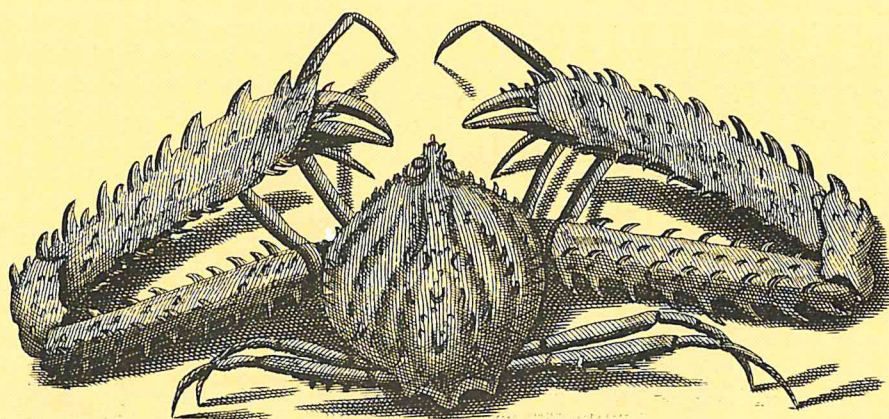
First-day cover of a series of stamps, issued by the Indonesian government on the occasion of the SNELLIUS II expedition.

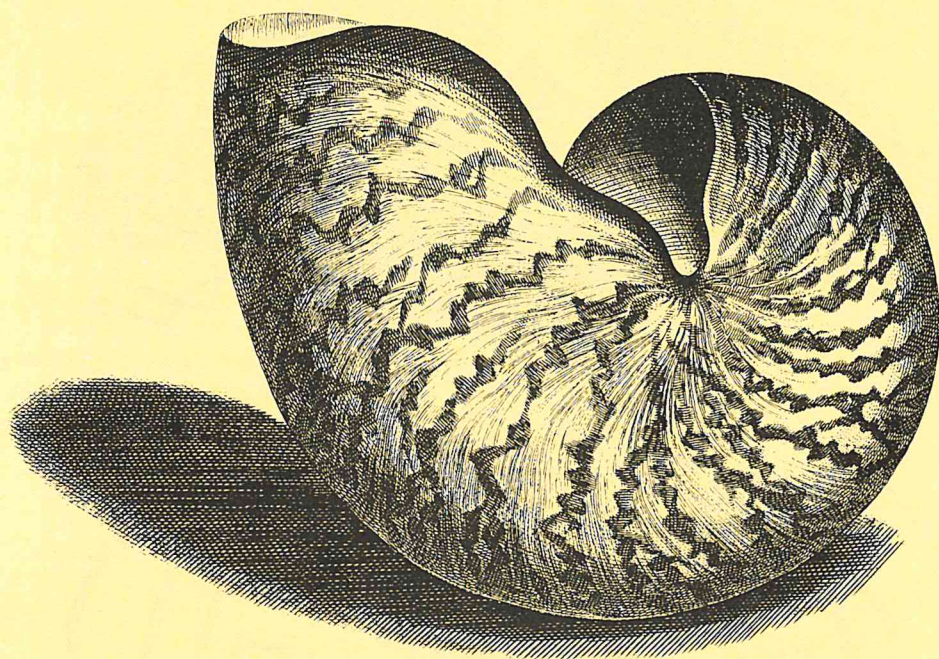




AMSTERDAM Gedrukt by JAN ROMAN de Jonge, Boekverkooper 1740.







1.4.3. Indonesia. The SNELLIUS II expedition

1.4.3.1. Geology of the southern basins

H4-09

Sedimentation in the Lombok Basin

During the first cruise to the Lombok Basin in November-December at 8 stations, CTD casts were made and boxcore and pistoncore samples were obtained. Bottom photographs, taken with a camera attached to the CTD, show that along the northern side of Lombok Basin the sea floor is covered with sand ripples indicating high bottom-current velocities. Sedimentation in the Lombok Basin takes place by turbidity currents. This is indicated by the presence of shallow-water debris, corals, molluscs, pumice and reworked gravel down to 1000 m water depth in Lombok Basin. They originate from Strait Bali and Strait Lombok.

Seismic results show the presence of both turbidites and slumps along the northern boundary of the basin. Within the Java Trench, no reduced sediments were found. Radiographs of a piston core from 6700 m water depth show plastic deformation, suggesting down-trench creep.

Sedimentology and geochemistry in the Makassar Strait and Flores Sea

H4-10

First results from bottom cores indicate that the bottom sediment map based on samples collected during the first SNELLIUS expedition are incorrect. Where the map indicates sediment of terrestrial or volcanic origin, thick layers of coccolith ooze were found. This completely altered our ideas on the sedimentation in the basins of Makassar Strait and Flores Sea, and therefore three objectives were pursued:

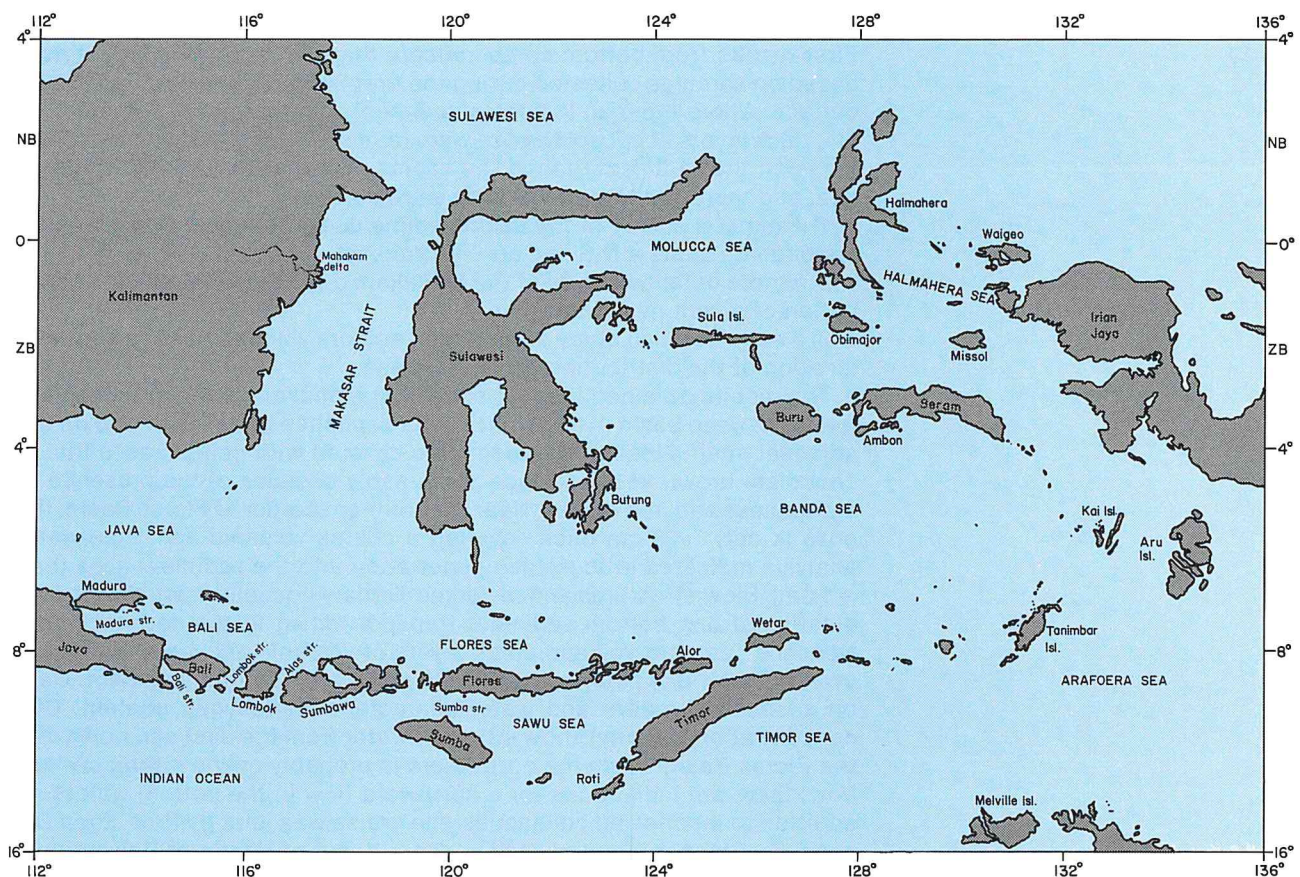
- 1) a general survey of the basin sediments by collected boxcores and pistoncores along a N-S and an E-W transect,
- 2) a more detailed survey of the Mahakam delta area to study the distribution of recent river muds; and
- 3) a more detailed study around the Tambora volcano to get a better indication of the distribution of volcanic ash.

The results obtained thus far show that Mahakam River mud does not reach the deep basin in front of it, but is deposited in the delta and on the adjacent shelf. Most of the basins are covered with pelagic ooze that is chocolate brown at the surface presumably because of the presence of manganese and iron oxides. Near the southern border of Flores Basin, the ooze is only ~20 cm thick covering a coarse volcanic ash. Pore-water analysis indicated little oxygen penetration into the sediment (less than ~1 cm). Flow structures and reworked Tertiary coccoliths are present, indicating strong bottom sediment transport down to the deepest parts. Near the Tambora volcano, thick layers of volcanic ash were found, but even in Saleh Bay pelagic ooze forms part of the bottom sediment. Data on suspended matter and water characteristics (oxygen content, CO₂ concentration, salinity) show inflow of water from the east and north into the Flores Basin. From the north there is probably only a strong surface flow; there are indications for a northward flow in the bottom waters. In addition to Indonesian colleagues, the cruise was joint by Prof. Egon Degens, Dr. Stephan Kempe, and Dr. Venu Ittekkot of Hamburg University.

1.4.3.2. The pelagic system of the Eastern Banda Sea and the Western Arafura Sea

In 1957 Wyrtky described the induction of upwelling by south-east monsoonal winds, and downwelling in the Eastern Banda Sea and Western Arafura Sea during the north-west monsoon. 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 first cruise took place in August, the time when biological activity is expected to be high because of upwelling. A second cruise is planned for February-March 1985, the period of prevailing northwestern winds (downwelling).

The four-week cruise consisted of a two-week survey covering 73 stations, and a period during which four three-day drogue stations were occupied. Two Indonesian ships also participated in the programme: R.V. "Samudera" (LON, the Indonesian Institute of Oceanography) carried out a hydrographical and plankton survey in the Arafura Sea and RV "Teng-giri" (BPPL, the Indonesian Fisheries Research Institute) made echo-sounding surveys over the whole area.



Hydrography, oxygen and nutrients

H1-01

During the cruise the wind blew mainly from the south-east with wind-strengths of 2-6 on the Beaufort Scale. Occasional rainstorms occurred. Hydrographical observations made during the survey period principally confirmed data obtained by previous studies during the south-east monsoon season. Surface temperatures were relatively low (25.7-26.7°C), salinities ranged from 33-34.5, and weak vertical gradients existed. Upwelling was observed west of the Aru islands. Some stations were repeated during the second part of the cruise. Except in the western part, these observations showed a slow upward movement of the water masses with probable upwelling velocities of up to $1 \text{ m} \cdot \text{d}^{-1}$. Other observations, not reported previously, are: 1) a well-developed temperature stratification at most stations; 2) low salinity surface water (< 33) was present in the northeastern part of the area, probably due to the rivers of Irian Jaya.

At four stations, a drogue with a radio buoy was launched to measure advection rates and to study productivity and mineralization in more detail. Current velocities in the 0-20 m layer, calculated from the drogue displacements, were $0.23\text{-}0.34 \text{ m} \cdot \text{s}^{-1}$. At three stations the drogue drifted westward, but at the station southwest of the Gorong islands the drogue drifted southeastward.

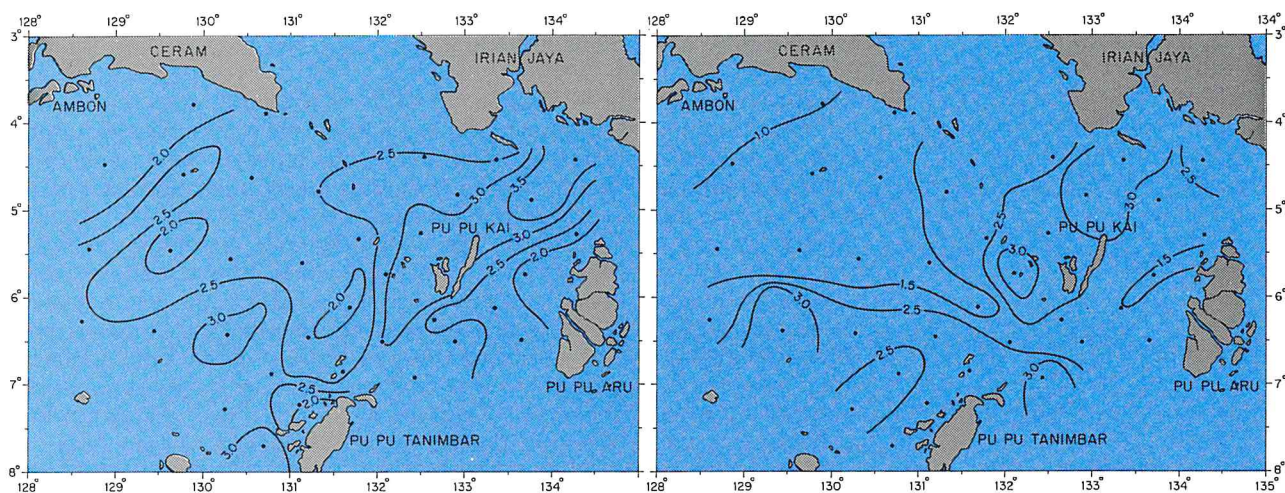
Vertical profiles of oxygen, taken near sunrise and sunset, often showed a diurnal rhythm. At the station between Irian Jaya and Aru, primary production estimates, based on the *in situ* diurnal variations of oxygen and on measurements with the oxygen light-and-dark bottle method, are among the highest ever recorded by the Netherlands Institute for Sea Research. Horizontal surveys at this station indicated that oxygen increase during the daylight period occurred over a large area.

During the survey, nutrient levels in the upper mixed layer were relatively high for tropical surface waters. Nitrate concentrations were $0.3\text{-}0.8 \mu\text{mol} \cdot \text{l}^{-1}$ except for an area along the Banda Arc where nitrate was below the detection limit. Silicic acid and phosphate also showed low levels here. At all stations a pronounced nitrate maximum was observed near the bottom of the mixed layer. Highest nutrient levels were measured by R.V. "Samudera" east of Aru.

Microbiology

B1-03

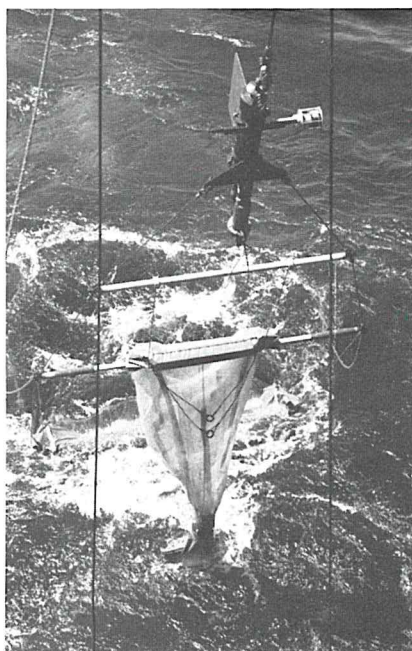
ATP (biomass) and ETS (respiration) measurements showed the biomass of organisms smaller than $50 \mu\text{m}$ over the upper 300 m of the water column to be between 1.4 and $4.4 \text{ g C} \cdot \text{m}^{-2}$. Respiration rates, recalculated for the *in situ* temperature, were between 1 and $4.2 \text{ g C} \cdot \text{m}^{-2} \cdot \text{d}^{-1}$. The horizontal distribution of respiration rates and biomass showed highest values south of Western Irian Jaya. In the water column, highest respiration rates and biomass were found in the upper 50 m. The respiration/biomass ratio was higher in deeper water than in the upper layer, probably because microplankton was dominated by algae in the upper layer and by bacteria in deeper water. Relatively high respiration rates were found just north-west of the areas with high biomass, probably due to the lag-time between primary production and mineralization of the produced organic matter. Assuming steady state in production and degradation over a one-day period, doubling times of microorganisms must have been between 0.5 and 1.5 days. In the northern part of the North Sea similar methods and calculations give doubling times of three days.



Horizontal distribution of biomass in the E Banda Sea and NW Arafura Sea in August 1984 integrated over the upper 300 m water column in $\text{g C}\cdot\text{m}^{-2}$ is shown (left). Horizontal distribution of respiration rate, integrated over the upper 300 m water column, in $\text{g C}\cdot\text{m}^{-2}\cdot\text{d}^{-1}$ is shown for the E Banda Sea and NW Arafura Sea in August 1984 (right).

Plankton research

B4-03

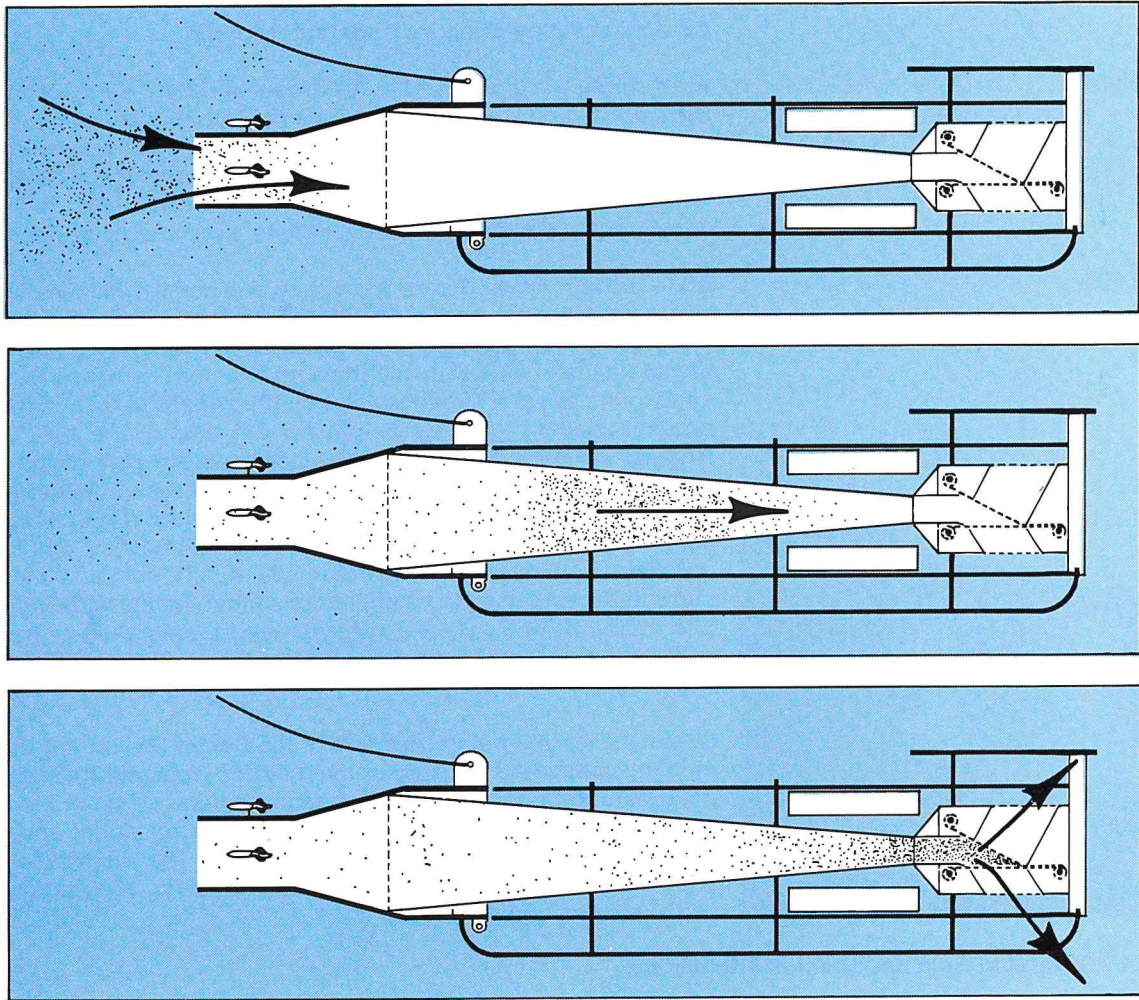


Hauling of the Rectangular Midwater Trawl net, (RTM) 1 + 8 (m^2), during SNELLIUS II.

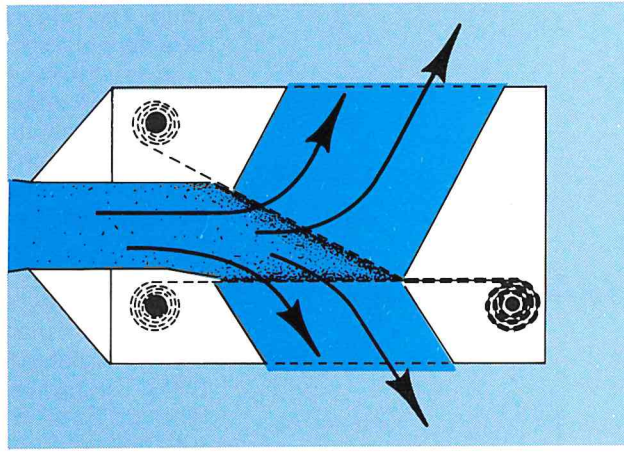
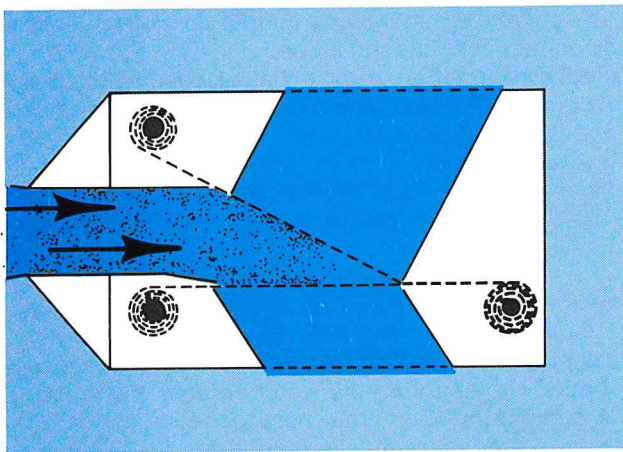
During the survey, the highest chlorophyll concentrations ($> 1 \text{ mg}\cdot\text{m}^{-3}$) were found southeast of Seram and south of Western Irian Jaya. This corresponds to the distribution of nutrients. Nutrient uptake experiments showed that the phytoplankton was not limited in growth by nutrients except for the area along the Banda Arc. At stations where much chlorophyll was found, phytoplankton was dominated by diatoms; in chlorophyll-poor areas with a distinct deep chlorophyll maximum, coccoid cyanobacteria were numerous.

Zooplankton often seemed to be inversely related to the distribution of chlorophyll. Mean zooplankton-displacement volume ($\sim 20 \text{ ml}\cdot\text{m}^{-2}$ over 0-150 m) was high for tropical areas but the distribution was very patchy. The area around Banda and Manuk was poorest. The R.V. "Samudera" recorded very high zooplankton and phytoplankton densities southeast of Aru. Vertical migration was registered at three drogue stations but not at the diatom-rich station between Aru and Irian Jaya. Here always 60% of the 0-500 m population occurred above 50 m depths. At all four drogue stations samples for diurnal variation in copepod gut fluorescence were taken. Respiration experiments showed that zooplankton accounted for 10% or less of community respiration.

Macroplankton-nekton studies were carried out with a Rectangular Midwater Trawl (RMT 1 + 8). Zooplankton abundance and vertical distribution derived from catches were similar to those found in 1982 in the upwelling area of North West Africa (NECTAR programme). With the echosounders of R.V. "Tyro" and R.V. "Tenggiri", patches were observed northwest of Aru and around the Kai islands. These echo patches, observed at a depth of 200-350 m by day, came to the surface at night, and were probably caused by larger fish or squids that were not caught by the RMT.



Handling and operating of the plankton recorder.

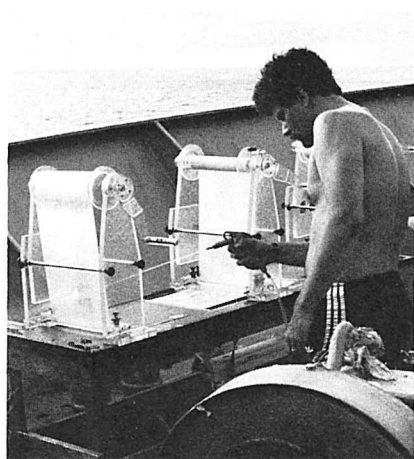


Carbon, sedimentation, and benthic research

B3-01

Both during the survey and at the drogue stations, samples of Particulate Organic Carbon and Dissolved Organic Carbon were collected. The samples will be analysed at a later date. Sediment traps were successfully employed at three drogue stations. As was also found in the North Sea during REFLEX (1.3.4) the carbon flux from the euphotic layer to deeper water consisted mostly of large faecal pellets, presumably from euphausiids.

B1-05



At several sites near Seram, Irian Jaya, and some other small islands, bottom samples were collected with a boxcorer. From 15 stations 42 undisturbed cores were obtained. Sediments ranged from soft mud along the south coast of Seram and Irian Jaya to hard coral and foraminiferous sand round Aru and Tanimbar. The benthic biomass of the Banda Sea was probably richer (~ 1 g dry weight per m^2) than in the Java Sea (1.4.3.3). Highest values were found in the northeastern part of the area (south coasts of Irian Jaya and Aru). Sediment samples of deeper stations and near Gorong and Tanimbar had a lower biomass. ATP measurements on sediment cores also indicated the highest biomass in this area. In sediments from water depths less than 100 m, ATP concentrations were the same as measured in sediments from similar depths in the northern North Sea during REFLEX (1.3.4.2). They tended to decrease with depth in the sediment. In general there was a decrease of ATP and ETS activity with water depth.

Summarizing, the pelagic system of the Banda Sea during the southeast monsoon appeared to be highly dynamic. Phytoplankton blooms occurred as a result of local nutrient enrichment by upwelling and by river runoff from Irian Jaya. Subsequent to the phytoplankton bloom, zooplankton develops and abundance of algae decreases. The distribution of macrozooplankton and small fish corresponded neither with that of chlorophyll nor of smaller zooplankton.

1.4.3.3. Input of Solo and Brantas into the sea

The aim of this programme is to study the rivers' discharge of various substances (e.g. heavy metals, chlorinated hydrocarbons and other chemical compounds) into the sea, both in solution and colloidal or particulate form. The impact of the chemical substances should be exerted most directly and intensively on adjacent coastal areas.

In order to obtain detailed information on the physical, chemical and biological processes that modify the distribution and chemical speciation of these substances and their impact on the sea in a tropical region, two river systems on eastern Java are being studied. They are a contaminated river and its estuary, *i.e.* the Brantas River system, and a relatively clean river system, *i.e.* the Solo River. Four major aspects have been investigated.

H3-01, H3-02, H3-03, H3-04

1. Hydrography and sediment transport and accumulation.—Data have been collected on the discharge of the rivers Brantas and Solo Rivers during two cruises; in the dry monsoon and the wet monsoon period respectively. During the dry period (July-August) the water column of the Java Sea and Strait Madura demonstrated a rather homogeneous character, with respect to temperature, salinity, acidity and turbidity. In the western

part of the Java Sea, salinity was slightly lower (30-32) than in the eastern part (32-34). At near-shore stations where the influence of rivers is greatest, a different profile was obtained. At stations with depths of 80-120 m an increase in salinity, temperature and turbidity has been observed at 60 m. During the wet season (November-December) the water column was less homogeneous with respect to all abiotic parameters including the water-current.

