

ANNUAL REPORT 1986



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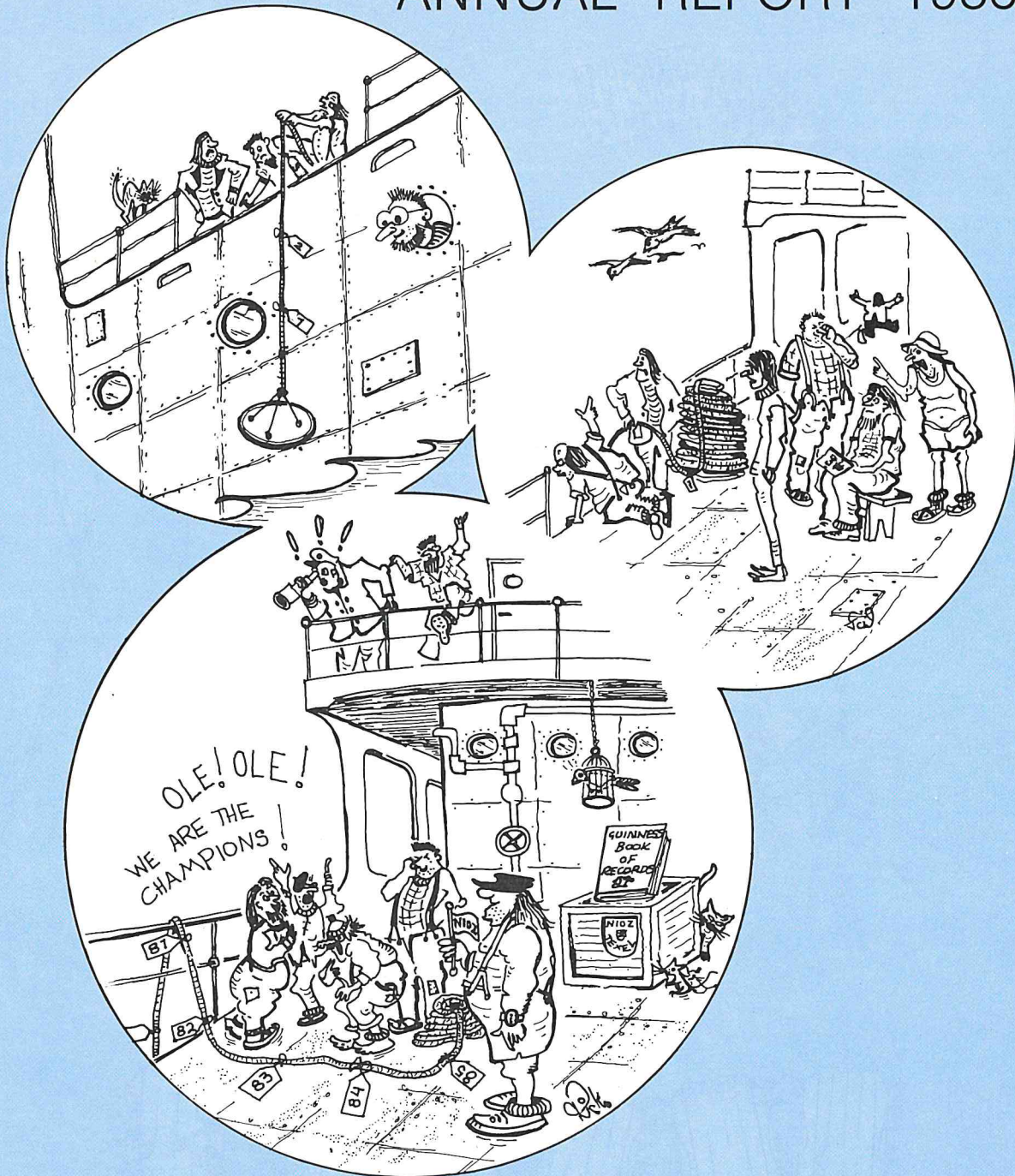
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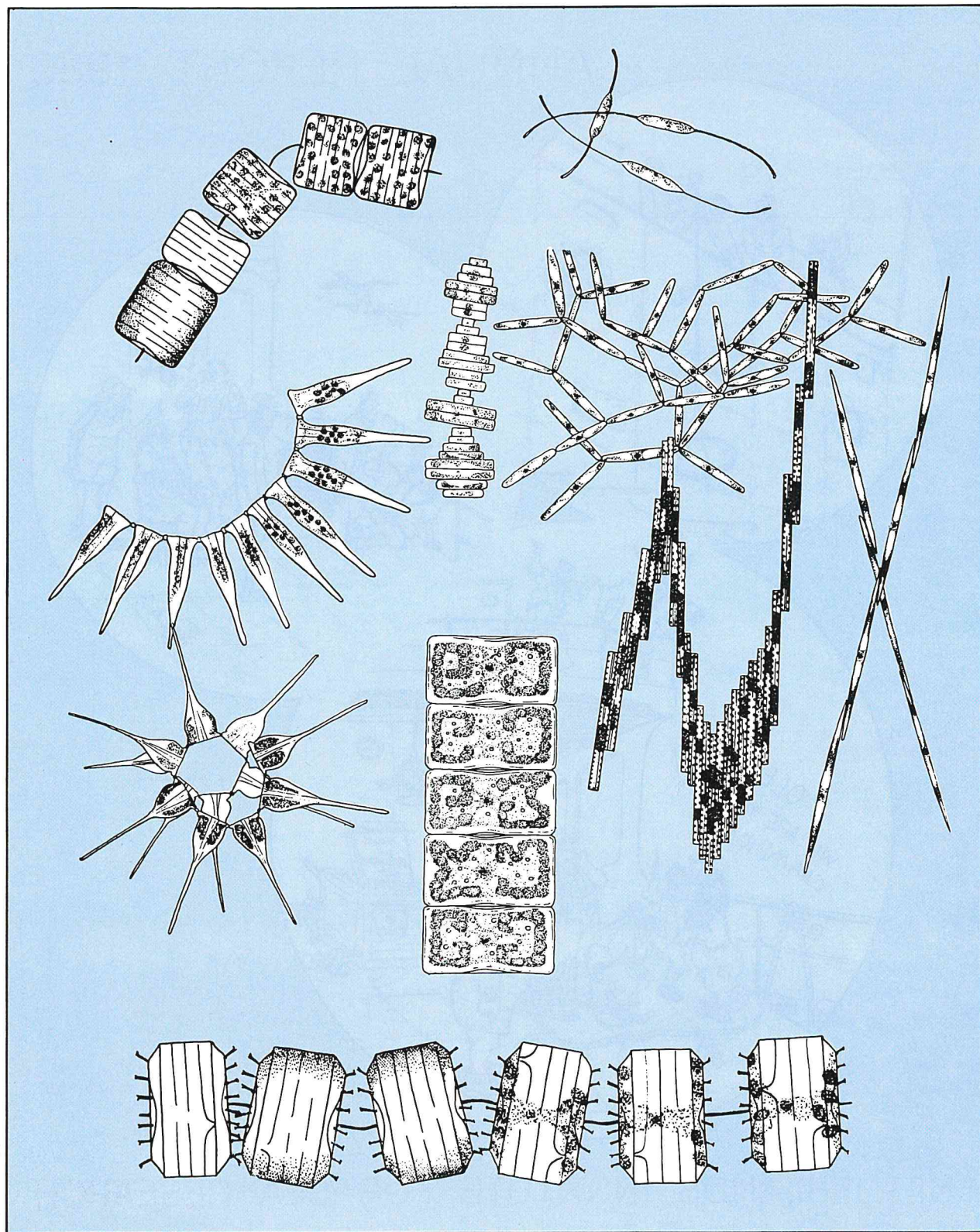
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1. Scientific activity

1.1. INTRODUCTION

The year 1986 was characterized by a change of directorate and a wide range of scientific activities. Prof. Dr. H. Postma retired in August 1986 and was succeeded by Dr. E.K. Duursma as scientific director. Prof. Dr. J.J. Zijlstra became general director and Ing. E. van Abs technical-administrative director.

Although the joint Dutch-Indonesian SNELLIUS II-expedition was completed in 1985, many NIOZ scientists devoted a great deal of 1986 to the analysis of samples and data collected and to preparing papers for publication. In fact the main results of the expedition are to be presented at a SNELLIUS II-symposium in Jakarta in November 1987. As a consequence of the post-expedition activities, a large number of Indonesian scientists (ca 30) were temporarily lodged in the NIOZ guesthouse, working together with their Dutch counterparts, and several NIOZ scientists and technical assistants paid short visits to Indonesia.

Major topics of research in the Wadden Sea and the North Sea concerned the various aspects of the quality of the marine and estuarine ecosystems and the processes that determine them. The multi-year records on nutrients, primary production and biomass of pelagic and benthic species in these regions are at present a basis for the understanding of the eutrophication of the North Sea and Wadden Sea as caused by the increased loads of nutrients from various freshwater inputs, such as the river Rhine. In this context, the modelling of the ecosystem of the western part of the Wadden Sea, making use of earlier collected data with some additional sampling, should be mentioned. This activity, which is in fact a continuation of similar modelling work in the Ems-Dollard estuary, is carried out via additional funding by a group of ministries.

As for the North Sea, the substructures of the different regions became clear from studies at the so-called Frisian Front, where a multidisciplinary investigation was carried out based on physical, chemical, sedimentological and biological research. Another important activity in the North Sea concerned the Synoptic Mapping Programme, an international exercise carried out in spring under the auspices of ICES to investigate and actually map the distribution and composition of the benthic fauna of the North Sea. Other participating countries were the Federal Republic Germany (with various institutes), the United Kingdom and Belgium. The data collected in these programmes will also be of importance for the future EON group (Ecology Research North Sea), which is to be established on behalf of and funded by a number of ministries.

The objective of EON is to arrive at results that can be translated to the responsible governmental boards for the management of the North Sea system with all its natural and anthropogenically important functions. Setting out trends also means research on pollution by PCB's, heavy metals and radionuclides, with as a future possibility the research on historical records of various organic residual compounds in sediments. For radionuclides, the investigations are to be carried out in a joint effort of various Dutch institutes and organizations and concern ^{210}Po as a major marker for alpha emitters of gypsum waste disposals.

The institute is also interested in promoting studies on the so-called mesocosms, which make use of the institute's own experimental facilities and those of the neighbouring institute RIN (Research Institute of Nature Management) in a concerted action with TNO (Netherlands Organization for Applied Scientific Research). Steps have been taken to broaden the research within OPEX (effect of oil pollution) and SEDEX (effects of eutrophication) with possibly extra funding from national and European sources.

The research on the behaviour of CO_2 in coastal waters has been continued, and broadened in a larger frame with literature studies on the various possible ecological effects of CO_2 increase in the atmosphere and sea water, as well on the ecological consequences of a possible future rise of the sea level.

A relatively new activity concerned research in the Southern Oceans (Antarctica), which makes use of the facilities of the Alfred Wegener Institut für Polar- und Meeresforschung in Bremerhaven (F.R.G.), whose hospitality is gratefully acknowledged. In 1986, 8 scientists and technical assistants participated in various expeditions of the polar research vessel "Polarstern". This participation was organized under the Antarctic Programme of the Netherlands Council of Oceanic Research (Royal Netherlands Academy of Arts and Sciences), for which organization NIOZ is in charge of the sea-going equipment.

As a whole, the NIOZ research is characterized by a diverse system of fundamental investigations, sometimes coordinated around a central topic, such as the Frisian Front, but on the other hand carried out by highly specialized individual scientists. This is reflected within all seven working groups, being three in the hydrographical section: Marine Chemistry & Pollution, Marine Geology & Sedimentology and Physical Oceanography, and four in the biological section: Experimental Systems, Autecology, Benthic Systems and Pelagic Systems. In total, the studies represent a major part of the Dutch efforts in marine research.

The connections with the marine groups from universities have been strengthened in 1986, with in particular a "covenant" with the Marine Biology sub-faculty of the University of Groningen, for which student courses in Oceanology and Marine Biology are organized on an annual basis. Likewise, cooperation exists with other universities, also through the Netherlands Council of Oceanic Research.

J.J. Zijlstra

E.K. Duursma

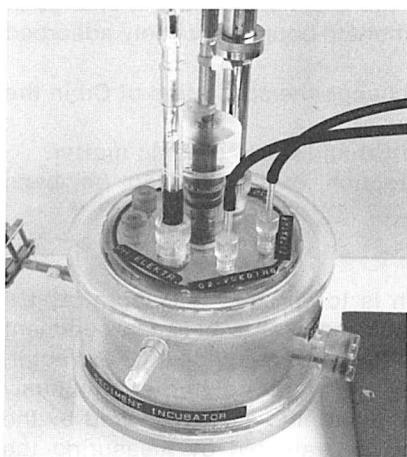
1.2. ESTUARINE RESEARCH

1.2.1. Physical and chemical research

1.2.1.1. Nitrogen cycling

H1-02, H1-03

W. Helder, P. Kierskamp



The temperature- and pH-controlled sediment-incubator for the study of the dynamics of the nitrogen-cycle.

Cycling of nitrogen at low oxygen concentrations was studied.

a. Studies of batch-incubated sediment slurries from the Mokbaai, Texel, show that production as well as consumption of N_2O occurs at low ambient oxygen concentrations ($10\text{--}30\ \mu\text{M O}_2$).

b. Sediment slurries were incubated at regulated oxygen concentrations, temperature and pH. By maintaining ambient oxygen concentrations at fixed values for a long time (not possible in batch incubations) dominant processes were studied as functions of the oxygen concentration. The results indicate that, at low oxygen concentrations ($0\text{--}10\ \mu\text{M}$), the first step of nitrification ($\text{NH}_4 \rightarrow \text{N}_2\text{O}$) and denitrification can occur simultaneously. Accumulation of N_2O was not comparable to results from batch incubations. A considerable N_2O accumulation, comparable to the maximum values found in sediments, was only indicated after addition of S^{2-} to the incubated sediment slurry, which emphasizes the role of sulfides in N_2O accumulation in marine sediments.

c. To investigate the occurrence and role of N_2O in shallow marine environments, attention was paid to optimization of N_2O analysis by gas-chromatography. Sediment profiles of N_2O taken from the Mokbaai indicate the presence of a strong N_2O maximum at the transition from light-coloured to black-coloured sediment.

1.2.1.2. Dynamics of the sediment-water interface

H1-03

K. Booij, W. Helder, B. Sundby

Existing microcosms suffer from the disadvantage that the shear-stress produced at the sediment-water interface, an indicator of the resistance to chemical transport across the interface, commonly is both weak and spatially inhomogeneous. For that reason we have developed a new stirring device that produces a shear-stress field that is spatially homogenous. The magnitude of the shear-stress, which can be varied at will and includes values typically found in the field, has been calibrated with a variety of techniques, including the use of skin-friction sensors.

Preliminary experiments show that, for example, the rate of oxygen uptake by sediments and the penetration of oxygen into the sediment both are strongly dependent on the magnitude of the shear-stress at the sediment-water interface. This research is carried out in collaboration with Prof. G. Gust, University of South Florida.

1.2.1.3. Exchange of trace metals between sediment and water

H1-05

L. Gerringa, R. Nolting

Cd and Cu are released from marine sediment to the overlying water in association with aerobic organic carbon degradation (early diagenesis). A direct relationship between degradation rate of organic carbon and fluxes of Cd and Cu at the sediment-water interface has not been established so far. In this project, processes responsible for fluxes of Cd and Cu at different redox conditions are studied. For this, Balgzand sediment (15 kg) was sampled to obtain a well-defined (grain-size distribution, organic carbon content, Cd and Cu concentrations, etc.), uniform sediment pool for future experiments.

Sequential extractions of this sediment have so far indicated that:

- a. most of the Cd and Cu in these sediments is associated with the organic matter.
- b. drying of the sediment prior to the extractions influences the speciation of Cd in the sediment. Drying of the sediment causes a change in organic matter-bound Cd to either carbonate-bound or loosely adsorbed Cd.
- c. drying of the sediment does not change the speciation of Cu in the sediment.
- d. there are different bond types of Cd and Cu to organic matter.
- e. possibly, the organic-bound fraction of Cd has so far been underestimated in the literature.

1.2.1.4. Exchange of organic micropollutants between sediment and water

H1-11

K. Booij

Equipment has been evaluated which is to be used for laboratory experiments on exchange rates of organic pollutants between sediment and water. It consists of a benthic chamber and a liquid-liquid extractor. The purpose of this set-up is to keep the water column continuously depleted of organic pollutants so that pollutants are redelivered by the sediment. Then, exchange rates can be evaluated by measuring the amount of extracted pollutant. The benthic chamber has a design similar to the one in use by the Department of Experimental Systems at NIOZ. The liquid-liquid extractor is an upscaled version of the one developed previously at NIOZ. It was shown that the water column in the benthic chamber is well mixed. Near the sediment surface the water movement is reduced. This poses a resistance to mass transfer from the sediment-water interface to the water column so that a concentration gradient of diffusing solutes builds up in the water column just above the sediment-water interface. This alters the concentration at the interface with respect to the concentration in the water column and lowers the exchange rates. Various techniques for determining the magnitude of this resistance have been tried. The results showed quite high boundary layer resistances, varying in magnitude with position in the chamber. Thanks to a cooperation with prof. G. Gust, University of South Florida, it has been possible to determine bottom stress distributions in the tank. He developed a stirring device that produces greater and more homogeneous bottom stresses than the old stirring device. For reasons that are presently not understood, the liquid-liquid extractor shows a lower extraction efficiency than before.

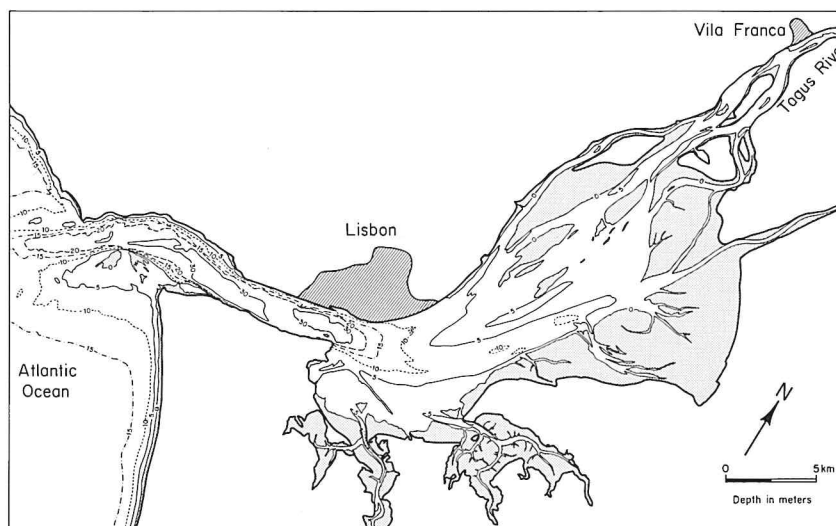
1.2.1.5. Suspended matter fluctuations in the Tagus estuary (Portugal)

H1-12

B. Sundby

Nine multi-ship synoptic surveys of the distribution of suspended sediment, each survey including the conditions at both low and high tide, were carried out over a 12-month period in the meso-tidal Tagus estuary in Portugal (In cooperation C. Vale, with Instituto Nacional de Investigação das Pescas, Lisboa, Portugal). Additional measurements of the semi-diurnal fluctuations of suspended sediment concentrations and current strengths were made at fixed stations during a neap and a spring tide. During the study period, the river discharge of water and suspended sediment remained below the mean annual discharge and did not show a pronounced seasonal fluctuation.

A turbidity maximum, defined as an area with suspended sediment concentrations greater than $50 \text{ mg} \cdot \text{dm}^{-3}$, was absent during neap tides (1.3 m amplitude), appeared and grew in both extent and turbidity as the tidal amplitude increased, and was fully developed with concentrations greater than $50 \text{ mg} \cdot \text{dm}^{-3}$ throughout the entire estuary during spring tides ($>3 \text{ m}$ amplitude). Maximum concentrations, reaching as much as $1000 \text{ mg} \cdot \text{dm}^{-3}$ during spring tides, were always found in the inner shallow bay region of the estuary. In contrast to the salinity distribution, which fluctuated from partly stratified during neap tides to well mixed



The dominant tidal effects on sediment dynamics in a meso-tidal estuary have been examined in the Tagus estuary, Portugal

during spring tides, the vertical distribution of suspended matter in the turbidity maximum zone was always stratified with highest concentrations near the bottom. The fluctuation in suspended matter concentration is interpreted as a fortnightly erosion-sedimentation cycle, caused by a cyclic variation in the strength of the bottom currents. Superimposed on this is a semi-diurnal cycle. The semi-diurnal fluctuation of the suspended sediment concentration was negligible during neap tides, but attained magnitudes during spring tides that were comparable to the fortnightly fluctuation. The amount of material involved in these cycles is equivalent to the input of suspended sediment by the Tagus river during a year of normal discharge conditions. The suspended sediment regime in the Tagus estuary is related to the considerable fluctuation in the wet cross section of the estuary over the spring-neap cycle and the frictional dissipation of tidal energy as the water spreads laterally over an extensive intertidal mud flat area.

1.2.1.6. Dating with naturally occurring isotopes

H3-10

G.W. Berger

At the request of and with financial support from the Ministry for VROM (Ministry for Housing, Regional Development and the Environment), a project was set up to detect possible influences of contamination of Dutch waters with ^{210}Pb from industrial activities. In addition, the project was to provide background values for sediment dating with ^{210}Pb .

Measurements of ^{210}Po were carried out both in water and suspended matter. Total ^{210}Po content (dissolved and particulate) varied from less than $10 \text{ dpm} \cdot 100 \text{ dm}^{-3}$ to more than $80 \text{ dpm} \cdot 100 \text{ dm}^{-3}$, depending on the variations in suspended matter content, the variations in ^{210}Po content in the suspended matter and, to a lesser extent, on the variations in salinity. Indications of local sources of ^{210}Po were found in the mouth of the river Rhine (Waterweg), the North Sea Canal and the IJmuiden outer harbour.

Based on the first results, a second sampling programme was carried out in October 1986 to look more closely at the local sources in the North Sea Canal, the IJmuiden outer harbour and Nieuwe Waterweg.



1.2.1.7. Sedimentation on tidal flats

H3-10, B3-01

D. Eisma, G.W. Berger,
G.C. Cadée

Sediment of a tidal flat, aerobic at the surface and, with decreasing oxygen, anaerobic in the deeper layers. There sulfate reduction occurs and the produced sulfides colour the sediment black. Where oxygen and sulfide meet a niche for chemolith-trophic S-oxydizing bacteria is created.



With two Chinese colleagues (East China Normal University, Shanghai) who stayed at NIOZ for 8 months, and three students (University of Utrecht and Free University, Amsterdam) research was started on the possibilities of using ^{210}Pb as a tracer to get more insight into the deposition and resuspension of tidal flat sediments. This was combined with a study of tidal flat morphology, sediment structure, pollen analysis, repeated soundings, historical data and events. As the ^{210}Pb content in the sediments varied with grain size, experiments were carried out to determine this relation more closely and to determine the speed of adsorption and desorption. There is a large difference in sedimentary conditions between (1) the inner parts of the Dollard and Jade, where predominantly mud is deposited, (2) and the exposed tidal flats, where deposition, erosion and reworking proceed rigorously and the morphology of channels and gullies changes more rapidly. In an area south of the island of Ameland, ^{210}Pb data compared with data from soundings indicated a large contribution of old reworked mud in the mud deposits, which points to rapid resuspension and redeposition. In the Dollard this was hardly the case. In general, ^{210}Pb data can give an indication of the time-scale on which the processes of erosion and deposition take place. Sandy deposits have very low ^{210}Pb contents, but with grains $<100\mu\text{m}$ the ^{210}Pb adsorption from solution onto the suspended particles proceeds very rapidly (within a few hours), whereas desorption proceeds very slowly.

Within the framework of a cooperative programme, D. Eisma and G.C. Cadée spent part of August and September at the Institute of Estuarine and Coastal Research, East China Normal University, Shanghai. They joined a programme of tidal flat studies along the north side of Hangzhou Bay and at the mouth of the Chang Jiang. Cores collected on the tidal flats were analysed in Shanghai and subsamples for ^{210}Pb dating were measured in Texel. Faunal studies and counts were made. The Chinese tidal flats studied have a very different morphology and are formed under very different conditions than the tidal flats in the Wadden Sea. A programme of bimonthly chlorophyll measurements on the tidal flats was set up and sediment samples are being collected along the coast to study a possible transport of Hoang He material to the tidal flats south of the Chang Jiang. Comparison of the East China tidal flats with those in the Wadden Sea proved that although large numbers of surface deposit feeders (bivalves, crabs, gastropods) were observed on the tidal flats near Shanghai, the chlorophyll content (= food) on these flats was low, which might be related to typhoon erosion at this time of the year.

1.2.1.8. Flocculation and deflocculation of suspended matter

H3-01

D. Eisma

In coastal waters, suspended matter is mostly present as large flocs (macroflocs), which are stable in the water but falling apart into much smaller units (microflocs and mineral particles) when sampled. Only by special techniques can large flocs be sampled intact. *In situ* photography of suspended particles has so far only been possible for particles larger than ca 100 μm . Therefore, construction was started of an *in situ*-suspension camera system that allows *in situ* photography of suspended particles ranging in size from less than 10 μm to more than several cm. It consists of three separate camera systems.

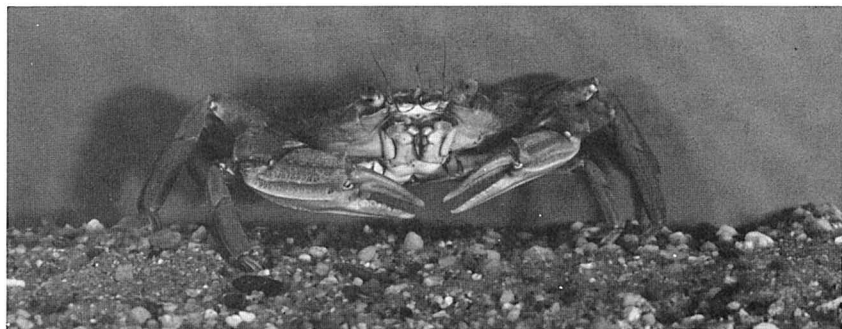
Photography of particles *in situ* gives a momentary picture. It is expected that usable pictures will be obtained in waters with suspended matter concentrations of up to 150 $\text{mg}\cdot\text{dm}^{-3}$. Work carried out in estuaries and coastal waters during the past year has, however, indicated that considerable deflocculation and reflocculation take place either by dissolution of polysaccharides, by the break-down of large organic molecules that keep particles together, or by replacement of the terrestrial organic matter in the flow by organic matter of estuarine or marine origin.

1.2.1.9. Carbon dioxide research

H1-04

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

In the CO_2 -research of the Wadden Sea the CO_2 - O_2 relation was given most attention. Six times, during the year, water samples were taken at three stations and analysed for alkalinity, total CO_2 and oxygen. Preliminary results show that till early April almost all oxygen saturation values in the Wadden Sea are around 100%. Only low-salinity Wadden Sea water, which receives a relatively large contribution of IJsselmeer water, showed oversaturation up to 114%. In May supersaturations of up to 160% were measured. A clear gradient of higher saturation values was detected towards the North Sea and towards high tide. In June and July nearly the complete area sampled showed undersaturated water. By the end of August the water sampled near the tidal inlets was saturated, while lower salinity water, farther from the influence of North Sea water, was still undersaturated, with values of around 90%. September showed overall undersaturation, values being as low as 87%.



1.2.1.10 Sublethal effects of heavy metals on marine organisms

H1-08

J.M. Everaarts

The uptake and distribution of Cu in the polychaete *Arenicola marina* (L.) have been studied both under experimental conditions and in a natural environmental situation by analysing the concentrations of the whole body and three body compartments: body wall, intestine and blood.

No relationship could be found between the Cu concentrations in various fractions of the sediment and any of the body compartments.

Under experimental conditions, the Cu concentrations in the blood were higher than in the intestine and the body wall. Uptake of dissolved Cu occurred directly from the water.

The data obtained from the field showed small differences in Cu concentrations between blood, intestine and body wall. The Cu concentrations in the blood varied from 1 - 4 $\mu\text{g}\cdot\text{cm}^{-3}$, in the intestine from 2 - 6 $\mu\text{g}\cdot\text{g}^{-1}$, and in the body wall from 1 - 3 $\mu\text{g}\cdot\text{g}^{-1}$ w.wgt.

A significant correlation was found between Cu concentration in the blood and body weight: small (young) individuals had higher Cu concentrations in their blood than larger (older) ones. This means that young animals will encounter more stress at similar environmental Cu levels than will older animals.

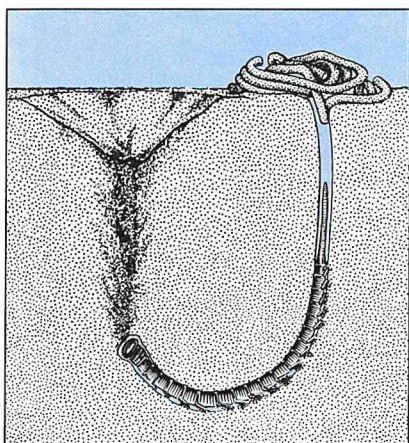
The concentrations in the different body compartments appear to be dependent on the season in which the samples were taken. The Cu concentration in the intestine and the body decreased from April to November, whereas the blood Cu concentration increased.

Haemoglobin in *Arenicola* has a high oxygen affinity, with a half saturation oxygen pressure of about 180 Pa at pH 7.4 and 15°C. The oxygen affinity decreases with increasing Cu concentration in the blood to about 300 Pa at pH 7.4, 15°C at a Cu concentration of 35 $\mu\text{g}\cdot\text{cm}^{-3}$. Cu exerts only a slight influence on the subunit cooperativity in oxygen binding. The oxygen affinity, subunit interaction and the Bohr effect are pH dependent. Cu affects the functioning of the blood by inhibiting oxygen binding to the haemoglobin in the respiratory area and oxygen delivery in the tissues.

In two experiments, the fate of Cd (dosed to sea water and sediment) and the impact of the bioturbating activity of the polychaete *Arenicola marina* (L.) on the Cd distribution in the sediment have been studied. Besides, the uptake and distribution of Cd in *Arenicola* have been determined by analysing three body compartments: intestine, body wall and blood.

When Cd is dosed to double-distilled water, its adsorption onto the sediment can be described by means of the Langmuir-isotherm. This does not count for sea water as a medium; strong complex formation with chlorides causes considerably lower adsorption values.

The bioturbating activity of the lugworm influences the adsorption of Cd to the sediment: maximum adsorption has been measured in the upper layer of the sediment column and at the bottom of the J-tube in which *Arenicola* lives.

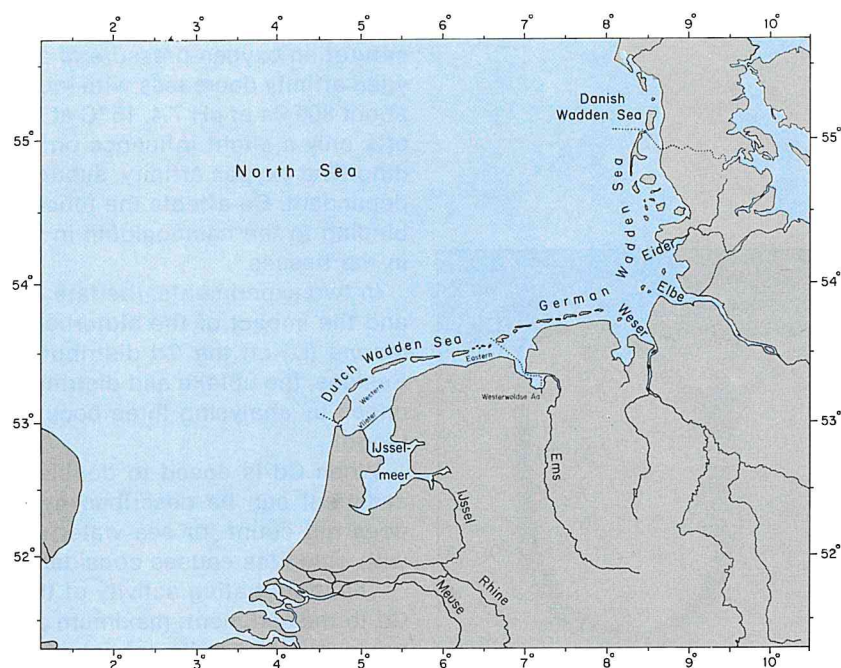


Field work: Mrs. Saraladevi (NIO, Cochin, India) digging up silty sediment from the Balgzand area, to be used in an experiment.



The adsorbed Cd is 60-92% extractable with 0.1 N HCl. Sediment polluted with Cd showed a time-dependent release of Cd to the interstitial water, both at pH 8 and 6; the amount desorbed is maximally 35% of the total amount of Cd adsorbed to the sediment.

The uptake of Cd in the three body compartments occurred both directly from the (overlying) water and from the sediment. Though there is a significant increase in Cd concentration in the interstitial water of polluted sediments, pore water seems to play a minor role in the Cd uptake of *Arenicola*.



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

1.2.2. Biological research

1.2.2.1. Production and transport of organic matter

B3-01
G.C. Cadée

Data on observed increases in phytoplankton primary production and biomass (chlorophyll and cell numbers) for the Marsdiep tidal inlet have been further worked out and published. This promising series of measurements was continued in 1986. The trend of increase in diatoms continued, culminating in a second peak in August. Flagellates again reached high numbers during summer, but *Phaeocystis* blooms were less dense than in 1985.

1.2.2.2. Mineralization of organic matter

B1-02
J.H. Vosjan

Vertical and horizontal distribution of mineralization activity and biomass was measured in water and sediments of various marine ecosystems. The standard methods used in these investigations were the measurement of ETS activity, and of ATP as a biomass parameter. In the anaerobic sediments of the Wadden Sea oxygen respiration is impossible and is taken over by respiration on sulphate, because sulfate occurs in large quantities. In February-March an anaerobic sulphate respiration of 20-90 mg organic carbon per m² per day was measured with radioactive sulphate. In late summer a ten times higher activity was obtained.

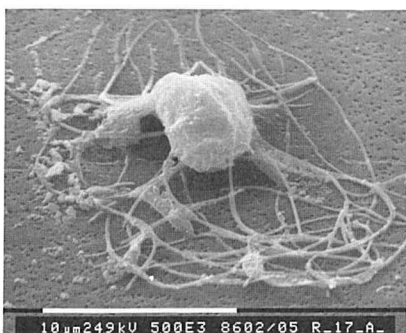
1.2.2.3. Protozoa

B1-06
R.P.M. Bak

Live counting of protozoa from the Marsdiep showed populations (size class 5-20 μm) to maintain a low winter density until March. Then the population size started to increase and the data suggest that densities peak in April before dropping to an intermediate summer level. A return to low winter values occurred in November. Counts of pelagic bacteria in the same samples suggest that the spring increase and November decrease in protist numbers are paralleled by the fluctuations in bacterial numbers. There seems to be no clear relation in numbers for the summer period.

A study on the influence of pollutants on protozoan populations showed the sensitivity of protists and the diversity of the response of populations to different pollutants. In an oil pollution experiment, population densities increased exponentially from $3 \times 10^3 \text{ cm}^{-3}$ to $15 \times 10^3 \text{ cm}^{-3}$. If oil was treated with a cleaning agent, populations dipped to a very low level, $0.15 \times 10^3 \text{ cm}^{-3}$, before exponential growth occurred. These variations in population density did not reflect similar changes in bacterial densities.

Cultures of a benthic flagellate (*Bodo curvifilus*) showed growth rates, $\mu = 0.95 \text{ day}^{-1}$, $t = 14^\circ\text{C}$, initial bacterial concentration $5 \times 10^6 \text{ ml}^{-1}$, comparable to cultured populations of pelagic heterotrophic flagellates.



Diaphanoeca (Marsdiep choanoflagellate).

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

B3-02a
J.J. Beukema

Long-term investigations (started in 1969) on the intertidal benthic macrofauna in the western part of the Wadden Sea were continued. The usual sampling schedule yielded the twice-annual data on numbers, biomass, recruitment, survival, growth rates and production of several tens of species of molluscs, polychaetes and crustaceans.

Total macrozoobenthic biomass remained at the high level reported earlier (Annual Report 1984). Preliminary estimates of total production by macrozoobenthos on tidal flats showed significantly increasing trends in productivity over the 15-year period for the two sets of data available.

One species, the tellinid bivalve *Macoma balthica*, was studied in detail. A recent enhancement in the productivity of this species proved to be caused by increases in both the success of its annual recruitment and its annual growth rate. The length of the annual growing season of *Macoma* appears to be governed mainly by temperature conditions. Its growth started earlier (in late winter at about 5°C) as winters had been milder and ended later (in early summer at about 15°C) as July water temperatures had been lower. Though the lengths of spring periods with favourable water temperatures appear to determine the length of the short annual period of growth in *M. balthica*, the actual rates during this period are probably governed by the availability of food rather than by prevailing temperatures. In autumn, a second annual period with suitable temperatures occurs. Positive growth in autumn has, however, never been observed in *Macoma* populations living in the Dutch Wadden Sea. In contrast, a second annual period of growth in autumn appears to be general in French estuaries. There feeding conditions in autumn do in fact appear to be better than in the Wadden Sea, where algal concentrations are usually extremely low in autumn.

1.2.2.5. Ecology of zoobenthos inhabiting soft bottoms along European coasts

B3-02b
J.J. Beukema

Part of the macrobenthos research is incorporated in the European Community project COST-647, an international long-term programme to assess and correlate fluctuations in numerical densities of selected species of benthic animals in European coastal areas.

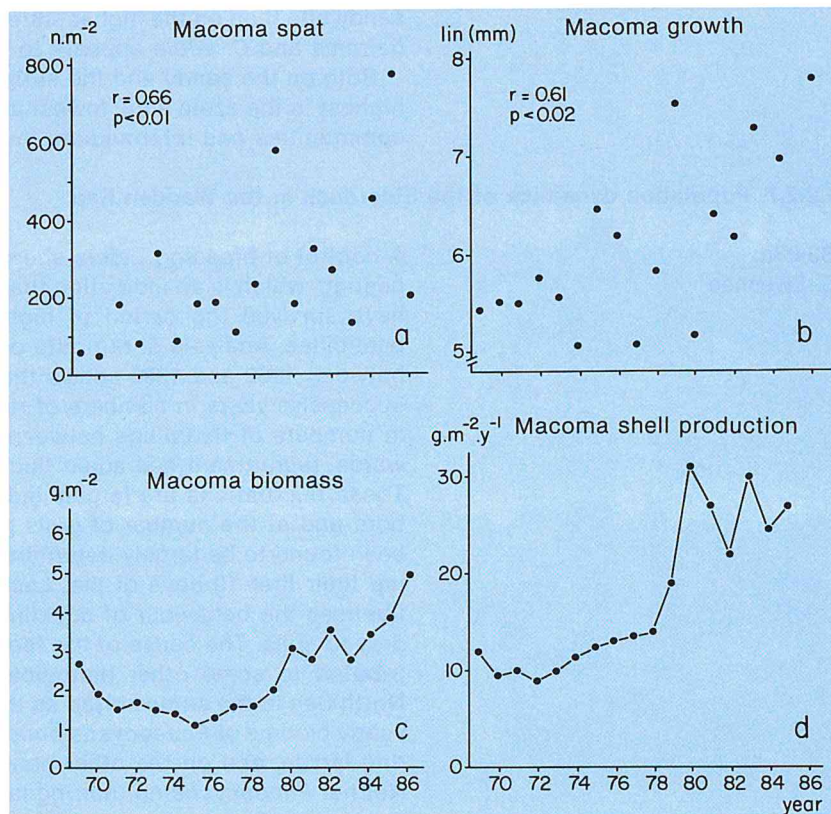
Several benthic species living on tidal flats show parallel fluctuations over vast areas, e.g. the entire Wadden Sea. Severe winters appear to be one of the synchronizing factors. In an area disturbed by discharges of waste water, aberrant fluctuation patterns were observed. These divergent fluctuation patterns were strictly local and thus clearly point to a locally operating disturbing factor. Knowledge of "natural" fluctuation patterns occurring on a broad geographical scale are a prerequisite for distinguishing local deviations and identifying effects of local disturbing factors.

Increasing trends during the last 15 years in populations of the bivalve *Macoma balthica* living on Balgzand, a 50 km² tidal-flat area in the western-most part of the Wadden Sea. Means of 15 fixed sampling places, scattered all over the area, are shown.

- Reproductive success (mean numbers per m² of spat in August),
- Growth rates (mean length increments in mm during the second year of life, starting from a length of 6 mm),
- Biomass (in g per m² of ash-free dry weights of the soft parts),
- Production of hard parts (in g per m² per year of shell material).

The graphs show that the increases in biomass and productivity were caused by better recruitment (producing higher numbers) as well as faster growth (producing bigger animals).

Probably, these increases are part of the general increase in biomass and productivity of the benthos in the area, which may be caused by the increases in algal stocks and primary production, and these in turn may be caused by the eutrophication (i.e. man-made increases in concentrations of P- and N-compounds) of the Dutch coastal waters.



1.2.2.6. Variability in year-to-year recruitment of benthic invertebrates on tidal flats in the Dutch Wadden Sea

B3-05

R. Dekker

Long-term investigations on intertidal soft bottom benthic invertebrates in the Dutch Wadden Sea have shown a strong year-to-year variation in the reproductive success in these animals. In 1985, settlement experiments with 12 x 12 azoic plots were started to investigate the impact of the presence or absence of macrobenthos components on settlement and survival of juvenile bivalve molluscs. This year, a mid-tide level sandy area was compared with an area higher on the shore with siltier sediments. Small sub-areas within the azoic plot were repopulated with adults of *Arenicola marina* and *Cerastoderma edule*. After the settlement and survival of juvenile bivalves, a biweekly sampling programme was carried out in repopulated and not-repopulated azoic areas, repopulated areas and in surrounding control areas.

Compared with 1985, the settlement of *Macoma balthica* (4300-m⁻² vs. 90 000-m⁻²) was much reduced, but the settlement of *Cerastoderma edule* (9500 vs. 8000-m⁻²) and *Mya arenaria* (18 000 vs. 25 to 30 000-m⁻²) remained about the same. In the experimental areas settlement of *Mytilus edulis* was observed, but the young settlers soon disappeared. At the sandy station, settlement of newly immigrated *Ensis directus* occurred in low numbers. In all species, settlement was higher on the lower

sandy site than on the higher siltier site. However, eventual survival in *M. balthica* and *C. edule* appears to be higher in the siltier area.

Both on the sandy and the siltier plots, settlement of all species was highest in the azoic area, lowest in the controls with undisturbed animal communities and intermediate in the partly repopulated areas.

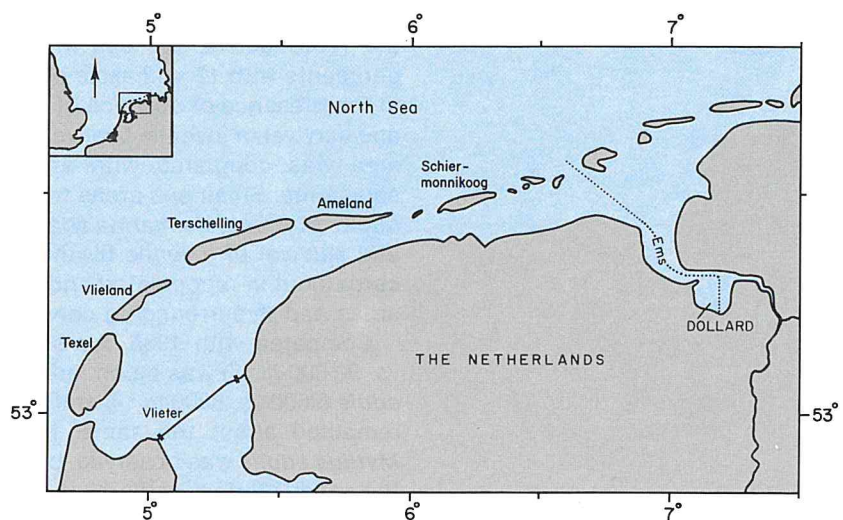
1.2.2.7. Population dynamics of the Eiderduck in the Wadden Sea

B3-03a

C. Swennen

A control of breeding Eiders showed that Eiders ringed in 1964 are still nesting, which is an indication that these birds can grow rather old. They have survived the period of high mortality in the sixties, caused by pesticides. Analysis of our data on fledging success of Eider ducklings between 1962 and 1986 shows that besides large fluctuations between successive years in numbers of recruits, there was a severe depression in numbers of fledglings between 1966 (1971) and 1978. From 1978 onwards, recruitment has again fluctuated round the level of before 1966. These fluctuations are largely independent of the number of ducklings born and of the number of gulls present. Earlier, fledging success had been found to be largely determined by gull predation on ducklings during their first 10 days of life. Lack of sufficient small food animals influences the behaviour of ducklings in such a way that they easily fall prey to gulls. The cause of the food failure is unknown, but it may be attributed to some other biological phenomena which occurred in the North Sea in the same period as the fledging failure: a depression in the yearly blooms of *Phaeocystis pouchetii*, a failure in the production of herring larvae, and on the other hand, an explosion in the stock of sprat. Neither *Phaeocystis* nor herring larvae can serve as food for Eider ducklings, and sprat is not a predator of ducklings. The correlation only indicates that there may have been a common cause that operated over a wide area and induced changes in food chains.

Wadden Sea with geographical names mentioned in this report.