H4-02

As expected, rivers in eastern Java had very high concentrations of dissolved silicic acid compared with the world average of about 174 μm . The Solo River had 410-430 μm and the Brantas River, in the Porong branch, had even higher concentrations of 700-780 μm . This is probably due to easily weathering soil components of volcanic origin.

Estuarine mixing of these waters with ambient sea water gave linear mixing curves of silicic acid compared to salinity. Conservative behaviour of silicic acid during estuarine mixing was previously found in the estuaries of the rivers Rhine, Scheldt, Zaire and La Plata at much lower silicic acid concentrations. These observations cast serious doubt on the widespread assumption that substantial amounts of dissolved silicic acid transported by rivers are inorganically precipitated in estuaries.

B3-01

2. Biological research.—Samples were taken to determine the distribution of zooplankton and phytoplankton in relation to chemical parameters of water and sediment. Benthic organisms (e.g. shrimps, crabs, sea-stars, flatfish) were collected for chemical analyses of trace metals and organochlorines. The bottom of the Solo and Brantas estuaries, Java Sea and Strait Madura is composed of extremely soft-clay sediment. The benthic fauna has an extremely low biomass. At deeper stations, sediments are coarser and less soft, and contain a higher biomass.

B1-05

At 17 bottom sampling stations in Java Sea and around the islands of Madura and Bali a total of 73 cores were collected for biological research in June. Subsamples were taken for macrofauna' and meiofauna' analysis, characterization of sediment and Electron Transport (ETS) activity. Most sampling stations showed soft to very soft fluid-mud sediments, which imposed considerable technical problems with respect to successful deployment of heavy sampling gear and respiration chambers. However, in a number of cases *in situ* benthic oxygen demand was measured and showed a high biological activity. Oxygen content of near bottom water showed values between 75 and 102% saturation. Only in Strait Madura a saturation as low as 48% was measured.

H2-01, H2-02

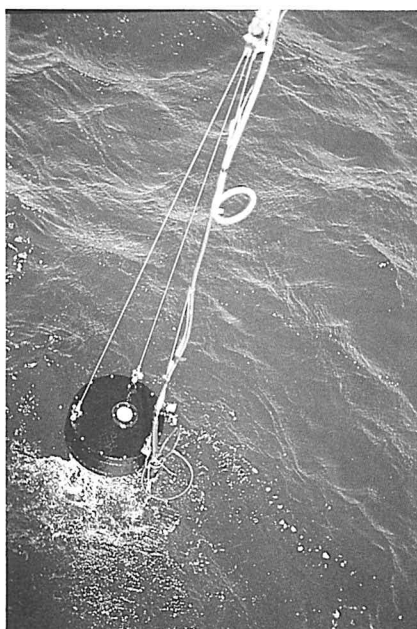
3. Remote sensing.—Studies on radiative transfer, including fluorescence and stratification effects, are continued employing two-flow model previously developed (see Annual Report 1983). As predicted from theoretical studies, striking phenomena related to fluorescence of chlorophyll pigments in the red part of the spectra were revealed from optical measurements in tropical Indonesian waters. 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, and to what is currently assumed, the reflectance and upwelling irradiance-attenuation coefficient in the red part appear to be dependent on water depth. This is true even for low concentrations of chlorophyll pigments. This feature can be ascribed to fluorescence effects.



Indoavia aircraft for remote sensing surveys.

H3-01, H3-02, H3-03, H3-04

Instrument for underwater spectral irradiance measurements.

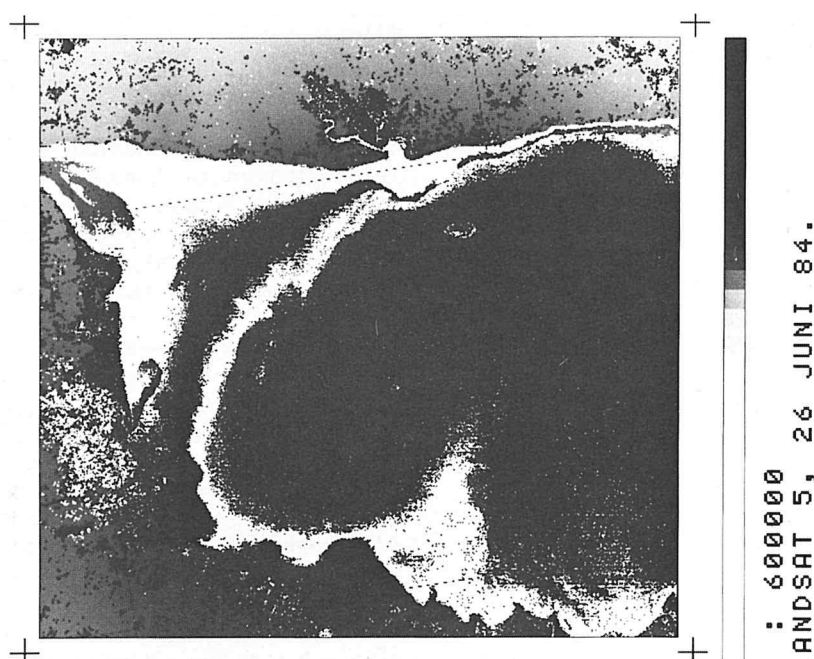


Satellite image (Landsat) showing the turbidity patterns in the Madura Strait. The satellite data were processed by LAPAN (Jakarta).

Analogous to the Dutch coastal research (see section 1.2.1), optical *in situ* and remote airborne measurements were performed in combination with extensive sampling of the coastal waters north-east of Java. The objectives of the research were similar to the Dutch coastal studies, though in both cases special attention was paid to possible use of specific instruments aboard the planned European (ERS II) and Netherlands-Indonesian (TERS) satellites.

Extensive sets of spectral *in situ* and airborne data were obtained and preprocessed in co-operation with the Indonesian National Aeronautic and Space Agency (LAPAN, Jakarta) and the Institute for Optoelectronics (DFVLR, Oberpfaffenhofen, Germany). Preliminary results include sets of spectral reflection curves for sites simultaneously scanned by optical scanners, as well as preprocessed satellite imagery of the studied area. The choice of spectral bands and establishment of specific algorithms in relationship to the design and development of the instruments and methods for remote coastal observations are the final goals.

4. Heavy metals and polychlorinated biphenyls.— There is some evidence that concentrations of Cu, Zn, and Cd in some selected animal species are lower in specimens taken from open sea areas (Java Sea, Bali Basin) than from estuaries and near-shore areas of the Java Sea and Strait Madura. Surprisingly, in samples taken from all environments polychlorinated biphenyls were detected. Moreover, relatively high concentrations of DDE, a decomposition product of DDT, occurred in the waterphase, in particulate matter and in benthic organisms.

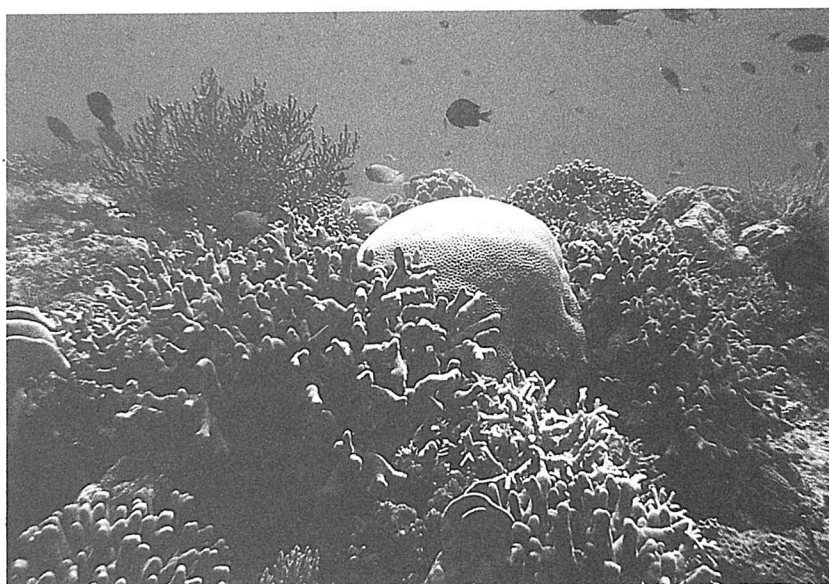
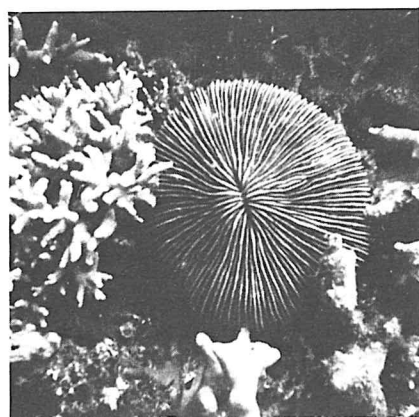
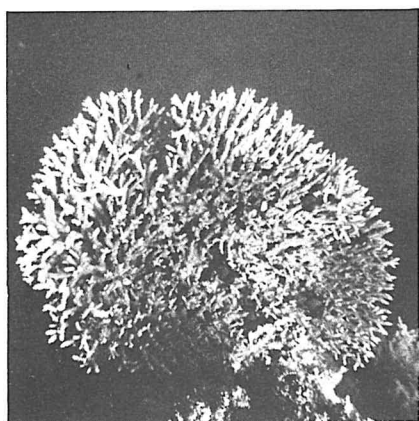


1.4.3.4. Coral reefs

B1-06

For an 11 week participation in theme 4 (coral reefs) a method was developed allowing a coral reef transect study group to do integrated surveys of reefs in order to (1) be able to relate taxonomic and ecological parameters studied within one transect, and (2) facilitate comparative studies of different reefs. To allow area-to-area comparisons, 42 transect studies were made at depths from 6 to 10 m on the seaward slopes of the reefs. Additional data on growth rates, bioerosion and juvenile coral abundance were obtained at various sites. Data recorded from the transects included cover of living corals, cover of dead components, cover of other components, and interactions between coral and noncoral species.

To study growth rates at the different sites, 226 massive *Porites* colonies were sectioned and X-rayed. Preliminary observations showed yearly growth increments to vary from 0.5 to 1.0 cm. The coral sections also indicated a high level of reef disturbance with recent partial mortality of colony surfaces ranging from 12 to 100% per sample.



1.4.4. Coral reefs in Curaçao, southern Caribbean Sea

B1-06

Before, during and following mass mortalities of the sea urchin *Diadema antillarum* in Curaçao in fall 1983, recruitment of *Diadema* (recruit test diameter ≤ 3 mm) has been studied on artificial substrata situated at two reefs along the coast of Curaçao. A catastrophe reduced urchin populations to 1% or less of former densities. Previously, *Diadema* was very abundant with densities up to 12 m^{-2} along the major part of the leeward coast of the island. At such high densities, urchins were the major bioeroders of the reef and are responsible for a negative balance of the total calcium budget.

The rate of urchin settlement varied significantly in space and time. At one reef, we recorded constantly higher numbers of recruits than at another reef at a distance of 24 km. This reflects the different local densities of *Diadema*. At the same time recruits preferred relatively clean substrata and it is possible that the grazing activity of dense populations stimulates local recruitment. Variations in recruitment through time are similar on these reefs: continuous throughout the year with two pronounced peaks (March-April, September-October) and two less distinct peaks (June-July, December-January) in settlement.

Recruitment was not immediately affected by the mass mortalities. Low numbers of recruits continued to settle and reached normal, pre-catastrophe peak values in March-April 1984 but were subsequently reduced to approximately zero. This last peak suggests that distant source populations were responsible for this and possibly former peak recruitment. Cessation of all recruitment indicates the virtual elimination of these source populations. The South Caribbean Current, the potential carrier for the larvae, passes the arc of the Lesser Antilles 1-1.5 months prior to reaching Curaçao, which is in the order of magnitude of the pelagic life of the larvae. Mass mortalities of source populations have indeed been reported for the southwestern Caribbean in February 1984, and the March 1984 peak in recruitment on Curaçao must represent the last broadcast of larvae from that part of the Caribbean.

It appears that algal abundance is increasing in permanent quadrats on the reef terrace and reef slope. This phenomenon correlates with the virtual disappearance of the urchins and is interpreted as a consequence of decreased grazing pressure.

1.4.5. Remanent magnetism in sediments

H4-04

Laboratory experiments dealing with processes by which fine-grained sediments acquire their remanent magnetization have been executed during 1983 and 1984. They concern the interaction of colloid-chemical particles and their role in the magnetization process of fine-grained sediments. It is widely acknowledged that fine-grained sediment ($< 1 \mu\text{m}$) tends to form aggregates in suspension depending upon salinity, surface adsorbed organic matter, pH and other factors. The influence, however, of particle aggregation on magnetization of sediments has never been studied.

We measured, as a function of time, magnetization of suspensions of artificial sediments and of natural deep-sea clays deposited in the earth's magnetic field. Artificial sediments consisted of non-magnetic matrix material (kaolinite, bentonite, quartz powder) to which a fine grained magnetic fraction (magnetite, maghemite) was added. Natural sediments

were obtained from Angola Basin cores (see section 1.4.1.1). As simulation of natural particle aggregation in the laboratory is not feasible, we only studied the magnetic consequence of electrochemical flocculation.

In the suspensions, flocculation rate was adjusted by adding varying amounts of NaCl and Peptizer (Na-polymetaphosphate). The experiments showed that after sedimentation, both inclination and intensity of remanent magnetization of fine-grained sediments depend on the degree of flocculation:

(1) When magnetic particles have been deposited as individual grains, inclination tends to be lower than field inclination, a phenomenon termed "inclination-error". In contrast, when magnetic particles have been deposited as part of aggregates, no inclination-error is observed.

(2) Sediments deposited from flocculated suspensions have a much lower intensity of magnetization than sediments deposited from deflocculated suspensions.

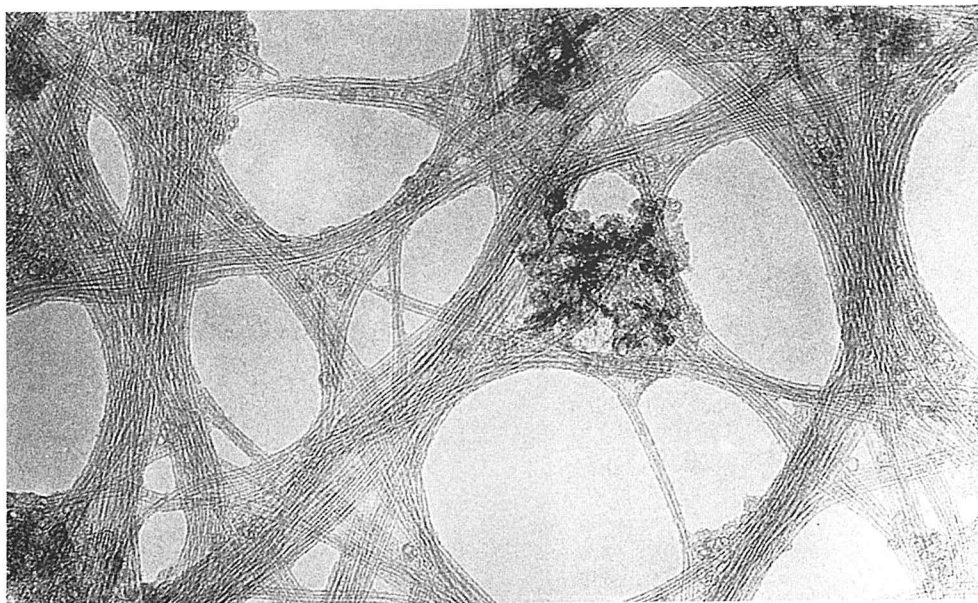
(3) The ability of magnetic grains in sediment interstices to rotate towards a changing magnetic field direction depends strongly of the sign and strength of colloid-chemical interparticle forces (e.g. Van Der Waals force, electrostatic forces).

1.4.6. Conversion of clay minerals

H4-05

Electron micrograph of imogolite, a low crystalline mineral from weathering of volcanic glass. Threads are bundles of parallel tubes, about 20 (Angstrom) in diameter (Electron micrograph reproduced by kind permission of Dr. S.I. Wada).

To study the origin of smectites in sediments and their relation to other clay minerals, a project with Dr. R.A. Kuhnel (TH, Delft) was continued. During hydration-dehydration experiments, a Na-montmorillonite showed low capacity to regain its original spacing. A hysteresis method was used to detect the path of recovery of the water molecules adsorbed to exchangeable interlayer cations. A change in crystallinity of montmorillonite, depending on the orientation of water molecules and state of hydration of the cations in the interlayer, was also observed. The hysteresis method proved to be a very sensitive tool to detect small differences between members of the smectite family.



In co-operation with Dr. C. Mizota (Kyushu University, Japan) large differences in crystallinity and crystal structures were detected for swelling and non-swelling clay minerals of volcanic origin formed under a range of climatic conditions. Together with Prof. Dr. K. Wada (Kyushu University, Japan) particle size, pore size and crystal structure of allophane and imogolite minerals were measured on a low angle X-ray diffraction apparatus developed at NIOZ. We found that allophane differs considerably in crystal structure from imogolite, which is accompanied by differences in morphology. The crystal structure of allophane was also found to be more stable than that of imogolite during heating.

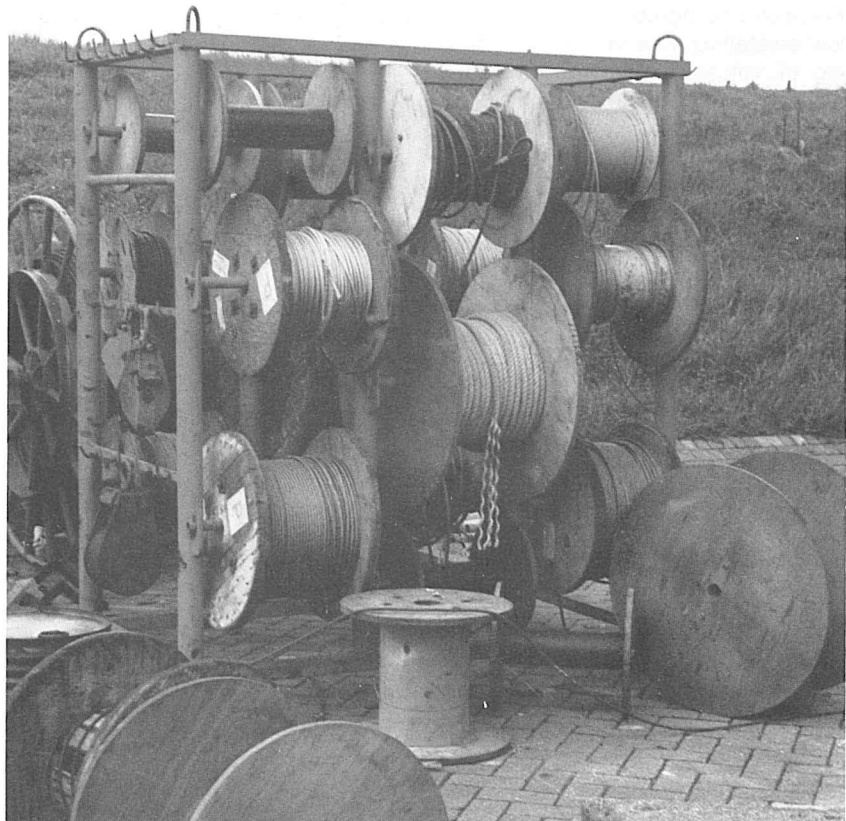
1.4.7. Quantitative microzooplankton research

B2-05

After former unsuccessful attempts to find a reliable preservative for microzooplankton, a series of experiments was carried out with fixatives that had appeared to be satisfactory for electron microscopy. Applied to cultured *Oxyrrhis marina*, however, the same result was obtained: only a small portion of the cells retained a recognizable shape.

B1-07

Another series of tests was run to distinguish very short-term and long-term preservation effects of various fixatives on microzooplankters. While preservation was unambiguously poor, short-term effects of some fixatives appeared to slow down protozoan locomotion facilitating the counting of samples.



1.5. SPECIAL PROJECTS

1.5.1. Biological Research Ems-Dollard Estuary (BOEDE)



In March 1984 the BOEDE project came to an end. The mathematical simulation model of the ecosystem of the Ems-Dollard estuary, which was developed in earlier years was revised and got its definitive formulation. The documentation and publication of the model is part of the EON project.

Ecological Research North Sea and Wadden Sea (EON)

The EON project started in March 1984 and will end in December 1987. It consists of four research projects which are carried out for a number of Ministries. The projects are:

a) DEDMOD.—This comprises the documentation and publication of the BOEDE-model of the ecosystem of the Ems-Dollard estuary.

The BOEDE-model has been compared with GEMBASE (General Ecosystem Model for the Bristol Channel and the Severn Estuary, IMER, Great Britain) and exchanges have been made with a group of scientists modelling the ecosystem of the Cumberland Basin (Canada).

The full documentation of all the parameters used in the model and the description of the model itself are nearing completion, thus fulfilling most of the project DEDMOD.

b) EMOWAD.—The development of a mathematical simulation model and the description of the ecosystem of the western part of the Dutch Wadden Sea, based on available knowledge and supplementary research.

Preliminary discussions have been held to gather the necessary information for the set up of such a model.

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

d) TECON.—Direct help and advice for different government agencies concerned with the management of North Sea and Wadden Sea.

Investigations of the bottom fauna in a discharge area for TiO_2 waste acid in the North Sea have been carried out. Two cruises have been made for sampling. Samples from previous years have been sorted and analysed. The results show considerable variation in the fauna which may largely be attributed to instable environmental conditions. Therefore it is difficult to establish immediate effects of the waste discharges on the fauna in the area concerned.

Data have been gathered regarding the coastal area where mud dredged in the harbour of Rotterdam is dumped.

The EON staff is formed by members of the former BOEDE staff. The programme is executed in close co-operation with members of the NIOZ staff and a few members of the biology department of the State University of Groningen.

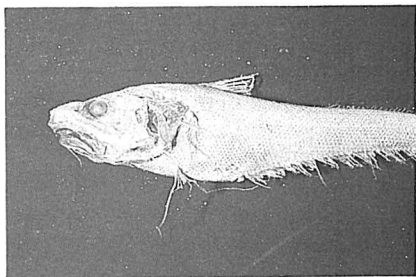
1.5.2. Research at radioactive waste disposal site (DORA)



The DORA (Deepsea 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".

Geochemical study.—Data on dissolved oxygen and manganese in pore waters from the site indicate that oxygen penetration is largest (> 2 m) in sediments situated at local highs or slopes. Reduced conditions, associated with mobilization of manganese and other metals, approach the sediment surface to 25-100 cm in the deep valleys. Carbonate dissolution was studied by electron microscopic analysis of tests of the foraminifer *Orbulina universa*. As usual, preservation is dependent on water depth. No difference in preservation was observed between the samples from surface sediments and from 15 cm depth, indicating that carbonate dissolution after burial is minimal in these carbonate-rich sediments poor in organic carbon.

Mixing in the bottom water was studied, using Radon-222 as a tracer. An extraction and counting system for Radon-222 was made operational (H4-11); and a computer programme developed to correct raw data for efficiency and background of the 4 counters, and from interference for other radioisotopes. The half-removal height of excess-Radon-222 (half-lifetime 3.8 days) was about 50-100 m, somewhat larger than was measured earlier by other workers. Water samples were analyzed for Pu isotopes, to investigate if the bottom water is contaminated with waste plutonium.



Biological study.—The main goal for the biological part of the DORA II expedition was to collect the larger (near-) bottom fauna of the dumpsite for chemical and radionuclide (^{210}Po and $^{239+240}\text{Pu}$) analyses. A 3.5 m Agassiz-trawl was used with a closing device to prevent contamination with macroplankton and pelagic fish. The closing mechanism worked continuously during the haul, and was open only during bottom contact. In the fairly rich catches, the largest animals belonged to the sea cucumbers of the taxa *Benthodytes* and *Psychropotes* with a maximum length of 51 cm, and to fish as e.g. rattails (*Coryphaenoides armatus*) and *Synaphobranchus bathybius* with maximal length of 67 cm. Smaller macrofauna was qualitatively collected with a bottom sledge with a 0.5 mm net and a closing door, especially designed to work also upside down (NIOZ-design). As the Agassiz trawl collected a large amount of surface sediment too, it was not necessary to use the sledge at all stations.

In 6 boxcores from the dumpsite, 10 subcores were taken to study the horizontal distribution of the meiofauna. First results demonstrate a fairly even distribution of Nematoda within a boxcore sample.



Agassiz-trawl catch, rattail (*Coryphaenoides armatus*) and boxcore sample (50 × 50 cm) with subcores, all from the NEA-dumpsite, hauled in during the DORA-1984 expedition.

1.5.3. India Project

Since 1982, the NIOZ has acted as advisor to the Netherlands Ministry of Foreign Affairs concerning the design and development of two coastal research vessels for the Geological Survey of India (GSI). Based on the expertise build up with North Sea and ocean research during the last years, this work was done together with a naval architect of Bureau Propulsion in Leiden. Building of the vessels started late 1983; during all stages of the building the shipyard was visited regularly to discuss modifications and changes in the design. The vessels are fitted out with a hydraulic A-frame, carry two labcontainers and two half-size refrigerated containers for the storage of bottom samples. The containers can be loaded and unloaded by a hydraulic crane, placed on a winch platform near the aft deck.

The scientific equipment on board was selected by the NIOZ and approved by the GSI, and installed in the lab-containers by NIOZ technicians. Purchases were done via the Ministry of Development Aid. For each vessel, a trial cruise of one week duration was held in the Wadden and North Sea to test the equipment and detect malfunctioning. The equipment consists of a 300 KJ Sparker shallow-seismic system with hydrophones and recorder, a hull-mounted transducer array for 3.5 kHz work, a side-scan sonar system and recorder, a magnetometer, and an underwater television system. For bottom sampling a piston corer, a vibrocorer, and grabsamplers were provided. Watersampling with Nansen bottles can be carried out via a hydrographic winch and davit on the fore deck. From this position also a Bergen Nautik self recording current meter can be lowered.

A Del Trisponder navigation system, using three remote, landbased transmitters, allows for an accurate positioning within 2-3 m at 30-50 km off the coast. A computerised system in the chartroom allows for the input of ships speed and direction. Updates of the positioning are stored on HP magnetic discs. During and after the cruise, the tracks and the diversion of the planned tracks as well as stations, bathymetric maps and profiles of the seabottom can be plotted automatically.



Indian and Dutch scientists working in the NIOZ laboratory.

The Indian R.V. "Samudra Shaudhikama" runs her trials in the Dutch Wadden Sea.



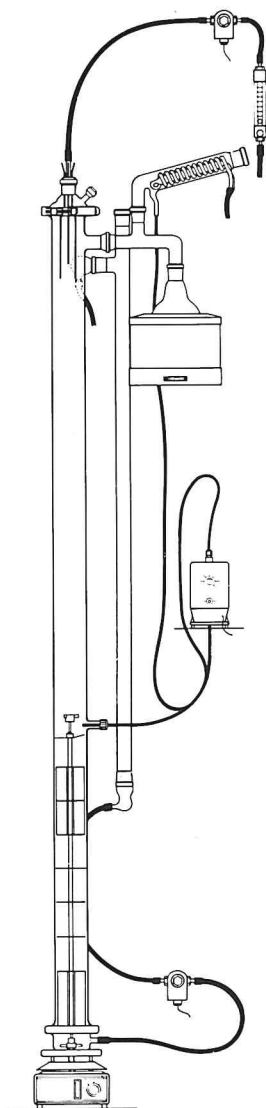
After testing the equipment of the two vessels in the Wadden and North Sea, the ships were finalized at the Delta Shipyard, and handed over to the Indian Ambassador on August 29. Immediately afterwards the vessels were transported to India. In October Tj. van Weering, T. Buisman, J. Schilling and J. Leytens left for India to give initial assistance immediately after arrival of the vessels. In conjunction with this aid 4 mechanical and electrical engineers were trained at the NIOZ during four months, in total 12 persons. In addition three scientists were hosted at our institute for periods ranging from 9 to 12 months.