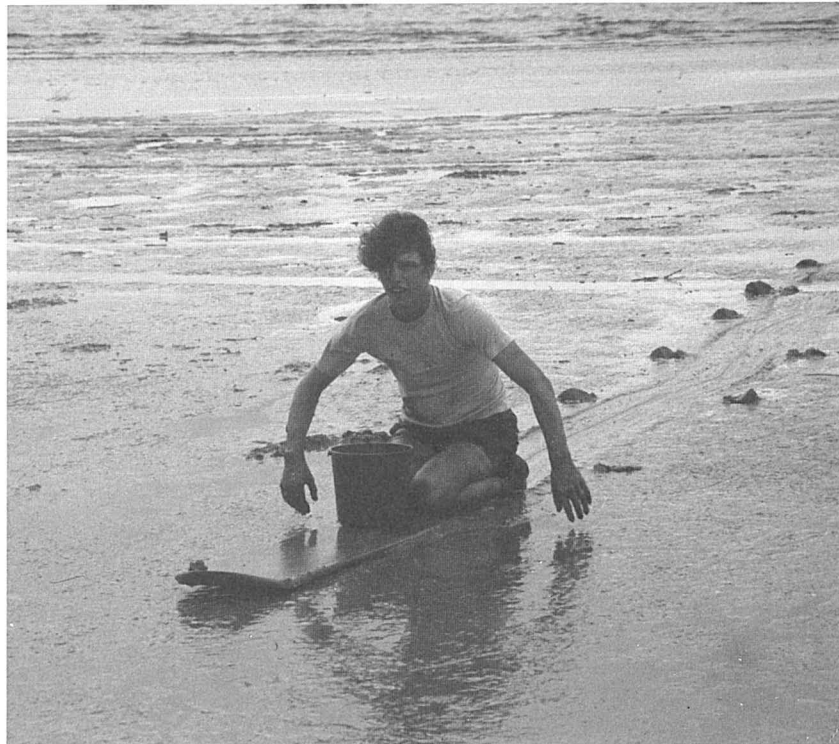
1.2.2.8. The role of Pattani Bay (Thailand) in the life cycle of migratory palaeartic waders

B3-03b

C. Swennen

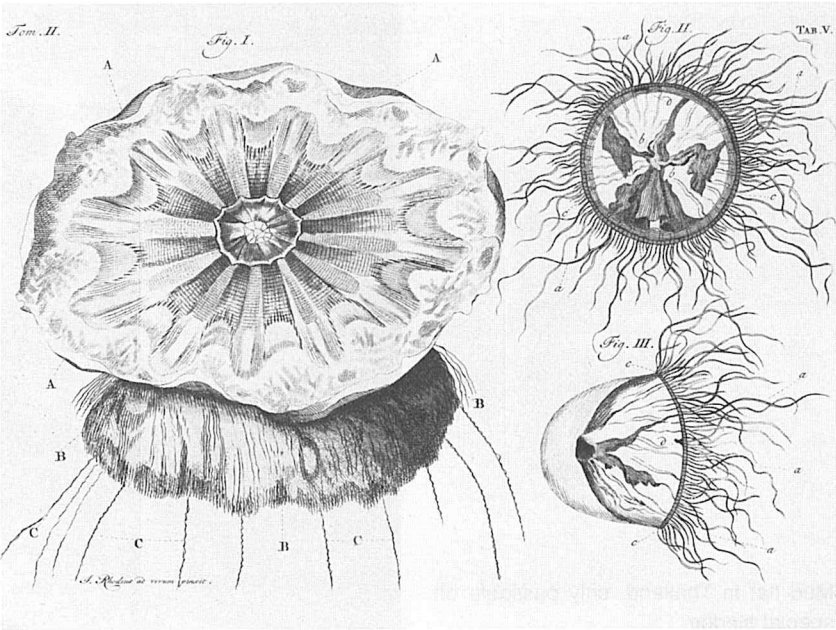
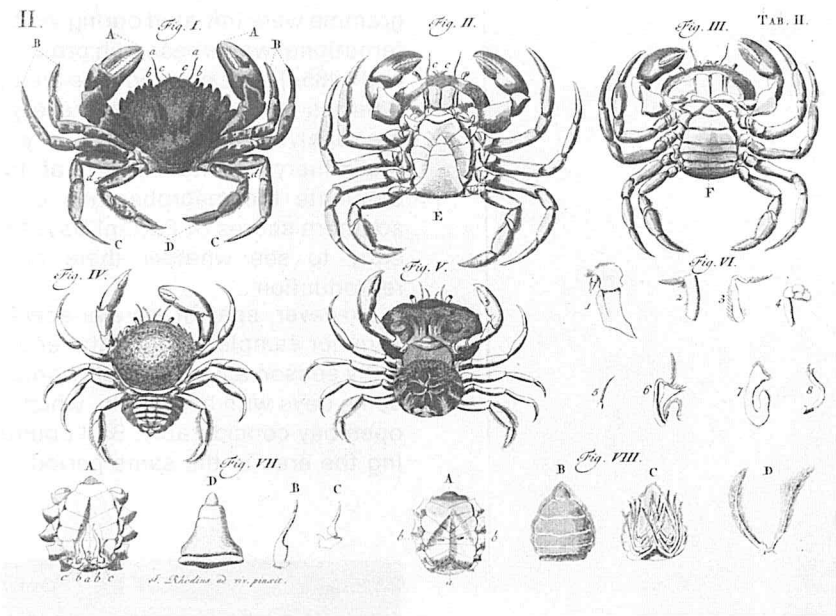
In cooperation with the Prince of Songkla University in Pattani (Thailand), a joint project has been started to study the role of Pattani Bay in the life cycle of migratory palaeartic waders. Bird counts and a sampling programme were initiated during visits to Thailand for participation in the international wader research project (Interwader project) in SE Asia in 1984 and 1985. These programmes are continued by staff members of the PSU. Benthos samples are taken every month and sent to Texel, where they are analysed and ash-free dry weight values are determined. The preliminary results show that in number and biomass, polychaetes dominate the macrobenthos of the muddy intertidal flats along the southern shores of Pattani Bay. After 9 months of sampling, it is still too early to see whether there are seasonal trends in biomass or in reproduction.

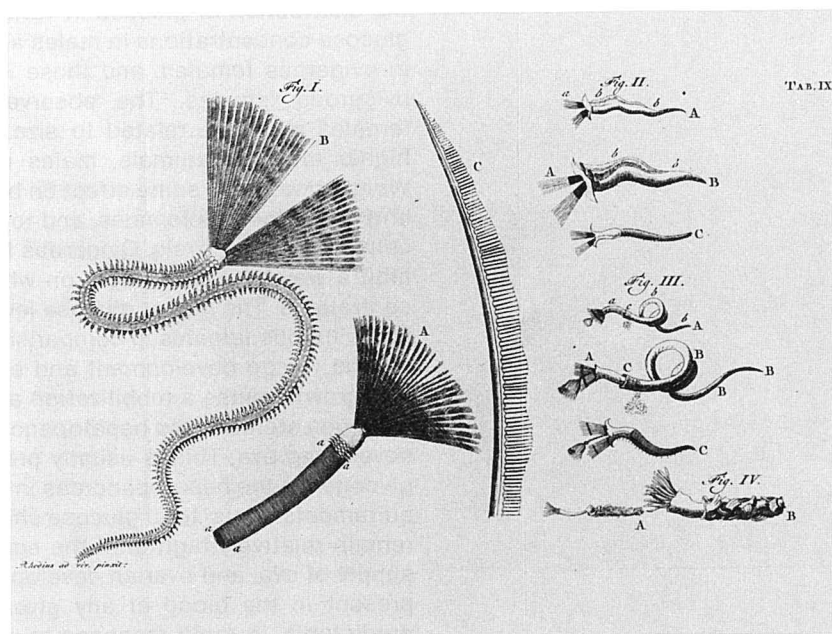
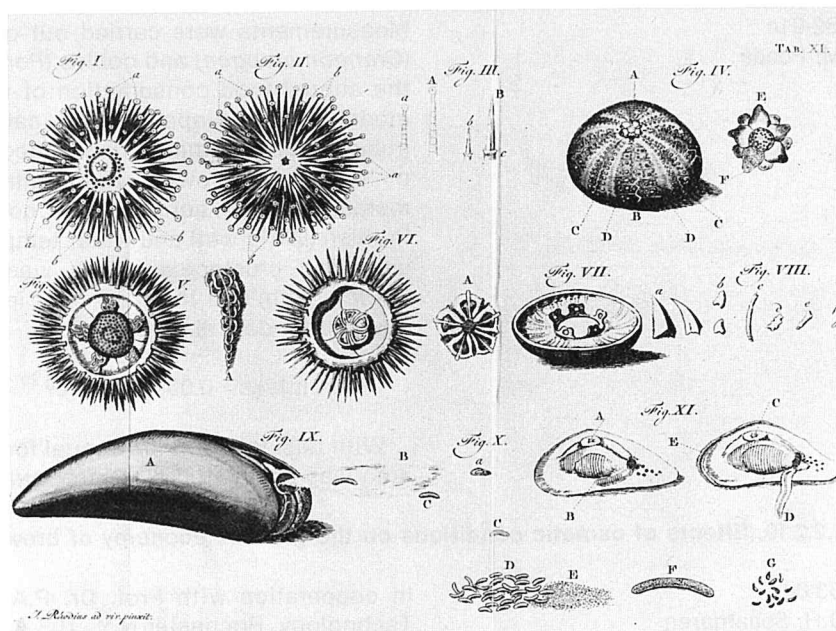
However, spat of several species of bivalves were found only in the summer samples around the end of the dry season, whereas during the rainy season a high mortality among some invertebrates was found after some days with heavy rain, which lowered the salinity of the water in the open bay considerably. Bird counts showed that most waders were leaving the area in the same period.



Mud flat in Thailand, only passable on special sledge.

Job Baster (1711-1775) was born at Zierikzee, to which town he returned as a doctor after his medical studies in Leiden (1728-1731) under among others Boerhaave. Besides medical problems he studied local flora and fauna around Zierikzee. Many of these studies were compiled in his book "Opuscula subsevica" (Dutch edition: "Natuurkundige Uitspanningen" 1759-1765). They show Baster as a critical and original scientist. Jan Rhodius (17??-1780) made the drawings and coloured the plates in this book. He was a house-painter at Zierikzee and worked on the plates in winter when he had little employment.





1.2.2.9. Energy budget and growth experiments of gobies and shrimps

B2-01c
M. Fonds

Measurements were carried out on metabolism and growth of shrimp (*Crangon crangon*) and gobies (*Pomatoschistus* spp.) for calculations of the annual food consumption of these species in the Wadden Sea. A model was developed for the calculation of the daily food intake of gobies, based on maintenance food requirements and the net conversion of food into growth. The maintenance food intake is related to metabolism and, consequently, correlated with the metabolic weight of the fish ($W^{0.8}$ g wet) and water temperatures (T , °C). The net food conversion for crustacean food was estimated at approximately 1.5 (food/growth) and the daily food intake in gram wet weight per fish per day can be described by:

$$\text{Food intake} \approx 0.005 W^{0.8} \times e^{0.1T} + 1.5 \times \text{growth}.$$

With this equation the annual food consumption of gobies in the Delta area was calculated by G. DOORNBOS (DIHO).

1.2.2.10. Effects of osmotic conditions on the glucose economy of brown shrimps

B3-04
D.H. Spaargaren

In cooperation with Prof. Dr. P.A. Haefner Jr. (Rochester Institute of Technology, Rochester N.Y., U.S.A.) a manuscript was completed on the effects of osmotic conditions on the glucose economy of brown shrimps, *Crangon crangon*. Special attention was paid to the influence of sex on the distribution of glucose in various body compartments. On average, glucose concentrations in males are slightly higher than those observed in ovigerous females, and these in turn are higher than those of non-ovigerous females. The observed differences between males and females might be related to size. Glucose concentrations tend to be higher in small animals, males usually being smaller than females. Weight does have some effect on blood glucose concentrations of males and non-ovigerous females, and to a lesser degree, on whole animal and cellular glucose levels. Ovigerous females, on the other hand, do not exhibit a weight-related effect on whole animal and cellular glucose concentrations. The higher glucose levels and associated greater variability for ovigerous females in comparison with non-ovigerous females can be related to egg development and extrusion. Active ovarian development and growth cause a mobilization and transport of reducing sugars from glycogen stores in the hepatopancreas to the ovary for redeposition into developing ova. This is usually preceded by an increased deposition of glycogen in the hepatopancreas in preparation for future reproductive requirements. Thus, total glucose should be high in ovigerous females and remain relatively high until the eggs hatch, the ovary is depleted of its supply of ova, and ovarian development ceases. The quantity of glucose present in the blood at any given time will, understandably, be less predictable, in rapid response to varying demands.

1.3. NORTH SEA RESEARCH

1.3.1. Dynamical oceanography

1.3.1.1. Experimental dynamical oceanography

H2-03

C. Veth, J.J.M. van Haren,
L.R.M. Maas, J.T.F. Zimmerman

The interpretation of collected data from Lagrangian drogue studies in the North Sea was taken up again, thanks to a ZWO grant. Comparison of the Lagrangian shear components with the Eulerian revealed that:

- 1) both are inversely proportional to the separation distance of the drifters
- 2) some Eulerian shear matrix components are strongly correlated
- 3) Lagrangian deformations contain more intense higher frequency components than the Eulerian ones, probably due to effects of bottom topography.

During spring 1986 a comprehensive experiment concerning the frontal structure of water masses in the central North Sea was carried out (see 1.3.5.). This large experiment was preceded by analyses of data collected during experiments in 1981 and 1982. The results show that the vertical structure of tidal and inertial currents in a stratified shelf sea strongly depends on frequency, *i.e.* whether or not the frequency concerned is super- or subinertial. The vertical structure of the tidal currents could be used for estimating the vertical eddy viscosities.



Fig. a.

Observed ellipses of subinertial (O_1), inertial (f) and superinertial (S_2) currents in the stratified Central North Sea (June 1981). The pycnocline depth is indicated by a dashed line. Water depth is 50 m. Rotation senses are indicated by arrows. Phases are indicated by sticks. Notice the 180° phase shift of the inertial current, indicative of its strongly baroclinic character.

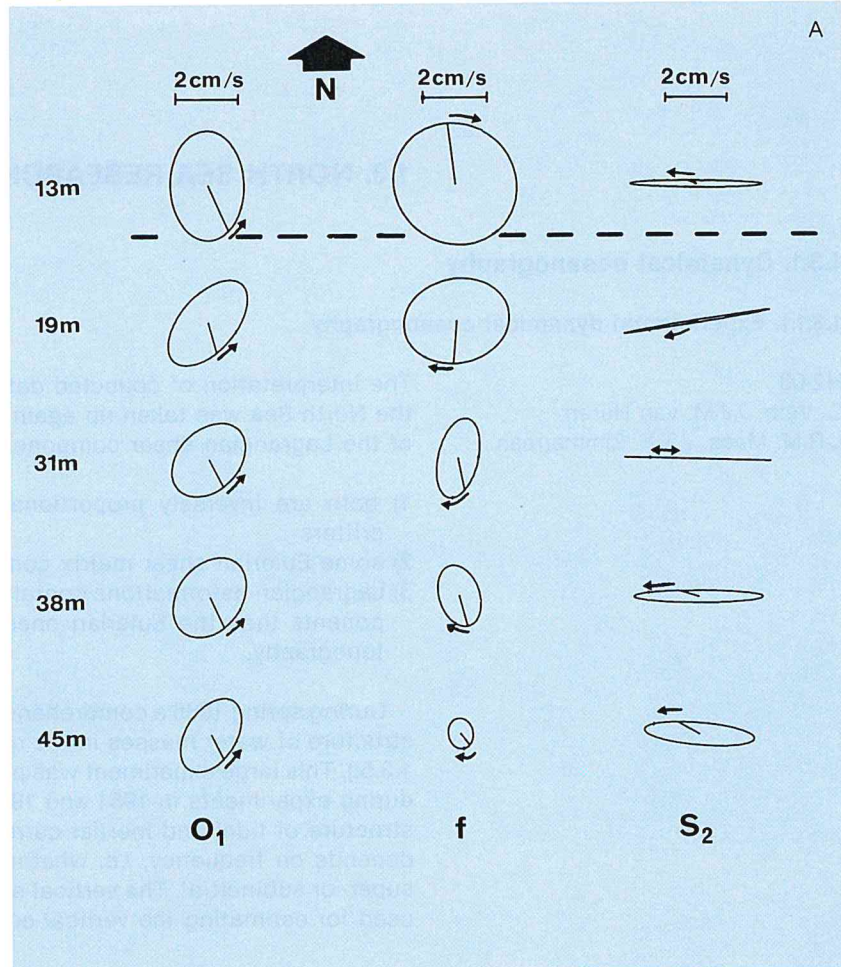
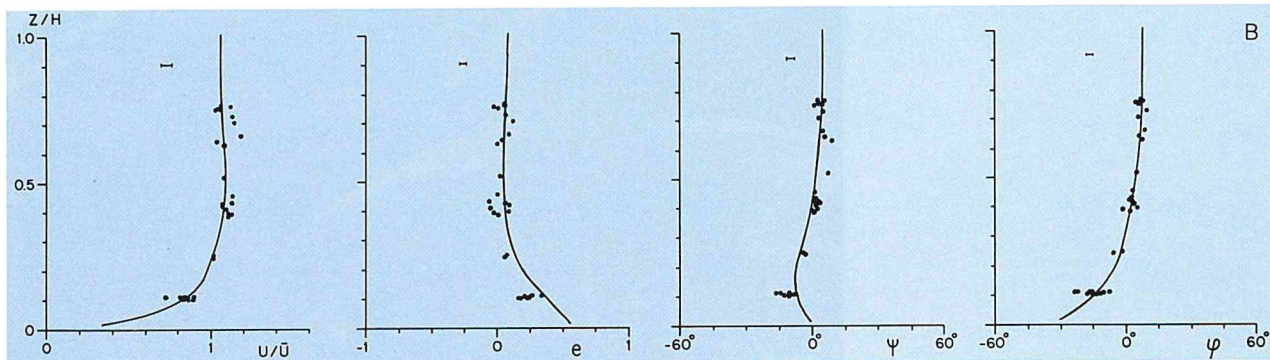


Fig. b.

Amplitude ($u/\bar{U}$), ellipticity (e), inclination angle (ψ) and phase angle (φ) values, which can be calculated from the ellipses in Fig. a (denoted by dots) may be compared to theoretical profiles as a function of depth z , scaled by total depth H , as for the M_2 tidal component shown here. The dominating influence of bottom friction is clearly visible.



1.3.1.2. Theoretical dynamical oceanography

H2-05

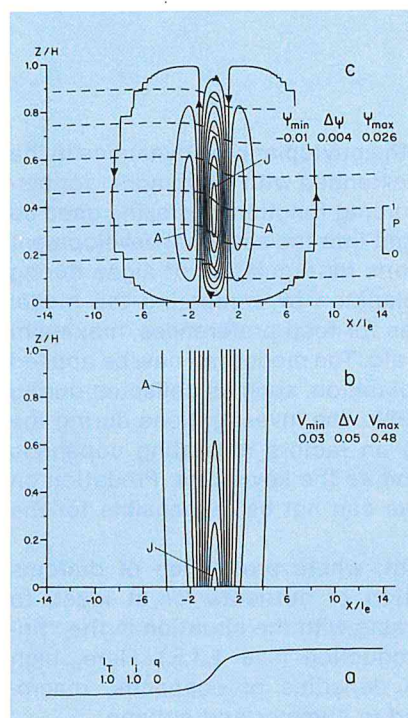
L.R.M. Maas, J.T.F. Zimmerman

A complete theory that describes both the generation of internal gravity waves and of vorticity waves by tidal currents flowing over a depth-varying topography in a stratified shelf sea was developed and finished this year. It unifies the generation of internal tides and baroclinic residual currents. In contrast to depth-averaged barotropic rectified flows, baroclinic residual currents also have a cross-isobath circulation with a downslope current near the bottom.

A theory of rectification in lateral viscous boundary layers has also been completed. Inconsistencies in earlier theoretical work were removed by introducing the concept of "double boundary layers", which physically means the incorporation of self-advection of vorticity by the residual flow. By this, it has been shown that for increasing width of the tidal basin, the rectified jet along the walls keeps a finite width. This work was carried out in collaboration with the Center of Mathematics and Informatics in Amsterdam.

Together with the Governmental Industrial Research Institute in Kure (Japan), a study was finished on the frictional vertical structure of residual currents over an undulating seabed. The concurrent existence of Ekman and Stokes layers near the bed was shown to lead to complicated residual currents there, with the bottom current being either up- or downslope depending on the relevant parameters. The results are thought to be of importance for sediment transport problems, but the theory is probably not fully consistent yet, as it seems to need the same "double boundary layer" approach as in our study of the lateral boundary layers, reported above.

Finally, a review of horizontal dispersion processes by tidal and residual currents was completed, incorporating some new results, viz. the probable existence of a "shear-cascade" dispersion process by which matter in a tidal shelf sea is dispersed in successive stages, each stage being characterized by its own shear-dispersion formalism.



For a monotonously sloping small-amplitude topography profile (a) one may calculate the tidally induced along-isobath residual current V (b), cross-isobath streamfunction field ψ (solid) and pressure field p (dashed) (c) as a function of depth (all variables in non-dimensional units) in a continuously stratified sea.

Topography scale l_t and internal Rossby deformation Radius l_i (which measures the degree of stratification) have been chosen equal to the tidal excursion amplitude. Fig. b shows bottom intensification of the along-isobath residual current. Fig. c demonstrates that a downslope cross-isobath bottom flow is established.

1.3.2. Sediment transport and sedimentation

H3-01

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

Data on the concentration, particle size, organic content and elementary composition of suspended matter in the North Sea, collected in 1980-1984 (particularly in the Norwegian Channel and the Skagerrak) were assembled. They show that the suspended matter varies characteristically in all these aspects in the different regions of the North Sea: the central and northern North Sea, the Norwegian Channel, the Skagerrak, the southern North Sea with two subregions (the English coastal waters and the continental coastal waters), the Channel inflow, the Baltic inflow and the North Atlantic inflow. The variations are related to the sources of the particulate material, the relative amount of organic matter, geochemical processes in the bottom and resuspension (particularly in the case of Mn) and to the degree of exchange of suspended material with bottom material.

Surface sediments of a number of box cores collected in 1984 were sampled for occurrence of REE (with G. Klaver, University of Amsterdam). Results show a definite relationship between grain size and distribution of the trace elements. Clays contain 5 x higher contents of Sc, Rb, Cs, LREE (La, Ce, Sm) and Th than do sands and silts. In the latter Hf and Zr have 3 x higher concentrations. Comparable concentrations have been found for Na and HREE (Tb, Yb, Lu and Ta). Some elements (Co, Fe, As, Sb) show enrichment in the surface layers caused by accumulation in the oxygenated zone.

1.3.3. The pelagic system

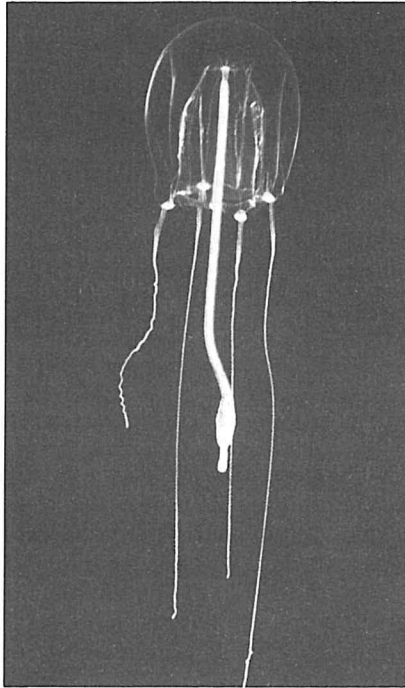
1.3.3.1. The pelagic system of mixed coastal areas

B4-01, B2-03

H.G. Fransz, W.W.C. Gieskes,
M.J.W. Veldhuis, F.A.C. Kouwets
R. Daan, B. Kuipers

The SEAWAQ model, which simulates the phytoplankton dynamics in the Southern Bight of the North Sea, was extended with a submodel for herbivorous zooplankton, to replace the forcing function of grazing used so far. It will now be possible to gain insight into the seasonal development of the herbivores and into the conditions for regulation of algae during summer by copepods and microzooplankton by comparing the model behaviour at different parameter values for food preferences, maximum growth and grazing rates, cannibalism etc. The model can now be applied for the interpretation of field data on plankton, such as collected during the REM island project in 1984 and 1985. The investigations during the REM-Island project in 1984 and 1985 on factors regulating copepods populations in summer, pointed to food as the key-factor. Predation on copepod eggs, larvae and adults alone can not be responsible for the observed summer-decline.