1.5.4. Dutch Joint Monitoring Programme on chlorinated hydrocarbons

On behalf of RIZA (Federal Research Institute for Water Purification) Dutch coastal waters were monitored for the appearance and the levels of individual PCB components in water and in suspended matter. Results of the programme, that started in 1981, were reported in 1984. The total PCB concentrations in Dutch coastal water seem slightly to decrease over the period 1981-1984.

A prerequisite for the above mentioned monitoring programme was the development of a new calibration procedure for determination of individual PCB components. Until recently calibration was carried out with technical mixtures of PCB's (f.i. Clophen and Arochlor). The fast improvement of separation characteristics of commercially available GC columns makes it possible, however, to discriminate between more than hundred individual PCB compounds. For this reason we now use a calibration mixture consisting of more than hundred well defined individual components. The composition of the calibration mixture will be adapted continuously, according to the detection of new and the occurrence of known PCB compounds in field samples.

1.5.5. Continuous liquid-liquid extractor



The low concentration levels of PCB's in the marine environment makes a preconcentration step previous to analyses, necessary. For this reason a manually operated liquid-liquid extractor with separated mixing and settling compartments was used until recently. Since then, the development of an automatically operated extractor, that can be used with solvents with a broad range of densities, came in a final stage. For analytical purpose an apparatus with an extraction rate of $10 \text{ l} \cdot \text{h}^{-1}$ is applied in our laboratory now. In co-operation with a Dutch and a German company, an upscaled version of our new extraction apparatus was designed and built. This technical scale extractor has an extraction rate of $500 \text{ l} \cdot \text{h}^{-1}$ and is a useful tool for 'cleaning-up' of large water volumes. The design will be protected by a patent request.



1.5.6. OPEX, oil pollution experiment

Early this year a feasibility study, in which the "natural" fluctuations of unpolluted Model Tidal Flats (MOTIF's) throughout the year were investigated, was ended. It was concluded that the development of the artificial systems closely resembled the events occurring in natural tidal flats. MOTIF's can safely be used as reliable instruments for ecotoxicological research. They provide an essential link between laboratory and field experiments. A final report was presented to the European Community and the Ministry of Public Work which were the main financial contributors.

In May a new project was started, aiming at the influences of dispersants on the fate and effects of oil in MOTIF's. This project covers a period of 3 years. In 1984 a larger oil spill was simulated and treated with the dispersant held in stock by authorities to combat oil pollution in the coastal waters of the Netherlands. The results will provide a future basis for an optimal treatment of oil spills. In May, a well attended press release was held, in which the OPEX programme was discussed.

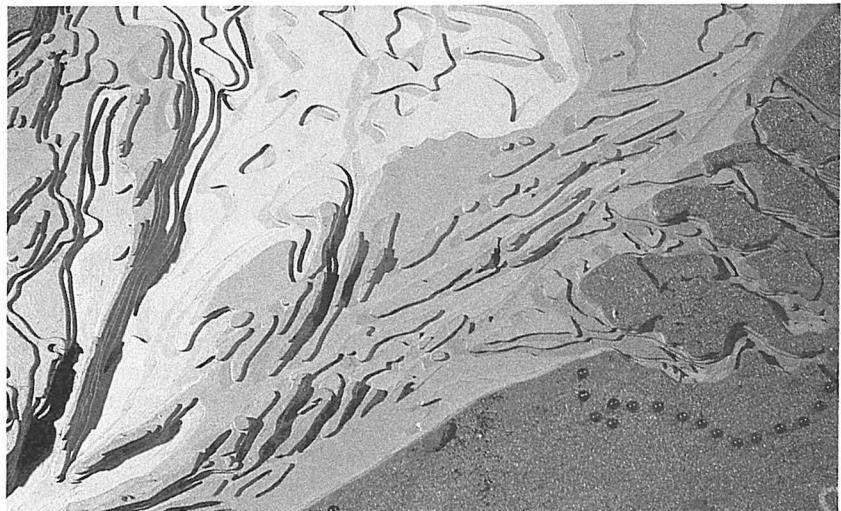
Two MOTIF's to which, 'North Sea Forties' oil was added were treated with an oil dispersant. In two other MOTIF's only oil was introduced, whereas to another two MOTIF's only the dispersant was added. Finally two MOTIF's without any addition were used as controls. As a direct result of addition of oil and dispersant both acute harmful effects to the flora and fauna of the mud flat ecosystems were observed.

The initial negative effects caused by addition of dispersant alone, however rapidly slowed down and the majority of the macrobenthos organisms in these MOTIF's were able to recover.

Severe acute effects were also observed in the systems to which oil was added. Thus it can be concluded that oil treated with dispersant and untreated oil are both trapped in the sediment, causing long-term harmful effects to many benthic species. This prevented a normal and healthy development of the oil spilled systems.

1.5.7. Benthos sampling programme in Zeeland coastal waters

On request of RWS Deltadienst Milieu en Inrichting a benthos sampling programme has been initiated in coastal waters in front of the enclosing dams of the Delta Area (Zeeland). It is a monitoring programme with the object of following possible changes in the bottom morphology and advection of polluted water. For macrofaunal studies a biologist and a technician have been appointed to the NIOZ in July. Meiofaunal studies are being carried out by the Laboratory for Morphology and Systematics of the University of Ghent, Belgium. The cruises are made with RWS vessels, the R.V. "Holland" for deeper parts and the R.V. "Hammen" for the shallow parts of the area.



1.6. ADDITIONAL RESEARCH

1.6.1. Research at NIOZ by guests

Mr. J. van Beusekom (Geologisch-Paläontologisches Institut, University of Hamburg, F.R.G.) co-operated with A.J. van Bennekom and W. Admiraal studying the role of diatoms in silicate- and aluminium cycles.

Dr. B. Corliss (Woods Hole Oceanographic Institution, U.S.A.) participated in a cruise with the R.V. "Aurelia" to the Skagerrak to study the relationship between benthic foraminiferal assemblages and organic carbon in the surface sediments.

Mr. C. Costopoulos (University of Athens, Greece) finished his experimental work on the combined effects of temperature and food ration on growth and condition of young plaice. In October he returned to Athens for preparing his thesis.

Mr. Biman Das (Geological Survey of India, Calcutta) carried out a study of trace metals in the Dutch marine environment.

Prof. Dr. W. Ebenhöh (University of Oldenburg, F.G.R.) participated in the modelling of the BOEDE group.

Horas Hutagalung (LON, Jakarta, Indonesia) trainee SNELLIUS II expedition.

Dr. M.I. Jenness (associate professor on sabbatical leave from Davis & Elkins College, Elkins, West Virginia, U.S.A.) successfully finished in June his studies on feeding and growth of the heart urchin *Echinocardium cordatum* in the southern North Sea, resulting into two publications in co-operation with Mr. G.C.A. Duineveld.

O. Klepper (G.U. Amsterdam) participated in the modelling and documentation of the Ems-Dollard ecosystem.

Mr. S. Majumdar (Marine Geology Division, Geological Survey of India, Calcutta) was introduced into the X-ray diffractometry technique. He applied this to the study of claymineral variations as indicators of climatic changes in cores from the Faroe Shetland Channels. He also took part in sedimentological studies on cores from the Vlieter (Dutch Wadden Sea).

Mr. D.M. Moelyo (D.P.M.A., Bandung) trainee SNELLIUS II expedition.

Mr. Ph. Radford (IMER, U.K.) made a comparison of GEMBASE with the BOEDE model.

Dr. C. Riaux-Gobin (St. Biolog. Roscoff CNRS, France) studied the amino-acid metabolism of benthic diatoms in co-operation with W. Admiraal and R.W.P.M. Laane.

Mr. B.K. Saha (Geological Survey of India, Calcutta) took part in sedimentological studies on cores from the Vlieter (Dutch Wadden Sea) and studied some seismic profiles from the Zaire deep-sea fan.

Dr. He Song-Lin (Institute of Estuarine and Coastal Research, East China Normal University, Shanghai) took part in the research programme in the Ems estuary studying the behaviour of suspended matter.

Mr. Ibrahim Sumanta (D.P.M.A., Bandung) trainee SNELLIUS II expedition.

Dr. G.C.N. de Vooy made a literature-review on behalf of the "Rijkswaterstaat" Department of Environmental Management (DDMI, Middelburg). The review concerned two oyster species, *Ostrea edulis* (European Oyster) and *Crassostrea gigas* (Japanese Oyster) and focused on their energetic budgets, such with respect to management of the Eastern Scheldt Estuary in the next future.

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

Yasuda (Governmental Industrial Research Institute, Kure, Japan) participated in theoretical studies of the vertical structure of tide-induced residual currents over a depth-varying topography. His research was made possible by a ZWO grant.

1.6.2. Participation in national and international programmes

As in 1983, zooplankton samples collected by the State Institute of Fisheries Research (RIVO) during the herring-larvae survey near the Orkney and Shetland Isles were analysed. The intention of this programme is to study the correlation between recruitment of herring stock, and food conditions of the juveniles in the northern North Sea throughout several years. The role of predators, such as the copepod *Candacia armata*, will also be considered. While 1983 samples were relatively poor in food organisms and rich in salps, the 1984 food conditions for herring larvae look much better.

Within the scope of NIOZ participation in the ICES Benthos Methodics Working Group (including an intended North Sea co-operative sampling programme in 1986), a successful intercalibration exercise was carried out in November with the R.V. "Aurelia". Apart from NIOZ participating institutes were the Institute of Offshore Engineering, Edinburgh, U.K., the Laboratory for Morphology and Systematics, Ghent, Belgium, the Institute für Meeresgeologie und Meeresbiologie, Wilhelmshaven F.R.G., the Institute für Meeresforschung, Bremerhaven, F.R.G., the Institute für Meereskunde, Kiel, F.R.G., and the Rijkswaterstaat Deltadienst Milieu en Inrichting, Middelburg. In order to compare methods of sample processing and work-up used by the different participants, a number of samples were collected at a sandy and a muddy location with the participants own sampling and sieving equipment. Additionally, two samples were taken by each participant with the most consistent grab sampler.

Ecology of zoobenthos inhabiting soft bottoms along European coasts

B3-02b

Part of the work on production and dynamics of macrobenthos in Wadden Sea and North Sea is incorporated in the EC-project COST-47, an international long-term programme to assess 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 on animal numbers cannot properly be studied by local investigations.

During 2 workshops, initial results were compared by Danish, German and Dutch members of the intertidal soft-bottom section of COST-47, working in the Wadden Sea and adjacent parts of the North Sea. It was encouraging to see that numerical densities fluctuated in parallel for a number of species (e.g. *Macoma balthica*). Severe winters, extending over the whole Wadden Sea area, clearly acted as a synchronizing agent. Upward long-term trends in abundance of some species e.g. *Heteromastus filiformis*, were found to occur probably over the entire Wadden Sea.

In co-operation with a number of Dutch Governmental institutes (RIJP, RIN, RIZA, and RWS-ADH) a study of the benthic macrofauna, 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.

Five staff members of the EON group participated in the Cumberland Basin Modelling Workshop, held at Bedford Institute of Oceanography (Canada) from 17-30 July.

H4-01

On behalf of Rijkswaterstaat (RIZA) the geology department determined the sedimentation rate, using ^{210}Pb of a boxcore collected on Loswal Noord off Scheveningen-Hoek van Holland. From 1940 to the present a constant rate of $\sim 0.5 \text{ cm} \cdot \text{y}^{-1}$ was found indicating that deposition of mud and sand in this area is probably not related to the dumping of harbour mud, but rather to other conditions along the coast. Only one core was analysed, and the results of more cores are needed to obtain a more precise sedimentation estimate in this area.

B3-04b

Wader birds in tropical intertidal areas and their food.— By participating in the international co-operative research project Interwader, research could be conducted on the Malaysian peninsula and in southern Thailand. The project was launched by the University of Malaya, the World Wildlife Fund and the International Council for Bird Preservation to investigate distribution and ecology of wader species wintering in S.E. Asia. On the intertidal flats, usually consisting of very soft mud, a rich variety of macrobenthic animals was found. Feeding methods and prey choice were assessed for a number of bird species, mainly Arctic and boreal Charadriiformes.

In co-operation with J.M. Everaarts and Dr. C.G.N de Vooy, the department of physiology and biological toxicology (Prof. Dr. D. Zandee and Dr. J.H. Kluytmans) of the University of Utrecht, carried out a long-term experiment on uptake, distribution, and other effects of cadmium in the mussel *Mytilus edulis*.

H3-02

The marine pollution department (M.T.J. Hillebrand) participated in an intercalibration programme of the Rijks Kwaliteits Instituut voor Land- en Tuinbouwproducten. Intercalibration of individual chlorinated biphenyls in fish-oil was concerned.

On the request of Hasselt en de Koning Engineers an advice was prepared by T.C.E. van Weering and B. Kuipers concerning the rehabilitation of the Hormuzgan Research Station and aquarium, Hormuz, Iran, considering a preliminary definition of its objectives, laboratories, and scientific equipment, and a brief appraisal of the required research vessel.

Pigment analyses in tulip bulb extracts were made by HPLC (high-performance liquid chromatography) for Dr. N. Gorin, Sprenger Institute, Wageningen (W.W.C. Gieskes).

By order of Rijkswaterstaat, Department Noordzee, investigations are carried out on the effects of the dumping of TiO_2 waste acid on the bottom fauna in the area off IJmuiden, North Sea (EON; TECON programme).

As a "professeur extraordinaire", R.W.P.M. Laane worked at the University of Bordeaux (France) between 1 February and 1 April.



1.7. LIST OF RESEARCH PROJECTS AND RESEARCH WORKERS

1.7.1. Hydrography (H)

Chemical Oceanography department (H. Postma)

- H1-01 Nutrient, oxygen and carbon investigations in Wadden Sea, North Sea and open ocean (S.B. Tijssen, H. Postma, assistants F. Wetsteyn, J.W. Rommets, R.P.T. de Vries)
- H1-02 Nitrogen cycle in marine sediments (W. Helder, assistant R.P.T. de Vries)
- H1-03 Redox-reactions of inorganic nitrogen compounds in marine sediments (J.F. Bakker, W. Helder)
- H1-04 Carbondioxide research (H. Postma, assisant J.W. Rommets)
- H1-05 Macro-ion concentrations in seas and estuaries (S.B. Tijssen, assistant F. Wetsteyn)

Physical Oceanography department (J.T.F. Zimmerman)

- H2-01 Marine optics 1: euphotic zone of oceanic waters (D. Spitzer, assistants M.R. Wernand, M.W. Manuels, W.M.L. Lambrechts)
- H2-02 Marine optics 2: remote sensing of coastal waters (D. Spitzer, assistants M.R. Wernand, M.W. Manuels, W.M.L. Lambrechts)
- H2-06 Experimental dynamical oceanography (J.T.F. Zimmerman, C. Veth, assistants M.W. Manuels, W.M.L. Lambrechts)
- H2-07 Small-scale turbulence, mixing layers and thermocline studies (C. Veth, W.M.L. Lambrechts)
- H2-08 Theoretical dynamical oceanography (J.T.F. Zimmerman)

Marine Pollution department (B. Sundby, J.C. Duinker)

- H3-01 Behaviour of metals in the marine environment (R.F. Nolting)
- H3-02 Identification and behaviour of organochlorines (J.M. Everaarts, assistant M.T.J. Hillebrand)
- H3-03 Chemical forms of metals in sea water (C.J.M. Kramer, assistant R.F. Nolting)
- H3-04 Sublethal effects of heavy metals on marine organims (J.M. Everaarts)
- H3-07 Accumulation of contaminants in the Wadden Sea (C.J.M. Kramer)
- H3-08 Organochlorines in marine organisms (J.P. Boon)
- H3-09 Sublethal effects on a number of selected chlorinated hydrocarbons on marine organims (J.M. Everaarts)

Marine Geology and Geochemistry department (D. Eisma)

- H4-01 Sediment transport and sedimentation in the North Sea (D. Eisma, A.J. van Bennekom, T.C.E. van Weering, assistants G.W. Berger, S.J. van der Gaast, J. Kalf, J. van Iperen)
- H4-02 Marine silica cycle (A.J. van Bennekom, J.H.F. Jansen, assistants G.W. Berger, S.J. van der Gaast, J. van Iperen)
- H4-03 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, D. Eisma, assistants G.W. Berger, S.J. van der Gaast, J. van Iperen, J. Kalf)
- H4-04 Palaeomagnetism of sediment cores and sedimentological experiments of remanent magnetism (M.J. van Vreumingen)
- H4-05 Conversion of clay minerals in the sea (S.J. van der Gaast, assistant A.J. Vaars)

- H4-06 Transport and sedimentation of suspended matter under influence of the Scotland-Greenland Ridge flow system (D. Eisma, S.J. van der Gaast, assistants J. van Iperen)
- H4-07 Sedimentation processes along continental margins (T.C.E. van Weering, assistants S.J. van der Gaast, J. van Iperen)
- H4-08 Aggregation, deaggregation, flocculation, and formation of particles in estuaries (D. Eisma, assistant J. Kalf)
- H4-09 Geology and geochemistry of the floor of southern Indonesian deep-sea basins (J.H.F. Jansen, T.C.E. van Weering, assistants G.W. Berger, S.J. van der Gaast, J. van Iperen, J. Kalf)
- H4-10 Transport and deposition of suspended matter in some Indonesian basins (D. Eisma, assistants S.J. van der Gaast, J. van Iperen, J. Kalf)
- H4-11 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
- B1-02 Structural identification of organic matter in marine ecosystems (J.H. Vosjan, P.A.W.J. de Wilde, R. Dekker, assistants A. Kok, E. Pauptit, G. Nieuwland)
- B1-03 Activity of microorganisms (J.H. Vosjan, P.A.W.J. de Wilde, assistants E. Pauptit, G. Nieuwland)
- B1-04 Bioturbation as environmental factor (P.A.W.J. de Wilde, J.H. Vosjan, assistant E.M. Berghuis, E. Pauptit, G. Nieuwland)
- B1-05 Energy consumption and production in dominant faunal elements; community metabolism (P.A.W.J. de Wilde, J.H. Vosjan, R. Dekker, assistants E.M. Berghuis, A. Kok, E. Pauptit, G. Nieuwland)
- B1-06 Coral research (R.P.M. Bak)
- B1-07 Microzooplankton (R.P.M. Bak)

Autecology (F. Creutzberg)

- B2-01 Role of carnivores in the tidal area (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 Role of carnivores in the benthic system of the southern North Sea (assistants G.J. van Noort, P. van der Puyl, R. Dapper)
 - a Distribution ecology (F. Creutzberg)
 - b Population research (F. Creutzberg, B.R. Kuipers)
 - c Feeding and growth (B.R. Kuipers, F. Creutzberg)
 - d Energy budget (M. Fonds)
 - e 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. Draai)
- B2-05 Quantitative investigation of microzooplankton (A.D.G. Draai)
- B2-06 Mariculture (M. Fonds, assistant P. van der Puyl)

Benthic systems (J.J. Beukema)

- B3-01 *In situ* production and input of organic matter (G.C. Cadée, assistant J. Hegeman)
- B3-02 a Production and dynamics of macrozooplankton in the Wadden Sea and adjacent North Sea (J.J. Beukema, assistants W. de Bruin, J. Zuidewind)
 - b Ecology of macrozoobenthos in coastal waters of western Europe (J.J. Beukema, assistants W. de Bruin, J. Zuidewind)

- B3-04 a The role in the food chain and population dynamics of seabirds in the Wadden Sea and adjacent North Sea (C. Swennen, assistants P. Duiven, J. Zuidewind)
- b Food of sea birds in tropical tidal areas (C. Swennen, assistants P. Duiven, J. Zuidewind)
- B3-05 Relation between chemical composition of sea water and of marine organisms (D.H. Spaargaren)
- 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, 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, assistants G.W. Kraay, S.R. Gonzalez, S.S. Oosterhuis)
- 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)
- B4-04 Population dynamics and bioenergetics in experimental pelagic ecosystems (W.C.M. Klein Breteler, assistant S.R. Gonzalez)

1.7.3. Special projects

- S-01 Biological Research of Ems-Dollard Estuary (BOEDE) and 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, A. Stam, P. de Wolf, W. Admiraal (stationed at University of Groningen), F. Colijn (allied scientist, University of Groningen), assistants A. Kop, H. Malschaert, M. Mulder, L. Venekamp (stationed at University of Groningen), A.C. Bol-den Heijer.
- S-02 Biological and geochemical investigations in relation to the deep sea dumping of low-level radioactive waste (DORA). M. Lavaleije, M.M. Rutgers van der Loeff, assistants D. Wayers, G.J. Zigterman (EC Brussels, Energie Centrum Nederland).
- S-03 Dutch joint monitoring programme on polychlorinated hydrocarbon. M.T.J. Hillebrand.
- S-04 Oil Pollution Experiments (OPEX). 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 Natuurbeheer, afdeling Texel, Nederlands Instituut voor Onderzoek der Zee).
- S-05 Continuous liquid-liquid extractor. M.T.J. Hillebrand.
- S-06 Benthos sampling programme in Zeeland coastal waters. P. Seip, assistant R. Brand.



2. Scientific outcome

2.1. PUBLICATION

2.1.1. Netherlands Journal of Sea Research and other series issued

The executive editor of the Netherlands Journal of Sea Research, J.W. de Blok, retired in August, after having been in charge ever since 1969.

The NIOZ continues the production of the Netherlands Journal of Sea Research. A new editorial board has been appointed: J.J. Beukema (NIOZ, editor-in-chief), P.H. Nienhuis (DIHO), W.J. Wolff (RIN), and J.T.F. Zimmerman (NIOZ & Utrecht University), assisted by A.C. Rijk (NIOZ).

During 1984 volume 17 was completed by issuing the combined no. (2-4) as a special issue, edited by J.H.F. Jansen, under the title of "Quaternary geology and oceanography of the Zaire deep-sea fan and adjacent Atlantic", containing 14 papers. The combined no. (1-2) of volume 18 appeared also as a special issue, edited by W.W.C. Gieskes, under the title of "Trophodynamics of the Oyster Ground, Central North Sea: production and consumption cycles in the pelagic and benthic ecosystems", containing 10 papers. Volume 18 (1984) will be completed early-1985 by again a special issue on research in the saline Lake Grevelingen.

2.1.2. Publications NIOZ 1984

- ADMIRAAL, W. (BOEDE). The ecology of estuarine sediment-inhabiting diatoms.—*Prog. phycol. Res.* **3**: 269-322.
- ADMIRAAL, W., R.W.P.M. LAANE & H. PELETIER (BOEDE). Participation of diatoms in the amino acid cycle of coastal water; uptake and excretion in cultures.—*Mar. Ecol. Prog. Ser.* **15**: 303-306.
- ADMIRAAL, W., H. PELETIER & T. BROUWER (BOEDE). The seasonal succession patterns of diatom species on an intertidal mudflat: an experimental analysis.—*Oikos* **42**: 30-40.
- BAARS, M.A. & TH.S. VAN DIJK. Population dynamics of two carabid beetles at a Dutch heathland. I. Subpopulation fluctuations in relation to weather and dispersal.—*J. Anim. Ecol.* **53**: 375-388.
- BAARS, M.A. & TH.S. VAN DIJK. Population dynamics of two carabid beetles at a Dutch heathland. II. Egg production and survival in relation to density.—*J. Anim. Ecol.* **53**: 389-400.
- BAARS, M.A. & H.G. FRANSZ. Grazing pressure of copepods on the phytoplankton stock of the central North Sea.—*Neth. J. Sea Res.* **18**: 120-142.
- BAARS, M.A. & S.S. OOSTERHUIS. Diurnal feeding rhythms in North Sea copepods measured by gut fluorescence, digestive enzyme activity and grazing on labelled food.—*Neth. J. Sea Res.* **18**: 97-119.
- BAK, R.P.M., M.J.E. CARPAY & E.D. DE RUYTER VAN STEVENINCK. Densities of the sea urchin *Diadema* before and after mass mortalities on the coral reefs of Curaçao.—*Mar. Ecol. Prog. Ser.* **17**: 105-108.
- BAK, R.P.M. & J.L.A. BORSBOOM. Allelopathic interaction between a reef coelenterate and benthic algae.—*Oecologia* **63**: 194-198.
- BERGER, P., R.W.P.M. LAANE, A.G. ILAHUDE, M. EWALD & P. COURTOT. Comparative study of dissolved fluorescent matter in four West-European estuaries.—*Oceanol. Acta* **7**: 309-314.

- BENNEKOM, A.J. VAN. Datering van pelagische sedimenten met ^{10}Be en ^{26}Al , literatuuronderzoek en mogelijke toepassingen. In: A.M. HOOGENBOOM. Verslag miniconferentie "Datering met de Utrechtse Tandemversneller", Utrecht: 24-29.
- BENNEKOM, A.J. VAN & G.W. BERGER. Hydrography and silica budget of the Angola Basin.—Neth. J. Sea Res. **17**: 149-220.
- BEUKEMA, J.J.. Zoobenthos survival during severe winters at high and low tidal flats in the Dutch Wadden Sea. In: J.S. GRAY & M.E. CHRISTIANSEN. Marine Biology of polar regime and Effects of Stress on Marine Organisms. John Wiley, Chichester: 351-361.
- —. Tidal mud flats/Watten/Les vasières intertidales/La battigia paludosa.—Naturopa **46**: 6-8.
- BEUKEMA, J.J., G.C. CADÉE & H. HUMMEL (1983). Differential variability in time and space of numbers in suspension and deposit feeding benthic species in a tidal flat area.—Oceanol. Acta Vol. Sp.: 21-26.
- BJØRKLUND K.R. & J.H.F. JANSEN. Radiolaria distribution in Middle and Late Quaternary sediments and palaeoceanography in the eastern Angola Basin.—Neth. J. Sea Res. **17**: 299-312.
- BOON, J.P.. Kinetics of individual polychlorinated biphenyl (PCB) components in juvenile sole (*Solea solea*) in relation to their concentrations in food and to lipid metabolism.—Comp. Biochem. Physiol. **79 C1**: 131-143.
- —. Uptake, distribution and elimination of selected polychlorinated biphenyl components of Clophen A 40 in juvenile sole (*Solea solea*) and effects on growth. In: J.S. GRAY & M.E. CHRISTIANSEN. Marine Biology of polar Regime and Effects of Stress on Marine Organisms. John Wiley, Chichester: 493-512.
- BOUWMAN, L.A. (BOEDE). A survey of nematods from the Ems estuary: Part II. Ecology.—Zool. Jb. Syst. **110**: 345-376.
- CADÉE, G.C.. Biological activity and sediments. In: J. MOLINARI. Sediments and pollution in waterways, general considerations. IAEA-Technical Documents 302: 111-126.
- —. Opportunistic feeding, a serious pitfall in trophic structure analysis of (paleo)faunas.—Lethaia **17**: 289-292.
- —. Particulate and dissolved organic carbon and chlorophyll a in the Zaire river, estuary and plume.—Neth. J. Sea Res. **17**: 426-440.
- —. Macrobenthos and macrobenthic remains on the Oyster Ground, North Sea.—Neth. J. Sea Res. **18**: 160-178.
- —. Has input of organic matter into the western part of the Dutch Wadden Sea increased during the last decades? Netherlands Institute for Sea Research. Publ. Ser. 1984-10: 71-82.
- CADÉE, G.C. & R.W.P.M. LAANE. Behaviour of POC, DOC and Fluorescence in the freshwater tidal compartment of the river Ems.—Mitt. Geol.-Paläont. Inst. Univ. Hamburg **55**: 331-343.
- COLIJN, F. & V.N. DE JONGE (BOEDE). Primary production of microphytobenthos in the Ems-Dollart estuary.—Mar. Ecol. Prog. Ser. **14**: 185-196.
- —. Relaties tussen milieuvariatiën en de ontwikkeling van het phytoplankton in het Eems-estuarium: veldonderzoek en mathematische modellen.—K.N.A.G. Geogr. Tijdschrift **18**: 265-270.
- CREUTZBERG, F., P. WAPENAAR, G. DUINEVELD & N. LOPEZ LOPEZ. Distribution and density of the benthic fauna in the southern North Sea in relation to bottom characteristics and hydrographic conditions.—Rapp. P.-v. Réun. Cons. perm. int. Explor. Mer **183**: 101-110.
- DANKERS, N., M. BINSBERGEN, K. ZEGERS, R. LAANE, M. RUTGERS VAN DER LOEFF. Transportation of water, particulate and dissolved organic and inorganic matter between a salt marsh and the Ems-Dollart estuary, The Netherlands.—Estuar. coast. Shelf Sci. **19**: 143-165.
- DUINEVELD, G.C.A. & M.I. JENNESS. Differences in growth rates of the sea urchin *Echinocardium cordatum* as estimated by the parameter omega of the von Bertalanffy equation applied to skeletal rings.—Mar. Ecol. Prog. Ser. **19**: 65-72.
- DUINKER, J., M.T.J. HILLEBRAND & J.P. BOON. Organochlorines in the Dutch Wadden Sea. Netherlands Institute for Sea Research. Publ. Ser. 1984-10: 211-228.