The situation in the Southern Bight, where production of diatoms decreases in summer due to depletion of nutrients (or at least, to changes in the nutrient-balance) contrasts with the situation in the "Frisian Front"-area, a zone of new production (see 1.3.5.). Here, high chlorophyll concentrations and high densities of copepods, macroplankton and pelagic fish are observed in summer and autumn.



Hydromedusae *Sarsia tubulosa*

The study of pelagic predators as regulators of zooplankton production, therefore, focussed on the Frisian Front for the years 1986 and 1987, where food limitation can be excluded as the key-factor (see also 1.3.5.).

The research on factors limiting algal growth during summer in the coastal zone of the Southern Bight of the North Sea was hindered by several practical difficulties. The bio-assay method proposed to test filtered sea water with cultured phytoplankton species proved to be useless, since P and Fe were removed almost completely from the water upon sterilization with a $0.15\ \mu\text{m}$ filter membrane. Therefore, unfiltered sea-water samples were incubated under controlled conditions in the laboratory, to follow the growth of the contained phytoplankton community by cell counting and by measurement of the chlorophyll concentration. However, owing to problems concerning the collection of sea water from interesting points in the Southern Bight, and the conditioning of the climate-room, results obtained so far were limited.

A research project on *Phaeocystis* (in cooperation with the State University of Groningen) was finished in August 1986. In this study the ability of *Phaeocystis* to utilize various phosphate compounds in the coastal waters of the North Sea was investigated. During a joint European cruise with R.V. "Charles Darwin" along the coastal zone of the North Sea in May, concentrations and exploitation of soluble reactive phosphate (SRP) and enzymatic hydrolysable phosphate (EHP) were estimated. In dense blooms of *Phaeocystis* SRP was very low, usually near the detection limit ($0.02\ \mu\text{mol}\cdot\text{dm}^{-3}$), but EHP could be present in concentrations up to $0.3\ \mu\text{mol}\cdot\text{dm}^{-3}$. At the same time the activity of alkaline phosphatases, enzymes required to hydrolyze phosphomono esters, was very high and comparable with those of phosphate-deprived *Phaeocystis* cultures. Based on these data the release of phosphorus from the EHP pool was calculated and compared with the uptake rate of inorganic phosphate. In some areas phosphorus originating from the EHP pool exceeded that of the inorganic pool, indicating the great importance of organic phosphates as a potential nutrient pool for phytoplankton growth.

A joint Belgian-Dutch paper on calculation methods in grazing experiments with the ^{14}C method was accomplished and formed the last contribution from the BION-Discussion Group on grazing. In the autumn, a new Discussion Group was started on assimilation, growth, egg production, faecal pellets and respiration in copepods. The meetings will also be attended by zooplanktonologists from Belgium and Germany.

In connection with the work on grazing of zooplankton (see 1.3.3.3.), a few continuous cultures of marine diatoms were maintained, to extend the knowledge and experience concerning the culturing of marine phytoplankton.

1.3.3.2. Sedimentation of organic matter

B3-01

G.C. Cadée

The REFLEX (Repeated Fladen Ground Experiment) data have been completed. Daily sedimentation amounted to ~1% of the daily primary production and 0.1-1% of the standing stock. This was based on a comparison of particulate carbon, chlorophyll and phytoplankton cell numbers in sediment traps (at 40, 60 and 70 m) and in the water column above these traps. All comparisons gave roughly the same result. This low sedimentation rate contrasts sharply with earlier estimates in the same area during FLEX (1976), when 20-35% of the primary produced materials was found to sink daily (DAVIES & PAYNE, 1984. Mar. Biol. **78**: 315-324).

1.3.3.3. Experimental investigations on zooplankton

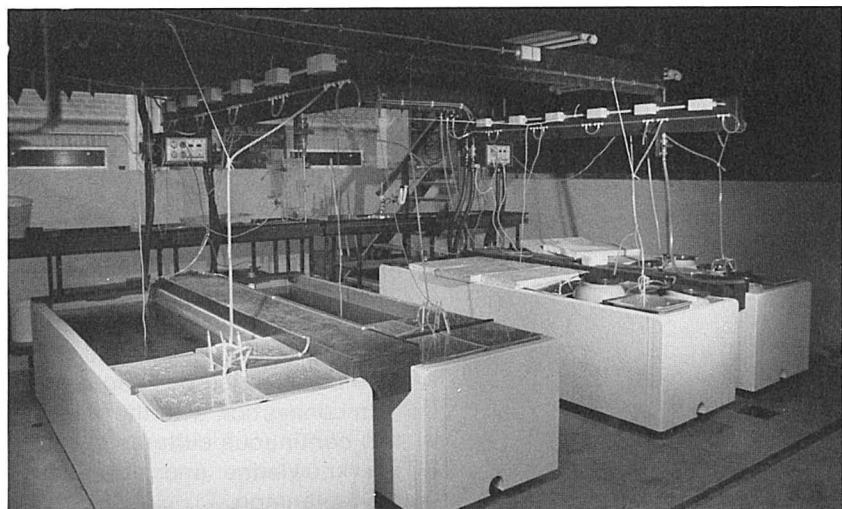
B4-04

W.C.M Klein Breteler,
M.J.M Reichert

Pelagic calanoid copepods were cultivated continuously in the laboratory for experimental purposes. The species *Temora longicornis* has been bred through the 70th generation and *Pseudocalanus elongatus* has been cultivated for 20 generations. Three generations of the latter species were raised under 16 different conditions of temperature and food. Stage of development, body length, weight and lipid content were measured. In both species, body length seems to be controlled both by temperature and food level.

An automatic food control system was further developed and tested, and may become operative next year.

The technique of continuously culturing marine algae was improved. After several initial complications the constant temperature culture rooms functioned well. With varying success the following diatoms have been kept in continuous cultivation: *Streptotheca thamensis*, *Nitzschia longissima*, *Stephanopyxis turris*, *Ditylum brightwellii*, and *Thalassiosira eccentrica*.



Temperature-control basins to incubate copepod cultures.

A culture of the colonial flagellate *Phaeocystis pouchetii*, received from M. Veldhuis (University of Groningen), was kept in continuous culture for three months before it collapsed. Single cells as well as colonies were present throughout the period of growth.

Algae other than diatoms were isolated and an attempt will be made to grow them in continuous culture. Since cultures collapsed regularly and since algal growth rates varied considerably, further improvement of the culturing technique is necessary.

Grazing experiments with the copepod *Temora longicornis* were continued. The experiments focused on the effect of various factors on food intake of copepods, among other things concentration of food in uni-algal suspensions, adaptation of the copepods to food type, and physiological state of the food algae. The results of these experiments are being worked out.

1.3.3.4. Pelagic predators

B2-03

B.R. Kuipers, R. Daan

The investigations on the Rijkswaterstaat measuring platform "Noordwijk" in 1984 and 1985 on the effect of different factors involved in the population development of copepods in summer, pointed to food limitation as the key-factor. Predation on copepod eggs, larvae and adults alone cannot be responsible for the observed summer-decline.

The situation in the Southern Bight, where production of diatoms decreases in summer due to depletion of nutrients (or at least, to changes in the nutrient-balance) contrasts with the situation in the "Frisian Front"-area, a zone of new production (see 1.3.5.). Here, high chlorophyll concentrations and high densities of copepods, macroplankton and pelagic fish are observed in summer and autumn. The study of pelagic predators as regulators of zooplankton production, therefore, focused on the Frisian Front for the years 1986 and 1987, where food limitation can be excluded as the key-factor.

1.3.3.5. Mortality in plaice eggs and larvae

B2-01d

F. Hovenkamp, J.J. Zijlstra

This project is a continuation of the study of density-dependent mortality in juvenile plaice. It showed that between-year fluctuations and year-class strength are already generated in the open sea, during the egg and larval stages. The new project aims at disclosing the factors responsible for these fluctuations and now focuses on "in vivo" measurements of growth rates of larval plaice from different spawning grounds. Accurate age determinations (by the otolith increment technique) will be used to find out more about temporal or spatial variations in mortality rates. Preliminary studies on larval otoliths show that they are formed of increments the width of which is related to the growth of the larvae. These increments are assumed to be formed daily, an assumption which has to be verified in rearing-experiments. Furthermore, an attempt will be made to use the increment growth patterns to identify settling larvae from different spawning grounds.

1.3.4. The benthic system

1.3.4.1. Synoptic Mapping

B1-02, B2-02e, B1-07, H1-08
P.A.W.J. de Wilde, F. Creutzberg,
G.C.A. Duineveld, J.M. Everaarts,
B.R. Kuipers, J.H. Vosjan

In the period 15 April to 2 May, a Synoptic Mapping Project was carried out in the southern and central North Sea. The Synoptic Mapping of the benthic fauna of the North Sea is an international programme initiated by the Benthic Ecology Working Group of ICES. The expedition was favoured by relatively quiet weather conditions and was most successful. The entire programme, including sampling with box corers and Van Veen grabs, 5.5-m beam trawls and large vertical nets at 71 stations, was all but completed. From undisturbed boxes, large numbers of subsamples were obtained for ATP and ETS determinations, and studies of meiofauna, sediment characteristics and algal pigments. Organisms to be used for contamination studies were selected from the Van Veen and beam trawl catches. Additional counting of sea-birds and mammals and registration of echo-sounding patches were carried out during sailing. No less than 346 box-core samples were taken and passed over 1-mm sieves. The retained material was sorted and preserved in formalin; 59 trawl catches were sorted, counted and partly measured or stored for further analysis.

Financial support from the Tidal Water Division of Rijkswaterstaat for elaboration of the samples is acknowledged.

1.3.4.2. Benthos in boundary systems

B2-02f
R.P. Heyman

The remarkable macrobenthic zonation found at the southern border of the Oyster Ground, the Frisian Front (see 1.3.5.), has given rise to the question whether in other boundary systems—with different hydrodynamic conditions—comparable faunistic transitions exist. If so, they may contribute to our understanding of the mechanisms through which such zonations develop.

Recognition of benthic zones around the Dogger Bank is, therefore, the first object of this project, which started in spring 1986. A benthic survey has been carried out with R.V. "Aurelia" (NIOZ) and R.V. "Holland" (RWS) along four transects across the Dogger Bank, coinciding with the ICES Synoptic Mapping 1986 transects, but with a higher frequency of sampling. At each of the 55 stations visited, 5 Reineck box cores were taken. Simultaneously, CTD casts were made, water samples taken for chlorophyll *a* determination in the water column, and bottom samples for the measurement of median grain size, mud content and POC content of the sediment.

One of the first results is the detection of a zone of *Amphiura filiformis* in densities of more than 1000·m² along the northern boundary of the Oyster Ground just south of the Dogger Bank. The chlorophyll *a* content of the water column is low on the Dogger Bank (<1 mg·m⁻³), whereas the values measured at the northern Oyster Ground are high (4-6 mg·m⁻³).

1.3.4.3. Metabolism of benthic fauna

B1-04

P.A.W.J. de Wilde, S. Cramer

Oxygen uptake in *Callianassa subterranea* was measured in relation to its body size and temperature, in the NIOZ laboratories. From the results it was estimated that about 3-5% of the total community respiration in the Oyster Ground area in the central North Sea is effected by this species.

From 3 to 7 March and again from 16 to 19 September a joint measuring and calibration exercise was carried out in cooperation with DIHO (Yerseke) in the Oosterschelde and Grevelingen comparing different types of bell jars in use by the institutes. R.V.s "Aurelia" and "Luctor" participated in this project.

1.3.4.4. Bioturbation

B1-03

P.A.W.J. de Wilde

Research dealing with bioturbation focused mainly on the behaviour and activity of *Callianassa subterranea*, a dominant crustacean in the central North Sea. Locally numerical densities of more than 100 specimens·m⁻² are found. In silty sediments, *Callianassa* inhabits a large and complicated burrow system with several galleries and vertical ventilation shafts. The burrows of small and large animals are intricately interwoven, never making contact with each other. It has been estimated that the burrows of *Callianassa* alone, may enlarge the surface area of the sea bed more than two times.

Due to intermittent ventilation activities, the oxygen saturation in the burrow is highly variable, showing near-anoxic conditions towards the end of inactive periods, and high oxygen contents during outbursts of pumping. On average, the oxygen saturation in the burrows was below 70%.

1.3.4.5. The role of carnivores

B2-02a-c

F. Creutzberg, G.C.A. Duineveld

The series of "Aurelia"-cruise reports on the benthic fauna of the southern North Sea has been completed with the edition of No. 9, which comprises an extension to the north of our grid of beam-trawl stations. A further extension of our grid to the north (up to 56°15' N) was accomplished by the participation in the ICES Synoptic Mapping with R.V. "Tyro" in April (see 1.3.4.1.); 12 of the 71 ICES stations could not be sampled with the beam trawl because of sand dunes or stones. The hauls at the remaining 59 stations were successful.

The comparative study on the role of the lesser weever (*Trachinus vipera*) at a clean sandy station and the dab (*Limanda limanda*) at a muddy station in the southern North Sea was completed. Unlike dabs, which (at the muddy station dominated by *Amphiura filiformis*) apparently live in an abundance of benthic organisms, the lesser weever withdraws a major part of its food from the pelagic system through the consumption of gobies, which mainly feed on copepods and mysids.

1.3.4.6. Energy budget of carnivores

B2-02d
M. Fonds

Measurements of metabolism, food consumption and growth of young cod demonstrated that the standard daily oxygen consumption is about equal to the daily maintenance food consumption. This opens the possibility of calculating maintenance food requirements from measurements of metabolism.

The net food conversion of cod fed with shrimp appeared to be much better (1.3 - 1.5 food/growth) than in cod fed with mussel meat (2.1 food/growth). However, the lipid and protein retention appeared to be similar for shrimps and mussel meat as food, and the suggestion arises that the cod does not utilize the 20% glycogen of the mussel meat. This has consequences for the calculation of annual food consumption of fish populations, based on the net growth efficiency.

1.3.4.7. Ecophysiology of benthic crustaceans

B3-04
D.H. Spaargaren

In 1986 research was carried out on two different aspects of the project on the ecophysiology of crustaceans, viz. (1) the relation between hydrodynamical properties of benthic crustaceans and their distribution and (2) the biological utilization of chemical substances, with particular stress on glucose.

Benthic crustaceans show a strong morphological variation which is closely related to their hydrodynamical and physiological properties. Larger animals generally have a lower buoyancy, but their physiological stability is higher. To compensate for the disadvantages of the loss in buoyancy with increasing size, numerous body shapes have developed, with either an improved streamlining or a better grip on the substratum. In the marine environment, these hydrodynamic properties are important for the distribution of a species.

To obtain more insight into the distribution of the various crustacean species, data on their density distribution (from the North Sea trawling surveys; CREUTZBERG *et al.*, 1976-1984 internal reports NIOZ) were analysed in relation to some hydrographical parameters (water temperature, salinity, depth, sediment composition). For the 23 most abundant species considered, it appeared that their numerical densities did not change much during the year. Their spatial distribution, however, clearly changed seasonally. In summer, population centres (the average geographical positions of specimens within a research area) are generally located near the coast; in winter they are found more centrally. Also, in the crustaceans considered the number of species appears to increase at greater depths, whereas their numerical densities decrease. Related to the shift in the position of the population centres, the annual temperature range to which the various species are exposed is very small (6-12°C). Further research will be devoted to the relation between the density distribution and those morphological characteristics that determine the hydrodynamic properties of the species.

Fig. a. Geographical positions of the population centres of 23 crustacean species in summer (○) and winter (●). In winter the population centres of all species considered fall into the hatched area.

The most abundant species: 1. *Crangon crangon*, 2. *Crangon allmanni*, 3. *Pagurus bernhardus*, 4. *Pontophilus trispinosus*, 5. *Macropipus holsatus*. The species are numbered in order of decreasing abundance.

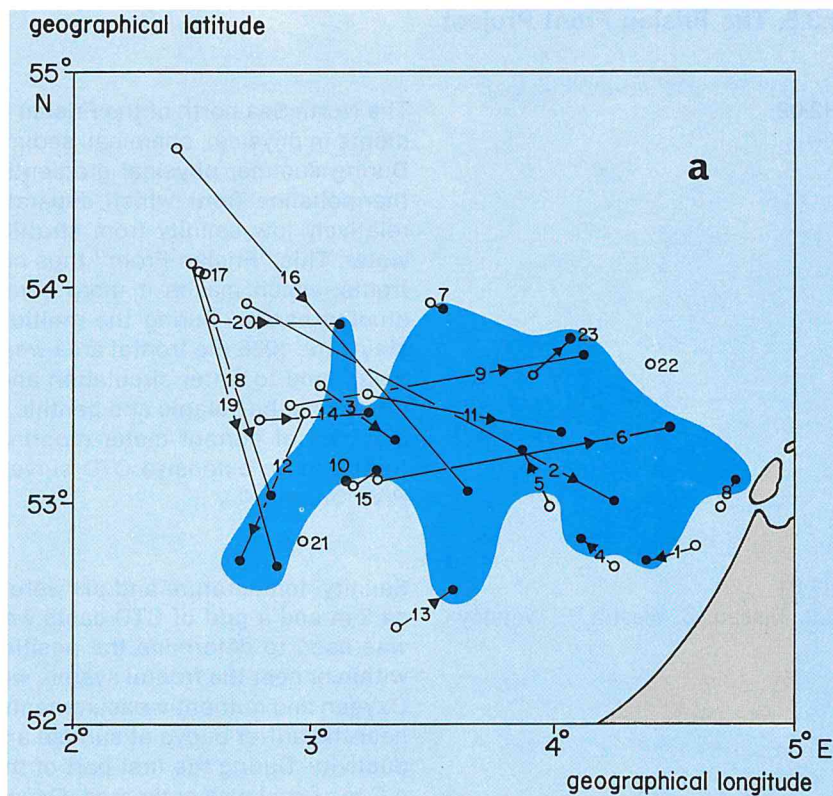


Fig. b. The relation between densities of 23 different species (log numbers/10.000 m²) and average salinity of occurrence.

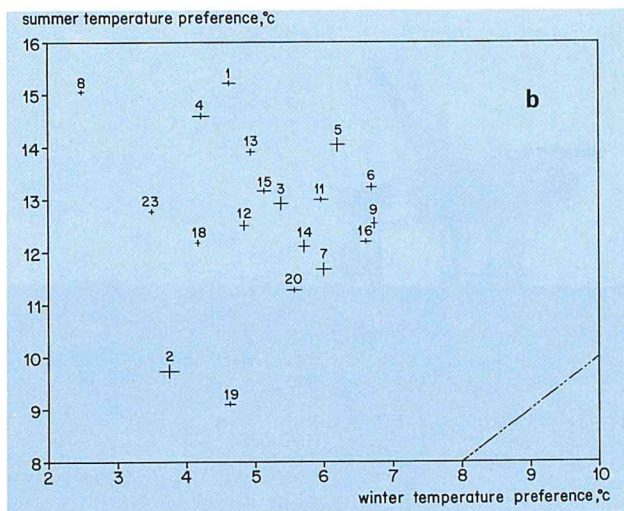
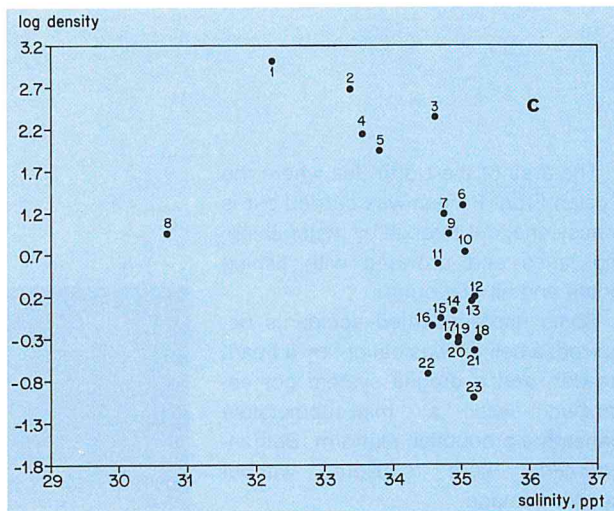


Fig. c. Average temperatures experienced by various crustacean species during summer and winter. The horizontal lines through the symbols indicate the standard errors of the means.



1.3.5. The Frisian Front Project

H2-02

The North Sea north of the Frisian Islands is characterized by strong gradients in physical, chemical, sedimentological and biological properties. During summer physical gradients in the water column develop a real thermohaline front which separates vertically-mixed coastal water of relatively low salinity from stratified, higher-salinity central North Sea water. This "Frisian Front" thus combines features of coastal and tidal fronts, which makes it more complicated than coastal or tidal fronts studied earlier. During the multidisciplinary "Frisian Front Project" in May-June 1986 the frontal area was studied *in extenso*, special attention being paid to water circulation and transport across the front and their effects on the pelagic and benthic communities. To reach this goal large numbers of current meter moorings were placed in the vicinity of the front and an extensive CTD survey was accomplished in the area with R.V. "Aurelia".

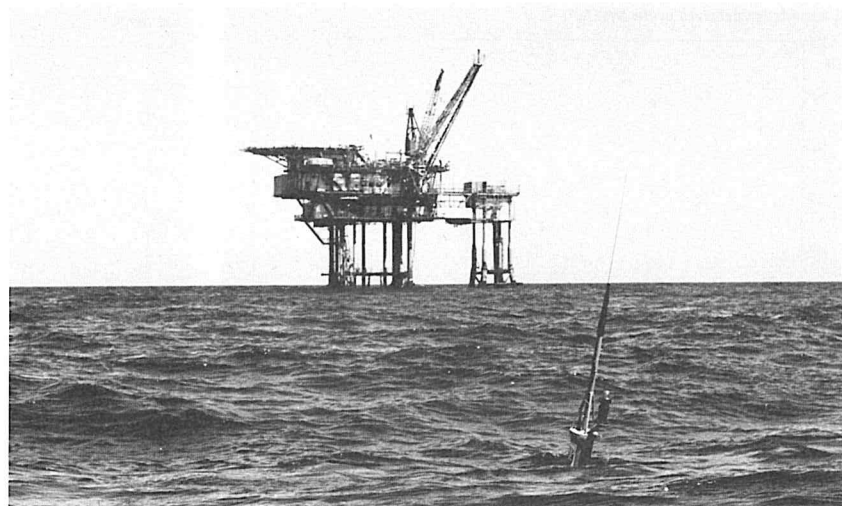
H1-01

S.B. Tijssen, C. Westra, F. Wetsteyn

Salinity, temperature and pH were measured continuously at a depth of ca 3 m and a grid of CTD casts was sampled. The information obtained was used to determine the position of the frontal zone. Water masses within or near the frontal system were marked with a drifter-buoy system. Oxygen and nutrient measurements were carried out across the front and near the drifter buoys at sunrise and at sunset to determine primary productivity. During the first part of the cruise, a primary productivity of $5.0 \text{ g C} \cdot \text{m}^{-2} \cdot \text{d}^{-1}$ was estimated. Oxygen saturation values as high as 139% were measured. The surface temperature increased from 6°C to 14°C across the front, the bottom temperature did not exceed 10°C, and the salinities remained between 33.0 and 35.3‰. It was concluded from drifter observations that the residual current was very wind-dependent.