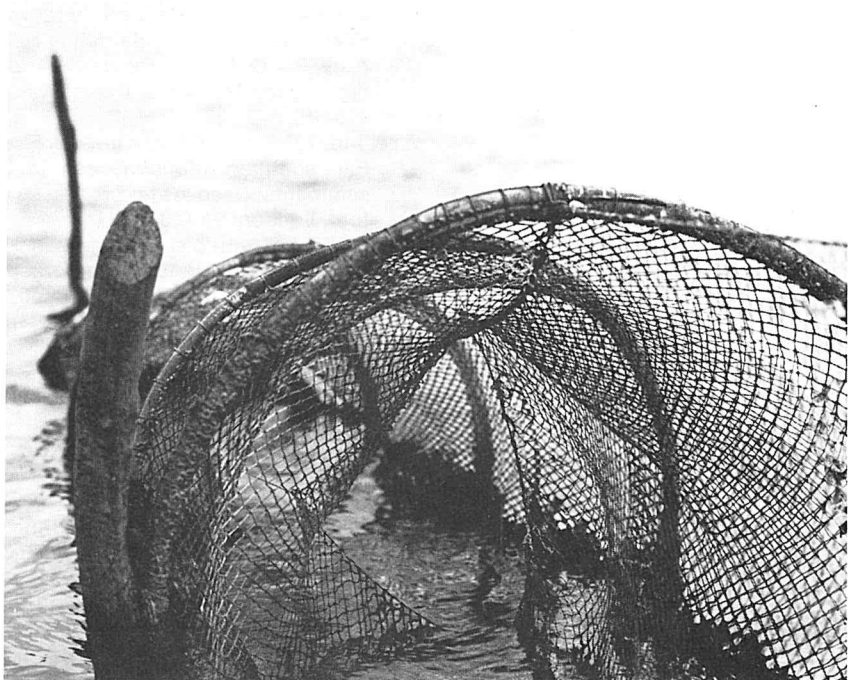
- EISMA, D.. Het Nederlandse Waddengebied.—Waddenbull. **19**: 17-19.
- —. Water in de Waddenzee.—Waddenbull. **19**: 124-126.
- —. Sediment distribution in the Tejo estuary. Consultant Report UNESCO: 1-11.
- EISMA, D. & G.W. BERGER. Sedimentatiesnelheid bepaling in een boxcore van Loswal Noord. Rapport t.b.v. RIZA: 1-9.
- EISMA, D., J. BOON, R. GROENEWEGEN, V. ITTEKKOT, J. KALF & W.G. MOOK, 1983. Observations on macro-aggregates, particle size and organic composition of suspended matter in the Ems estuary.—Mitt. Geol. Paläont. Inst. Univ. Hamburg, SCOPE/UNEP Sonderband **55**: 295-314.
- EISMA, D., E. JACOBS, G. BERGER & A. STOLK. Mud-accumulation in the German Bight, First Results. ICES Papers Rostock Meeting 1984-2: 1-12.
- EISMA, D. & J. KALF. Dispersal of Zaire river suspended matter in the estuary and the Angola Basin.—Neth. J. Sea Res. **17**: 385-411.
- EISMA, D., J. SKEI, S. WESTERLUND, J. KALF, B. MAGNUSSON, K. NAES & K. SÖRENSEN. Distribution and composition of suspended matter and trace metals in the Skagerrak. ICES Papers Rostock Meeting, 1984-2: 1-43.
- FRANSZ, H.G. & W.G. VAN ARKEL, 1983. Fluctuation and succession of common pelagic copepod species in the Dutch Wadden Sea.—Oceanol. Acta. Sp.: 87-91.
- FRANSZ, H.G. & W.W.C. GIESKES. The unbalance of phytoplankton and copepods in the North Sea.—Rapp. P.-v. Réun. Cons. perm. int. Explor. Mer **183**: 218-225.
- FRANSZ, H.G., J.C. MIQUEL & S.R. GONZALEZ. Mesozooplankton composition, biomass and vertical distribution, and copepod production in the stratified central North Sea.—Neth. J. Sea Res. **18**: 82-96.
- GAAST, S.J. VAN DER & J.H.F. JANSEN. Mineralogy, opal, and manganese of the Middle and Late Quaternary sediments of the Zaire (Congo) deep-sea fan: origin and climatic variation.—Neth. J. Sea Res. **17**: 313-341.
- GERRITSEN, A.F., Y.M. VAN HEEZIK & C. SWENNEN. Chemoreception in two further *Calidris* species (*C. maritima* and *C. canutus*).—Neth. J. Zool. **33**: 485-496.
- GIESKES, W.W.C., B. BEESE & M. ELBRÄCHTER. Horizontale und vertikale Verteilung von Chlorophyll zwischen der Antarktischen Halbinsel und der Scotia See und der Beitrag des Phytoplanktons zur spektralen Lichtabsorption.—Ber. Polarforsch. (Reports on Polar Research) **18**: 29-30.
- GIESKES, W.W.C. & G.W. KRAAY. State-of-the-art in the measurement of primary production. In: M.J.R. FASHAM. Flows of Energy and Materials in Marine Ecosystems. Plenum Press, New York: 171-190.
- —. Phytoplankton, its pigments, and primary production at a central North Sea station in May, July and September, 1981.—Neth. J. Sea Res. **18**: 51-70.
- —. Analysis of phytoplankton pigment by HPLC before, during and after mass occurrence of the microflagellate *Corymbellus aureus* Green during the spring bloom in the Fladen Ground area of the North Sea in 1983. ICES C.M. 1984/B: 15.
- JANSEN, J.H.F., P. GIRESSE & G. MOGUEDET. Structural and sedimentary geology of the Congo and southern Gabon continental shelf. A seismic and acoustic reflection survey.—Neth. J. Sea Res. **17**: 364-384.
- JANSEN, J.H.F., T.C.E. VAN WEERING, R. GIELES & J. VAN IPEREN. Middle and Late Quaternary oceanography and climatology of the Zaire-Congo fan and adjacent eastern Angola Basin.—Neth. J. Sea Res. **17**: 201-249.
- JONG, L., DE & W. ADMIRAAL (BOEDE). Competition between three estuarine benthic diatom species in mixed cultures.—Mar. Ecol. Prog. Ser. **18**: 269-275.
- C.J.M. KRAMER. Mobility of heavy metals at the sediment water interface: dissolved copper bound by anoxic sediments.—Thalassia jugosl. **18**: 173-179.
- KRAMER, C.J.M. & J.C. DUINKER. Complexation capacity and conditional stability constants for copper of sea- and estuarine waters, sediment extracts and colloids. In: C.J.M. KRAMER & J.C. DUINKER. Complexation of trace metals in natural waters. Nijhoff, Junk Publ., The Hague, 217-228.
- KRAMER, C.J.M., YU GUO-HUI & J.C. DUINKER. Possibilities for misinterpretation in ASV-speciation studies of natural waters.—Fresenius Z. Anal. Chem. **317**: 383-384.

- KRAMER, C.J.M., YU GUO-HUI & J.C. DUINKER. Optimalization and comparison of four mercury working electrodes in speciation studies by differential pulse anodic stripping voltametry.—*Analytica chim. Acta* **164**: 163-170.
- KUIPER, J., R. DEKKER, P.A.W.J. DE WILDE & W. WOLFF. De ontwikkeling van een modelwadecosysteem ten behoeve van ecotoxicologisch onderzoek. Rep. MT-TNO, Delft, R 84/141: 1-95.
- KUIPER, J., P.A.W.J. DE WILDE & W. WOLFF. Effects of an oil spill in outdoor model tidal flat ecosystems.—*Mar. Pollut. Bull. NS.* **15**: 102-106.
- KUIPERS, B.R. & R. DAPPER. Nursery function of Wadden Sea tidal flats for the brown shrimp *Crangon crangon*.—*Mar. Ecol. Prog. Ser.* **17**: 171-181.
- LAANE, R.W.P.M. Characteristics of organic matter in the Wadden Sea. Netherlands Institute for Sea Research. Publ. Ser 1984-10: 23-40.
- LAANE, R.W.P.M. (BOEDE). Comment on the structure of marine fulvic and humic acids.—*Mar. Chem.* **15**: 85-87.
- LAANE, R.W.P.M. & V. ITTEKOT. (BOEDE) Behaviour of dissolved organic waste in a part of the Ems-estuary: The Dollart.—*Mitt. Geol.-Paläont. Inst. Univ. Hamburg.* **55**: 343-352.
- LAANE, R.W.P.M. & C.J.M. KRAMER (BOEDE). Complexation of Cu^{2+} with humic substances in relation to different extraction procedures of sandy and silty marine sediments. In: C.J.M. KRAMER & J.C. DUINKER. Complexation of trace metals in natural waters. Nijhoff, Junk Publ., The Hague, 335-348.
- LAANE, R.W.P.M., M.W. MANUELS & W. STAAL (BOEDE). A procedure for enriching and cleaning up Rhodamine B and Rhodamine WT in natural waters, using a sep-pak C18 cartridge.—*Water Res.* **18**: 163-165.
- LAVALEYE, M.S.S.. Cumacea van Nederland. Tabellenserie van de Strandwerkgemeenschap 26: 1-23.
- LEOPOLD M.F. & E.C.L. MARTEYN. Waarschijnlijk bastaard *Tadorna tadorna* en Nijlgans *Alopochen aegyptiaca* op het Balgzand.—*Limosa* **56**: 258-259.
- PACKARD, T.T., C. JOIRIS, P. LASSERRE, H.J. MINAS, M. PAMATMAT, A.R. SKJOLDAL, R.E. ULANOWICZ, J.H. VOSJAN, R.M. WARWICK AND P.J. LEB. WILLIAMS. Respirations. In: M.J.R. FASHAM. Flows of Energy in Marine Ecosystems. Plenum Press, New York: 641-650.
- POSTMA, H.. Introduction to the symposium of organic matter in the Wadden Sea. *Neth. Inst. Sea Res. Publ. Ser.* 10-1984: 15-22.
- — —. Concluding remarks of session chairman at the dynamics of turbid coastal environments symposium, V.—*Can. J. Fish. Aq. Sci.* **40**: 357-358.
- — —. Estuarine sedimentation and sediment transport. In: *Proceedings of International Symposium on Sedimentation on the Continental Shelf, with Special Reference to the East China Sea*. China Ocean Press, Peking: 129-134.
- — —. De SNELLIUS expedities.—*Verh. K. ned. Akad. Wet. (afd. Natuurkunde)* **93**: 92-97.
- POSTMA, H., W.M. KEMP, J.M. COLEBROOK, J. HORWOOD, J.R. JOINT, R. LAMPITT, S.W. NIXON, M.E.Q. PILSON AND F. WULLF. NUTRIENT CYCLING IN ESTUARINE AND COASTAL MARINE ECOSYSTEMS. In: M.J.R. FASHAM. Flows of Energy and Materials in Marine Ecosystems. Plenum Press, New York: 651-661.
- POSTMA, H. & J.W. ROMMETS. Variations of particulate organic carbon in the central North Sea.—*Neth. J. Sea Res.* **18**: 31-50.
- ROMEYN, K. & L.A. BOUWMAN (BOEDE). Food selection and consumption by estuarine nematodes.—*Hydrobiol. Bull.* **17**: 103-109.
- ROMEYN, K., L.A. BOUWMAN & W. ADMIRAAL (BOEDE). Ecology and cultivation of the herbivorous brackish water nematode *Eudiplogaster paramatus* (Rhabditidae, W. Schneider 1973).—*Mar. Ecol. Prog. Ser.* **12**: 145-153.
- RUITER, R.S.C. DE, J.H.F. JANSEN & T.C.E. VAN WEERING. Middle and Late Quaternary silicoflagellates from the Angola Basin.—*Neth. J. Sea Res.* **17**: 293-298.
- RUTGERS VAN DER LOEFF, M.M., L.G. ANDERSON, P.O.J. HALL, Å.I. IVERFELDT, A.B. JOSEFSON, B. SUNDBY AND S.F.G. WESTERLUND. The asphyxiation technique: An approach to distinguishing between molecular diffusion and biologically mediated transport at the sediment-water interface.—*Limnol. Oceanogr.* **29**: 675-686.
- SPAARGAREN, D.H. On ice formation in sea water and marine animals at subzero temperatures.—*Mar. Biol. Letters* **5**: 203-216.

- SPAARGAREN, D.H. & H.J. CECCALDI. Some relations between the elementary chemical composition of marine organisms and that of sea water.—*Oceanol. Acta* **7**: 63-76.
- SPITZER, D.. Oceanografie vanuit de ruimte. TNO-Project 12: 116-118.
- —. De kleur van het water gezien vanuit de ruimte.—*Ned. Tijdschrift Fotonica* **10**: 4-11.
- SWART, H.E. DE & J.T.F. ZIMMERMAN. Tidal rectification in lateral viscous boundary layers of a semi-enclosed basin. Report AM-R 8415, Center for Mathematics and Computer Sciences: 1-15.
- SWENNEN, C.. Differences in quality of roosting flocks of Oystercatchers. In: P.R. EVANS, J.D. GOSS-CUSTARD & W.G. HALE. Coastal waders and wildfowl in winter. Cambridge University Press: 177-189.
- —. Enige opmerkingen over het waarnemingsgebied. In: C.J. CAMPHUYSEN & J. VAN DIJK. Zee- en kustvogels langs de Nederlandse kust.—*Limosa* **56**: 89-95.
- —. De papagaaiduiker.—*Vogels* **24**: 207-209.
- —. Een vondst van een levende Amerikaanse Zwaardschede in de Noordzee voor Texel.—*Zeepaard* **44**: 131-132.
- TIJSSSEN, S.B. & J.F. WETSTEYN. Hydrographic observations near a subsurface drifter in the Oyster Ground, North Sea.—*Neth. J. Sea Res.* **18**: 1-12.
- —. Diurnal pattern, seasonal change and variability of oxygen in the water column of the Oyster Ground (North Sea) in spring-summer 1981.—*Neth. J. Sea Res.* **18**: 13-30.
- VEER, H.W. VAN DER, M.J.N. BERGMAN & J.J. ZIJLSTRA. Predation on newly-settled O-group plaice (*Pleuronectes platessa* L.) by crustaceans in a continental tidal nursery area, the Wadden Sea. ICES C.M. 1984/G76: 1-13.
- VEER, H.W. VAN DER & C.F.M. SADÉE. The seasonal occurrence of the ctenophore *Pleurobrachia pileus* in the western Wadden Sea.—*Mar. Biol.* **79**: 219-227.
- VOOYS, C.G.N. DE. De biologie van de kokkel *Cerastoderma edule* L., in het bijzonder met betrekking tot de plaats in de voedselketen. Een literatuuronderzoek. Rapport uitgevoerd in opdracht van de Deltadienst, Rijkswaterstaat, Hoofdafdeling Milieu en Inrichting, Middelburg.
- —. Energiebudgetten van twee oestersoorten. *Ostrea edulis* L. en *Crassostrea gigas* Thunb., met betrekking tot hun plaats in de voedselketen. Een literatuuronderzoek. Rapport uitgevoerd in opdracht van de Deltadienst, Rijkswaterstaat, Hoofdafdeling Milieu en Inrichting, Middelburg.
- WILDE, DE, P.A.W.J. & J.J. BEUKEMA. The role of zoobenthos in the consumption of organic matter in the Dutch Wadden Sea. *Neth. Inst. Sea Res. Publ. Ser.* 1984-10: 145-158.
- WEERING, T.C.E. VAN & J. VAN IPEREN. Fine grained sediments of the Zaire Deep Sea Fan, southern Atlantic Ocean. In: D.A.V. STOW & D.J.W. PIPER. Fine grained sediments: Deep Water processes and facies. Blackwell Scientific Publ., Oxford, London: 93-113.
- WEERING, T.C.E. VAN & C.J.M. KRAMER. Het bedreigde Zeemilieu, de Noordzee. Uitgave Stichting Ekologie/Werkgroep Noordzee, Amsterdam: 1-120.
- WERF, B. VAN DER & J.H. VOSJAN. Respiratory activity and ATP of microorganisms in the North Equatorial Current of the Atlantic Ocean.—*Antonie van Leeuwenhoek* **50**: 109-110.
- WERF, B. VAN DER & G. NIEUWLAND. Bacterial biomass and respiratory electron transport system activity in the Oyster Ground area (North Sea) in 1981.—*Neth. J. Sea Res.* **18**: 71-81.
- WILDE, P.A.W.J. DE, E.M. BERGHUIS & A. KOK. Structure and energy demand of the benthic community of the Oyster Ground, central North Sea.—*Neth. J. Sea Res.* **18**: 143-159.
- WOLF, P. DE (BOEDE). Bio-indicators and the quality of the Wadden Sea.—*Environm. Monitoring Assessm* **3**: 355-367.
- ZIJLSTRA, J.J.. The biological productivity of North Atlantic Shelf Areas.—*Rapp. P.-v. Reün. Cons. perm. int. Explor. Mer* **183**: 1-284.
- —. Introduction.—*Rapp. P.-v. Reün. Cons. perm. int. Explor. Mer* **183**: 5-7.
- ZIMMERMAN, J.T.F.. Windscale effluent as an oceanographic tracer for continental shelf circulation.—*Nature, Lond.* **311**: 102-103.

2.1.3. Internal Reports NIOZ 1984

- NOORT, G.J. VAN, F. CREUTZBERG & R. DAPPER. "Aurelia"-cruise reports on the benthic fauna of the southern North Sea. Report 8: Trawl survey October 1976. No. 1984-1.
- RUTGERS VAN DER LOEFF, M.M. & M.S.S. LAVALEYE. Geochemical and biochemical research at the NEA dumpsite for low-level radioactive waste. No. 1984-2.
- RUYITNO, E. PAUPTIT & J.H. VOSJAN. Orientation on electron transport system activity measurement in different organisms (training for Indonesian-Dutch SNEL-LIUS II-expedition in 1984-1985). No. 1984-3.
- MAJUMDAR S. A methodology of x-ray diffraction and interpretation of x-ray diffraction data on the clay-sized fraction of cores from the North Atlantic Ocean between the Faeroe and the Shetland Islands. No. 1984-4.
- SAHA, B.K. Report on studies of seismic profile of the Zaire deep-sea fan, Atlantic Ocean. No. 1984-5.
- DAS, B.R. Study of trace metals in Dutch marine environment. No. 1984-6.
- SAHA, B.K. Report on systematic studies on core sediments from the Vlieter channel, Wadden Sea, The Netherlands - application of techniques and diagnosis of data on grain size, calcium carbonate and organic C.N.N. content and XRD-XRF PB-210 analysis. No. 1984-7.
- BROUWER, C. Reproduction of several nematode species of different salinities and temperatures and the consumption of different diatom species. BOEDE Publicaties en Verslagen 1984-1: 1-36.
- STAM, A. Fishes, crabs and shrimps of the Ems-Dollard estuary. III. Quantitative survey of the flatfishes. BOEDE Publicaties en Verslagen 1984-2: 1-51.
- KLEPPER, O. A stable situation in an artificial marine ecosystem. BOEDE Studentenverslagen 1984-3: 1-61.
- JONGE, V.N., L.D. BOOM, H. BOORSMA, L. BIJLSMA & L.A. VILLERIUS. Comparison of different sampling techniques for determining the concentration of suspended matter in waters influenced by tides. BOEDE Publicaties en Verslagen 1984-4: 1-31.



2.2. LECTURES, etc.

2.2.1. Colloquia and lectures at the Institute

(titles translated)

6 January	W.W.C. Gieskes (NIOZ): (Research in Antarctic waters in October-November with the "Polarstern". 1. General impressions of the environment. 2. Same preliminary results of phytoplankton research. A.J. van Bennekom (NIOZ): (The influence of Aluminium on the silicium-cycle in antarctic seas). P. Lagendijk (Greenpeace): (Aspects of nature conservation in Antarctica).
20 January	P. Wiersinga (RU Groningen): (The population dynamics of <i>Nereis diversicolor</i> in an experimental tidal flat ecosystem). Y. van Scheppingen (RU Utrecht): (The energy flow in an experimental tidal flat ecosystem).
17 February	DORA (Deep Sea Research Radio Active Wastes): (Research on the NEA dumping site for radioactive waste in the Atlantic Ocean). M. Rutgers van der Loeff (NIOZ): (Geochemical research). M. Lavaleye (NIOZ): (Research on benthic fauna).
24 February	(Research on plaice (<i>Pleuronectes platessa</i>) in the dutch coastal waters). M. Fonds (NIOZ): (1. Introduction. 2. Dry weight and caloric values of plaice in relation to their length and wet weight). A. van Rijnsdorp (RWO): (Fecundity and energetics of reproduction and growth of North Sea plaice). K. Costopoulos (University of Athens): (The effect of temperature and food supply on growth of young plaice). J.J. Zijlstra (NIOZ): (Density dependent growth of young plaice in the Wadden Sea). P. Blotkamp (University of Leiden): (Measurements of the rate of development and survival of plaice eggs at 2°, 5°, 8°, and 11°C). H. van der Veer (NIOZ): (Mortality of O-group plaice during and after settlement in the Wadden Sea).
9 March	(Zooplankton research during REFLEX 1983 (Repeated Fladen Ground Experiment)). H.G. Fransz (NIOZ): (Growth and development of the <i>Calanus finmarchicus</i> population in the northern North Sea in the spring of 1983. Field observations). S. Diehl (T.U. Braunschweig): (Measurements of food intake of <i>Calanus finmarchicus</i> with different methods). M.A. Baars (NIOZ): (The balance between phytoplankton production and consumption by copepods). B.R. Kuipers (NIOZ): (Macroplankton in the dutch coastal area of the North Sea). R. Daan (NIOZ): (The importance of Hydromedusae as predators of herbivorous zooplankton). C.J.M. Kramer (NIOZ): (The complexing capability of the marine environment). G. de Niet (TH Twente): (Introduction of the structure of colloid substance in the marine environment).

29 March	(Benthos investigations in the southern North Sea). F. Creutzberg (NIOZ): (Introduction. Differentiation of the benthic communities in relation to hydrography and bottom structure). M. de Bruin (University of Leiden): (Research on distribution and behaviour of <i>Calibanassa</i> (Crustacea) in the bottom of the North Sea). J.J. Beukema (NIOZ): (Fluctuations in numbers and growth of <i>Echinocardium cordatum</i> in the North Sea coastal area off Texel and Terschelling). G. Duineveld (NIOZ): (Density and growth of <i>Echinocardium cordatum</i> at greater depth in the North Sea, in relation to hydrography and structure of the bottom). I. Jenness (Davis & Elkins College, West Virginia, USA): Laboratory measurements of the growth of <i>Echinocardium</i> in relation to temperature and sediment. S. Cramer (University of Amsterdam): (Measurements of respiration of <i>Echinocardium</i> in relation to temperature and body size). P.A.W.J. de Wilde (NIOZ): (Measurements of the oxygen consumption of the bottom community in the northern North Sea). P. Cornelis (University of Utrecht): (Measurements of the oxygen consumption of the bottom community in the southern North Sea).
6 April	(Official opening of the NIOZ seawater show aquaria, a gift from the Dutch Zoological Society, by the president Prof. Dr. E. Joosse-van Damme). M. Fonds (NIOZ): (Introduction and explanation at the aquaria). P.A.W.J. de Wilde (NIOZ): (Research on an artificial tidal flat ecosystem). J. Everaarts (NIOZ): (The use of aquaria in marine pollution research). W.C.M. Klein Breteler (NIOZ): (Laboratory culture and growth of copepods). M. Fonds (NIOZ): (Measurements of daily food intake and growth of flatfish in aquaria). F. Creutzberg (NIOZ): (The use of carousel-aquaria for experimental investigations). C. Swennen (NIOZ): (A sea water system for research on birds).
13 April	A. Dral (NIOZ): (The amphibic vision of seals). P. Reijnders (RIN): (A lower recruitment and lower survival chances, but still increasing numbers of seals in the Wadden Sea).
11 May	R. Laane (EON): (Structures of dissolved fluorescent substances: a survey). J. Suylen (RW Den Haag): (The use of new detection methods for artificial fluorescent tracers in physical oceanographic research in the North Sea). R. Dirks (University of Utrecht): (Fluorescence in a stratified water column). C. Veth (NIOZ): (A turbulent tail on the Ekman spiral, measurements in the wind-mixed layer of the North Sea).
25 May	A. Buma (University of Groningen): The measurement of C¹⁴ in algal pigments as a method to estimate phytoplankton biomass. M. Veldhuis (University of Groningen): (Factors determining the bloom of <i>Phaeocystis pouchetii</i> in the North Sea).
28 September	R. Whitlatch (University of Connecticut, U.S.A.): Demographic importance of statistically significant biological interaction: a benthic example. R.W.P.M. Laane (EON): (Optical aspects of dissolved organic matter in estuaries). A.L. Eversdijk (TH Enschede): (Photochemical oxygen consumption in water). H. Etcheber (University of Bordeaux, France): Organic matter in the Gironde estuary.
19 October	D. Spaargaren (NIOZ): (The effect of salinity and temperature on the lipid levels of shore crabs). L. de Jong (University of Groningen): (The influence of food concentration on the grazing behaviour of the copepod <i>Temora longicornis</i>). W.C.M. Klein Breteler (NIOZ): (The rate of development of <i>Temora longicornis</i> cultivated under various temperatures and food concentrations).

16 November	W. Admiraal (EON): (Amino-acid metabolism in phytoplankton). H.G. Fransz (NIOZ): (Modelling of primary production in relation to eutrophication in the Southern Bight). C. Veth (NIOZ): (Chaos in the water).
23 November	J. v.d. Kreeke (University of Miami, U.S.A.): Stability of multiple inlets. H. Yasuda (Governmental Industrial Research Institute, Kure, Japan): Tide induced residual currents with 3-D structure on a rotating large ridge.
30 November	Preliminary results of NECTAR III (North Equatorial Current Transatlantic Research, March 1982). W.W.C. Gieskes (NIOZ): (Analyses of algal pigments: domination of green algae below the photic zone and blue algae in the top of it). M.A. Baars (NIOZ): (Fluorescence of stomach content and metabolic activity in copepods). H. Postma (NIOZ): (Vertical distribution and day-night analyses in concentrations of carbon and carbo-hydrates). S.B. Tijssen (NIOZ): (Measurements of oxygen in relation to primary production and variability).
7 December	R. Daan (NIOZ): (Development of <i>Phialidium</i> in relation of the remaining zooplankton during summer). F. v.d. Ende (University of Amsterdam): (Growth experiments with copepods). B.R. Kuipers (NIOZ): (Scypomedusae in the Wadden Sea).

Topographic interactions and residual circulations

A symposium entitled "Topographic interactions and residual circulations" was held at 3 and 4 May. The symposium brought together various scientists from The Netherlands and abroad (U.S.A., Japan, U.K.) currently working on problems of interaction between tidal currents and the sea bed and the generation of residual currents. Some of the foreigners were at the time engaged as visiting scientists at one of the Dutch research institutions (MOW, NIOZ). The journal "Continental Shelf Research" has agreed to consider the symposium contributions for publication in its regular series.

Lectures:

K. v. Gastel (KNMI): Imaging of depth variations by radar.
R. Booy & J.P.Th. Kalkwijk (THD): On the secondary currents in tidal channels.
H. de Swart (C.W.I.A.): Tidal rectification in lateral frictional boundary layers.
H. Yasuda (G.I.R.I., Kure, Japan): Horizontal circulation caused by the bottom boundary layer with a sloping bed.
J. Dronkers (RWS/DD): Residual discharge in a sealevel channel.
H. Gerritsen. Numerical computations of residual currents in the North Sea: Theory and practical approach.
D. Ou (LD, New York, U.S.A.): Meanflow driven by long internal waves.
L.R.M. Maas (IMOU): Internal tides and baroclinic residual currents.
H.W. Riepma (KNMI): Scale analysis of topographically generated vorticity components in the southern North Sea.
G. Abraham & G.H.J. Lindijer (WLD): On the significance of sub-grid circulations.
M.B. Collins & S. Pattyeratchi (Swansea, U.K.): Water circulation around a headland associated sandbank.
J.T.F. Zimmerman (NIOZ): 3d and 2d vorticity dynamics of tidal residual circulation.

Posters:

- A. Roos & J.C.M. Dijkzeul (RWSDD): A 2d vorticity dynamics of tidal residual circulation.
J.A. Pagée & W.P.M. de Ruyter (RWSDD): Age functions and water mass distributions in the southern North Sea derived from numerical model calculations.

Nutrients in estuaries, eutrophication and other effects

A symposium on "Nutrients in estuaries, eutrophication and other effects" was organized by the Dutch Hydrobiological Society and the British Estuarine and Brackish Water Science Association (EBSA), at NIOZ in the period 11-13 September, 1985. The symposium attracted about 120 visitors and 15 lectures and 7 posters were presented that are listed here. A special volume of the Netherlands Journal of Sea Research, edited by Dr. F. Colijn (RU Groningen) and Dr. W. Helder (NIOZ), will be dedicated to the symposium.

Lectures:

- P.D. Keizer & D.C. Gordon (Marine Ecology Laboratory, Bedford Institute of Oceanography, Canada): Nutrient dynamics of the Bay of Fundy, Canada.
L.A. Geldermalsen (DIHO, The Netherlands): Evaluation of nutrient dynamics in the Oosterschelde.
M. Somville, E. de Becker, P. Servais & G. Billen (Université Libre de Bruxelles, Faculté des Sciences. Laboratoire d'Océanographie, Belgium): Nitrogen budget in the Western Scheldt estuary.
A.W. Morris, R.J.M. Howland, E.M.S. Woodward, A.J. Bale & R.F.C. Mantoura (Natural Environment Research Council, IMER, United Kingdom): Nitrite and ammonia in the Tamar estuary.
P.G. Watson, P.E. Frickers & C.M. Goodchild (IMER, United Kingdom): A comparison of nutrients in the interstitial water of reducing (Tamar Estuary) and oxic (Carmarthen Bay) coastal sediments.
G.E. Millward, S.A. Crosby (Dept. of Marine Science, Plymouth Polytechnic, U.K.) and M. Whitfield, E.I. Butler & D.R. Turner (marine Biological Association, The Laboratory, United Kingdom): Iron-phosphate interactions in freshwater and seawater.
J.M. Maskell (Hydraulics Research Limited, U.K.), A.L. Downing (Binnie and Partners, U.K.), P.J. Radford (IMER, U.K.) & A.N. Other (Environmental Protection Agency, Hong Kong): Modelling the impact of land-derived nutrients on an enclosed bay.
H.G. Fransz (NIOZ) & J.H.G. Verhagen (Delft Hydraulics Laboratory, The Netherlands): Modelling research on the production cycle of phytoplankton in the southern North Sea in relation to riverborne nutrient loads.
L.A. Hobson (Department of Biology, University of Victoria, Canada): Seasonal variations of phytoplankton nutrients and their dependence on physical and biological variables in water of southeastern Vancouver Island, British Columbia, Canada.
L. Goeyens, G. Decadt, H. Dedeurwaerder & W. Baeyens (ANCS-V.U.B., Belgium): Nitrogen-15, a useful tool in nutrient-phytoplankton interrelationships' studies.
P.G. Soulsby, D. Lowthion & H.A.C. Montgomery (Southern Water Authority, U.K.): The role of sewage derived nutrient in the colonisation of intertidal mudflats by *Enteromorpha*.
R.F. Dame & T.G. Wolaver (Belle W. Baruch Institute for Marine Biology and Coastal Research and the University of South Carolina, U.S.A.): Ammonia release by Oyster reefs.
I. de Vries (Delft Hydraulics Laboratory, The Netherlands): Factors influencing low phytoplankton concentrations in Lake Grevelingen.
C.P. Spencer (University College of North Wales, United Kingdom): Phytoplankton growth, with special reference to *Phaeocystis*, and the physical and chemical conditions in Liverpool bay.

T. Höpner & K. Wonneberger (Fachbereich Biologie der Universität Oldenburg, Western Germany): Contributions to a perception of the epiphytobenthos patchiness.

Posters:

G.C. Cadée (NIOZ): Increase in primary production in the Marsdiep tidal inlet area (Dutch Wadden Sea).

F.Vegter, A.G. Vlasblom & P.R.M. de Visscher (DIHO, The Netherlands): Influence of environmental parameters on primary production established by multiple regression analysis.

A.C. Smaal (DDMI, The Netherlands): Filtration, respiration and biodeposition rates of the blue mussel (*Mytilus edulis* L.) under natural food conditions.

T.C. Prins & A.C. Smaal (DDMI, The Netherlands): Relationships between current speed and food intake and growth of the blue mussel *Mytilus edulis* L.

S. Wellershaus & W. Heiber (Institut für Meeresforschung, Bremerhaven, Western-Germany): The phosphorus distribution in the Weser estuary.

J.H.B.W. Elgerhuizen & R. Wortelboer (DIHO-DDMI, The Netherlands): DOC in the Eastern Scheldt: conservative or non-conservative behaviour?

A. Rees (University College of Swansea): Nutrient profiles in the interstitial water of a non steady-state accumulating sediment (Swansea Bay).

Biologisch Onderzoek Eems-Dollard Estuarium

A symposium was organized by the BOEDE group on May 16 to inform people of the Ministries responsible for the BOEDE project and people from government agencies involved with the management of the estuary, about the outcome of the project and the use of it. There were 110 participants. The symposium was opened by the Minister of Public Works, Mrs. drs. N. Smit-Kroes.

Lectures:

V.N. de Jonge (BOEDE): Morphology and hydrography.

F. Colijn (BOEDE): Biology of the pelagic system.

H.G.J. Schröder (BOEDE): Biology of the benthic system.

J.W. Baretta (BOEDE): Simulation model of the ecosystem.

P. Ruurdij (BOEDE): Example of the application of research results for management purposes.



Workshop Monitoring of the marine environment

A workshop entitled "Monitoring of the marine environment" was organized (6-7 June) as a followup of the research project "Contaminants in the Wadden Sea" (Ministry of Public Health and Environment). The aim of the workshop was among others to encourage the discussion between representatives of the government, management institutes and scientific institutes, to attain to an exchange of ideas and views and to come to an evaluation of the knowledge of fundamental processes and techniques, essential for performing monitoring programmes.

Lectures:

- C. Venema (RIZA, Lelystad): Monitoring of the quality of the aquatic environment in the North Sea.
H. van 't Sant (Min. VROM): Does monitoring fit in North Sea management of the Dutch government?
P. Hagel (RIVO): Monitoring of fish and fish products.
W. ter Keurs (Milieubiologie, RUL): What is biological monitoring?
H.C. van Latesteijn (Milieubiologie, RUL): The analysis of monitoring data, using a time-series analysis.
W.G. Beefting (DIHO): Research on heavy metals on wetlands in South-West Netherlands, wishes and possibilities of monitoring.
A.A. de Goede (RIN, Texel) and P. de Voogt (IVM-VU): Monitoring of pollutants in feathers of birds from the Wadden.
J.M. Everaarts (NIOZ): Monitoring by means of effect-rapportage.
C.J.M. Kramer (NIOZ): Monitoring of the abiotic compartments: sediments, water and particulate matter for heavy metals.
D. Spitzer (NIOZ): Relevance of remote sensing for monitoring of the marine environment.
J.P. Boon (NIOZ): Monitoring of chlorinated hydrocarbons in the marine environment.
W.C. de Kock (TNO, Den Helder): Monitoring of heavy metals and organic micro-pollutants using marine macro-invertebrates.
J. Kuiper (TNO, Den Helder): Monitoring of the fate and effects of oil components in the marine environment.
M.A. van Arkel & M. Mulder (BOEDE): On the macrobenthic fauna at the dumping area of H₂SO₄ waste of titanium-pigment industry, west of Scheveningen.
A.A. Beukema (RWS, Directie Noordzee): Management and monitoring.

2.2.2. Lectures of NIOZ scientists given elsewhere

- Bak, R.P.M.: The role of disturbances in coral reef communities. LON, Ambon, Indonesia, 27 August.
—: Aspects of community organization in relation with the SNELLIUS II coral reef surveys. University Pattimura, Ambon, Indonesia, 29 August.
Baretta, J.W.: (A simulation model of the Ems-Dollard ecosystem). K.U. Nijmegen, 22 May.
—: The Ems-Dollard estuary ecosystem model. Cumberland Basin Ecological Modelling Workshop, Bedford Institute of Oceanography, Canada, 25 July.
Bennekou, A.J. van: Dissolved silicate as a tracer of North Atlantic and Arctic water masses. Nordic symposium on chemical tracers for studying masses and physical processes in the sea, Reykjavik, Iceland, 1 September.
—: (The role of Antarctic water in the oceans). Studieconferentie over Antarctica, Werkgroep Antarctica van IUCN-ledencontact, 1 November.
Beukema, J.J.: (Energy in ecosystems). Biologische Raad Symposium Bio-energie, Kon. Ned. Akad. van Wetenschappen, Amsterdam, 20 Januari.

- Beukema, J.J.: Long-term changes in the macrobenthic fauna of the tidal flats of the Dutch Wadden Sea. Workshop COST-47, Bremerhaven, Western-Germany, 25-27 April.
- : (Biology of a tidal flat). Symposium SWG en VWG, Wageningen, 17 November.
- Boon, J.P.: Kinetics of organochlorines in marine organisms. LON, Jakarta, Indonesia, 12 November.
- Creutzberg, F.: (Distribution of chlorophyll *a* in an area with a tidally-induced front). 19th European Marine Biology Symposium, Plymouth, U.K., 21 September.
- Dral, A.D.G.: (The cetacean retina). 12th Symposium of the European Association for Aquatic Mammals, Nice, France, 12-15 March.
- : (Optical properties of the eye of the harbour-seal). Nederlandse Natuurkundige Vereniging, secties Optica en Fotonica, Amsterdam, 27 April.
- Eisma, D.: Distribution and composition of suspended matter in the Skagerrak. ICES Working Group on Marine Sediments in relation to Pollution, Rostock, Eastern-Germany, 23 February.
- : Mud deposition in the German Bight. ICES Working Group on Marine Sediments in relation to Pollution, Rostock, Eastern-Germany, 23 February.
- : The fate of particulate organic matter in estuaries SCOPE/UNEP Meeting Caracas, Venezuela, 27 March.
- : (Suspended matter in North and Ems- and Rhine estuaries), University Leuven, Belgium, 3 April.
- : (Mud transport in the North Sea, especially along the Dutch coast). Middelburg, 9 May.
- Everaarts, J.M.: Marine Pollution: a general introduction in environmental toxicology and more specific about biological effect of pollutants. LON, Jakarta, Indonesia, 4 December.
- Fransz, H.G.: (Herbivores and carnivores in marine ecosystems). Lecture series "Man and the marine Environment", Dept. Marine Biology, University of Groningen, 3 February.
- : Models for the estimation of growth and mortality applied to marine copepods with continuous reproduction. Workshop on "Modelling the population dynamics, production, and life cycle events of zooplankton populations" of the Plankton Ecology Group of the International Limnological Society, Oosterschelde, 1-4 May.
- : Secondary production by *Calanus finmarchicus* (Gunnerus) (Copepoda, calanoidae) in a transitional system of the Fladen Ground area (northern North Sea) during spring 1983. 19th European Marine Biology Symposium, Plymouth, 16-21 September.
- Gieskes, W.W.C.: Primärproduktion und Algenverbreitung in dem tropischen oligotrophen Atlantik. Limnologisches Institut, Universität Konstanz, Konstanz, Switzerland, 29 May.
- : Bloom of *Corymbellus aureus* in the Fladen Ground area, North Sea. Special Meeting on exceptional Marine Blooms and related Events. ICES, Copenhagen, Denmark, 5 October.
- : (Distribution of phytoplankton, food of krill around the Antarctic Peninsula: research aboard R.V. "Polarstern"). Studieconferentie over Antarctica, Werkgroep Antarctica van IUCN-ledencontact, 1 November.
- : (Antarctic research aboard R.V. "Polarstern"). Werkgroep Antarctisch Weekend, Leiden, 10 November.
- : Workshop on preliminary results of Antarctic Research October-November 1983. Sylt, Western Germany, 14-15 November.
- Helder, W.: Dutch geological research at the NEA-dumpsite. CRESP-meeting Hamburg, 4 April.
- : Aspects of the N-cycle in Wadden Sea and Ems-Dollard estuary. Nordic Sediment Symposium, Skallingen, Denmark, 3 May.
- : Hydrography and the N-cycle in the Ems-Dollard Estuary (Wadden Sea). University of Odense, Odense, Denmark, 22 May.
- Hillebrand, M.T.J.: Analyses of hydrochlorinated carbons in the marine environment. LON, Jakarta, Indonesia, 12 November.

- Iperen, J., van.: (Application of the scanning electron microscope at the Netherlands Institute for Sea Research). Eindhoven, 25 mei.
- : Diatom distributions in the Zaire Deep Sea Fan, southeastern Atlantic Ocean. 8th Symposium on living and fossil diatoms, Paris, France, 30 August.
- Jansen, J.H.F.: (Series of lectures, Marine Geology). Hogere Zeevaartschool, Amsterdam, February-March.
- : (Clay mineralogy of the Congo deep-sea fan and climate in Africa during the quaternary period). Gespreksgroep kleimineralogen, Landbouwhogeschool, vakgroep Bodemkunde en Geologie, Wageningen, 17 May.
- : Opal accumulation and preservation in the Angola Basin, southeastern Atlantic. Hans Pettersson Symposium on Oceanography. Maringeologiska Institutionen, Göteborgs Universitet, Göteborg, Sweden, 7 June.
- : Production, dissolution et accumulation carbonatée et accumulation terrigène du bassin de l'Angola en fonction de la océanographie et climatologie au Quaternaire moyen et supérieur. Centre de Recherches de Sédimentologie marine de Perpignan, Perpignan, France, 2 July.
- : Accumulation du carbone organique au delta sous-marin profond du fleuve Congo. Centre de Recherches de Sédimentologie marine de Perpignan, Perpignan, France, 2 July.
- Jansen, J.H.F. & S.J. van der Gaast: Mineralogy and chemistry of Quaternary sediments of the Zaire (Congo) deep-sea fan. A pitfall for XRD analysts. 5th European regional meeting of sedimentology. Int. Ass. Sedimentologists, Marseille, France, 10 Oktober.
- Jonge, V.N., de: (Morphology and hydrography of the Ems-Dollard estuary). K.U. Nijmegen, 22 May.
- Klein Breteler, W.C.M.: Culture and development of *Temora longicornis* (Copepoda, Calanoida) at different conditions of temperature and food. 2nd International Conference on Copepoda, University of Ottawa, Canada, 13-17 August.
- Kramer, C.J.M.: Copper complexation capacity and conditional stability constants in North Atlantic waters. 8th International Symposium Chemistry of the Mediterranean, Primosten, Yugoslavia, 16 May.
- : Development in trace metal speciation studies in the marine environment. SCOR seminar on Biogeochemical processes at the land-sea boundary. Roscoff, France, 22-24 October.
- : Speciation of trace elements in the marine environment. Symposium LON, Jakarta, Indonesia, 12 November.
- Laane, R.W.P.M.: Series of lectures on estuarine ecology, University of Bordeaux, France, 1 Februari-1 April.
- : State of the art of dissolved fluorescent matter in natural waters. Photochemical department, University of Bordeaux, France, 22 March.
- Nolting, R.F.: The determination of a low concentration of trace elements in the marine environment. LON, Jakarta, Indonesia, 12 November.
- Postma, H.: (The increase of carbon dioxide in the oceans). Netherlands Oceanographic Society, Amsterdam, 12 April.
- : (The SNELLIUS expedition). Lecture in the Science Division of the Royal Netherlands Academy of Arts and Sciences, Amsterdam, 29 October.
- Rutgers van der Loeff, M.M.: The total carbonate transport across the sediment-seawater interface: A result of biological and geochemical processes. Paper with L.G. Anderson and P.O.J. Hall, presented at 3rd International Symposium on interactions between sediments and water, Geneva, Switzerland, 30 August.
- Schröder, H.G.L.: (The Ems- Dollard ecosystem, biology of the sediment). K.U. Nijmegen, 22 May.
- Spaargaren, D.H.: Some aspects of element turnover in marine organisms. Werkgroep toegepaste Ecologie en Radiobiologie, SCK/CEN, Belgium, 4 September.
- Spitzer, D.: Variations in the red part of the reflectance spectra of natural waters, EARSeL/ESA Symposium on Integrative Approaches in Remote Sensing. University of Surrey, Guildford, U.K., 10 April.
- : Optical remote sensing of coastal areas. Flinders University, Adelaide, Australia, 14 November.

- Spitzer, D.: Fluorescence phenomena in natural waters. CSIRO, Division of Oceanography, Hobart, Tasmania, Australia, 14 November.
- : Application of remote sensing in oceanography. LON, Jakarta, Indonesia, 4 December.
- Swennen, C.: The oystercatcher as a predator of marine animals in the intertidal zone: flexibility in the bill form and feeding behaviour. Prince of Songkhla University, Pattina, Thailand, 17 October.
- Tijssen, S.B.: (Hydrographical aspects and the study of changes in oxygen concentration in the Oyster Ground area). Nederlandse Oceanografen Club, Trippenhuis, Amsterdam, 12 April.
- : A comparison of the oxygen regime in Dutch coastal waters and on the Oyster Ground. Arbeitsgruppe Eutrophierung der Nord- und Ostsee, Biologische Anstalt Helgoland, Hamburg, 18 June.
- Veth, C.: (Turbulent and stratified sea water measurements during 'Tyro' expeditions 1981 and 1982). Nederlandse Oceanografen Club. Kon. Ned. Akad. van Wetenschappen, Amsterdam, 12 April.
- Weering, T.C.E., van: Series of lectures Introduction to Sedimentology. Hogere Zeevaartschool Amsterdam. February-March.
- Zijlstra, J.J.: Fluctuations in marine populations and ecosystems. R.U. Groningen, vakgroep Mariene Biologie, 24 February.
- : Marine ecosystems (18 lectures). R. U. Groningen, vakgroep Mariene Biologie, Groningen, 12-15 June.
- : Ecosystem Banda Sea, B.P.P.L. Jakarta, Indonesia, 7 September.
- Zimmerman, J.T.F.: (Symmetry properties of nonlinear theories of ocean circulation). Natuurk. Colloq. University of Utrecht, 12 March.
- : (Physical oceanography). Lecture series International Institutes for Hydraulics and Environmental Engineering, Delft, June.
- : Principal differences between 2d and vertically 3d models of tidal topographic rectification. Symposium on the Physics of Estuaries and Inland Seas, Miami, U.S.A., 30 August.
- : (Global renormalization of nonlinear boundary layers in geophysical flow systems). Colloq. Centrum voor Wiskunde en Informatica, Amsterdam, 29 October.
- : (Lecture series wind- and density currents). University of Utrecht, September-December.

2.2.3. Advice offered

- Advice was given to the consultant agency HasKoning about the construction of a marine laboratory in Iran, January-February.
- Advice to representatives of the Danish Ministry of Environment on production of the Wadden Sea, 22-23 May.
- On behalf of the Wadden Working Group the series "Ecology of the Wadden Sea" was presented to the director-general of the Ministry of Agriculture and Fisheries, 27 June.
- Advice was given to an advisory committee (WUON) of the Ministry of Waterworks on research in the North Sea, 20 October.
- A report was prepared for the Ministry of Education and Science on Antarctic Research Project, December.
- Consultations were arranged with Belgian colleagues about co-operative research projects, Brussels, Gent, (Belgium), 27-28 November.
- Advice to Netherlands America Commission for Educational Exchange for the adjudication of the Fullbright Award, 15 February.
- Advice to Volker Stevin/Aveco on the effects of dredging in a coral reef area at Guam, 28 November.

2.2.4. Visitors from abroad

Prof. Wang Bao-can, Shanghai
Dr. P. Bernard, Department of physics, University of Antwerpen, Belgium.
Mr. Dagan Kadarisman, Marine Geological Institute, Bandung, Indonesia.
B. Das, Geological Survey of India, Calcutta, India.
Dr. V. Gordeev, Shizhov Institute of Oceanology, USSR Academy of Sciences, Moscow, USSR.
Dr. He Song-lin, Institute of Estuarine and Coastal Research, East China Normal University, Shanghai, China.
Mr. Helfinalis, Indonesian Institute of Sciences, Jakarta, Indonesia.
Dr. D. Horstman, Sea Fisheries Research Institute, Roggebaai, South-Africa.
Dr. G. Irion, Senckenberg Institut, Wilhelmshaven, B.R.D.
R. Lester, World Resources Institute, Washington D.C., U.S.A.
Dr. T. Lindholm, Åbo University, Finland.
Dr. W.C. Mahaney, Department of Geography, Atkinson College, York University, Downsview, Ontario, Canada.
S. Majumdar, Geological Survey of India, Calcutta, India.
Prof. D.W. Park, Department of Geography, Seoul National University, Seoul, Korea.
Dr. A. Pequeux, Laboratoire de Physiologie Animals, Liège, Belgium.
S. Puymbroek, van, Radiobiologie SCK/CEN Mol, Belgium.
Prof. Dr. G. Rüppel, Technische Universität, Braunschweig, B..R.D
B.K. Saha, Geological Survey of India, Calcutta, India.
Prof. R.C. Sharma, Department of Geography, Jawaharlal Nehru University, New Delhi, India.
Prof. R.J. Stanton, Texas A & M University, College Station, Texas, U.S.A.
Prof. Dr. J.O. Strömberg, Marine Biological Institute, Lysekyl, Sweden.
Dr. Sukarsono, National Institute of Oceanography, Jakarta, Indonesia.
Dr. F.S. Thurberg, NOAA/NMFS, Northeast Fisheries Center Milford Laboratorium, United States Department of Commerce, Milford, Co.
Prof. Dr. O. Vanderborght, Radiobiologie SCK/CEN Mol, Belgium.
Dr. J.H.O. Vangenechten, Radiobiologie SCK/CEN Mol, Belgium.
Prof. Wang Bao-can, Institute of Estuarine and Coastal Research, East China Normal University, Shanghai, China.



3. Nederlandse samenvatting van de wetenschappelijke activiteiten

3.1. INLEIDING

De activiteiten van het instituut werden in 1984 in sterke mate bepaald door voorbereiding en uitvoering van de SNELLIUS II-expeditie die van mei 1984 tot juli 1985 in Indonesische wateren plaats vindt. Voorafgaande aan het vertrek op 28 mei van het onderzoeksschip "Tyro" uit Den Helder werd door de technische afdelingen van het instituut hard gewerkt om de uitrusting van het schip als lieren, laboratorium containers en instrumenten op tijd aan boord te krijgen. Uiteraard was bij deze voorbereidingen ook personeel van de wetenschappelijke werkgroepen betrokken. Op die dag werden de trossen van de "Tyro" losgegooid door de Minister van Onderwijs en Wetenschappen, drs. W.J. Deetman, die daarna het instituut bezocht. Na aankomst van de "Tyro" in Indonesië vonden in 1984 een 7-tal tochten met het schip plaats met onderzoek over zeeverontreiniging (2 tochten), pelagische systemen (1 tocht), koraalriffen (2 tochten) en mariene geologie (2 tochten). Aan al deze tochten, die in tijdsduur van 2-5 weken varieerden, werd door wetenschappelijk en technisch personeel van het instituut deelgenomen. Bovendien werd gedurende 2 perioden, tijdens de droge (juli-augustus) en de natte moesson (november-december) een landstation bezet in Surabaya, waar een "containerdorp" voor laboratorium-ruimte zorgde. Vanuit dit landstation werd onder meer de verontreiniging en het sediment-transport van de rivieren de Brantas en de Solo op Oost-Java bestudeerd, waarbij wetenschappelijk personeel van het NIOZ in sterke mate was betrokken. De grote inzet van het instituut bij de SNELLIUS II-expeditie heeft uiteraard invloed gehad op de activiteiten in andere zeegebieden, als Waddenzee en Noordzee.

Vermeldenswaard over 1984 is voorts dat het instituut een belangrijk contract afsloot met het Rijks Instituut voor Zuivering van Afvalwater (RIZA), waarbij het Ministerie van Verkeer en Waterstaat optrad namens een groep van ministeries die betrokken zijn bij het beheer van Noordzee en Waddenzee. Het onderzoeksproject, waarvoor 10-15 personeelsleden bij het NIOZ werden aangesteld, staat bekend onder de naam Ecologisch Onderzoek Noordzee en Waddenzee (EON) en is ten dele een voortzetting van het voormalige BOEDE-project (Biologisch Onderzoek Eems-Dollard Estuarium), dat in maart 1984 werd beëindigd. Het betreffende contract werd aangegaan voor een periode van 4 jaar, eindigend op 31 December 1987. Over het doel van het onderzoek wordt onder "Speciale projecten" gerapporteerd.

3.1.1. Waddenzee en andere estuaria

Estuarien onderzoek werd zowel in het van oudsher voor het instituut belangrijke Waddengebied als in andere estuaria uitgevoerd. De relaties tussen optische eigenschappen (zoals absorptie en verstrooiing) en samenstelling van troebel kustwater (voor wat betreft de zwevende en opgeloste stoffen) in de westelijke Waddenzee werden onderzocht. Op deze wijze werd beoogd de algoritmen vast te stellen voor de optische remote sensing van al dan niet lokaal en temporeel variabele kustgebieden.

Gedurende een periode van harde zuid-oosten wind in januari, waarbij veel slib werd opgewoeld en een sterke zoetwaterafvoer optrad uit het IJsselmeer werden zware metalen concentraties in het water bij verschillende saliniteiten bepaald. Voor Cu, Zn en Ni werd een conservatieve menging gevonden, bij Pb en Cd waren de uitkomsten onduidelijk.

In een studie naar sublethale effecten van zware metalen bleek dat uit "in vitro" experimenten met bloed van de wadpier en de bot dat het haemoglobine van beide soorten (extracellulair in de wadpier, intracellulair in de bot) een sterke complexerende capaciteit voor metalen als Zn, Cd, Pb en Cu bezit. Deze capaciteit bleek afwezig in het ATP in de bot-erythrocyt. Cd heeft bij een pH tussen 7,3 en 7,85 slechts een geringe invloed op de zuurstof-affiniteit van wadpier-haemoglobine, maar beïnvloedt wel de interactie tussen de haemoglobine moleculen. Bij proefopstellingen bleek de wadpier de absorptie van Cd aan het sediment te beïnvloeden door bioturbatie. De hieruit resulterende hogere Cd-concentraties in het sediment hadden echter geen effect op de Cd-opname van de wadpier. Deze werd vooral bepaald door de concentraties in het bovenstaande water.

Studies over (des)agregatie van gesuspendeerd materiaal en het verband met de samenstelling van organisch materiaal werden voortgezet in de estuaria van de Gironde, Eems en Rhône. Dit internationale samenwerkingsproject (België, Duitsland, Frankrijk en Nederland) werd voor het onderzoek in Franse rivieren gefinancierd in het kader van het GRECO-ICO programma.