The area of the North Sea where the Frisian Front Project was carried out is a busy one, cut through by major shipping lanes and crowded with fishing boats and oil platforms.

Some unprecedented accidents occurred: a bell jar was caught by a beam trawler, and a drogue system got entangled with a mini-submersible beneath a production platform. Both instruments were recovered without severe damage.



H2-04
C. Veth

A number of turbulence measurements have been carried out close to current-meter moorings in the stratified part of the area where the project takes place, in order to determine the influence of turbulence generated by bottom friction on stratification. The measurements were carried out close to current-meter moorings, because we wanted to relate turbulence to vertical shear in the tidal current.

B4-02
H.G. Fransz, W.W.C. Gieskes,
M.A. Baars, M.J.M. Reichert

The May cruises were characterized by frequent onsets of stratification during calm weather, followed by equally frequent spells of rough weather during which the water column became homogeneous again. The vertical distribution of chlorophyll suggested sedimentation of phytoplankton populations, possibly reaching the area from further south. During days with more wind the high concentrations of chlorophyll *a* near and at the bottom of the transitional zone were resuspended. Chlorophyll concentrations were generally high; they showed a patchy horizontal distribution. In contrast to observations in previous years, the upper layer in the frontal area often showed lower chlorophyll *a* values than the areas to the north or to the south. Preliminary results by HPLC analysis showed that in the beginning of May these low values coincided with high concentrations of phaeophorbide, which suggests high grazing pressure right in the frontal area. Actually, egg production by *Temora longicornis* in shipboard experiments was high in water from the front zone, whereas in southern or northern waters it was 2 to 3 times lower. After May, egg production dropped dramatically and with the definite onset of stratification in June, differences between the three water types were slight and partly insignificant in this respect. A series of grazing experiments according to the ¹⁴C method was performed from the end of May onwards, and copepods did not demonstrate a constant preference for any of the three types of water. In the frontal zone water filtering rates were not necessarily highest. The Frisian Front Project will be continued in 1987 with cruises in August, when mineralization of the sedimented material in the transitional zone is expected to have led to a more active pelagic community than communities in the nutrient-depleted waters to the south and to the north of this biological front (a hypothesis by CREUTZBERG *et al.*).

B2-02e
G.C.A. Duineveld

The Frisian Front Programme offered the opportunity to relate the distribution of the macrobenthos in this area to the hydrographical conditions, which had so far been unknown in detail. The remarkable north-south zonation of the resident macrofauna in this area suggests a major influence of the hydrology on the distribution of the benthic fauna. In order to assess this relationship, the distribution of some dominant pelagic macrobenthos larvae was studied at three transects across the frontal area concurrent with hydrographical measurements by the department of Physical Oceanography.

The first results show that even in early June, when stratification has not yet fully developed, there is a significant difference between numbers

The Frisian Front Project in the North Sea during May and June 1986 was a multi-ship programme, with NIOZ-scientists performing research on both R.V. "Tyro" and R.V. "Aurelia".



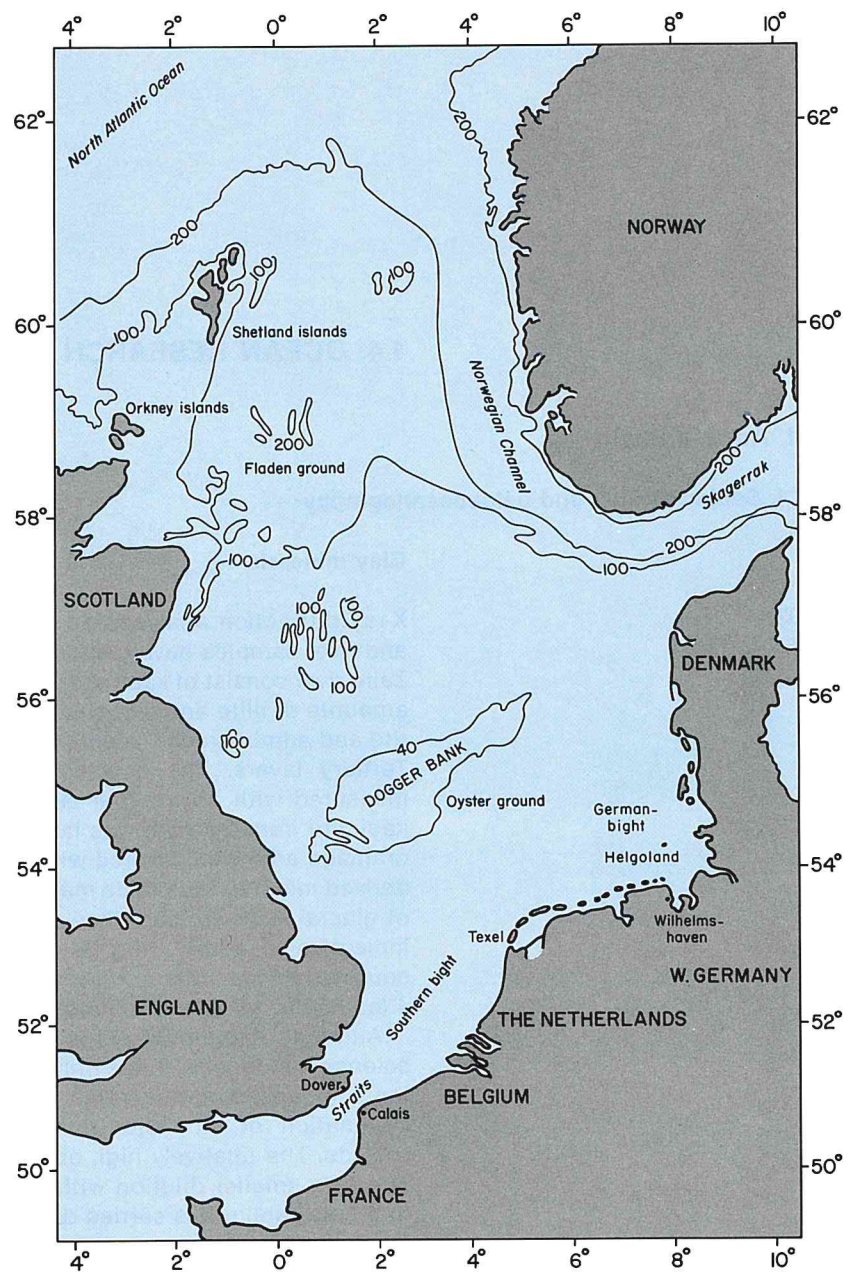
of echinoderm larvae north and south of the frontal area. Striking is the early presence of *Echinocardium* larvae just north of the 30 m isobath as opposed to their absence at the southern stations. Several weeks later *Echinocardium* larvae also occurred at the southern stations, but in much higher numbers than ever observed at the northern stations. A similar distribution of pelagic *Echinocardium* larvae as found in July 1986 was also observed in June and July 1985.

The July distribution of pelagic larvae, however, does not fit the distribution pattern of settled *Echinocardium* in bottom samples collected in April 1986 at the same transects. This phenomenon stresses the need for monitoring the success of the settlement. For this purpose box-core samples were taken in June and July and at two-month intervals in autumn.

B1-04, B1-02

P.A.W.J. de Wilde, S. Cramer,
J.H. Vosjan

Metabolic benthic activity was studied in a transect across the front. Besides a benthic station located at the probable position of the front, two other stations were chosen, one 10 miles south of the front station, and the other 10 miles north of it. The southern station was characterized by a sandy bottom, poor in benthic organisms; the other stations had silty sediment and a very rich benthic fauna. A total of 20 successful *in situ* bell-jar measurements, 22 deck incubations and 60 laboratory incubations were carried out. From small subsamples, ETS activity was measured. Due to the rough weather conditions during the greater part of the Frisian Front Project, a stable front in the water column could not develop. This was also reflected in the relatively small differences in benthic activity at the stations.



North Sea with geographical names mentioned in this report.

1.4. OCEAN RESEARCH

1.4.1. Angola Basin

1.4.1.1. Sedimentation and palaeoceanography

Clay minerals

H3-03
J.H.F. Jansen

X-ray diffraction analyses on piston cores from the Zaire deep-sea fan and river samples have demonstrated that the sediments of the present Zaire river consist of kaolinite, low crystalline smectite, quartz, and minor amounts of illite and gibbsite. The shelf supplies high crystalline smectite and admixtures of zeolite and cristobalite originating from opal-rich Tertiary layers. The downcore distributions of the major minerals, measured with an internal standard, suggest that the contribution of kaolinite from the river was large in interglacial periods, when the Zaire drainage area was covered with tropical rainforest. The supply of shelf-derived minerals was at its maximum in glacial intervals, giving evidence of glacial shelf erosion; they are absent in interglacial maxima. Illite is indicative of aridity, and its distribution points to expansions of the southern African desert during the glacial stages 2 (ca 18 000 yBP) and 4 (ca 65 000 yBP) and the interstadial (ca 160 000 yBP).

Although this model fits in well with the weathering theories of soil-science handbooks, it has only a relative value. A translation of the contents in accumulation rates ($\text{g}\cdot\text{cm}^{-2}\cdot\text{y}^{-1}$) demonstrates that the accumulation of all major minerals was highest during arid (glacial) periods. The relatively high abundance of kaolinite in humid periods is due to a smaller dilution with “arid” weathering products. It suggests that less kaolinite is carried down from tropical forests than from areas covered with savanna and steppe vegetation.

Biogenic opal

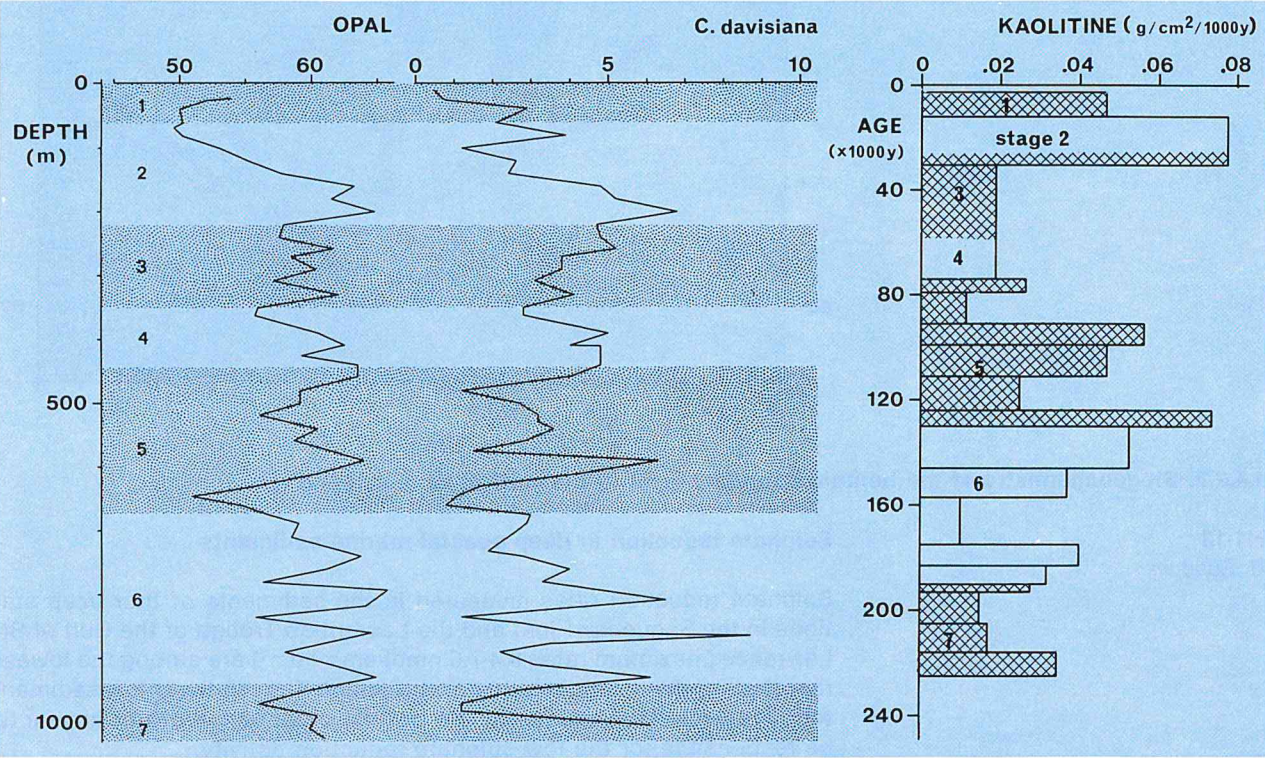
The content of biogenic opal, measured by X-ray diffraction (XRD), is very high in all Zaire fan sediments (on average ca 60%). In both surface samples and average core data it increases from slope to ocean, whereas opal accumulation rates decrease. This difference is caused by dilution

Kaolinite accumulation rates (weight units·cm⁻²·y⁻¹) of core T78-33 from the Zaire fan (left).

Biogenic opal concentrations (weight %) and contribution (%) of *Cycladophora davisiana* to the radiolarian associations of core T78-33 from the Zaire fan. The opal concentrations are corrected for a long-term downcore decrease of 1.3%·m⁻¹ for the upper 8 m (right).

with terrigenous material. Accumulation rates are the result of production and preservation. Since the preservation of recognizable tests is best in the deepest cores, decreasing rates indicate that productivity of opaline organisms is largest near the shelf. This is true both for the present time and for the Late Quaternary.

Downcore, the opal percentages show a long-term decrease which indicates that about 5% of the biogenic opal was decomposed by early diagenesis in 100 000 y. The percentages and accumulation rates are generally highest for glacial maximum intervals and lowest for interglacial maximum intervals. Because the same is true for the preservation, the rates do not give direct information on the palaeoproduction of opal. The diatom and radiolarian associations of the cores indicate, however, that the opal percentages reflect production rather than preservation processes. For example, there is a good correlation between the opal content, corrected for long-term decrease, and the contribution to the radiolarian associations of *Cycladophora davisiana*, a species which, in this region, is thought to be indicative of nutrient-rich conditions. The cores from locations on the continental slope show intervals with extra high opal accumulation rates caused by coastal upwelling during the glacial stage 2.

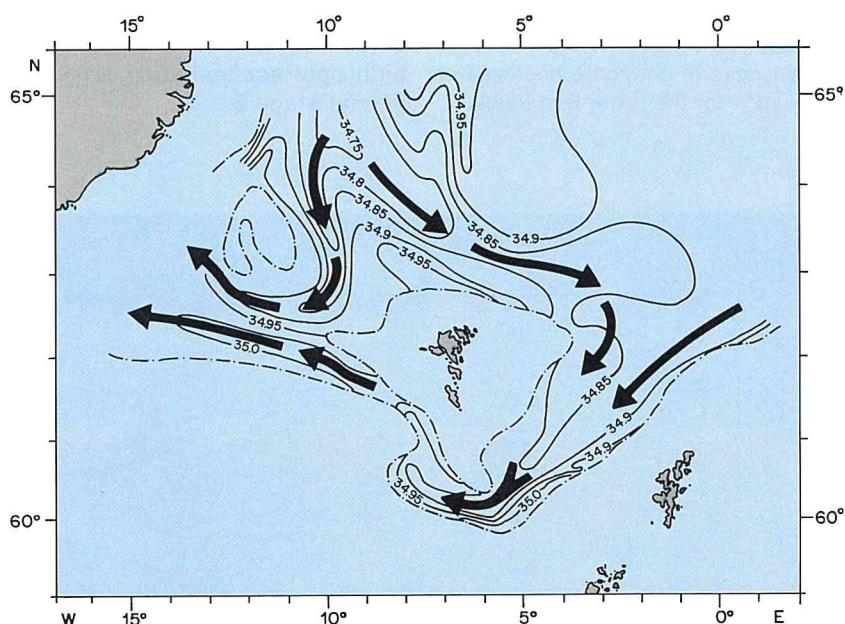


1.4.2. North Atlantic Ocean

1.4.2.1. Water flow over the Scotland-Greenland Ridge

H3-06
D. Eisma

The distribution of water masses and water transport in the Scotland-Iceland area were determined (chiefly by H.M. van Aken, University of Utrecht) on the basis of detailed sampling carried out in this area in 1983. In the surface water, four different water masses were distinguished on the basis of salinity and temperature: water coming from the North Atlantic, from the sea area off NE Iceland and coastal waters from the region off Faroe and Scotland. Intermediate waters originate from arctic or polar regions or from the Greenland and northern Iceland seas. The deep water is Norwegian Sea deep water. Overflow occurs over the Iceland-Faroe Ridge and over the sill in the Faroe Bank Channel. Since 1972, low salinity water, of polar or arctic origin, has been dominant in the overflow water.



1.4.2.2. Biogeochemistry of the benthic boundary layer in the Gulf of St. Lawrence

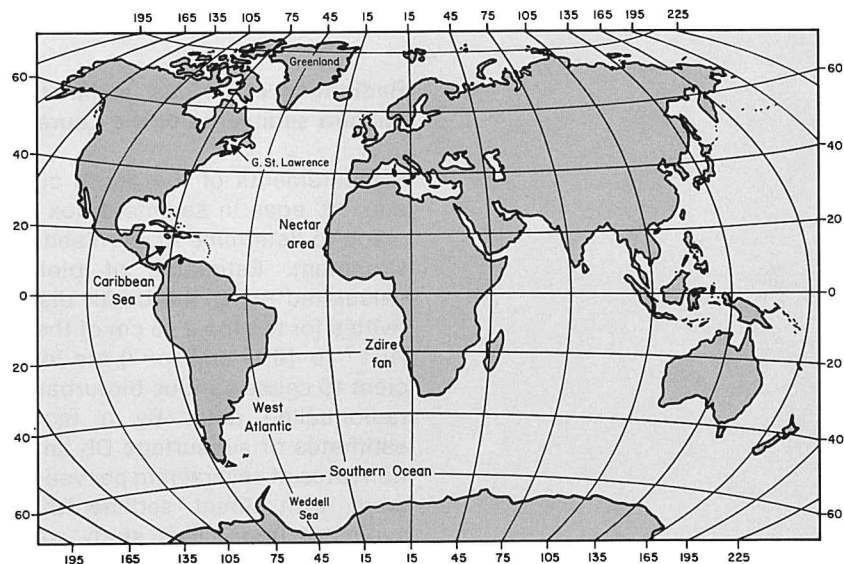
H1-12
B. Sundby

Sulphate reduction in deep coastal marine sediments

Sulphate reduction rates measured in the sediments of four deep stations in the Saguenay Fjord and the Laurentian Trough of the Gulf of St. Lawrence (maximum rates $0.4-7.0 \text{ nmol} \cdot \text{cm}^{-3} \cdot \text{d}^{-1}$) are among the lowest reported for the coastal marine environment. The relatively low sedimentation rates and the constantly low bottom water temperatures appear to be responsible for the low sulphate reduction activity.

Regional differences in the maximum reduction rate and in the rate integrated over the sediment column correlate with sediment trap measurements of total sedimentation rate and downward flux of organic carbon to the sediment.

Sulphate reduction accounts for the degradation of 5 to 26% of the estimated downward flux of organic matter to these sediments. Unlike the absolute rate of sulphate reduction, the rate integrated over the sediment column is not directly correlatable with the sedimentation rate but is a function as well of the composition of the organic matter, the intensity of bioturbation, and the abundance of sub-oxic electron acceptors. Thus, the lowest value was determined at a station where a combination of low sedimentation rate and low bioturbation intensity allowed a long residence time of organic matter in the surface sediment and, in consequence, a low flux of labile organic matter into the sulphate reduction zone. The highest value was observed at a station with a similar organic carbon flux to the sediment but with a higher bioturbation intensity and a higher sedimentation rate. An intermediate value of the contribution of sulphate reduction to organic matter degradation was measured at the station with the greatest organic matter flux and total sedimentation rate, and is attributed to the exhaustion of porewater sulphate. The proportion of organic matter degraded via sulphate reduction in deep coastal environments can be highly variable both spatially and temporally. This study was carried out in collaboration with H.E. Edenborn, N. Silverberg and A. Mucci, University of Quebec, Canada.



Cd diagenesis in Laurentian Trough sediments

The depth distributions of Cd, Mn and Fe in pore water and sediment were determined on three replicate box cores collected at a 325-m-deep station in the Laurentian Trough. The results reveal a surface layer in which the content of solid-phase Cd first decreases but then increases sharply with depth. In contrast, Mn decreases regularly over the same depth interval. In the oxygenated zone of this layer, Cd, probably associated with organic matter, is released to the pore water, resulting in concentrations that are more than an order of magnitude higher than in the overlying water column. Some of the dissolved Cd is returned to the water column and some migrates downward and is precipitated at depth. This part of the Cd cycle is virtually complete within the surface layer, the base of which corresponds to the base of the zone of Mn enrichment.

In the surface layer, solid-phase Cd and Mn show little or no concentration change. However, dissolved Cd, which reaches minimal, often non-detectable concentrations (<0.05 nM) in this layer, increases once again deep within the anaerobic zone and may attain concentrations which are even higher than those observed in the surface layer. The presence of dissolved Cd complexes, revealed by 1.5 to 8 fold increases in electrochemically active Cd in pore water after UV-treatment, as well as mutual inconsistencies between the distributions of dissolved and solid-phase Cd, indicates complexities in Cd diagenesis that merit further investigation. This research was carried out in collaboration with C. Gobeil, Department of Fisheries and Oceans, Canada, and N. Silverberg, University of Quebec, Canada.

Radionuclide profiles, sedimentation rates and bioturbation rates in modern sediments of the Laurentian Trough

Measurements of the depth distribution of ^{210}Pb and ^{137}Cs activities, and ^{14}C ages in sediment box cores from the Laurentian Trough were made to determine modern sedimentation rates in this deep coastal environment. Estimates of biological mixing coefficients (Db) were calculated using the depth distribution of excess ^{228}Th and ^{234}Th activities for the top 2 - 5 cm of the sediment. Although these surficial Db's (10^{-7} to 10^{-8} $\text{cm}^2 \cdot \text{s}^{-1}$) are low for coastal sediments, they are sufficient to cause serious bioturbational errors in the slopes of uncorrected radionuclide data. By a model of depth-zoned bioturbation, and estimates of subsurface Db an order of magnitude smaller, sedimentation rates of several mm per year were arrived at. These are in good agreement with direct sedimentation-rate measurements obtained with sediment traps. This study was carried out in collaboration with N. Silverberg, University of Quebec, Canada.

1.4.3. Southern Ocean

1.4.3.1. Chemical dynamics near the sediment-water interface

H3-02

A.J. van Bennekom

Measurements of nutrients and oxygen in the water column of a section approximately along the 10°E meridional in spring 1986 indicate that only minor amounts of Antarctic Bottom Water are transported northward along the Dinguane and Shaka fracture zones.

Nutrient concentrations in interstitial waters indicate that, with the exception of silica, very small amounts of biogenic substances were decomposed in the sediment. For interstitial dissolved silica large variations were found: high values south of the Antarctic Convergence and near Maud Rise and extremely low values, hardly above concentrations in bottom water, in the western Weddell Sea. Further study awaits the arrival of the sediment samples taken. Dissolved aluminium in interstitial water, determined by the newly developed continuous-flow fluorometric method, was lower than elsewhere. In the water column Al was 2-6 nM, hardly above the detection limit of about 2 nM; no consistent relationship with depth was found.

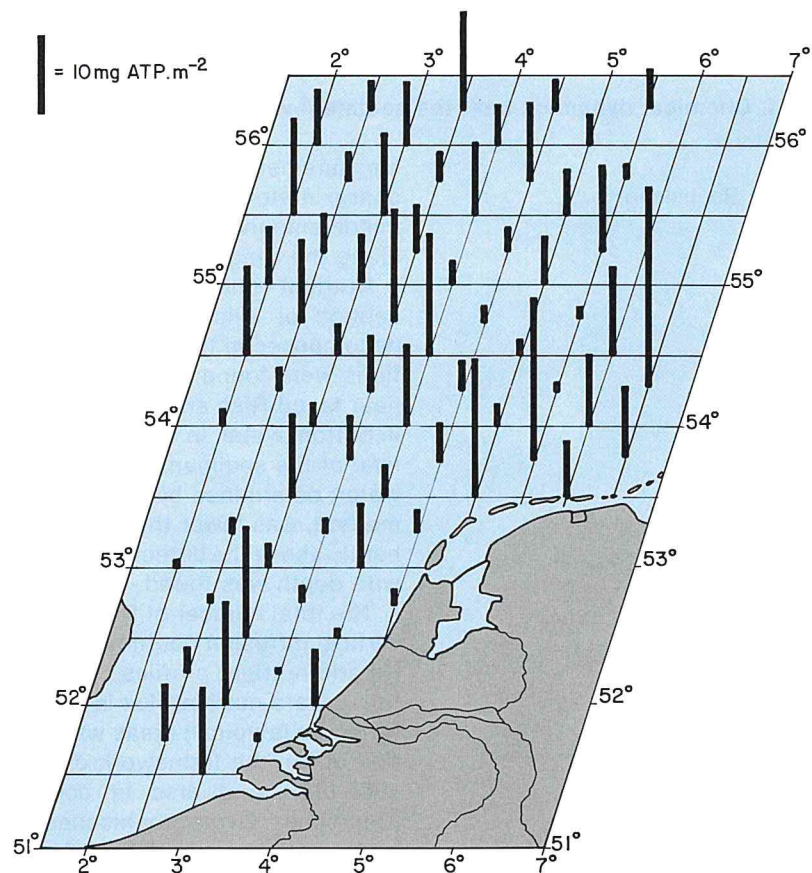
The total number of Rn profiles in near-bottom water was 6. Here high vertical diffusion coefficients were found. The number of stations where Rn and nutrient profiles can be combined into meaningful estimates of the upward nutrient flux is very limited because the programme concentrated on (atypical) areas with strong bottom relief. This project was carried out in the framework of the Dutch Antarctic Research programme 1985-1987, and also in cooperation with West German scientists (Deutsches Hydrographisches Institut, Hamburg, for research in the water column, and Alfred Wegener Institut für Polar- und Meeresforschung, Bremerhaven, for research in the sediments).

1.4.3.2. Biomass and activity of microorganisms

B1-02

J.H. Vosjan

Microbial biomass and respiratory activity were estimated in a large series of water samples and a few ice and sediment samples during an Antarctic cruise in May-June. In total, more than 2000 analyses were made. The first set of data was obtained from the fishery stations around Elephant Island. At 13 rosette-sampler stations at 9 depths the ATP concentration and ETS activity were measured. Biomass decreased from the surface downwards; the mean concentration in the upper 100-m water column amounted to $77 \pm 12 \text{ ng ATP} \cdot \text{dm}^{-3}$; integrated over 100 m water this is $7.7 \text{ mg} \cdot \text{m}^{-2}$. Assuming a conversion factor of 250, a biomass of $1.9 \text{ g C} \cdot \text{m}^{-2}$ was estimated, or $13 \times 1.9 = 25 \text{ g wet weight} \cdot \text{m}^{-2}$. Integrated over the upper 200-m water column, the biomass was $3.5 \text{ g C} \cdot \text{m}^{-2}$. The respiratory activity over the upper 100 m, when recalculated to an *in situ* temperature of 0°C , was about $0.23 \text{ g C} \cdot \text{m}^{-2} \cdot \text{d}^{-1}$. Assuming a steady state, in $1.9 : 0.23 = 8$ days, an amount of carbon which equals the existing biomass was respired. In tropical waters, a turn-over time of the



Distribution of ATP in the upper cm sediment in $\text{mg ATP} \cdot \text{m}^{-2}$.

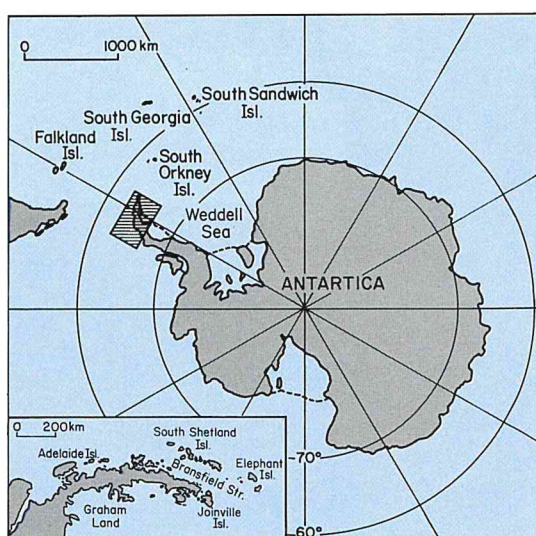
biomass of 1 day was measured and in the North Sea of 2 days. The effect of temperature on the respiratory activity was $14 \text{ kCal} \cdot \text{Mol}^{-1}$. This means a Q_{10} of 2.6, which is a normal value for biological processes.

Around Elephant Island, a dense grid of sampling stations (22 stations analysed) was investigated. Here the biomass in the upper 100 m was $9.2 \pm 2.3 \text{ mg} \cdot \text{m}^{-2}$. Concentrations of ATP in the different water layers ranged from $108 \text{ ng ATP} \cdot \text{dm}^{-3}$ in the upper 50 m to less than $10 \text{ ng ATP} \cdot \text{dm}^{-3}$ below 1000 m.

During a series of tracks to the south, as far as Adelaide Island, another 48 rosette stations were studied. This gave a kind of "synoptic" map of biomass. The highest figures, $8.1\text{-}8.3 \text{ mg ATP} \cdot \text{m}^{-2}$ in a water column of 100 m, were found around Elephant Island and in an area NW of the South Shetland Islands; the lowest figures, $3 \text{ mg ATP} \cdot \text{m}^{-2}$, in the De Gerlach Strait. Also on the Bransfield Strait side of the south Shetland Islands low values, $4.5\text{-}6.5 \text{ mg ATP}$, were observed. Finally, at the end of the cruise the samples from 10 rosette stations were analysed again. Now, one month later, the biomass of microorganisms was significantly lower.

Additionally, a few ice samples and 15 sediment samples from various locations were studied. The ice samples often contained 100 times higher ATP values per volume than the surrounding sea water. In the sediment samples the figures were several thousand times higher than in the bottom water.

During the cruise we had the opportunity to compare and calibrate the two methods for estimating ATP concentrations, as used by Vosjan (NIOZ) and Ernst (AWI, Bremerhaven). For the Elephant Island area a good similarity was obtained; our figure was $20 \text{ mg C} \cdot \text{m}^{-3}$ in the upper 50-m water column; Ernst found $23 \text{ mg C} \cdot \text{m}^{-3}$. This project was carried out in the joint German-Dutch research programme, during a cruise in May-June 1986 (ANT V/1).



1.4.3.3. The pelagic system

B4-02, H2-04

W.W.C. Gieskes, H.G. Fransz,
C. Veth

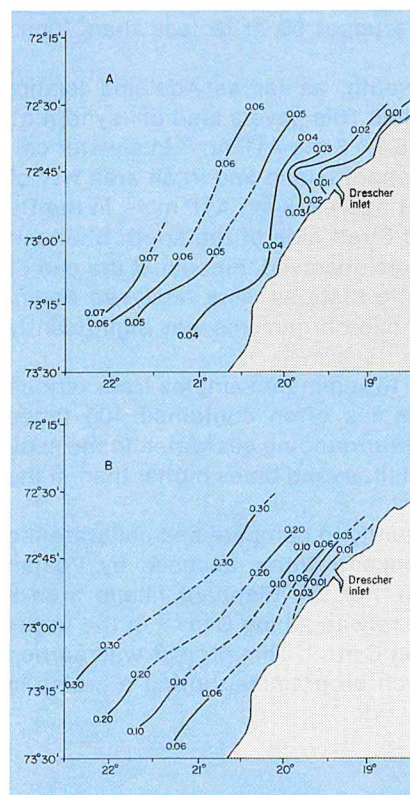


Fig. a. Chlorophyll a concentration in the upper 50 m in the "Vestkapp" box; A: quasi-synoptic plot of measurements between 15 October and 4 November. B: situation on 17 and 18 November.

During the last three months of the year, NIOZ-scientists participated in the Winter Weddell Sea Project 1986, a cooperative project in the eastern part of the Weddell Sea on board R.V. "Polarstern" (AWI, Bremerhaven).

The aim was to make a contribution to a better understanding of the evolution and utilization by copepods of the phytoplankton spring bloom in the eastern Weddell Sea and its coastal polynyas, which are large open areas within the sea ice close to the ice shelf. For this purpose the biomass and species composition of phytoplankton algae and copepod populations were recorded. The accumulation of biomass was studied in relation to factors influencing growth, such as light and structure of the water column. Since the availability of light is a requisite for primary production, the vertical extent to which phytoplankton is mixed downwards by turbulence plays an important role in setting the rate at which the spring bloom develops. For this reason turbulence measurements were incorporated in the pelagic programme. From simultaneously measured horizontal and vertical turbulence spectra it is possible to derive information on turbulent mixing rates, the relevant length scales, and turbulent velocities.

Chlorophyll fluorescence was recorded *in situ* to a depth of 270 m at 44 stations located in the eastern Weddell Sea between the northern edge of the pack-ice and the polynya off Halley station in the south. The region surveyed most intensively was around Vestkapp. Fluorescence measurements were calibrated frequently with chlorophyll samples taken at discrete depths that were measured spectrophotometrically. The turbulence in the polynya and also in the water under the sea ice was measured with a laser-doppler technique to obtain undisturbed measurements. Copepods were sampled from the upper 200 m with a 50 μ m vertical net.



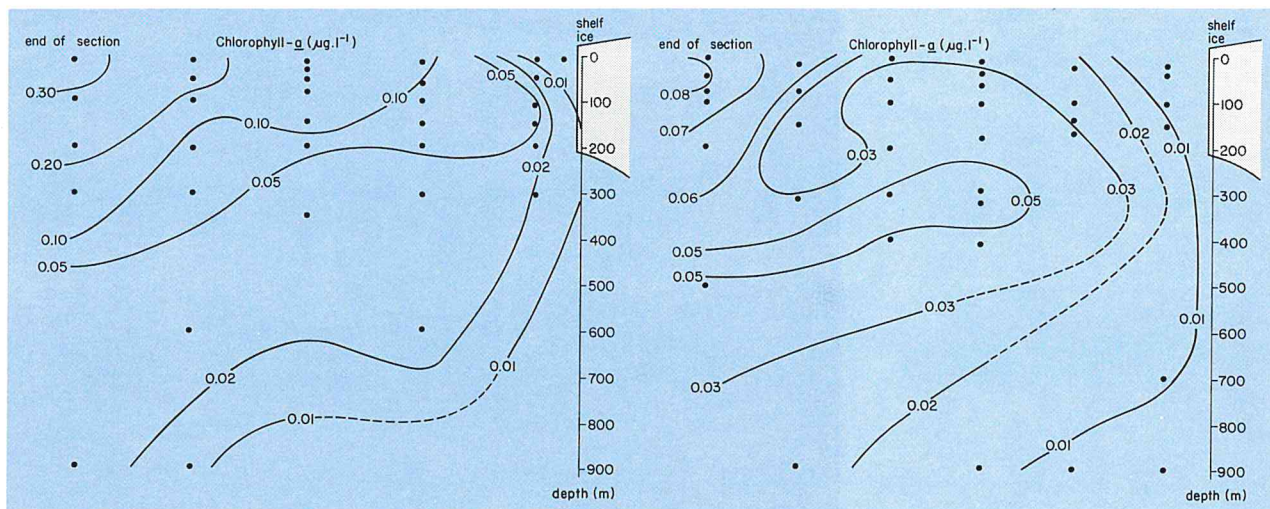
Secchi disc with two scientists.

During the first half of the cruise unexpectedly low chlorophyll concentrations were registered along the ice shelf, both near the surface and at greater depths. The number of algal cells was correspondingly low. This extreme phytoplankton scarcity can partly be ascribed to the fact that before 1 November the polynya was still frequently largely covered by ice, which prevented light penetration to sufficient depths for production of new algal cells to take place. However, where areas of open water occurred the euphotic zone was estimated to extend as deep as 200 m, Secchi disc visibility was between 70 and 80 m! The scarcity of suspended particles during the first half of the cruise, in October, precluded the use of laser-doppler turbulence measurements, since not enough light was scattered in the laser beam by these particles. After 1 November, when the polynya had become a predominantly open-water area, a gradual increase in chlorophyll concentration and in algal cell number was recorded. The increase was by far the most rapid on the sea-ice side, although here the chlorophyll concentrations did not exceed $0.25 \mu\text{g} \cdot \text{dm}^{-3}$. Close to the ice shelf little change was observed; even at the end of the cruise no more than $0.01 \mu\text{g} \cdot \text{dm}^{-3}$ was present locally.

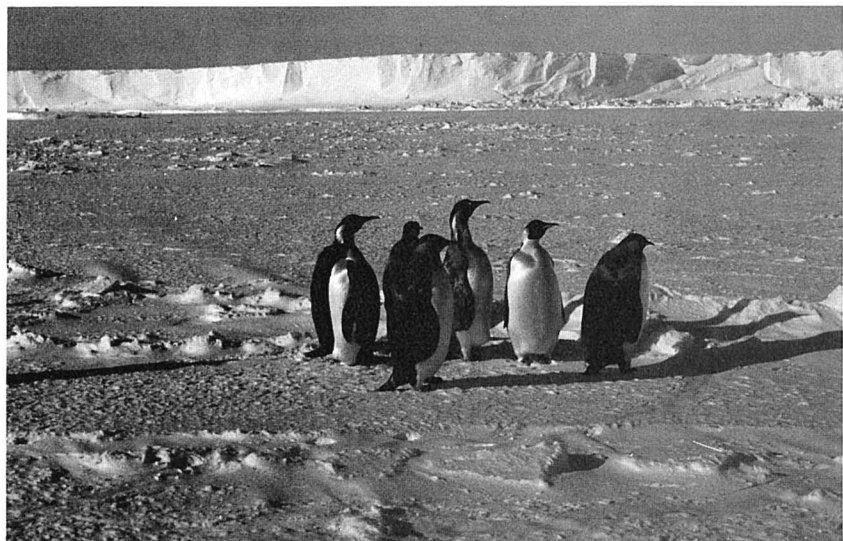
The algal crop associated with the sea-ice and present between platelets attached to the sea-ice was locally so dense that it was visible to the naked eye as a chocolate-brown discoloration of the water in the ship's wake. In this brown water chlorophyll concentrations of up to $200 \mu\text{g} \cdot \text{dm}^{-3}$ have been determined but even at a depth of a few meters under the ice the concentration was never more than $0.4 \mu\text{g} \cdot \text{dm}^{-3}$.

Copepods were present throughout the Weddell Sea and in the coastal polynya in numbers of 500 to 2 000 per m^3 . The main species were *Oithona similis*, *Calanus propinquus* and *Metridia gerlachei*. All developmental stages were present and eggs were produced in the absence of food algae, presumably to keep the numbers high enough to utilise the short spring and summer algal blooms.

Fig. b. Vertical distribution of chlorophyll *a* of sections perpendicular to the ice shelf in the "Vestkapp" box (see Fig. a). A: quasi-synoptic plot of measurements between 15 October and 4 November. B: situation on 17 and 18 November.



After the spring bloom had started, enough scattering particles were present to conduct turbulence measurements with the laser-doppler turbulence meter. Measurements were made off Drescher Inlet during periods of very low wind speeds and high insolation. Turbulence spectra showed only weak turbulence levels with energy dissipation rates of $2 \cdot 10^{-10}$ to $2 \cdot 10^{-8} \text{ W} \cdot \text{kg}^{-1}$, turbulent length scales of 1 to 3 m and turbulent velocities of 0.001 to $0.005 \text{ m} \cdot \text{s}^{-1}$. The shapes of the spectra showed isotropy in the high wave numbers indicating only a weak stratification at the measurement depth (30-50 m). However, the very low values of turbulent energy, combined with the low wind stress and strong insolation, made the circumstances favourable for stratification to intensify in the upper layers of the Vestkapp polynya waters in November. Turbulence measured in Atka Bay appeared to be different. The ice-covered bay was exposed to a strong wind stress and a considerable drift speed of the ice-cover was determined. Turbulence spectra showed a background turbulence with a rather high intensity (dissipation rate between $5 \cdot 10^{-8}$ and $5 \cdot 10^{-7} \text{ W} \cdot \text{kg}^{-1}$). Superposed on this background turbulence were bursts of even higher intensity turbulent kinetic energy with dissipation rates of $3 \cdot 10^{-6} \text{ W} \cdot \text{kg}^{-1}$. The background turbulence showed length scales of more than 10 m, but the bursts had length scales in the order of 1 m. It is likely that bursts can be related to overturning events of structures which are also visible in the CTD profile of the Atka Bay station.



1.4.4. Indonesia. The Snellius II expedition

1.4.4.1. Input of rivers to the sea

H1-07

R. Nolting

The concentrations of the dissolved metals Cu, Zn, Cd, Ni, Pb and Fe in the Porong and Solo rivers and in the coastal waters near Java and Bali are low and of the same order of magnitude as in unpolluted rivers and coastal areas in other parts of the world. During the wet season, the concentrations of Zn, Fe, Pb and Cu were higher than in the dry season; the Fe concentration was 10 to 100 times higher, the concentrations of the other elements, in contrast, only 2 times.

Suspended particulate matter (SPM) in the rivers contained a high percentage of organic material (40-50%). As expected, the suspended load was much higher during the wet season, especially in the river Porong, where SPM concentrations reached $800 \text{ mg}\cdot\text{kg}^{-1}$. This higher amount of SPM was reflected in a lower total metal content and a lower concentration of Cd, Pb, Cr, Fe, Al, Ni, K and Mg in the acid leachable fraction. The dissolved silicate concentration in the rivers (800 and $400 \mu\text{mol}\cdot\text{dm}^{-3}$ in the Porong and the Solo respectively) is due to the high chemical weathering rate of soils in the tropics. This results in a low Si-Al ratio (2.0 to 2.7), compared to 3.5 to 5.0 in the SPM in rivers in more moderate climates.

Element ratios to Al are also useful to show the pathways of the SPM carried by rivers. On the basis of elemental ratios we were able to estimate that seaward transport of SPM by the Porong and Solo was restricted to the immediate coastal zone close to the rivers mouths. Farther away from the coast, the SPM was mostly biogenic.

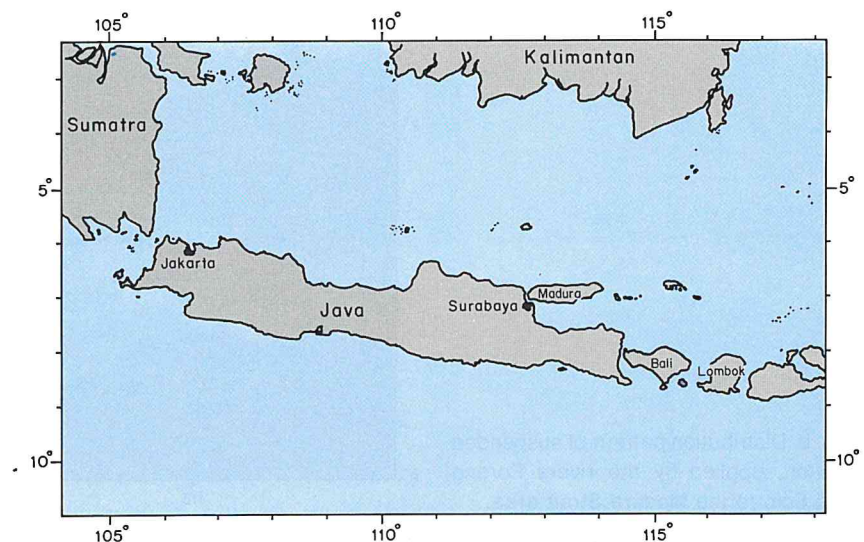


Fig. a. Depth profiles of dissolved Cd ($\text{nmol}\cdot\text{kg}^{-1}$) at two stations in the Indian Ocean.
A: dry monsoon; B: wet monsoon.