Uit een analyse van gegevens over chlorofiel en primaire productie in het Marsdiep bleek een toename van beide variabelen in de laatste jaren. Deze toename kan niet alleen veroorzaakt worden door eutrofiëring, maar hangt mogelijk ook samen met klimaatsfactoren, die tot een lagere troebeling leiden. Vorig jaar werd reeds gemeld dat ook de productie van ééncellige bodemalgen de laatste jaren is toegenomen.

In het macrobenthos van de westelijke Waddenzee werd ook een toename geconstateerd, van ongeveer 30 g asvrij drooggewicht m^{-2} in de zeventiger jaren tot ca 50 g m^{-2} in 1980-1984. Deze toename hangt ten dele samen met een sterke broedval na de strenge winter van 1978-1979, maar lijkt hierdoor niet geheel bepaald. De mogelijkheid dat deze verandering samenhangt met de hierboven genoemde hogere primaire productie wordt niet uitgesloten, evenmin overigens als een samenhang met b.v. een lagere troebeling of een afname in de mate van verontreiniging. Uit een vergelijking van de bodemfauna in de gehele Waddenzee (Deens, Duits, Nederlands) tijdens workshops van het EEG Cost 47-project bleek dat diverse soorten parallelle aantalsfluctuaties vertoonden, kennelijk samenhangend met het optreden van koude winters. Enkele soorten vertonen een regelmatige toename in het gehele gebied.

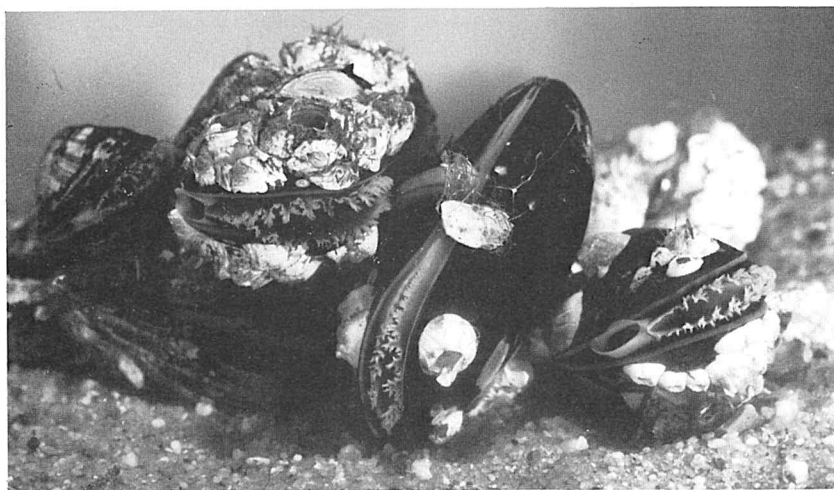
De mortaliteit van jonge schol, die volgens eerdere studies bijzonder hoog is direct na vestiging van de larven op de platen, wordt vooral veroorzaakt door garnalen en strandkrabben, zoals blijkt uit zowel veld- als experimenteel onderzoek. De periode van hoge sterfte onder de jonge schol eindigt wanneer de dieren een lengte van ~30 mm hebben bereikt, hetgeen erop wijst dat de garnaal, die de schol tot die lengte consumeert, vermoedelijk de voornaamste predator is. De sterfte onder de jonge schol blijkt dichtheidsafhankelijk, maar de relatie is vermoedelijk niet lineair.

Bij diverse kreeftachtigen, vissen en de zeester *Asterias rubens* uit Wadden- en Noordzee werd experimenteel het verband tussen groeisnelheid en temperatuur vastgesteld bij overmaat van voedsel. Het effect van temperatuur op de groeisnelheid bleek bij benadering lineair, althans beneden de optimale temperatuur. Sommige soorten (zeester, schar) bleken een relatief lage optimum temperatuur te hebben (14°C), terwijl andere als tong en bot niet alleen een hogere optimum temperatuur lieten zien, maar ook een sterkere temperatuur-invloed op de groei vertoonden. De experimenten werden verricht om in het veld groei, respiratie en voedselopname te berekenen uit temperatuur gegevens.

In een biochemische studie werd het effect van de osmotische omstandigheden op het lipide-niveau in strandkrabben geanalyseerd. Onder meer werd gevonden dat lipoproteïnen snel in concentratie daalden bij een hoge activiteit en bovendien een rol spelen bij het reguleren van de ionconcentraties in het bloed. Concentraties van totaal lipide, triglyceride en cholesterol bleken maximale concentraties te vertonen rond saliniteiten van normaal zeewater (33), hetgeen een aanwijzing kan zijn dat ze een rol spelen bij het reguleren van membraam permeabiliteit.

Onderzoek aan de populatie van eidereenden op de Waddeneilanden leverde voor het eerst het bewijs, dat vrouwelijke eenden uit het Oostzeegebied soms in onze kolonies broeden. Dat deze eenden uit de Oostzee het Waddengebied in juli, na de broedperiode, bezoeken voor de rui, was reeds eerder aangetoond.

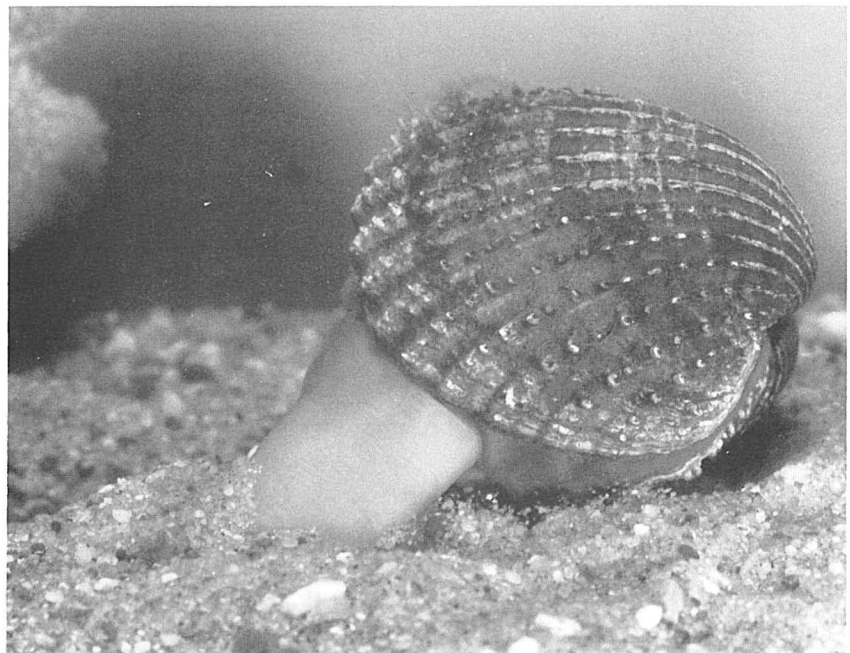
In het kader van het internationale onderzoeksproject Interwader, waaraan onder meer het Wereldnatuurfonds en de Internationale Raad voor Vogelbescherming deelnemen, werd onderzoek verricht aan arctische en boreale plevierachtigen, voorkomend in het getijdengebied van Maleisië en zuid-Thailand.



3.1.2. Noordzee

Het fysisch onderzoek in het project "Breeveertien" betreffende groot-schalige transportprocessen in de Zuidelijke Bocht toonde aan dat er sprake kan zijn van twee onafhankelijke turbulentievelden, waarvan er een de "gewone" turbulentie is en de andere geïnduceerd wordt door de in dat gebied aanwezige megaribbels. Het onderzoek naar kleinschalige turbulentie in het project "Breeveertien" is nagenoeg voltooid. Een model is ontwikkeld op basis van de balansvergelijking voor turbulente kinetische energie, waarmee een goed beeld is verkregen van de kleinschalige turbulentie in de waterkolom van een ondiepe shelf-zee. Het turbulentieonderzoek voortvloeiend uit het project "Stratified North Sea 81/82" is voortgezet. Het model, dat de turbulentie in een wind-gemengde laag beschrijft, is uitgebreid met termen die rekening houden met golfgroei. Theoretisch dynamisch onderzoek op het gebied van de niet-lineaire wind-gedreven circulatie werd gecontinueerd. Verder is er onderzoek voltooid betreffende de restcirculatie veroorzaakt door wrijving aan zijwand-grenslagen en restcirculatie gegenereerd door stapvormige topografie. Onderzoek is aangevangen naar de drie-dimensionale structuur van de reststroming in de buurt van zandbanken; hiervoor is een sterk niet-lineaire aanpak nodig.

In de Duitse Bocht werd in samenwerking met het Senckenberg Institut in Wilhelmshaven onderzoek verricht naar sedimenttransport onder invloed van de getijdestroom. Er zijn indicaties dat het transport van gesuspendeerd materiaal sterker is tijdens de landwaarts gerichte vloed dan tijdens de eb, hetgeen waarschijnlijk samenhangt met het asymmetrische getij in het gebied. Dit wijst op een mechanisme dat de ophoping van slib in het gebied verklaart. Bodemkernen uit het gebied duiden op een onregelmatig verloop van de sedimentatie van slib en zand en een sterke bioturbatie.



In het Skagerrak en de Noorse Geul werd het verband tussen de levende bentische foraminiferen en hydrografische en sedimentologische factoren bestudeerd. Deze studies werden uitgevoerd in samenwerking met onderzoekers uit Noorwegen en de Verenigde Staten. In een onderzoek naar de zuurstofhuishouding en de stikstofcyclus in het sediment van de Noordzee werd gebruik gemaakt van een nieuw ontwikkelde sediment incubator. Hiermee kunnen nitrificatie, denitrificatie en ammonificatie in mariene sedimenten worden bestudeerd. De voor deze proeven belangrijke O_2 -gradiënt in het sediment kan worden bepaald met behulp van micro-electroden, die tijdens een reis in het Skagerrak werden getest.

Uit het materiaal verzameld tijdens het REFLEX-programma van april-mei 1983 in de noordwestelijke Noordzee bleek dat in het begin van de waarnemingsperiode diatomeeën overheersten in het fytoplankton. Vanaf midden mei daarentegen, bestond het bijna geheel uit een kolonievormende microflagellaat *Corymbellus aureus*. Uit een analyse van afbraakproducten van algenpigmenten bleek dat herbivore copepoden slechts in zeer geringe mate op deze alg graasden. Deze geringe graasactiviteit bleek ook uit graasproeven, waarin dagelijks slechts 1% van de aanwezige algen werd geconsumeerd. Dit ondersteunt de veronderstelling dat tijdens de voorjaarsbloei in de Noordzee slechts een zeer bescheiden deel van de primaire productie in de waterkolom wordt geconsumeerd en gemineraliseerd door copepoden. In overeenstemming hiermee werd in het sediment een vrij grote biomassa gemeten (als ATP). In sedimentvallen, opgehangen in de waterkolom, werd echter slechts weinig organisch materiaal gevonden, namelijk ca 1% van de dagelijkse primaire productie. Tenslotte dient vermeld dat de copepoden-productie tijdens de waarnemingsperiode laag was, eigenlijk te laag om de copepodenstand te verklaren. Vermoed wordt daarom dat de copepoden, voornamelijk bestaande uit *Calanus finmarchicus*, elders in frontale zones ten oosten van de Orkneys en Schotland worden geproduceerd en worden getransporteerd.

Het modelleren van het planktonsysteem van de Zuidelijke Bocht werd voortgezet in samenwerking met het Waterloopkundig Laboratorium, waarbij een biologisch-chemisch model werd gecombineerd met een tweedimensionaal hydrologisch model. Hierbij werd in het bijzonder aandacht besteed aan het mogelijke effect van eutrofiëring van het kustwater. Het model geeft aan dat de biomassa van flagellate algen in de zomer sinds 1930 met een factor 2-4 zou zijn toegenomen door eutrofiëring. Volgens het model zou fytoplankton groei binnen 16 km van de kust niet door nutriënten of licht beperkt zijn, maar door zeewaarts transport. Verder dan 16 km uit de kust zou in de zomer Si-beperking voor diatomeeën en P-beperking voor andere algen optreden. Deze resultaten zijn in redelijke overeenstemming met de vroegere veldwaarnemingen, al geldt dit niet voor de toename van het flagellatenbestand in de zomer in het kustgebied.

In het kader van een door BION gesubsidieerde studie naar het optreden en de ontwikkeling van de alg *Phaeocystis pouchetii*, uitgevoerd in samenwerking met de vakgroep Mariene Biologie, Rijks Universiteit Groningen, werd in de periode maart-juni een opname gemaakt van de bloei van deze alg in de Zuidelijke Bocht.

Vanaf het REM-eiland werden in juli-augustus waarnemingen gedaan over groei en mortaliteit van copepoden in het kustgebied, en vergeleken met groei-experimenten in grotere bakken. De groei en ontwikkeling van *Temora longicornis* bleek overeen te komen met die onder gematigde voe-

dingsomstandigheden in het laboratorium. De laboratorium-experimenten lieten zien dat constante lage groeisnelheden in het veld, verklaard kunnen worden door lage temperaturen in het voorjaar, bij hoge voedseldichtheden en door lage voedseldichtheden in de zomer, als de temperatuur veel hogere groeisnelheden toestaat. Tevens bleek dat copepoden hun filtratiesnelheid opvoeren bij afnemende voedseldichtheid, zonder dat hieraan een limiet is gesteld, zoals voorheen werd gedacht. Bij zeer lage voedseldichtheden sterven de dieren door een te gering rendement van voedselopname.

Vanaf het REM-eiland werd in het kader van een door BION gesubsidieerde studie eveneens onderzoek verricht naar de mortaliteit van copepoden door predatie. Een snelle afname van de dominante copepode *Temora* in begin augustus bleek samen te hangen met predatie van de zoöflagellaat *Noctiluca* en de hydromeduse *Phialidium haemisphaericum* op de eieren van de copepode, die het hoofdbestanddeel van het voedsel van beide soorten uitmaakte.

In het kader van onderzoek naar de bodemfauna van de Noordzee werd gevonden, dat buiten de kustzone op het Nederlandse plat tenminste 3 typen bentische ecosystemen kunnen worden onderscheiden, die een duidelijke samenhang vertonen met de hydrografische situatie. In het ondiepere, door sterke getijstroom gemengde gebied is de bodemfauna relatief arm ($\sim 3 \text{ g asvrij drooggewicht m}^{-2}$), in het diepere noordelijke gebied met een stratificatie in de zomer is ze rijker ($\sim 12,5 \text{ g m}^{-2}$), terwijl de rijkste bodemfauna wordt aangetroffen in het overgangsgebied ($\sim 25 \text{ g m}^{-2}$). Ieder van deze gebieden heeft een karakteristieke fauna. Speciale aandacht werd besteed aan de populatie-biologie van de echinoderm *Amphiura filiformis*, die in het bijzonder talrijk is in het overgangsgebied. De populatie wordt overheerst door volwassen dieren waarvan de groeisnelheid wordt geremd door regelmatige predatie op de boven het zand uitstekende armen, waarbij regeneratie optreedt. Een klein deel van deze "predatie" gebeurt waarschijnlijk door de schar, die voor 60% van zijn voedselvoorziening van deze prooi afhankelijk is. Daarnaast werd voorkomen en groei van *Echinocardium cordatum* bestudeerd, een soort die in alle drie gebieden voorkomt. Deze zeeëgel, talrijk in de overgangszone en relatief schaars in het gemengde en zandige gebied, bleek het snelst te groeien in de zandige sector, waar weinig voedsel voor het dier aanwezig lijkt. De combinatie van veldwerk en experimentele studies gaven een mogelijke oplossing voor het probleem van de snelle groei in het arme zandige gebied. *Echinocardium* zou het tijdens kentering tijdelijk op de bodem afgezette organisch materiaal uit de waterkolom als voedsel kunnen gebruiken. Bovendien bleek uit experimenteel werk dat de energie-behoefte van dit dier relatief laag is.

Detailstudies over de voedselopname van een gangenbewonende kreeftachtige *Callinassa subterranea* maakten waarschijnlijk, dat dit dier bij zijn voedselopname selecteert op kleine deeltjes met een hoog gehalte aan organisch materiaal.

Naast de zeer talrijke schar blijkt in zandige gebieden de kleine pieterman (*Trachinus vipera*) talrijk voor te komen en een belangrijke predator te zijn. Deze vis blijkt vrijwel geheel op kleine vissoorten als gobius te azen, die op hun beurt weer vooral van onder andere kleine garnalen leeft. Op grond van het energie-budget van de kleine pieterman kan worden berekend dat dit dier en zijn prooidieren een sterke invloed uitoefenen op de bodemfauna in de zandige sector van het Nederlandse plat.

3.1.3. Oceaan

In de afzettingen van diepzeedelta van de Zaïre rivier, in het NE deel van het Angola Bekken, werden aanwijzingen gevonden voor een lange termijn overgang van meer "glaciale" naar meer "interglaciale" omstandigheden rond 350 000 jaar geleden. Op andere plaatsen op het zuidelijk halfrond bestaan hiervoor ook aanwijzingen. Op het noordelijk halfrond vond omstreeks die tijd echter een overgang naar meer "glaciale" omstandigheden plaats. Deze asymmetrische klimaatsverschuiving hangt waarschijnlijk samen met variaties in de excentriciteit van de aardbaan, die met een periode van 413 000 jaar voorkomt.

In oppervlaktemonsters van de diepzeedelta kunnen 7 diatomeëen-associaties worden onderscheiden, die verband houden met hydrografische verschijnselen, zoals de pluim van de Zaïre rivier en de Zuid-Equatoriale Tegenstroom. Daarnaast werden fytolieten gevonden, afkomstig van landplanten en getransporteerd door de ZO-passaat. Tenslotte kon worden aangetoond dat radiolariën van de soort *Cycladophora davisiana* niet gelijktijdig op alle onderzochte plaatsen talrijk voorkomen, zodat dit "signaal" niet bruikbaar blijkt voor een wereldwijde stratigrafische correlatie. Sedimentmonsters, bestudeerd met de neutronen activeringstechniek, gaven in het algemeen constante verhoudingen tussen de zeldzame aarden te zien, hetgeen een gemeenschappelijke bron van het sediment impliceert.

In 4 kernen uit de diepzeedelta werden grote calcietskristallen aangetroffen. Op het eerste gezicht lijken ze op woestijnrozen van gips, waardoor ze voorheen werden gezien als omgevormde gipskristallen afkomstig van de wanden van de Zaïre canyon. Analyse van de isotopensamenstelling en kristalvorm gaf echter aan dat het ter plaatse gevormde kristallen zijn, die vanuit een ten dele opgeloste carbonaat fase omgevormd zijn tot calciet.

Met betrekking tot de silikaat-cyclus in de diepzeedelta van de Zaïre werd gevonden, dat in opaal-deeltjes van alle afmetingen in het sediment aluminium aanrijking heeft plaatsgevonden, waardoor de oplosbaarheid zeer laag is.

De kleimineralen inhoud van kernen uit de diepe geul tussen de Faeroër en Shetland eilanden, Noord Atlantische Oceaan, vertonen variaties in samenstelling die samenhangen met klimaatsveranderingen. Studies aan watermassa's in de noordelijke Atlantische Oceaan tijdens het Kwartair, in 1983 uitgevoerd met de "Tyro", laten zien dat het over de Groenland-Schotland Rug stromende water nu minder zout en kouder is dan in het verleden, zonder dat het silikaatgehalte veranderde. Vergelijkbare trends werden reeds eerder in het Angola Bekken gevonden en geven aan dat geleidelijke veranderingen in de oceanische circulatie reeds geruime tijd plaatsvinden. De diepe wateren van de Noorse Zee hebben echter een lager silikaatgehalte dan voorheen, het zoutgehalte is wat hoger en ze bevatten enig tritium. Tenslotte bleek het water op meer dan 4000 meter diepte in de noordoostelijke Atlantische Oceaan gekenmerkt door een veel hoger silikaatgehalte dan het diepe water westelijk van de Mid Atlantische Rug, terwijl zoutgehalte en temperatuur vrijwel identiek zijn in beide gebieden. Op grond van het silikaatgehalte kan worden gesteld dat in de noordoostelijke Atlantische Oceaan het bodemwater voor ~25% uit Antarctica Bodem Water bestaat.

Uit de eerste resultaten van geologisch werk in het kader van de SNEL-LIUS II-expeditie blijkt dat aan de noordzijde van het Lombok Bekken sterke bodemstromen moeten staan en dat in het gebied veelvuldig

troebelingsstromingen en afglijdingen voorkomen. In de Straat van Makassar en in de Flores Zee bleken de diepzee sedimenten voornamelijk te bestaan uit coccolieten ooze in plaats van uit terrestrische en vulkanische sedimenten, zoals eerder onderzoek aangaf. Het slib van de Mahakam-rivier (Kalimantan) bleek dan ook in de delta te worden afgezet en het diepe bekken niet te bereiken. Voorts bleek de as van de grote Tambora-uitbarsting (begin 19e eeuw) slecht in de onmiddellijke nabijheid van de vulkaan aantoonbaar in het sediment.

In de maand augustus, tijdens de ZO-moesson, werd een eerste expeditie ondernomen naar de oostelijke Banda Zee en het westelijke deel van de Arafura Zee, waar de hydrografie en de biologische activiteit in de bovenste 300 meter van de waterkolom werd bestudeerd. In deze periode van het jaar werd op grond van eerdere waarnemingen "opwelling" verwacht. Inderdaad bleken er aanwijzingen dat in het gebied een omhoog gerichte stroming plaatsvond met een snelheid van $\sim 1 \text{ m d}^{-1}$, waarschijnlijk veroorzaakt door de noord-westelijke verplaatsing van het oppervlaktewater onder invloed van de wind. Het oppervlaktewater (de bovenste 20 meter) bleek meestal met redelijk grote snelheid ($\sim 10 \text{ mijl d}^{-1}$) in westelijke richting verplaatst te worden. Nutrientconcentraties waren relatief hoog voor tropisch oppervlaktewater met uitzondering van een N-Z gerichte strook in het midden van het waarnemingsgebied. In het oostelijk en vooral noordoostelijk deel van de Banda Zee, bezuiden Irian Jaya, was de saliniteit van het oppervlaktewater lager. Dit water is vermoedelijk afkomstig uit de Arafura Zee, waarbij de lage saliniteit samenhangt met een sterke rivierafvoer. De biologische productiviteit bleek redelijk hoog, in het bijzonder in het noordoostelijke gebied. De gemiddelde primaire productie was $\sim 1\text{-}2 \text{ g C}\cdot\text{m}^{-2}\cdot\text{d}^{-1}$, met hier en daar nog aanzienlijk hogere waarden. Ook het zooplankton en nekton was goed vertegenwoordigd. In ondiepere gebieden werd de bodemfauna bemonsterd met een boxcorer, waarbij vooral langs de kust van Irian Jaya aanzienlijke faunadichtheden werden aangetroffen. In het oostelijk deel van de Banda Zee werden met acustische methoden aanwijzingen gevonden voor de aanwezigheid van grote visscholen. Aan het programma namen naast de "Tyro" twee Indonesische schepen deel. Een vervolg op deze tocht zal gehouden worden in februari-maart 1985. Dan heerst de NW-moesson, en wordt "downwelling" verwacht.

In het kader van de SNELLIUS II-expeditie werd zowel tijdens de droge moesson (juli-augustus) als de natte periode (november-december) de afvoer van silicaat, zware metalen, gechloreerde koolwaterstoffen en andere chemische bestanddelen naar zee bestudeerd in de oost-Javaanse rivieren Solo en Brantas. In het aangrenzende zeegebied werden het sediment en de daarin levende organismen onderzocht op contaminanten.

De eerste resultaten van dit onderzoek geven aan, dat de Oost-Javaanse rivieren hoge concentraties silicaat bevatten, waarbij bij de mengingszone in het estuarium een conservatief gedrag van dit silicaat optrad. De bodem van de estuaria van de rivieren bestond uit zeer zacht slib met een zeer arme bodemfauna. Verder uit de kust werd het sediment wat grover en de bodemfauna iets rijker, maar ook in de Java Zee was de bodem zeer modderig en arm.

Ten aanzien van contaminanten wezen de eerste analyses op hogere metaalconcentraties in organismen uit de estuaria dan uit de open zee. Zowel in het water, in gesuspendeerd materiaal als in bentische organismen werd een vrij hoog gehalte aan DDE, een afbraakproduct van DDT, gevonden. Verrassend was de aanwezigheid van PCB's in alle bemonster-

de compartimenten, hetgeen op luchttransport kan wijzen.

Tijdens de studie werden spectrale (ir)radiantie metingen uitgevoerd vanaf schepen en vanuit een meetvliegtuig (remote sensing) in combinatie met de bemonstering van het gebied. De verzamelde gegevens zullen dienen voor de interpretatie van beschikbare satelliet-opnamen van hetzelfde gebied. Bij dit onderzoek werd samengewerkt met Indonesische en Duitse instituten.

Tijdens het koraalrifonderzoek in SNELLIUS II-verband werd op een groot aantal transecten de bedekking met levend en dood koraal en met andere elementen vastgelegd. Op vele plaatsen werden aanwijzingen gevonden voor verstoringen van de riffen. Op diverse locaties werd de groeisnelheid van *Porites*-kolonies bepaald, die volgens voorlopige resultaten $0.5\text{--}1\text{ cm}\cdot\text{j}^{-1}$ bedroeg.

Bewerking van in 1983 verzamelde gegevens over de zeeappel *Diadema antillarum* uit het Caraïbisch gebied (Curaçao) geeft een beschrijving van een catastrofale sterfte onder deze dieren op de koraalriffen. Merkwaardig is dat via een aanvoer van larven uit bovenstrooms gelegen eilanden, de recrutering van de zeeappel nog enige tijd doorging terwijl de oudere dieren reeds waren verdwenen. Echter ook op deze eilanden beëindigde het afsterven van de zeeappel de larven-aanvoer en de recrutering. Onder tussen lijkt door het verdwijnen van de voornaamste begrazer, de zeeappel, de algengroei op de Curaçaose riffen toe te nemen.

In het laboratorium werden experimenten verricht over het ontstaan en de ontwikkeling van remanent magnetisme in kunstmatige en diepzee sedimenten. Uit de experimenten bleek dat de mate van aggregaatforming een sterke invloed heeft op zowel de intensiteit als de inclinatie van het remanent magnetisme in fijnkorrelig sediment.

In samenwerking met enkele Japanse onderzoekers is ontdekt dat in vulkanische bodems behalve allophaan, imogoliet, halloysiet en kaoliniet ook zwellende kleimineralen met een slecht kristallijne structuur gevormd kunnen worden. Van de eerste groep werd met X-ray diffractie de deeltjesgrootte, poriëngrootte en kristalstructuur gemeten. In de zwellende kleimineralen werd een superstructuur met gebogen vlakken ontdekt. Met een Nederlandse onderzoeker uit Delft is in een reeks metingen aan een goed kristallijne smectiet waargenomen dat bij wisselende relatieve vochtigheid een sterke hysteresis in de waterbindende eigenschappen van de "interlayers" optreedt.

3.1.4. Speciale projecten

Zoals vermeld in de inleiding (3.1) werd het BOEDE-project in maart 1984 definitief beëindigd na het gereedkomen van het simulatiemodel van het Eems-Dollard estuarium. Terzelfdertijd startte het EON-project (Ecologisch Onderzoek Noordzee en Waddenzee) voor een periode van bijna 4 jaar, tot december 1987. Dit project kent 4 onderdelen: (1) Documentatie Eems-Dollard Model (DEDMOD), (2) Ecologisch Model westelijke Waddenzee (EMOWAD), (3) Verkenning onderzoeksmogelijkheden in de Noordzee (VONZEE) en (4) Toepassing Ecologisch onderzoek in de Noordzee en Waddenzee (TECON).

In 1984 werd veel tijd besteed aan het eerste onderdeel, dat haar voltooiing naderde. In het kader van TECON werd onderzoek verricht naar de effecten van TiO_2 -lozingen op de bodemfauna van de Noordzee. Daarnaast werden gegevens verzameld op een stortplaats van havenslib uit Rotterdam.