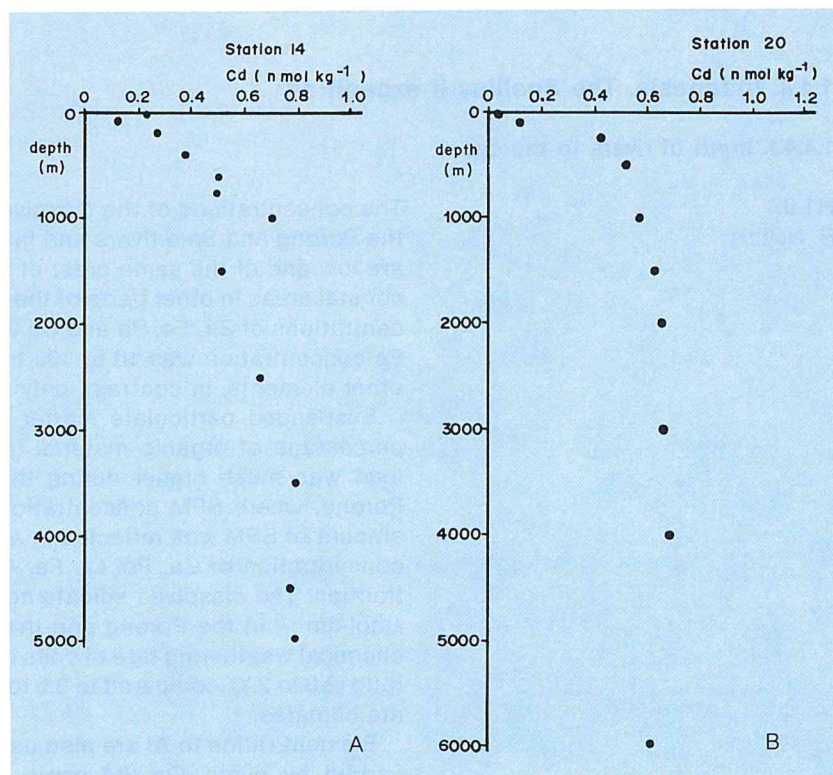
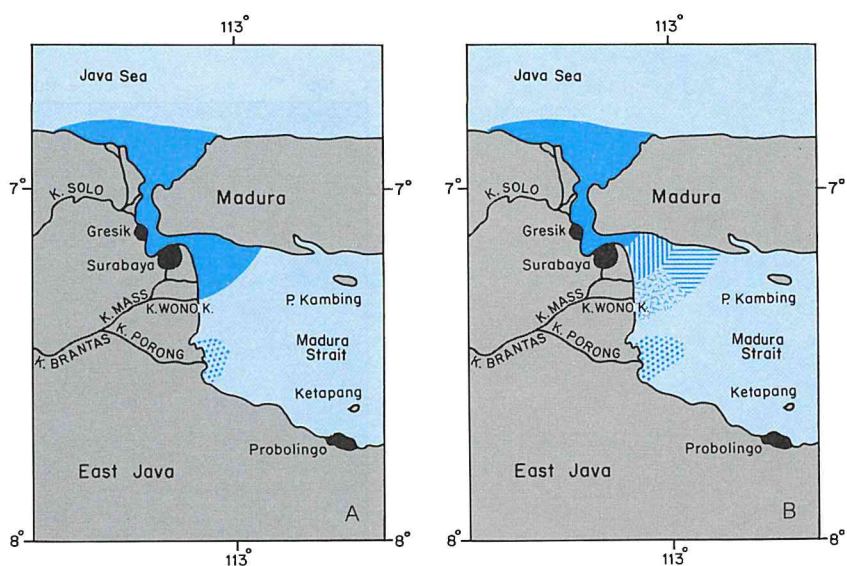
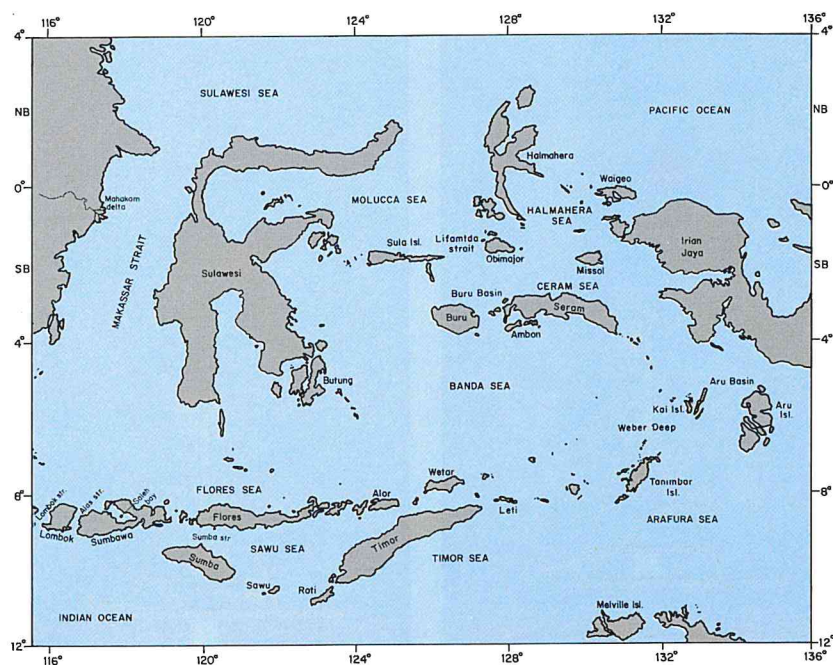


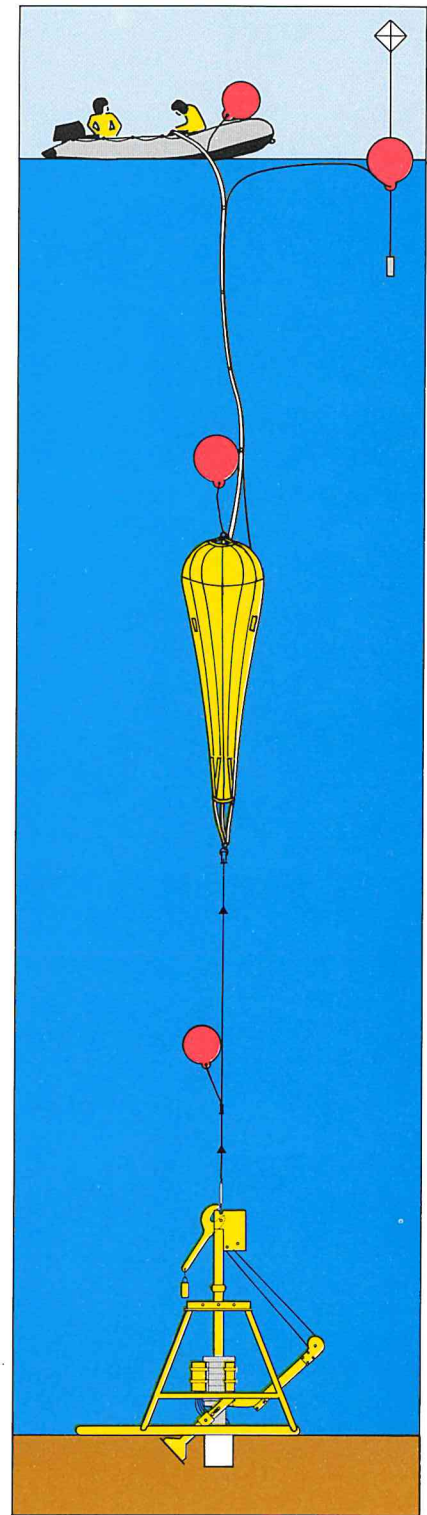
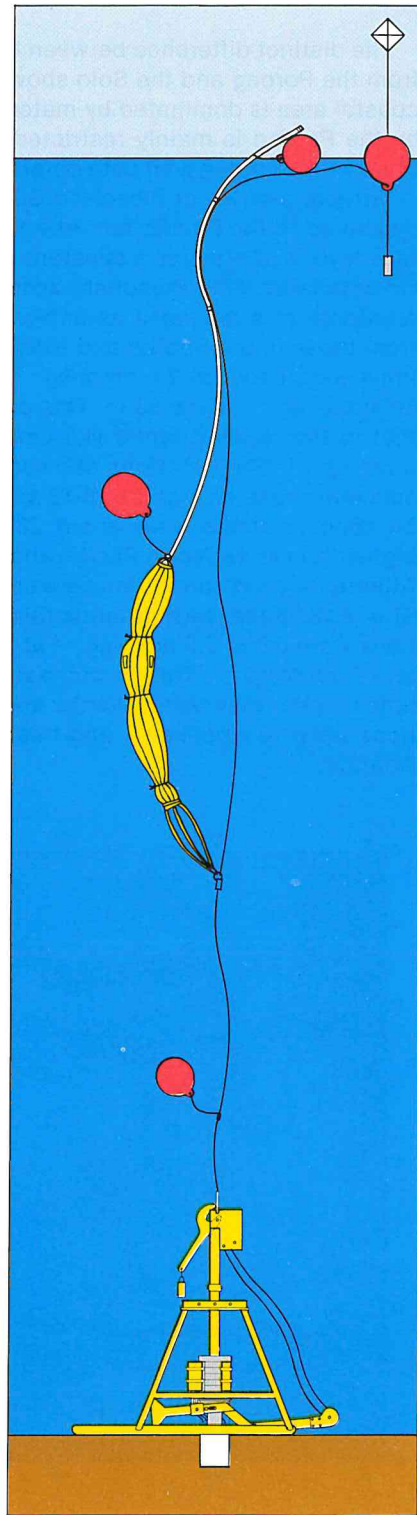
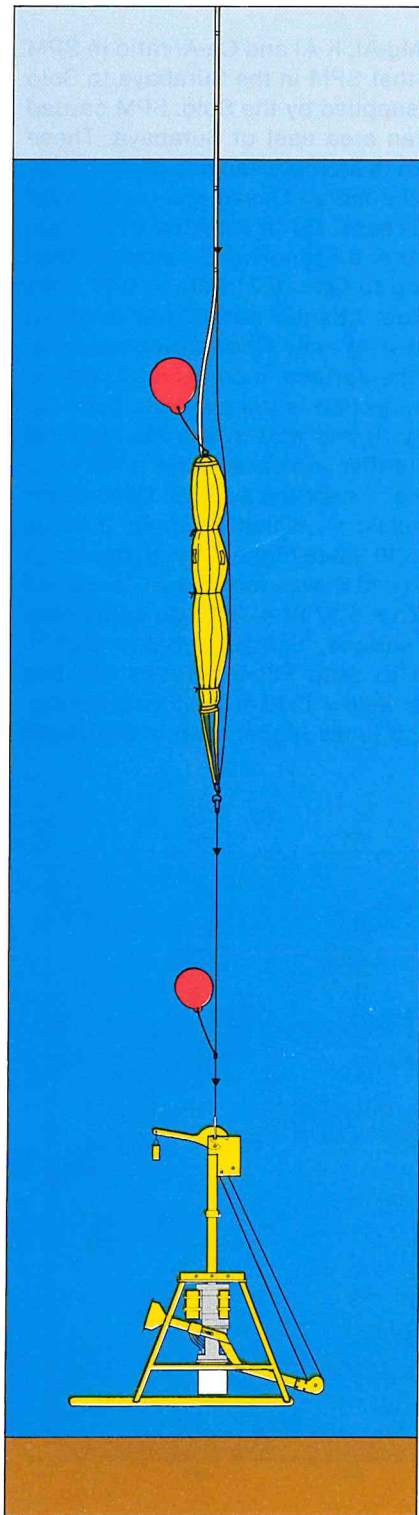
Fig. b. Distribution pattern of suspended matter supplied by the rivers Porong and Solo to the Madura Strait area.
A: dry monsoon; B: wet monsoon.

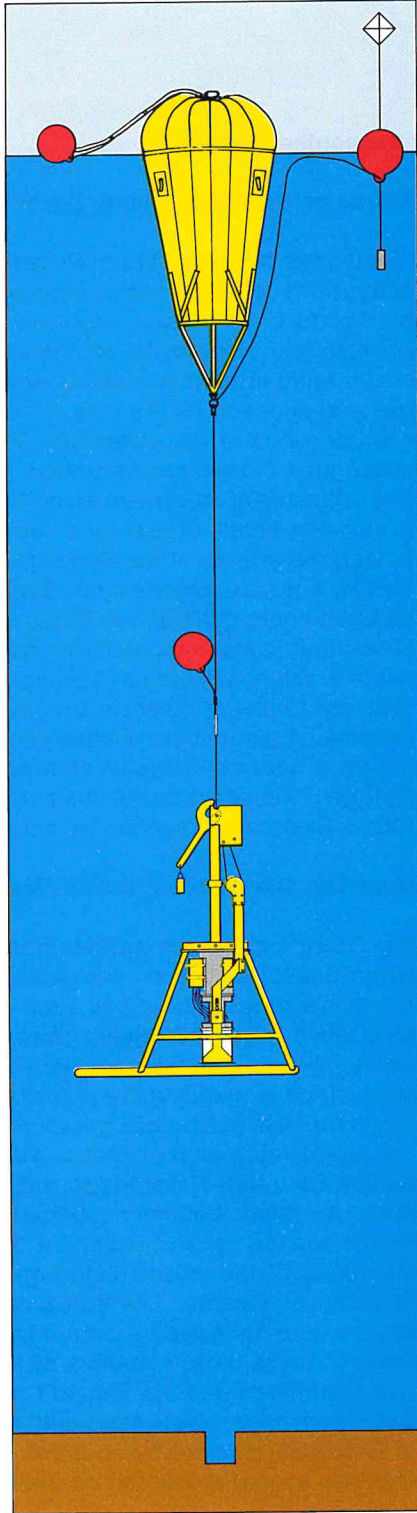
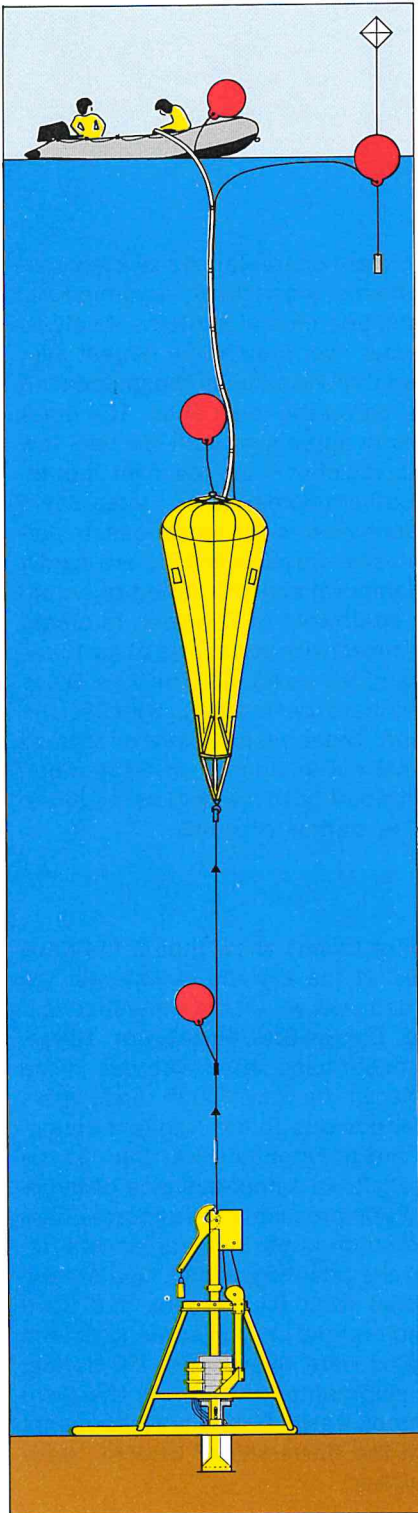


The distinct difference between the Mg-Al, K-Al and Ca-Al ratio in SPM from the Porong and the Solo showed that SPM in the Surabaya to Solo coastal area is dominated by material supplied by the Solo. SPM carried by the Porong is mainly restricted to an area east of Surabaya. These observations agree with data obtained in the remote sensing programme.

Vertical profiles of dissolved Cd in the Indian Ocean resemble those measured in the Pacific and Atlantic Oceans. Cd is depleted in the surface layer and reaches a constant value of $0.7 \text{ nmol} \cdot \text{kg}^{-1}$ below 1000 m. Cd correlates with phosphate according to $\text{Cd} = 0.21 \text{ PO}_4 + 0.07$. This relationship is the same as in North East Atlantic waters, but different from those in the Pacific and North West Atlantic Ocean. Ni concentrations were between $2\text{--}4 \text{ nmol} \cdot \text{kg}^{-1}$ at the surface, increasing rapidly to $6\text{--}8 \text{ nmol} \cdot \text{kg}^{-1}$ below 50 m. This concentration is intermediate between that in the North Atlantic ($4.3 \text{ nmol} \cdot \text{kg}^{-1}$) and that in the Pacific ($10.9 \text{ nmol} \cdot \text{kg}^{-1}$). Shelf stations showed a further increase below 1000 m to concentrations as high as $16\text{--}18 \text{ nmol} \cdot \text{kg}^{-1}$ near the bottom. Deep water Zn concentrations were about $20 \text{ nmol} \cdot \text{kg}^{-1}$, which is about 2 times higher than in the North Pacific and 4 to 10 times higher than in the North Atlantic. A good correlation between Zn and Si was found with $\text{Zn} = 0.145 \text{ Si} + 2.18$. In the North Atlantic this is $\text{Zn} = 0.17 \text{ Si} + 2.30$. Cu concentrations were 0.5 to $3.0 \text{ nmol} \cdot \text{kg}^{-1}$ at the surface, increasing below 1000 m to $4.0 \text{ nmol} \cdot \text{kg}^{-1}$. This is comparable to deep Pacific waters but two times higher than deep Atlantic waters. Below 1500 m the Fe concentrations were $10 \text{ nmol} \cdot \text{kg}^{-1}$, and this is 2.5 times higher than in the North Atlantic.







Handling and operating of the bell-jar.

1.4.4.2. Geology and geochemistry of the southern basins

Makassar Strait and Flores Basin

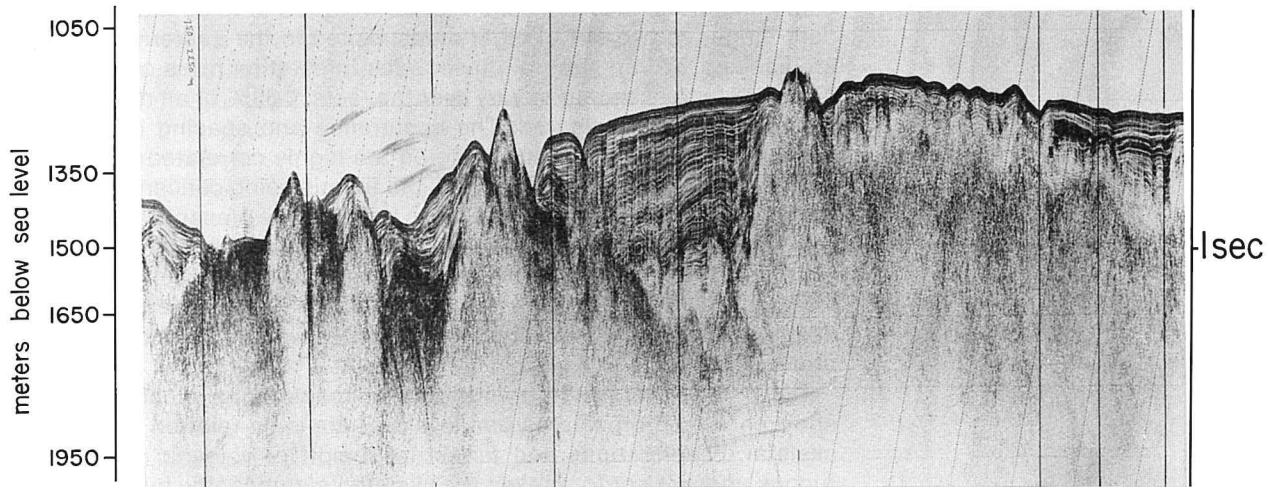
H3-08
D. Eisma

Suspended matter and bottom sediments are characterized by high concentrations of planktonic organic remains (coccoliths, foraminifera, pteropods, diatoms) and a very low content of mineral particles. Analysis of seismic profiles made off the Makassar river mouth (the largest river discharging into these waters) indicated that virtually all the suspended material supplied by the river is deposited on the inner shelf. The outer shelf consists of relict deposits. This is in agreement with the very low suspended matter concentration ($\leq 0.5 \text{ mg-dm}^{-3}$) off the river mouth. The influence of volcanism along the southern border of the Flores Basin is also very small, except for a narrow zone near to the volcanoes. In particular, the effects of the Tambora explosive eruption in 1815 are hardly visible. Analysis (chiefly by B. Buch, Hamburg) and ^{14}C dating of an undisturbed core collected in Saleh Bay, southwest of Tambora, in an old submerged crater indicated that ashes mixed with pteropods at ca 15 cm depth in the core were already more than 5500 years old. The loss of top material from the cores is assumed to have been small, because the kevlar-rope piston-core system was used. These results were confirmed during a second cruise in this area with "Die Sonne" in September-October 1986. Most of the volcanic contribution to the sediments in the Flores Basin was supplied by submarine slumps or slides.

Savu Sea and adjacent Indian Ocean

H3-08
T.C.E. van Weering, J.H.F. Jansen

The 3.5 kc and air gun profiles from these basins show that in the Savu Basin acoustic "voids", transparencies of the surface sediments, are found in a zone bordering an area with deposits which have slumped and slid down into the basin from the Sumba-Savu-Roti-Timor Ridge. Although generally the acoustic voids occur associated with gas in the subsurface, it seems more plausible that in the Savu Basin these voids originate from pore water pressure changes due to the frequent slumping. Uplift rates of the Lombok Ridge are apparently lower than at the Sumba-Savu-Roti-Timor Ridge, which results in a near-absence of large-scale slumping phenomena. Because of compression of the accretionary wedge sediments, soft sediment deformation is obvious and shows frequent clay diapirism and disturbance of the relatively young, Quaternary-Pliocene sediments. The cores collected from the Lombok and Savu Basins were analysed for carbonate and organic carbon content. On the basis of these data, a number of samples were selected for ^{14}C dating. The preliminary results indicate high sedimentation rates in the Savu Basin and intermediate rates in the Lombok Basin. Volcanic components in turbidites, studied by students from the University of Utrecht, show that two source areas can be distinguished.



High resolution single channel airgun profile of sedimentary basin deformation in accretionary wedge south of Savu. The distance between the vertical lines is approximately 3 n. miles.

1.4.4.3. The pelagic system of the eastern Banda Sea

H1-01, B4-03
W.W.C. Gieskes, S.B. Tijssen
W. Zevenboom, J.J. Zijlstra

A further analysis of the hydrographic data collected during the SE monsoon period (August 1984) revealed that Banda Sea slope-water penetrates into the NW Arafura Sea as bottom water, probably rising all along the western part of the south coast of Irian Jaya. A similar process was found in the southern Arafura Sea by Rochford (1966). This process of slope water upwelling adds to the increased fertility of the Banda Sea-Arafura Sea region during the SE monsoon, in addition to the slow upwelling over the whole area as mentioned in the Annual Report 1984.

A further HPLC analysis of algal pigments in samples collected during both monsoonal periods (SE monsoon, August 1984; NW monsoon, February-March 1985) showed a drastic change, indicating a dominance of diatoms during August in the (north)eastern part of the area, where upwelling was indicated to be most intense. In this area a calanoid copepod, *Calanoides philippinensis*, often found associated with upwelling areas, was abundantly present in August 1984. During this period, the remaining part of the area was probably dominated by Prymnesiophyceae and Cyanobacteria (blue-green algae). Most of the Banda Sea was dominated by blue-greens during the NW monsoon, but in the shallow Arafura Sea Prymnesiophyceae were found to be the dominant phytoplankton group.

From incubation experiments carried out during the surveys it appears that light was in most cases the limiting factor for phytoplankton growth during the SE monsoon, and nutrients during the NW monsoon.

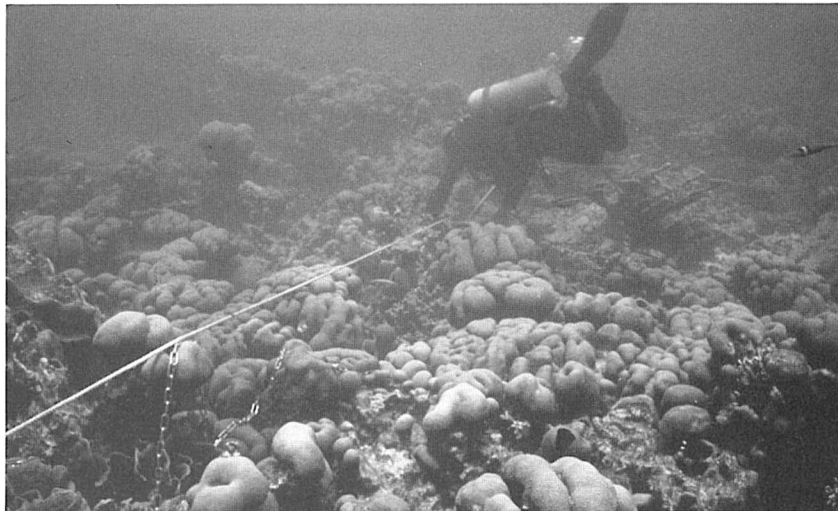
1.4.4.4. Coral reefs

B1-05

R.P.M Bak

Skeletons of the massive coral *Porites* were found to be infested with a dark fungus in two out of eight areas visited in the Eastern Indonesian archipelago. Within each of these areas infestation rates of coral colonies with fungus appear to vary over the reefs, 0-33% of all massive *Porites* species being infected. The occurrence and spacing of the black fungus discolorations in the skeleton are highly correlated with the appearance of skeletal density bands, the fungus being concentrated in the low density areas. There is no relation between the presence of black fungus bands and the variations in width of pairs of high/low density bands. Such pairs are usually interpreted as growth bands. They showed no significant differences in growth rates, $\pm 8 \text{ mm year}^{-1}$, between *Porites* colonies within infected areas and between infected and uninfected areas.