In het kader van het DORA-project (Diepzee Onderzoek Radioactief Afval), in 1982 aangegaan voor een periode van 4 jaar, werd in het voorjaar een tweede reis gemaakt naar het dumpgebied in de Golf van Biskaje, uitgevoerd met Hr. Ms. Tydeman. Gevonden werd onder andere dat zuurstofpenetratie in de bodem het hoogst is op hellingen en lokale hoogten. In de diepere delen werden op 25 cm onder het oppervlak gereduceerde condities gevonden, waarbij Mn en andere metalen werden gemobiliseerd. Met behulp van Ra-222 werd de mengsnelheid van het water boven de bodem bestudeerd, waarbij een mengingsduur van ca. 4 dagen werd gevonden.

Tijdens de tweede tocht van DORA werd met succes de grotere bodemfauna bemonsterd met behulp van een 3,5 m Agassiz-trawl, voorzien van een sluitingsmechanisme om contaminatie met organismen uit het pelagiaal te voorkomen. De monsters zullen ten dele worden gebruikt voor chemische en radionuclide bepalingen. De vangsten waren redelijk goed. Kleinere bodemfauna werd verzameld met een bodemslee, de meiofauna met een boxcorer.

Sinds 1982 adviseert het instituut het Ministerie van Buitenlandse Zaken (Ontwikkelingshulp) ten aanzien van de bouw, uitrusting en het gebruik van 2 onderzoeksschepen voor India. De schepen zijn bestemd voor het gebruik in kustgebieden ten dienste van de "Geological Survey of India". Het instituut assisteert bij het ontwerpen en uitrusten van de schepen, die eind 1984 aan India werden afgeleverd. Bovendien liepen in het kader van dit project een 3-tal Indiase geologen op het instituut een stage van 9-12 maanden en werden 12 technici gedurende 4 maanden opgeleid. Bij het in dienst treden van de schepen in India verleenden 4 personeelsleden van het instituut assistentie.

In opdracht van het RIZA (Rijks Instituut voor Zuivering van Afvalwater) werd een monitoring programma uitgevoerd naar de verspreiding van individuele PCB-componenten in de Nederlandse kustwateren. Dit programma was mogelijk doordat via een nieuwe methode meer dan honderd individuele PCB-componenten herkend kunnen worden in uit het veld verzamelde monsters. Het programma werd in 1981 gestart en in 1984 afgesloten met een rapportage. Er zijn aanwijzingen dat het PCB-gehalte in de Nederlandse kustwateren wat afnam in de waarnemingsperiode.

In de loop van het jaar werden onderhandelingen gevoerd met enkele bedrijven over het in productie nemen van op het instituut ontwikkelde apparatuur voor het continue extraheren van contaminanten als chloorkoolwaterstoffen uit oplossingen. Voor het werkingsprincipe van deze apparatuur, waarvan een laboratoriumversie bestaat en een technische versie wordt ontwikkeld, is patent aangevraagd.

Een overeenkomst werd gesloten met het Ministerie van Waterstaat voor het uitvoeren van een tweetal opnames van de bodemfauna in de voordelta voor Zeeland. Hiermee zal de huidige situatie in het gebied worden vastgelegd, voordat de Oosterscheldedam gereed komt.

3.2. BEZOCHTE CONGRESSEN

ITC Seminar on SPOT Technology and Applications, Enschede, Nederland, 25-26 januari: D. Spitzer.

ICES Working Group on Marine Sediments in relation to Pollution, Rostock Meeting, West-Duitsland, 22-24 februari: D. Eisma.

Oceanology International Exhibition Conference, Brighton, Engeland, 6-8 maart: T. Buisman, J. Wagenaar, R. Groenwegen & H. Franken.

Meeting "Planningscommissie" SNELLIUS II, Theme 3, Jakarta, Indonesia, 5-15 March: J.J. Zijlstra.

Meeting "Planningscommissie" SNELLIUS II, Theme 2, Jakarta, Indonesia, 11-17 March: H. Postma.

SCOPE/UNEP Meeting on Transport of Carbon and Minerals in Major World Rivers, Caracas, Venezuela, 25-31 maart: D. Eisma.

Congress Society for Experimental Biology, Cardiff, U.K., 2-6 april: D.H. Spaargaren.

CRESP-meeting (Co-ordinated Research and Environmental Surveillance Program), georganiseerd door Nuclear Energy Agency (NEA), Hamburg, West-Duitsland, 2-7 april: W. Helder.

5th European regional meeting of sedimentology, International Association of Sedimentologists, Marseille, France, 9-11 april: J.H.F. Jansen.

Third International Symposium on Accelerator Mass Spectrometry, Zürich, Zwitserland, 10-13 april: A.J. van Bennekom.

Symposium Werkgroep Osmoregulatie & Mineraalhuishouding, Amsterdam, Nederland, 17 april: D.H. Spaargaren.

Workshop COST-47, Bremerhaven, West-Duitsland, 25-27 april: J.J. Beukema.

Workshop "Modelling the population dynamics, production and and life cycle events of zooplankton populations". Plankton Ecology Group of the International Limnological Society, Oosterzee, Nederland, 1-4 mei: H.G. Fransz.

Nordic Sediment Symposium, Skallingen, Denemarken, 1-6 mei: W. Helder.

Meeting Benthos Methodics Working Group (ICES), Hirtshals, Denemarken, 15-18 mei: P.A.W.J. de Wilde.

8th International Symposium Chemistry of the Mediteranean, Rudjer Boskovic Institute Center for Marine Research, Zagreb, Joegoslavië, 16-24 mei: C.J.M. Kramer.

Hans Pettersson Symposium on Oceanography. Maringeologiska Institutionen, Göteborgs Universitet, Göteborg, Zweden, 4-8 juni: J.H.F. Jansen.

Vergadering begeleidingscommissie "Biologische Anstalt Helgoland", List, West-Duitsland, 11 juni: H. Postma.

Vergadering begeleidingscommissie Institut Océanographique, Parijs, Frankrijk, 15 juni: H. Postma.

Symposium in Wave Breaking and Radio Probing of the Ocean Surface, Sendai, Japan, 19-25 juli: J.T.F. Zimmerman.

International Humic Substances Society, 2nd conference, Birmingham, Engeland, 22-28 juli: R.W.P.M. Laane.

Session Intergovernmental Commission for the Caribbean of 10 CARIBE), Curaçao, 19-26 augustus: H. Postma.

First Congress, Comparative Physiology and Biochemistry, Section of International Union of Biological Scientists, Luik, België, 27-31 augustus: C.G.N. de Voors.

Symposium on the Physics of Shallow Estuaries and Inland Seas, Miami, U.S.A., 29-31 augustus: J.T.F. Zimmerman.

3rd International Symposium on Interactions between Sediments and Water, Genève, Zwitserland, 28-31 augustus: M.M. Rutgers van der Loeff & B. Sundby.

European Marine Biology Symposium (EMBS), Plymouth, Engeland, 17-21 september: J.J. Zijlstra, J.J. Beukema, R. Daan, B.R. Kuipers, F. Creutzberg & H.G. Fransz.

Geotagung (Deutsche Geologische Gesellschaft and Paläontologische Gesellschaft), Hamburg, West-Duitsland, 23-26 september: G.C. Cadée.

Meetings of the consultative panel on coastal systems of UNESCO and of the Scientific Committee on Oceanic Research (SCOR), Roscoff, Frankrijk, 16-26 oktober: H. Postma.

Expertpanel for evaluating previous and future programmes on the disposal of radioactive wastes at sea (IMO-IAEA), Wenen, Oostenrijk, 22-25 oktober: G.C. Cadée.

Biochemical processes at the land-sea boundary, SCOR seminar, Station Biologique Marine, Roscoff, Frankrijk, 22-26 oktober: C.J.M. Kramer.

Antarctica Symposium, Amsterdam, 1-2 November: J.A. van Bennekom, G.C. Cadée, W.W.C. Gieskes & J.J. Zijlstra.

Vergadering ad hoc commissie voor de reorganisatie van de mariene wetenschappen I, aan de Universiteit van Hamburg, Hamburg, West-Duitsland, 12 november en 10 december: H. Postma.

3.3. BESTUURSFUNCTIES

- R.P.M. Bak
 - lid redactieraad Marine Ecology Progress Series
 - lid redactieraad Coral Reefs
 - adviseur wetenschappelijke studiering Nederlandse Antillen
 - adviseur Biological Oceanography Program, National Science Foundation, USA
- M.A. Baars
 - lid Technische subcommissie Snellius-II, Nederlandse Raad voor Zeeonderzoek
- A.J. van Bennekom
 - lid werkgroep Antarctica van IUCN-ledencontact
- 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
- J.P. Boon
 - lid begeleidingscommissie Accumulatie van organochloorverbindingen in steltlopers in de Waddenzee, Instituut voor milieuvraagstukken van de VU (RIZA)
- G.C. Cadée
 - lid commissie voor buitenlandse marien-biologische stations KNAW
 - lid DORA commissie (diepzee opberging radioactief afval)
- J.C. Duinker
 - bestuurslid BION werkgemeenschap aquatische oecologie
- voorzitter group of experts for methods, standards and intercalibration (GEMSI, IOC)
- lid marine chemistry working group (ICES)
- lid begeleidingscommissie Ministerie van Volksgezondheid en Milieuhygiëne, PCB in afvalstromen
- Nederlands vertegenwoordiger in marine environmental quality committee (ICES)
- 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
- 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
- H.G. Fransz
 - bestuurslid werkgemeenschap populatiebiologie (BION)
 - 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
M.T.J. Hillebrand
- lid begeleidingscommissie RIZA projekt Accumulatie van PCB's in steltlopers
- lid Technische subcommissie Snellius-II, Nederlandse Raad voor Zeeonderzoek
C.J.M. Kramer
- voorzitter stichting werkgroep Noordzee van de samenwerkende milieuorganisaties
- secretaris werkgemeenschap Survey, Surveillance, Monitoring, Marine
B.R. Kuipers
- lid adviesgroep Visonderzoek Oosterschelde, Yerseke
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
- lid beheerscommissie ZWO Laboratorium Isotopengeologie
- 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 Oceanografische gegevens
M.M. Rutgers van der Loeff
- lid taakgroep Geochemie en fysische oceanografie van het Coordinated Research and Environmental 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
D. Spitzer
- lid werkgroep remote sensing van de Nederlandse Raad voor Zeeonderzoek
- lid werkgroep zichtbaar licht in open water van Rijkswaterstaat
- lid gebruikerswerkgroep CAESAR-projekt van het Nationaal Lucht- en Ruimtevaart 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 V. en W.
C. Swennen
- lid werkgroep bijlage V EG-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 commissie Snellius II
- 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 studiekring 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 group
- lid begeleidingsgroep macrobenthos, Oosterschelde
P. de Wolf
- lid voorlopige commissie voor de milieueffectrapportage
J.T.F. Zimmerman
- lid commissie fysische oceanografie van de Nederlandse Raad voor Zeeonderzoek
- 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
- 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
- voorzitter stuurgroep commissie van beheer en onderzoek Waddengebied (COBW)
- lid commissie van beheer van het Limnologisch Instituut
- lid wetenschappelijke commissie van het Rijksinstituut voor Natuurbeheer (RIN)
- lid redactiecommissie boek Inleiding tot de oecologie
- president European Marine Biology Symposium
- lid biological oceanography committee ICES
- voorzitter SCOR-UNESCO werkgroep 65: coastal-offshore interactions

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).

J.P.T.M. Aerts	Mollerinstituut Tilburg	B3-04a
P. Blotkamp	R.U. Leiden	B2-01c
J. Boere	L.H. Wageningen	H3-04
H. Bos	R.U. Utrecht	H4-01
M. de Bruin	R.U. Leiden	B2-02e
A. Buma	G.U. Groningen	B4-01
M.C. Capiteijns	S.O.L. Utrecht	B3-04a
S. Cramer	R.U. Amsterdam	B1-05
S. Diel	T.U. Braunschweig	B4-02
R.W.J. Dirks	R.U. Utrecht	H2-01
J. Dols	S.O.L. Utrecht	H3-08
J. van Elk	T.H. Delft	H2-06, B4-02
F. van de Ende	V.U. Amsterdam	B4-01
M. Engelkes	R.U. Groningen	EON
A. Eversdijk	T.H. Eindhoven	EON
M. Grashof	R.U. Groningen	B1-01
E.M. de Heer	S.O.L. Utrecht	B3-04a
G.R. Helling	T.U. Braunschweig	B4-02
K. Hoppeneheidt	T.U. Braunschweig	B2-01c
E. Jacobs	R.U. Utrecht	H4-01
J. Jacobs	Analistenschool Beverwijk	EON
Z. Jager	L.H. Wageningen	B4-02
L. de Jong	R.U. Groningen	B4-04
K. Koelemaij	G.U. Amsterdam	B2-03
R. Koops	I.H.B.O. Eindhoven	H3-04
F. Lent	G.U. Amsterdam	B2-03
M.F. Leopold	R.U. Utrecht	B3-04
C.M. van der Mark	L.H. Wageningen	B3-04a
L. Moelver	S.O.L. Utrecht	B3-04a
M. Rebers	L.H. Wageningen	H4-01
J.M.M. Regtien	R.U. Groningen	H2-02
M. Reichert	G.U. Amsterdam	H3-04
J.H.M. van Rijn	S.O.L. Utrecht	B3-04a
C. Roghair	L.H. Wageningen	H3-04
H. Rose	T.U. Braunschweig	B2-01c
I. Sprong	G.U. Amsterdam	H4-06
M. Starink	G.U. Amsterdam	B3-02a
A. Stolk	R.U. Utrecht	H4-01
D. Stroe	T.H. Eindhoven	EON
P. Tolsma	I.H.B.O. Eindhoven	H3-02
P. van Wensvoort	S.O.L. Utrecht	H3-08

3.5. CURSUSSEN, VERGADERINGEN EN EXCURSIES

3.5.1. NIOZ cursussen

De cursus mariene oecosystemen werd gegeven van 16 tot 29 juni. Er namen 45 studenten aan deel. De cursus vormde het praktische gedeelte van de algemene cursus mariene biologie, die in samenwerking met de Rijksuniversiteit van Groningen is opgezet. Het hoofdthema omvatte de stofkringloop in het pelagische en bentische systeem van de Waddenzee.

3.5.2. Andere cursussen gehouden op het NIOZ

23-25 februari	cursus biologie Technische Universität Braunschweig (BRD)
6-7 juni	workshop "Monitoring in het mariene Milieu"
3-7 september	cursus Van Den Broek-Instituut, Amsterdam
10 oktober	cursusdag Reform. Guido de Brès, Rotterdam

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

21 maart	excursie, 's middags O ₂ experimenten, Stichting Opleiding Leraren, Utrecht.
12 april	excursie Hoger Rijks Instituut voor Tuinbouw, Vilvoorde
13 april	excursie van Leeuwenhoek Instituut, Delft
16 mei	BOEDE Symposium
25 mei	excursie Gemeente Den Helder, afd. Sport- en Jeugdzaken
29 mei	excursie Bernardus Mavo, Hillegom
13 juni	excursie Texelse Gereformeerde Vrouwen Vereniging "Ora et Labora"
14 juni	excursie 5-VWO leerlingen Scholengemeenschap Casimir, Amstelveen
4 september	excursie Kerncentrale, Mol, België
6 september	excursie gemeentesecretarissen uit de kop van Noord-Holland
7 september	excursie Visserijschool, Den Helder
11-13 september	congres "Nutrients in estuaries, eutrophication and other effects", Ned. Oceanografen Club, Hydrobiologische Vereniging, en Estuarine and Brackish Water Science Association
10-14 september	excursies Stichting Vrije Leergangen, Vrije Universiteit, Amsterdam
14 september	Ned. Instituut voor Preventieve Gezondheidszorg
21 september	excursie docenten aan het Instituut HBO, HTS Eindhoven. afd. Chemische technologie
12 oktober	excursie Pedagogische Academie, Ede
16 oktober	bezoek leraren Werenfriedus Scholengemeenschap, Hoorn
17 oktober	bezoek van leerlingen leraren van de Pedagogische Academie, Sittard
31 oktober	excursie Scholengemeenschap Nieuwediep, Den Helder
15 november	excursie RWS dienstkring Noordzee kust, Huisduinen
22-23 november	jaarvergadering BION werkgemeenschap Populatie Biologie
13-15 december	najaarsvergadering BION werkgemeenschap Ethologie

4. HULPAFDELINGEN

4.1. Bibliotheek

In 1984 werden 57 boeken aangeschaft en 2 atlassen. 8 lopende series van boeken bleven gehandhaafd.

Enkele oude oceanografische waarnemingen van het KNMI (1856- 1909) werden toegevoegd bij de al aanwezige collectie.

Initial reports of the Deep Sea Drilling Project zijn aangekocht vanaf Vol. 5 (1970).

Met ingang van 1984 heeft de bibliotheek abonnementen op de volgende tijdschriften:

- Applied Environmental Microbiology (1984)
- Geo-Marine Letters (vol. 3, 1984)
- Pascal Explore Multidisciplinary (1984)

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

- South African Journal of Marine Science (no. 1, 1983)
- Zbornik Vychodoslovenskeho Muzea
- Acta Musei Slovaca Stazione Idrobiologica di Milano
- Quadererni Della civica Stazione Idrobiologica di Milano
- Utrecht Micro paleontological Bulletin (1981)
- Wuyi Science Journal (vol. 1, 1984)
- Marine Geology & Quaternary Geology (1983)
- Bulletin Joint Geological Survey, Univ. Cape Town, Marine Science Unit (no. 12, 1984)
- International Union of Radioecologists. Commission of the European Communities Proceedings and Reports of Workshops (1982)
- Bulletin of Korea Ocean Research & Development Institute, Seoul (Vol. 5, 1983)

De volgende tijdschriftabonnementen werden beëindigd:

- Analytica chimica Acta
- Aqua Culture
- Comparative Biochemistry & Physiology

4.2. Rekencentrum

In 1984 werd de NORD-100, voornamelijk gebruikt voor gegevensopslag, gegevensverwerking, ontwikkeling van modellen (BOEDE/EON), statistische bewerkingen en tekstverwerking.

In 1984 werd de geheugenruimte in de vorm van een schijfteenheid met 150 MB vergroot en werden er meer terminals geplaatst.

De rekenintensiteit in 1984 lag ongeveer op het zelfde niveau als in 1983, ondanks het feit dat een groot aantal onderzoekers gedurende het laatste half jaar van 1984 in Indonesië verbleef.

Het is de bedoeling om in 1985, naast de bestaande NORD-100, een NORD-530 te plaatsen. Deze extra computer zal er voor moeten zorgen de toenemende vraag naar rekentijd op te vangen.

4.3. Reprografische afdeling

In het verslagjaar heeft de reprografische afdeling een verdere uitbouw gerealiseerd betreffende de grafische verwerking van het Netherlands Journal of Sea Research. Tevens zijn er voorbereidingen getroffen om te komen tot een nieuwe opzet van dit tijdschrift.

In het kader van de aanloopwerkzaamheden, ten behoeve van de SNEL-LIUS II expeditie, zijn op verzoek van enkele werkgroepen fototechnische adviezen gegeven en experimenten uitgevoerd.

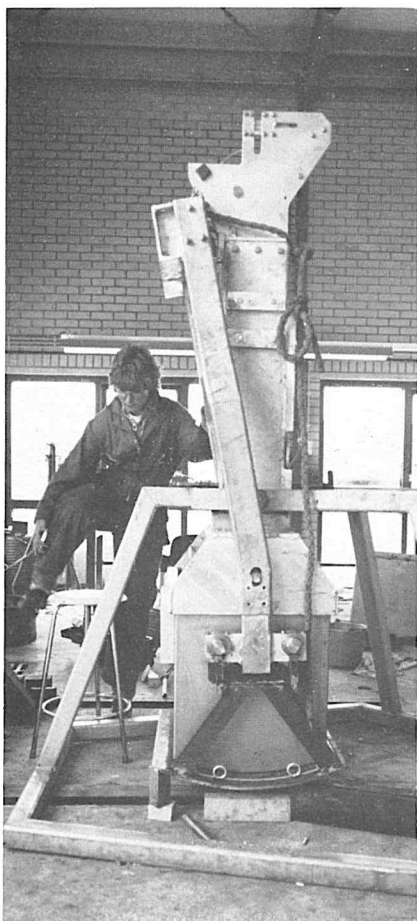
Ter gelegenheid van het bezoek van de minister van Verkeer en Waterstaat, Mw. Drs. N. Smit-Kroes, en de minister van Onderwijs en Wetenschappen Drs. W.J. Deetman, is de permanente expositie binnen het NIOZ gebouw aan de nieuwste onderzoekprojecten aangepast.



4.4. Biologisch studiemateriaal

De afdeling, gevestigd aan de Buitenhaven in Den Helder, leverde evenals voorgaande jaren, levend en gefixeerd biologisch studiemateriaal aan universitaire laboratoria, scholen, buitenlandse instituten en educatieve instellingen. Circa 95 000 levende en/of gefixeerde dieren werden verkocht. Educatieve instellingen, zoals Artis, waren de grootste afnemers van levende organismen, terwijl scholen en universitaire laboratoria in binnen- en buitenland de voornaamste klanten voor het prijziger gefixeerd materiaal waren. Bij het verkrijgen van het biologisch materiaal werd steun verkregen van de visserij-afdeling van het NIOZ op Texel. Tevens werd aan diverse instellingen in totaal een 68 000 liter zeewater geleverd.

4.5. Werkplaatsen



Voor de SNELLIUS expeditie werden 5 nieuwe containers gebouwd, voor verschillende disciplines, en werden 3 gebruikte containers opgeknapt. Voor het walstation werden 7 containers van zonnetenten voorzien en 9 containers kregen een nieuwe airco. Ook werd voor de expeditie een nieuwe planktonrecorder gemaakt, alsmede twee planktontorpedo's en een incubator ten behoeve van C^{14} onderzoek. De planktonlier werd zodanig verbouwd dat plaatsing onder het A-frame van de "Tyro" mogelijk werd. Het deining-compensatie systeem van de CTD-lier werd veranderd, zodat de veeruitslag werd verdubbeld.

Voor het seismisch onderzoek werd een door Shell geschonken drijflichaam verbouwd en aangepast aan een array van 5 airguns, en werd een nieuwe hogedruk compressor in een container ingebouwd. Een zware en extra grote box sampler werd gebouwd, deze doet nu volop dienst aan boord van de "Tyro".

In samenwerking met een constructiebedrijf werd door de elektronische afdeling een hydraulische trekbank ontwikkeld voor het testen van kabels en eindverbindingen, ten behoeve van het diepzee-verankeringssysteem. Tijdens de expeditie zijn 2 nieuwe diepzee-verankeringssystemen samengesteld.

Voor het onderzoek op de rivieren werd de SNELLIUS II expeditie uitgerust met een catamaran, waarop onder andere een 220 V generator, een buitenboordmotor met afstandsbediening, 2 Davits met handliertjes en een dekwas pomp werden geïnstalleerd. Naast de SNELLIUS II voorbereidingen heeft de W.T.K. afdeling zich bezig gehouden met diverse andere projecten. Zo waren twee technici nauw betrokken bij de bouw van 2 onderzoekschepen voor India, inclusief de constructie van monstername-apparatuur en containers. Tevens werd gedurende 1 jaar een training gegeven aan Indiase technici. Er is geadviseerd bij de constructie van 2 box samplers voor de Delta dienst van Rijkswaterstaat, waarbij tevens assistentie werd verleend bij het in gebruik nemen ervan. In Januari werd de "Tyro" in Rotterdam vaarklaar gemaakt voor een reis met de Rijks Geologische Dienst naar Puerto Rico. Aan deze reis namen twee NIOZ technici deel.



In februari begonnen de voorbereidingen voor een DORA-reis met de "Tydeman". Voor deze reis werden onder andere een roestvrij stalen C.T.D-frame, visvallen met diepzee-verankering en diepzee-vistuigen met open- en sluitmechanismen gemaakt. De CTD-lier van de "Tydeman" werd uitgerust met een hydraulische deining-compensator. Een diepzee lier met 10 000 kevlar kabel en diesel power pack werden op het heli-dek vastgelast. Verder werd het schip aangepast voor het nemen van piston-cores vanaf het heli-dek.

In december kreeg de schoorsteen van de "Potvis" een nieuwe roestvrij stalen binnenwerk, en werden de voorbereidingen getroffen voor de plaatsing van een 75 KW wind-generator. De instrumentmakerij werd opnieuw ingedeeld en uitgebreid met een nieuwe draaibank. De extractor werd in samenwerking met de Werkgroep Zeeverontreiniging verder ontwikkeld en met het bouwen van een vergroot industrieel model werd een start gemaakt.

Elektronische afdeling.—Het grootste deel van de inspanningen in het eerste half jaar betrof de voorbereidingen van de SNELLIUS II expeditie. Daarna waren gemiddeld twee tot drie medewerkers in Indonesië aan boord van de "Tyro" teneinde de apparatuur operationeel te houden.

Tussen de bedrijven door werd medewerking verleend bij het installeren en testen van seismische- en navigatieapparatuur aan boord van de onderzoekingsvaartuigen bestemd voor India.

Op het instituut werd een aanvang gemaakt met de realisatie van een ontwikkelingsafdeling.

Voor SNELLIUS werden de diverse oceanografische systemen vaarklaar gemaakt. Twee containers werden ingericht.

De CTD-rossette sampler combinatie kreeg uitgebreidere koppelingsmogelijkheden met andere, "vreemde" systemen. De mogelijkheid werd geschapen de besturingscomputer te vervangen door een nieuwer model (HP9826) zodat de data-opslag in het vervolg op de floppy-disk kan plaatsvinden.

Alle seismische systemen zijn volledig gebruiksklaar gemaakt. Bovendien werd dit geheel uitgebreid met dataopslag op audiotape.

Voor DORA is in samenwerking met de instrumentele werkplaats en het ECN een dubbele set scintillatietellers gebouwd voor gebruik aan boord.

Ten behoeve van werkgroepen op het instituut zelf werden een microprocessorgestuurde zuurstoftitrator en een mini-echolood met hoge nauwkeurigheid voor bodemdieptes kleiner dan 50 centimeter ontwikkeld.

Het solid-state datalogger project werd al direct sterk vertraagd door leveringsmoeilijkheden. Het belangrijkste onderdeel werd in verband met de Amerikaanse exportbepalingen voor strategische goederen pas aan het einde van het jaar door de douane vrijgegeven.

In samenwerking met de Instrumentele afdeling is de ontwikkeling gestart van een processorgestuurde goniometerbesturing ten behoeve van de röntgendiffractometer gebruikt door de afdeling Geologie.

Met assistentie van een tijdelijke medewerker is een begin gemaakt met de ontwikkeling van een destructor ten behoeve van de chemisch oceanografische afdeling.



4.6. Haven en vaartuigen

Ten behoeve van het onderzoek werden met de "Aurelia" 152 vaardagen gemaakt, met de "Navicula" 159 en met de "Griend" 113.

4.7. Logeergebouwen

In het voorjaar werd een begin gemaakt met de uitbreiding van het "Potvis"-complex met 15 éénpersoonskamers en een vergroting van de centrale leefruimte. Hieraan werd een oude éénpersoonskamer opgeofferd. De uitbreiding werd uitgevoerd door Drijver Bouw B.V. als leerlingenbouwplaats. De architectuur en begeleiding was in handen van architectenbureau Alkema. Op 30 november is deze uitbreiding op feestelijke wijze in gebruik genomen.

De bezettingsgraad van de woningen bedroeg 82,7% en van de 10 éénpersoonskamers 97,5%. De 16 slaapzalen voor studentenbewoning werden gebruikt, met een bezettingsgraad van 52%. Het aantal studenten en stagiaires bedroeg 71, tesamen overnachtten zij 6199 keer. Het aantal cursisten bedroeg 348 (769 overnachtingen), en het aantal gasten kwam dit jaar op 114 (198 overnachtingen). Voor 10 gasten werden de verblijfskosten door NIOZ vergoed (11 overnachtingen). In totaal werd in 1984 door 543 personen 7177 keer in de kamers en slaapzalen in de "Potvis" overnacht.



5. SOCIAAL JAARVERSLAG

5.1. Algemeen

Het NIOZ is ruim 100 jaar geleden onder de naam Zoölogisch Station gesticht door de Nederlandse Dierkundige Vereniging (NDV). Sinds 1930 ontvangt de vereniging voor de exploitatie gelden van het Rijk; voordien hadden directeur en enkele medewerkers een dubbelfunctie en waren tevens in dienst van het Rijksinstituut voor Visserijonderzoek (RIVO), dat ressorteert onder de Minister van Landbouw en Visserij.

De naamsverandering dateert uit 1961, toen de Minister van Onderwijs en Wetenschappen, in verband met de toenemende maatschappelijke betekenis van de zee en de groeiende behoefte aan onderzoek, besloot het instituut te laten groeien tot een compleet oceanografisch instituut. Hierbij werd uitgegaan van de situatie in andere landen met een goed ontwikkeld zeeonderzoek.

Uitgaande van het standpunt dat het instituut tot een volwaardige instelling voor zeeonderzoek diende uit te groeien verstrekke de Minister gelden voor een nieuw complex op Texel dat in de periode 1969-1977 werd gebouwd. Het bestaat uit een hoofdgebouw, laboratoria, een zogenaamd experimenteeraquarium, een havencomplex en een gastverblijf voor studenten en gastonderzoekers. Voorts kreeg het instituut in 1972 de beschikking over een onderzoekingsschip voor de Noordzee.

Bij het vaststellen van de afmetingen van de gebouwen werd uitgegaan van een uiteindelijke personeelsbezetting van ongeveer 160 personen, waaronder 34 academici, inclusief de directie; verder van de aanwezigheid van 16 promotieassistenten en enkele tientallen studenten. De bezetting is niet volledig gerealiseerd: op 31 december 1984 waren 114 personen in vaste dienst en waren er 3 promotieassistenten.

5.2. Beheer

De NDV, als ontvanger van de subsidie, is verantwoordelijk voor het beheer van het NIOZ. Wel werd de invloed van de Minister versterkt bij de transformatie van Zoölogisch Station naar NIOZ. Zo wordt de directie door de Minister benoemd, op voordracht van het bestuur van de NDV. Voorts heeft de Minister een ambtelijke vertegenwoordiger in de Financiële Commissie, en benoemt hij, eveneens op voordracht van het bestuur, de leden van de Wetenschappelijke Commissie. De laatste Commissie kan de Minister direct adviseren over de wetenschappelijke zaken betreffende het instituut en het Nederlands zeeonderzoek in het algemeen. Zij maakte in 1983 hiervan gebruik door de Minister op de hoogte te stellen van haar, positieve, standpunt betreffende voorgenomen onderzoek in Indonesië (SNELLIUS II). In de Wetenschappelijke Commissie hebben zitting vertegenwoordigers van de Nederlandse universitaire instellingen en van enkele zusterinstituten werkzaam op het gebied van zeeonderzoek.

De Financiële Commissie bestaat uit de genoemde vertegenwoordiger van het ministerie, de voorzitter van de Wetenschappelijke Commissie, de penningmeester van de NDV en een speciaal aangewezen lid van het bestuur (de "commissaris van de NDV") die doorlopend belast is met het toezicht op de directie. Bij belangrijk overleg van de directie met OZB is de commissaris aanwezig.

Als gesubsidieerd instituut beschikt het NIOZ over een rechtspositiereglement in overeenstemming met artikel 136j van het Burgerlijk Wetboek. Dit betekent dat het personeel ambtenaar is in de zin van de pensioenwet.

Bestuur (per 1-12-1984)

Commissaris:	Prof. Dr. W. Scharloo
Commissie van toezicht:	Prof. Dr. W. Scharloo Dr. J.G.D. Lambert (penningmeester NDV) Prof. Dr. J. Lever
Financiële commissie:	Prof. Dr. W. Scharloo Dr. J.G.D. Lambert Prof. Dr. A.D.F. Addink Drs J. Bezemer (Ministerie van O en W)

Wetenschappelijke commissie

	vertegenwoordigt:	vakgebied:
Prof. Dr. J. Lever (voorzitter) Biologisch Laboratorium van de Vrije Universiteit van Amsterdam	Vrije Universiteit Amsterdam	mariene biologie
Prof. Dr. C. den Hartog (ondervoorz) Laboratorium voor Aquatische ecologie	Katholieke Universiteit Nijmegen	aquatische ecologie
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 oceanogr.
Prof. Dr. C. van den Hoek Laboratorium voor Plantensystematiek, Haren (Gr.)	Rijksinstituut Groningen	plantensys- tematiek
Prof. Dr. 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

Prof. Dr. W.G. Mook Laboratorium voor Isotopenfysica Rijksuniversiteit	Rijksuniversiteit Groningen	isotopen- fysica en -chemie
Dr. Ir. L. Otto Afd. Oceanografie, KNMI, De Bilt	KNMI, De Bilt	fysische oceanogr.
Dr. R.C. Peters Laboratorium voor Vergelijkende fysiologie	Rijksuniversiteit Utrecht	aquatische fysiologie
Prof. Dr. R.A. Prins Rijksinstituut voor Natuurbeheer	Rijksinstituut voor Natuur-	micro- biologie
Dr. E.A.Th. Verdurmen ZWO Laboratorium voor Isotopen- geologie, Amsterdam	ZWO Laboratorium Isotopengeologie	geologie chemie
Prof. Dr. W. Scharloo Lab. voor Populatie- en Evolutie- biologie, Utrecht	Nederlandse Dierkundige Vereniging	biologie

5.3. Werkoverleg

Het jaarverslag van de ondernemingsraad is in dit boekje opgenomen (zie onder 6).

Werkoverleg tussen de directie en de hoofden van dienst (stafvergadering) vond 18 keer plaats. Tijdens dit overleg werd gesproken over onder meer begrotingszaken, investeringen, uitvoering van grote projecten, verslagen van externe vergaderingen en hun consequenties voor het instituut, algemene personeelszaken e.d. Daarnaast vond in werkgroepverband overleg over werk in kleinere kring plaats.



5.4. personeelsbeleid

Bevorderingen

In 1984 werden onderstaande personen bevorderd:

P.R. Alkema	S. de Porto
A.J. Asjes	G.E. de Schipper
A. Balk	R. Witte
R. Dapper	J. Wagenaar
R. Groenewegen	G.J. Zigterman
J. Nieuwenhuizen	

Mutaties

Onderstaande mutaties vonden plaats in 1984:

In dienst	A.C. Rijk	01-03	
	R. Lakeman	01-06	
	Th. Kuip	01-06	
	B. Sundby	01-07	
Uit dienst	M. Manshanden	01-02	VUT
	J. van Weereld	01-05	ontslag
	J.W. de Blok	01-09	VUT
	J.P. Boon	01-10	ontslag
Overleden	J. de Vries	juli	
oud personeel	D.E. Jourdan	aug.	
Overplaatsing	H.J. Boekel	01-02	naar instrumentmakerij

5.6. personeelslijst (per 31-12-84)

<i>Direktie:</i>	<i>Secretaresse:</i>	<i>Assistentie:</i>
Prof. Dr. H. Postma	J. Hart-Stam	J.W. Rommets
Dr. J.J. Zijlstra	L. Everhardus	J.I.J. Witte
	C. Leverington	

Beheerder:
Ing. E. van Abs

Onderzoekafdelingen

afd. chemische oceanografie en
onderzoek zeeverontreiniging

<i>Onderzoeker:</i>	<i>Assistentie:</i>
Dr. B. Sundby	M.T.J. Hillebrand
Drs J.M. Everaarts	R.F. Nolting
Drs J.F. Bakker	
Dr. W. Helder	R.T.P. de Vries
Drs S.B. Tijssen	F.J. Wetsteyn

afd. fysische oceanografie

Drs C. Veth	M.R. Wernand
Prof. Dr. J.T.F. Zimmerman	M.W. Manuels
Dr. D. Spitzer	W.M.L. Lambrechts

afd. mariene geologie en geochemie

Dr. D. Eisma	G.W. Berger
Dr. J.H.F. Jansen	S.J. van der Gaast
Dr. T.C.E. van Weering	J. van Iperen
Drs A.J. van Bennekom	J. Kalf
	J. Schilling

afd. experimentele systemen

Dr. P.A.W.J. de Wilde	E.M. Berghuis
Dr. J.H. Vosjan	A. Kok
Dr. R.P.M. Bak	G. Nieuwland
	E. Pauptit

afd. autecologie	Dr. F. Creutzberg A.D.G. Dral Dr. M. Fonds 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. bentische systemen	Dr. J.J. Beukema Dr. G.C. Cadée C. Swennen Dr. D.H. Spaargaren	W. de Bruin J. Hegeman P. Duiven J. Zuidewind
afdeling EON	Dr. P. de Wolf Dr. W. Admiraal Drs. M.A. van Arkel Drs. J.W. Baretta Dr. R.W.P.M. Laane Drs. P. Ruardij Drs. H.G.J. Schröder A. Stam	H. Malschaert M. Mulder L. Venekamp A. Kop A.C. Bol-den Heijer

Hulpafdelingen

publikatie en bibliotheek	Dr. J.J.J. Beukema (redactie) J. v.d. Wal-Doornekamp (bibliotheek)		A.C. Rijk M. Bruining-du Porto
administratie	G. Goslinga	D.J. Bruin	E.C. Lanser I. Wernand-Godée G. Zonnenberg
reprografie	H. Hobbelink	B. Verschuur	R.P.D. Aggenbach G.E. de Schipper
rekencentrum		F. Eijgenraam R. Dapper	
onderhoudsafdeling	T. Verveer T. Buisman L. Heerschap F.J. Schilling	S.D. Groot F.J. Parlevliet H.H. de Porto R.M. Daalder A. Ran	J. Visser S. Gieles
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
biologisch studiemateriaal (Den Helder)	J.M. Nieuwenhuizen		
huishoudelijke dienst	G.H. Steenhuizen	G.C. Weijdt-Eelman	
logeergebouw "de Potvis"	S.W. de Porto		

haven en vaartuigen

H.A. Beumkes
C. Wisse
C. van Zwieten

W.P. Jongejan
J.C. Tuntelder
C. Gerssen
J.C. Groot

E. Adriaans
R.J.R. Anthonijsz
A. Boon
G.L. de Vries
A.J. Souwer
E. Sebens
C. Mozes
W.J.M. Koomen

5.6. Tijdelijke personele ondersteuning

N. Schogt	01-01 tot 01-03 en 01-11 tot 31-12	planktontelster
B. Koelemeijer	01-01 tot 15-10	TAP electronica
Y.M.A. Coenegracht	15-03 tot 01-05	DORA
J.J. Blom	01-04 tot 01-06	technische dienst
G. Vlamming	01-01 tot 01-07	technische dienst
J. Starreveld	01-06 tot 01-09	EON
C.M. Oomens- Meeuwsen	01-05 tot 01-11	afdeling geologie
P.J.A. Tolsma	01-08 tot 01-09	vakantiehulp
M. Portanger	01-07 tot 01-10	vakantiehulp
H. Spigt	01-09 tot 31-12	magazijn en expeditie
R. Nichols	01-09 tot 31-12	reprografische afdeling
C. Leverington	01-11 tot 31-12	vervanging secretaresse
W. Lewis	01-01 tot 31-12	EON via uitzendbureau

ZWO-beurzen

Onderzoekers met een ZWO-beurs:

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

Stimuleringsfonds Ministerie van O en W, afd. DGWB

W.M.L. Lambrechts	fysische oceanografie
-------------------	-----------------------

Werken met behoud van uitkering

In 1984 hebben een aantal personen op het instituut gewerkt met behoud van een uitkering. In sommige gevallen is een contract gesloten met het Leerlingenstelsel, hetgeen inhoudt dat leerlingen één dag per week onderwijs volgen op een streekschool en de andere dagen ervaring op doen. Tevens is van de mogelijkheid gebruik gemaakt om personen die een uitkering genieten vrijwilligerswerk te laten verrichten. Dit geschiedt na goedkeuring door of de gemeente, de bedrijfsvereniging of het Ministerie van Binnenlandse Zaken, vrijwilligerswerk te laten verrichten.

G. van de Bosch	DORA
P. Boereboom	documentatie
C. Fisher	experiment biologie/zeewaterverontreiniging
W. Frankema	DORA
I. Ginus	chemische oceanografie
J. Jacobs	EON
O. Klepper	EON
E. Okkels	DORA
H. Stil	DORA
M. Tijssen	reprografische afdeling en elektronica

Speciale projecten

Het NIOZ verleent haar 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. Zij stelt hiervoor ruimte en wetenschappelijke kennis ter beschikking, op basis van werkelijk gemaakte kosten. Personeel voor deze projecten wordt speciaal ingehuurd voor de duur van het project. Het NIOZ personeel, dat de eigenlijke taak van het instituut uitvoert (fundamenteel onderzoek), is hierbij slechts in een adviserende rol betrokken.

Het beleid van de directie bij het aannemen van deze speciale projecten is terughoudend; in principe worden slechts projecten aangenomen die samenhangen met 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	P. Seip	01-07 tot 31-12
BOVO/RWS	R. Brand	15-09 tot 31-12
Contaminantenonderzoek Waddenzee	Drs. C.J.M. Kramer	tot 01-10
DORA	Dr. M.M. Rutgers van der Loeff	
DORA	Drs. M. Lavaleye	
DORA	G.J. Zigterman	
DORA	D. Waijers	
EON	W. Admiraal	vanaf 01-07
EON	M.A. van Arkel	vanaf 01-06
EON	J.W. Baretta	vanaf 01-07
EON	R.W.P.M. Laane	vanaf 01-06
EON	H. Malschaert	vanaf 01-07
EON	M. Mulder	vanaf 01-06
EON	P. Ruardij	vanaf 01-07
EON	L. Venekamp	vanaf 01-07
EON	A.C. Bol-den Heijer	vanaf 01-09 21,5 uur
EON	P. de Wolf	gedetacheerd door TNO
EON	A. Kop	gedetacheerd door TNO
EON	H.G.J. Schröder	gedetacheerd door TNO
EON	A. Stam	gedetacheerd door TNO
Indiaproject	H. van der Veer	01-07 tot 31-12
OPEX	Drs. R. Dekker	
R.W.S./Deltadienst	Drs. C.G.N. de Vooy	01-08 tot 15-10
VAARPLAN	P.R. Alkema	
	A.J. Asjes	
	A. Balk	
	H. Franken	
	A. Goes	tot 01-07
	H. van Veen	
	J. Wagenaar	
	R.J.C. Witte	

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 1984:

R. Botter	01-01 tot 01-06	MTS Alkmaar, werktuigbouwkunde
M. Portanger	01-01 tot 01-07	MTS IJmond, elektronica
M. Bakker	01-01 tot 01-07	MTS Hoorn, elektrotechniek
R. Verschoor	01-01 tot 01-03	MTS Alkmaar, werktuigbouwkundige
H. Windt	01-02	MTS Alkmaar, elektronica
P.J.A. Tolsma	01-01 tot 01-08	HTS Eindhoven, milieutechniek
J.J. Waning	01-01 tot 01-05	Bakhuys Roozeboom Instituut
J.H. Boogaard	01-01 tot 01-06	Bakhuys Roozeboom Instituut
R.M. Boogaard	01-01 tot 01-03	MTS Hoorn, elektrotechniek
J.D. Jacobs	01-01 tot 01-05	Bakhuys Roozeboom Instituut
E. de Jonge	01-01 tot 01-02	MTS Alkmaar
H.R.M. Koops	01-01 tot 01-03	HTS Eindhoven, milieutechniek
K. Hopman	01-02 tot 01-07	HTS Alkmaar, elektrotechniek
J. de Rooy	01-03 tot 01-05	SOL, Utrecht
J. van Dam	01-03 tot 01-07	MTS Alkmaar, elektrotechniek
S. de Vries-vd Berg	01-03 tot 01-07	MTS Alkmaar, werktuigkunde
E.C. Stikvoort	01-07 tot 31-12	Van den Broek Instituut, Amsterdam
B. Koster	01-07 tot 01-12	Nautisch College, Den Helder
J. Stark	01-08 tot 31-12	MTS Hoorn, werktuigbouwkunde
B. Laulier	01-09 tot 31-12	MTS IJmond, elektrotechniek
D. Stroo	01-09 tot 01-11	TH Eindhoven, bedrijfskunde
E. Kuiper	01-09 tot 01-12	HTS Enschede, chemische technologie
C. Eriks	01-11 tot 31-12	IJmond MTS, elektrotechniek

5.7. Verdere personeelszaken

Deeltijd

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	35 uur	bibliotheek-assistente
G.C. Eelman	11,5 uur	kantine assistente
L. Everhardus	36 uur	secretaresse
W. Klein Breteler	33 uur	bioloog
E.C. Lanser	28 uur	administratie-assistente
G.E. de Schipper	36 uur	redactie-medewerkster
J. van der Wal-Doornekamp	35 uur	bibliotheecaresse
I. Wernand-Godee	24 uur	administratie-assistente
J.T.F. Zimmerman	24 uur	fysicus
M. Zonnenberg	37 uur	telefoniste

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.

Het ziektepercentage over 1984 bedroeg 3,3% (1983: 5,18%).

5.8. Veiligheid, gezondheid en welzijn

De voorbereidingscommissie voor veiligheid, gezondheid en welzijn bestaat uit de leden: H.J. Boekel, J. Hegeman, W.P. Jongejan, J.W. Rommets en J.I.J. Witte. Het is de bedoeling dat deze commissie volgend jaar wordt omgezet in een vaste commissie.

Dit jaar zijn binnen het instituut geen bedrijfsongevallen geregistreerd.

A. Vaars behaalde het diploma hoofd brandwacht van de stichting brandweeropleidingen.

5.9. Verslag van de personeelsvereniging

De personeelsvereniging heeft in 1984 verschillende activiteiten georganiseerd voor de medewerkers van het instituut.

De toneelgroep "Comedia de la NIOZ" heeft in de eerste helft van dit jaar drie eenacters van Brecht gebracht: "De Spion", "Het Kruis van Krijt" en "Burgermansbruiloft". Op dit jaarlijks terugkerende festijn was na afloop van het toneelspel ruimte om op de klanken van de "Steven Stapel Band" te swingen. Bij de cocktail-bar werd de muziek verzorgd door de "NIOZ House Band".

De toneelstukken van Brecht werden voor het Texelse publiek opnieuw gespeeld in de zaal van "De Lindeboom" in Den Burg. Later in het jaar is er meegedaan aan een themamaand in Den Helder, handelend over fascisme. Hier werden "De Spion" en "Het Kruis van Krijt" werden nogmaals gespeeld. In deze tijd is er ook ingeschreven voor een eenacterfestival in Schagen met het stuk "De Spion". Dit werd voor de vierde keer ten tonele gebracht rond Pinksteren in het Regiocentrum, te Schagen.

In mei is heeft een personeelsreis plaatsgevonden naar het aquarium in "Artis" en naar het "Buitenmuseum" in Enkhuizen. 's Avonds werd hier de maaltijd genuttigd.

Ook is er dit jaar weer een pannekoekeneetmiddag voor de NIOZ kinderen gehouden. De kinderen, en overigens ook ouders, deden zich te goed aan de stapels pannekoeken. Video-films, een poppenkastspel en een stukje toneel omlijstten deze eetpartij.

Sportberichten 1984.—Wegens de drukke voorbereidingen voor SNELLIUS II heeft het voetbalteam van het NIOZ het nationaal bekende biogentoernooi af moeten zeggen.

In de eigen competities zijn de twee teams, NIOZ 1 en NIOZ 2, in de middenmoot geëindigd. NIOZ 1 heeft voor de zoveelste maal de jaarlijkse fairplay-cup in de wacht gesleept.

Het volley-bal dames team "Retsina" is in de eilandcompetitie iets boven de middenmoot geëindigd.

5.10. Toekomstvisie

Ook in 1985 zal het oceanografische onderzoek in Indonesië (SNELLIUS II) nog veel inspanning vergen van onderzoekers, technici en het personeel dat door de Nederlandse Raad van Zeeonderzoek bij het instituut is gedetacheerd. Veel aandacht zal verder worden gevraagd voor het incorporeren van 13 medewerkers die in 1984 bij het instituut zijn aangesloten in het kader van het EON project (Ecologisch Onderzoek Noord- en Waddenzee). Ten slotte moet met waardering gewag worden gemaakt van de toezegging door het instituut voor 13 extra medewerkers in het kader van de herbezettingsoperatie. Deze zullen in de loop van het jaar worden aangesteld.

Alles bijeen genomen kan worden gesproken van een aanzienlijke verdere groei van overigens ten dele tijdelijk aangestelde personeelsleden.

De gesprekken over de interne reorganisatie van het instituut zullen naar verwachting in de loop van 1985 worden voltooid. Extern is een discussie gaande over de positie van de para-universitaire instellingen van het ministerie, waarvan het NIOZ er één is. Deze discussie kan gevolgen hebben voor onze nauwe relatie met de Nederlandse Dierkundige Vereniging, welke tevens als beheersorganisatie optreedt: overigens een situatie die tot wederzijdse tevredenheid al bijna honderd jaar bestaat.

Met het Delta Instituut voor Hydrobiologisch Onderzoek (van de Koninklijke Nederlandse Akademie van Wetenschappen) te Yerseke, werden de banden in 1984 nauwer aangehaald. Deze ontwikkeling zal in 1985 worden voortgezet. Hierdoor zal de coördinatie van het grensverleggende onderzoek in de kustzone worden versterkt.

Daarnaast is het van belang te vermelden dat het "Netherlands Journal of Sea Research" in 1984 een andere redactiesamenstelling en een redactiesecretaresse heeft gekregen, waarbij er naar is gestreefd dit tijdschrift een status losser van het instituut te verschaffen. Deze ontwikkeling zal in 1985 worden versterkt door de aanstelling van internationaal erkende "referees" die voor een onafhankelijke beoordeling van de op te nemen publicaties zullen zorgen.

Ten slotte blijkt de directie er naar te streven de functie van het instituut als toegang naar zee voor geïnteresseerde universitaire groepen te versterken. Verwacht wordt dat van de inmiddels gereed gekomen uitbreiding van het logeergebouw in 1985 een druk gebruik zal worden gemaakt, ook door buitenlanders.

6. JAARVERSLAG ONDERNEMINGSRAAD 1984

6.1. Algemeen

Meer nog dan in voorafgaande jaren heeft de OR zich geprofileerd als volwaardig gesprekspartner van de directie. Tijdens de overlegvergaderingen werden meningen en gevoelens van de achterban aan de directie kenbaar gemaakt en werden directieplannen en -beslissingen besproken en beoordeeld op de gevolgen voor het personeel; bij de directie werd erop aangedrongen, tijdens deze vergaderingen inzicht te verschaffen in de motieven die achter directiebesluiten en -plannen schuilgingen. Ook via persoonlijke contacten probeerden OR-leden te anticiperen op het beleid. Omdat het directiebeleid nooit erg concreet omschreven was, viel het de OR niet altijd gemakkelijk om op een efficiënte manier mee te denken of de directie van repliek te dienen. De notulen van de OR- en overlegvergaderingen vormden een bron van informatie over het besprokene die blijkens de vele reacties het hele personeelsbestand bestreek. De stem van vrijwel alle personeelsleden werd frequent beluisterd door OR-leden tijdens de vergaderingen met de achterban, die dit jaar vaker dan ooit werden belegd.

6.2. Punten van aandacht

Na veel discussie onder het personeel en na ampel overleg tussen directie en Ondernemingsraad kwam een overwerkregeling tot stand, die in de toekomst niet alleen voor de werkzaamheden gedurende de SNELLIUS II expeditie zal gelden maar ook betrekking zal hebben, wellicht in iets gewijzigde vorm, voor andere onderzoekstochten. Het belangrijkste punt in de regeling is dat in principe niet langer dan 12 uur per dag gewerkt mag worden, ten behoeve van de veiligheid aan boord en het welzijn van de betrokkenen.

Ook over reorganisatie werd veel gediscussieerd. Dit betrof zowel de plaats van het NIOZ in het geheel van zeeonderzoeksinstituten in Nederland, de interne reorganisatie van het NIOZ zelf, als reorganisatie op kleine schaal, namelijk binnen afdelingen van het NIOZ. Deze laatste werden soms doorgevoerd zonder overleg met de OR. Na klachten hierover beloofde de directie, meer zorgvuldigheid te betrachten en de OR tevoren te raadplegen alvorens ook klein-schalige veranderingen in de NIOZ-structuur aan te brengen. Wat de NIOZ-reorganisatie betreft werd een directievoorstel afgewogen tegen een reorganisatieschema dat was opgesteld door de OR na overleg met de gehele achterban. In beide schema's wordt een derde poot onder het NIOZ geplaatst, te weten een afdeling voor toegepast wetenschappelijk en beleidsonderbouwend onderzoek.

Ook het instituut “Vrijwilligerswerk” werd uitgebreid besproken. Er zijn nog geen wettelijke regelingen ten aanzien van het “derde arbeidscircuit” (verrichten van produktieve arbeid met behoud van uitkering), hoewel officieus al heel wat vrijwilligers een nuttige bijdrage leveren aan het NIOZ-werk. De OR benadrukte dat zij betrokken wil worden bij het aantrekken van vrijwilligers en bij het opstellen van regels voor dit soort werknemers.

De positie van zgn. AIO's (Assistenten In Opleiding), mensen die betaald gaan worden uit de “1% herbezettingsregeling”, werd besproken in afwachting van hun komst. Het zal uiteindelijk gaan om wel 13,5 nieuwe werknemers — niet alleen academici maar ook hulppersoneel (analisten, technici en administratie). Aan het NIOZ zullen relatief veel AIO's komen, omdat het NIOZ een zwaartepuntspositie inneemt.

6.3. Verkiezingen en samenstelling OR

Op 30 mei werden verkiezingen gehouden. De verkiezingscommissie bestond uit Rob de Vries en Winfried Gieskes. Er dienden geen verkiezingen gehouden te worden, omdat in alle voor verkiezingen in aanmerking komende groepen maar 1 kandidaat aangemeld was. De OR had na 30 mei de volgende samenstelling:

Rob Dapper	(voorzitter), voor het administratief personeel en personeel in algemene dienst
Winfried Gieskes	(secretaris), voor het biologische wetenschappelijk personeel
Wim Jongejan	(ABVA), voor het varend en havenpersoneel
Kees Veth	voor het niet-biologisch wetenschappelijk personeel (geologen, chemici, fysici)
Rob de Vries	voor het niet-biologisch laboratoriumpersoneel (geologen, chemici, fysici)
Eilke Berghuis	voor het biologisch laboratoriumpersoneel
Herman Boekel	voor het technisch personeel

6.4. Commissies

De veiligheidscommissie (een voorbereidingscommissie, ingesteld ter voorbereiding van de Arbowet) bestond uit Herman Boekel, Wim Jongejan, Joop Rommets en Jan Hegeman (de laatste twee als toegevoegde, niet OR-leden).

Rob Dapper en Eilke Berghuis hielden zich (hoewel niet in commissieverband) bezig met het financiële NIOZ-beleid, terwijl Rob de Vries en Kees Veth het personeelsbeleid volgden (ook niet in commissieverband).

6.5. Vergaderingen

Er werden 9 vergaderingen van de OR belegd, en er werd 6 maal in overleg getreden met de directie en de heer Van Abs, de beheerder.

6.6. Scholing

In december werd door Kees Veth en Rob Dapper een cursus voor voorzitter en secretaris gevolgd van het Scholings- en Vormingsinstituut van de Arbeidersgemeenschap der Woodbrookers in Kortehemmen bij Beetsterzwaag.

6.7. Financiën

Het door de OR uit te geven bedrag stond voor 1983 begroot op f 4000,-. De voornaamste uitgavepost bestond uit kosten die gemoeid waren met de cursus (zie punt 6.6). Het abonnement op het OR-blad werd gecontinueerd. Aan het eind van het jaar was f 2700,- besteed voorzover kon worden nagegaan dd. 30-1-85.