Regions in the skeleton with high concentrations of black mycelia show enhanced organic carbon levels. There is no relation between the skeletal discolorations and terrestrial run-off or volcanic activity. The fungus appears not to weaken the skeleton significantly, but the fruiting bodies (ascocarps) cause mortality on the living coral surfaces.



Underwater survey of a reef along the southern coast of Aruba. A line-transect method is used to record characteristics such as coral cover, reef structure and species composition.

1.4.5. Coral reefs in the Antilles, southern Caribbean Sea

B1-05

R.P.M. Bak

Characteristics of the coral reefs along the southwest coast of Aruba, such as structural complexity, abundance of living coral and selected species, and occurrence of juvenile corals, were studied in relation with pollution factors. On this coast an oil refinery and oil trans-shipping facility were operative for 61 years (1924-1985). The reef upcurrent, in front and downcurrent of the refinery appears to have been rather uniform in terms of structure and coral community composition.

Quantitative surveys showed the characteristics to vary significantly in relation to the location of the refinery and the direction of the persistent local current. The spatial structure of the reef has deteriorated, living coral cover is low and fewer juveniles are present in front and downcurrent of the refinery. Numerous large colonies of *Montastrea annularis*, aged >500 years, have been destroyed. Some coral species show a large gap in their distribution in the polluted area along the coast, but the species *Diploria strigosa* is relatively abundant there. The impact of 61 years of chronic oil pollution (spills, clean-ups etc.) is clearly discernible over a distance of 10 to 15 km along the reef.

1.4.6. Visual capacity of cetaceans

B2-04
A.D.G. Draai

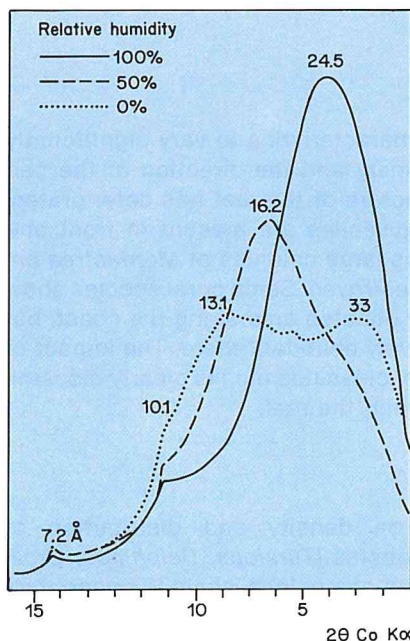
After completion of the studies on density and distribution of retinal ganglion cells in some odontocetes (*Tursiops*, *Delphinus*, *Orca*, *Phocoena*), similar studies on the retina of a baleen whale (*Balaenoptera physalus*) were started. So far, the results have indicated that in this species the visual sense is much less well developed, with a low visual acuity all over the field of vision. A specialized area of the retina, as found in the former species, is lacking in the baleen whale, which indicates an immobility of the eyes in this species.

1.4.7. Conversion of clay minerals in the sea

H3-05.
S.J. van der Gaast

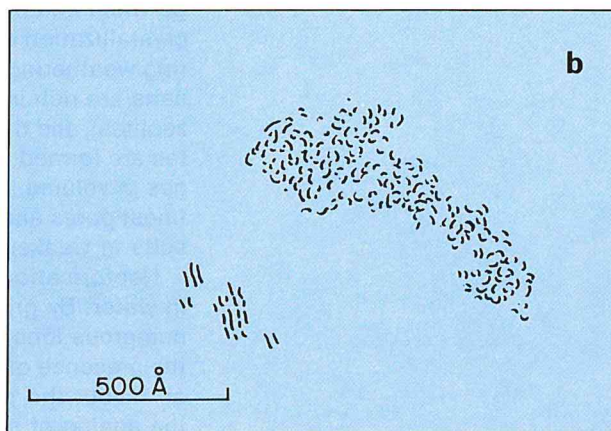
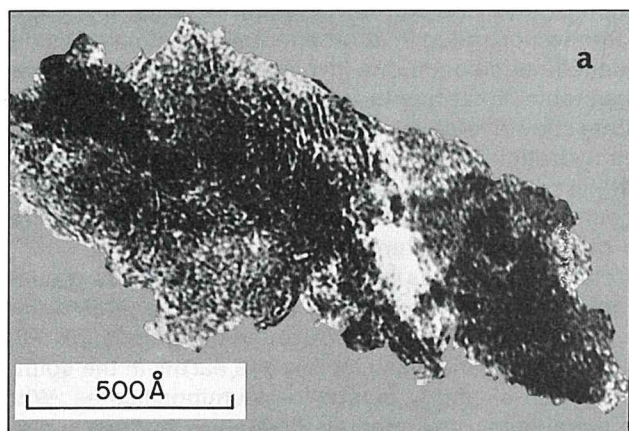
Weathered basalt is one of the sources of clay minerals for sediments and soils. Some basalts, according to their composition, show tendencies to fast weathering and/or mechanical decay. In such degrading processes, clay minerals, in particular smectites, play an important role. In basalt clay minerals were formed mainly in (1) the early postvolcanic stage when solidification of lava in a wet environment resulted in a rapid crystallization and transvaporization (hydrothermal alteration) and (2) during weathering under climatic conditions (hypergene alteration). Basalts are rich in less stable constituents (e.g. glass, feldspathoids and zeolites), and therefore show a relatively faster weathering. When smectites are formed, their hydration and rehydration is accompanied by changes in volume. Swelling pressure and deeper penetration of water in the finest pores and fissures then accelerate chemical weathering, which results in weakening of mechanical strength.

Neoformation of clay minerals has been observed on basalts ground in water. By grinding, a large, new and active surface is generated and numerous ions are liberated and dissolved. Alkaline conditions (pH > 8), the presence of silica, alumina and alkali metals and earths in the solution favour the precipitation of poorly crystalline aluminosilicates. With the ageing of such precursors, clay minerals crystallize in time.



X-ray powder diffraction pattern of a soil sample ($< \mu\text{m}$) from Kenya. A smectite reflection shifts from 24.5° at 100% relative humidity (r.h.) to 16.2° and 13.1° at 50% and 0% r.h., respectively. The low-angle reflection at 33° represents the curvature of the smectite. The peak at 7.2° represents kaolinite/halloysite and the one at 10.1° illite.

Transmission electron micrograph (a) and drawing (b) of a particle from one of the soil samples indicating curled structures with spacings of 20-40 Å (top) and 15-20 Å (bottom).



Series of X-ray diffraction (XRD) analyses (humidity diffractometry) have been carried out under wet and dry grinding conditions; rock samples were ground in water and cyclohexane, respectively. With cyclohexane only mechanical diminution took place, while during wet grinding mechanochemical reactions prevailed. In fractions $< 4 \mu\text{m}$, large amounts of quasi-amorphous aluminosilicate mass were found from which clay minerals crystallize by ageing. In all cases, basalts ground in water gave a higher background and a broad humidity sensitive 001 reflection of 14-17 Å. XRD patterns of basalts ground in cyclohexane did not show distinct peaks of neoformed clay minerals; the clay minerals present were formed by transvaporization during the solidification of the lava. This study is carried out in cooperation with Dr. R.A. Kühnel (Technical University, Delft).

Curled smectite is found in soils from volcanic ash in Kenya and Tanzania. Low-angle X-ray powder diffraction measurements of soil samples at controlled relative humidity show the presence of three major reflections: 20-33 Å, 10-27 Å, and 7-8 Å. The first reflection, which increased in intensity but did not shift in spacing with decreasing relative humidity, represents curled smectite layers. This spacing is also observed by high resolution transmission electron microscopy. The value of 10-27 Å for the second reflection, being the 001 reflection of smectite, is unusually high probably due to poorly stacked, irregularly curled layers. The 7-8 Å reflection originates from kaolinite or dehydrated halloysite, which also contain curled layers. The more curled the layer structure of the smectite, the more difficult it is to detect this phase; therefore, the XRD relative peak heights are not directly proportional to the percentages of the smectite.

In allophane and imogolite, a meta-kaolinite structure has been detected, with large spacings which are probably responsible for the morphology of these minerals. This meta-kaolinite structure can explain the large differences in the Al-Si ratio of allophane, without showing important changes in its morphology and structure.

1.5. SPECIAL PROJECTS

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

S-01

EON staff members see 5.6

The EON project started in March 1984 and will end in December 1987. The staff, which has 17 members, is executing a programme in close cooperation with members of the NIOZ staff and members of the Biology Department of the State University of Groningen.

The project, which is carried out for several ministries, consists of the following sub-projects:

a) DEDMOD.—Documentation of the ecosystem model of the Ems-Dollard estuary, a continuation of the BOEDE project (Biologisch Onderzoek Ems-Dollard Estuary).

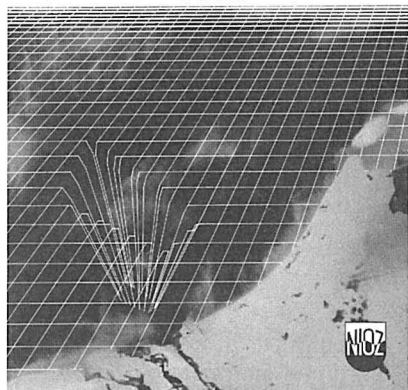
A book giving a description of the model, including the full documentation of all parameters used, will be published in 1987.

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

During 1986, an intensive field programme was carried out in the western part of the Wadden Sea. Organic carbon concentrations, pelagic bacterial biomass and production, benthic respiration, phytoplankton composition and production, meio- and macro-zoobenthos distribution and biomass, meso-zooplankton biomass and respiration, pelagic and benthic predator biomass and food uptake, and many abiotic parameters were measured on a regular basis (6-12 times during the year) at different sampling sites in the study area. A photographic inventory of phytoplankton, protozoa (mainly ciliates) and microzooplankton revealed some striking phenomena. Young *Phaeocystis pouchetii* colonies ($\phi < 50 \mu\text{m}$) were found attached to diatoms blooming during the period in which the *Phaeocystis* started to bloom (as reported for the English Channel by Boalch). Apparently, attachment to diatoms induces colony formation. During the bloom of *Phaeocystis* different cell types were distinguished, indicating different phases of the bloom. Tintinnids (ciliata) from the preserved samples clearly contain *Phaeocystis* cells, dinoflagellates and diatoms, which appear to be their food. Cells of the diatom *Rhizosolenia delicatula*, blooming in June, were found inside dinoflagellates, whereas 5-10% of the *Rhizosolenia* cells were infected by probably parasitic dinoflagellates. In June extensive amounts of larvae of molluscs and polychaetes occurred. A first setup of the ecosystem model was made.

ONDERZOEK NAAR DE MOGELIJKE EFFECTEN
VAN HET LOZEN VAN TITAANDIOXIDE
AFVALZUUR OP DE MACROBENTHISCHE
FAUNA IN DE NOORDZEE

M. Mulder



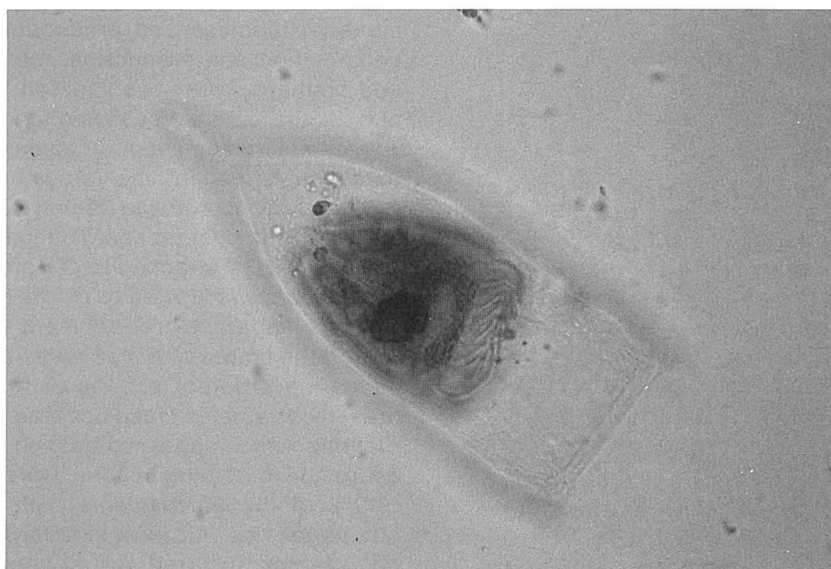
ECOLOGISCH ONDERZOEK NOORDZEE EN WADDENZEE
TECON RAPPORT 1

The model, including documentation, will be finished by the end of 1987.
c) VONZEE.—Preliminary investigations for research regarding the ecology of the North Sea.

In 1986 the Ministry of Transport and Public Works, together with 5 other ministries involved in management of the Dutch part of the North Sea, initiated a new consultation structure to coordinate applied marine research in Dutch waters. The EON staff are actively involved in several groups.

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

Macrofauna samples taken in 1985 around two drilling platforms in the North Sea have been sorted and analysed. During two cruises around these and some other platforms, more samples were collected. A baseline study of an area to be taken into exploration was carried out, followed by a sampling programme, after the drilling had started. In an area up to 500 m from the drilling platforms, a significant change in macrofauna composition was found, whereas close to the platform the discharge of cuttings with attached oil-based drilling mud had wiped out the entire fauna.



Tintinned with consumed dinoflagellate.

1.5.2. Water movement in the western Wadden Sea (WAWAMO)

S-01a

H. Ridderinkhof

With a software packet from Rijkswaterstaat (WAQUA), a two-dimensional hydrodynamic model, gridsize 500 m and timestep 2.5 min., was set up to study tidally induced residual flows and mixing processes in the Wadden Sea and adjacent North Sea.

Results of this model will be used to set up the transport part of the Wadden Sea-ecosystem model (EMOWAD). As the exchange coefficients at the sea boundaries of this "box" model strongly determine the time scales for sea water in the interior of the Wadden Sea, a detailed model, gridsize 250 m, is used to compute the exchange through the tidal inlets. First results of the 500-m-gridsize model indicate a residual circulation from the Vlie inlet towards the Marsdiep inlet which could explain the relatively high salinities in the Marsdiep basin.

1.5.3. Research at the NE Atlantic dumpsite for low-level radioactive waste (DORA)

S-02

M.M. Rutgers van der Loeff,
M.S.S. Lavaleye

The DORA (Deep Ocean research on RadioActive waste) project, a four-year study of the NEA (Nuclear Energy Agency) dumpsite for radioactive waste in the NE Atlantic, was completed in May of this year. Based on two cruises to the site, a detailed description has been made of the geochemical and biological characteristics of the deep-sea floor at the dumpsite.

Biology

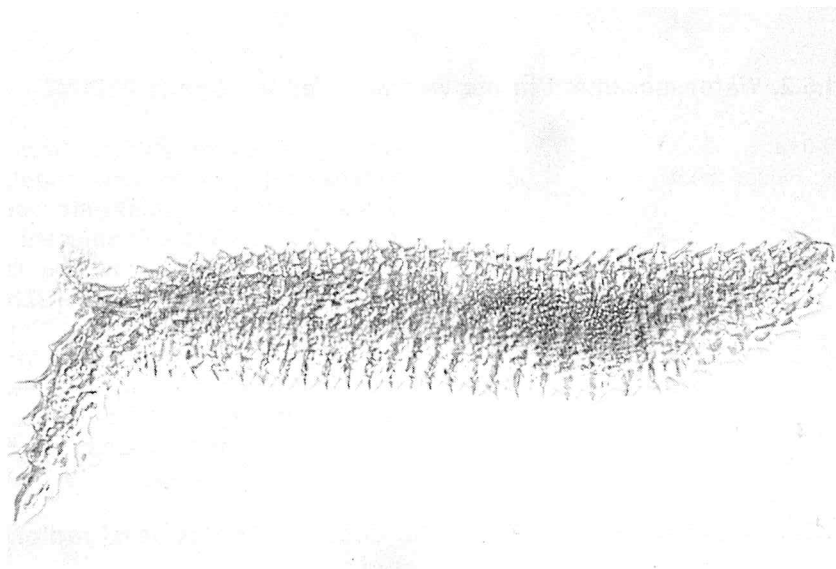
The composition, density, biomass, vertical and horizontal distribution of benthic meiofauna and macrofauna have been studied. The meiofauna has a mean density of 527 000 per m² and a mean biomass of 24.3 mg dry weight per m². Nematoda are the most important meiofauna group in density and biomass. 75% of the meiofaunal biomass is concentrated in the upper 3 cm of the sediment. The horizontal distribution of Nematoda within a box core sample is homogeneous. No correlation was found between densities and biomass. The diversity of the Nematoda fauna is high. Deposit feeders dominate the population with 70% of the biomass.

The macrofaunal metazoans have a mean density of 124 per m² and a mean biomass of 79.7 mg dry weight per m², of which only 29% is found in the upper 3 cm. Polychaeta have the highest average density (45 per m²).

The Metazoa belonging to the large meiofauna (>0.5 mm and <1 mm) have a density of 366 per mm² and a biomass of 14.6 mg dry weight per m². Of this group Polychaeta have the highest density and biomass.

The megafauna (>1 cm and >50 mg) has a density of 42.5 per 10 000 m² and a biomass of 929 g wet weight per 10 000 m². Sea-anemones have the highest abundance and sea-cucumbers are the largest organisms collected. Most of the benthic animals of the meiofauna, macrofauna and megafauna are deposit feeders.

Meiofauna from the boxcore samples. Nematode belonging to the family Desmoscolecidae, length 330 μm (core 5B).



Geochemistry

It had been established earlier that the transition from oxygenated to suboxic conditions in the sediment has a large influence on the mobility of trace metals in the dumpsite sediments. Since rare earth elements (REE) can to some extent be regarded as chemical analogues to the waste components Pu and Am, their behaviour in this transition zone was investigated. Through neutron activation analysis of sediments after selective extraction it was demonstrated that the behaviour of REE is also affected by this transition. When dissolved oxygen is depleted in the pore water, REE are mobilized through reductive dissolution of the metal hydroxide carrier phase. The resulting diagenetic fluxes are, however, relatively small, except in the case of Ce.

The data of dissolved oxygen and nitrate concentrations in the pore water, and of particulate organic carbon in the upper 20 cm of the sediment were described by a diagenetic model. Using this model, we were able to show that the material settling on the ocean floor contains about 3.6% organic carbon, which is about 15 times as much as the highest contents observed in the surface sediment. Fresh organic particles are apparently scavenged efficiently by bottom organisms.

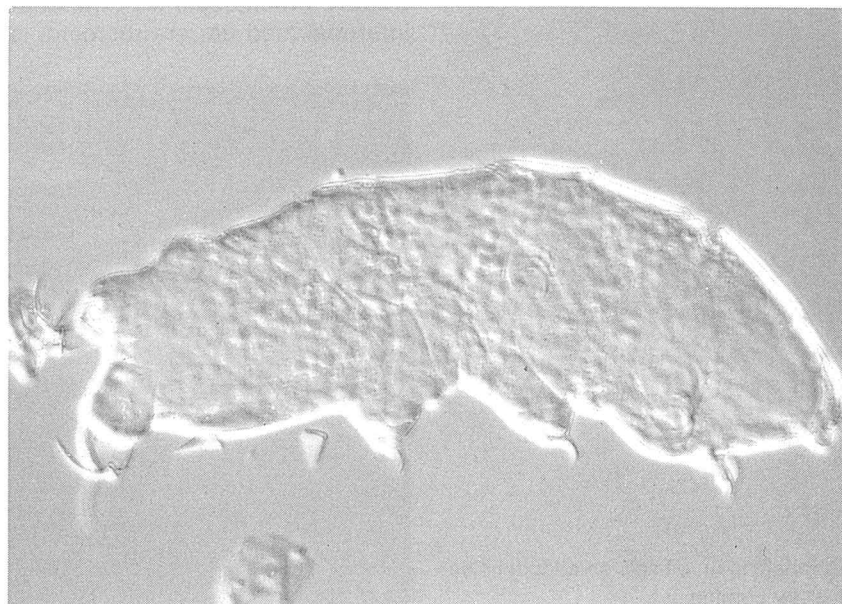
Most of the meiofauna and macrofauna live in the upper 10 cm of the sediment and the majority feed on sediment particles. Owing to their feeding and burrowing activities they turn over the upper 6 cm in a few hundred years. Aerobic mineralization within the bioturbated layer dissolves between 25 and 40% of the CaCO_3 even above the lysocline, and decomposes 98% of the organic matter that settles on the ocean floor. About half of this mineralization can be accounted for by the respiration of macrofauna and meiofauna.

Conclusions regarding the behaviour of waste radionuclides at the sediment-water interface

Once incorporated in the sediment waste radionuclides are subjected to the early diagenetic processes that change all material that settles on the seafloor. Freshly settled organic matter is either decomposed at the surface or scavenged by deeper-living organisms, mixed downwards, and decomposed within the bioturbated layer. Radionuclides bound to organic matter are thus taken up in the food chain and ultimately released at the surface or within the bioturbated layer. In this way the major part of the ^{14}C , and an unknown portion of the Pu and Am of the dumped material will be released to the water column.

Redox reactions have a profound influence on the mobility of various radionuclides, but redox changes occur only at such depths that redox-related releases to the bottom water are unlikely.

The major unknown remains, however, the rate at which suspended particles with their load of radionuclides are incorporated in the sediment by the net result of settling, resuspension and bioturbation. This is the key parameter which determines whether the radioactive isotopes of particle-reactive elements such as Pu, Am and Co will be transported over long distances by bottom currents, as can be expected for the isotopes of more soluble elements such as ^3H , ^{14}C , ^{90}Sr , and ^{134}Cs , or deposited in the sediment near the dumpsite.



Meiofauna from the boxcore samples.
Specimen of the phylum *Tardigrada*,
length 240 μm (core 4B).

1.5.4. Oil pollution experiment (OPEX)

S-04

G.W.N.M. van Moorsel,
P.A.W.J. de Wilde

During earlier OPEX studies fate and effects of North Sea Forties oil and dispersants in outdoor model tidal flats were investigated. Besides NIOZ, TNO and RIN participated in this project. Macrofauna responses were studied by NIOZ. Apart from short-term effects (see annual report 1985), interesting long-term effects were discovered. Mortality as a result of oil or dispersed oil caused a change in both intraspecific and interspecific competition for food. Ten months after the artificial oil spills, the total macrobenthic biomass in most treatments and controls was comparable, but the structures of the present macrofauna communities diverged. In addition to the technical problems of mixing oil and dispersant adequately, this makes the use of dispersants as an oil-combating technique highly disputable. A report on this part of the project was presented to the European Community.

In May 1986 an experiment was initiated in which an oil-gas mixture spill from the F3 field and two different combating techniques were simulated: mechanical removal and the use of a substance which ignites upon contact with water. This substance was proposed in the "disaster scheme" of the NAM. In the experiment, ignition was able to remove part of the F3 mixture, but this resulted in a very high mortality, especially in cockles (*Cerastoderma edule*) and lugworms (*Arenicola marina*). Recovery of the community was very slow. Although the applied F3 mixture ($0.3 \text{ dm}^3 \cdot \text{m}^{-2}$) had a relatively long weathering period, the effects were comparable to those of $0.5 \text{ dm}^3 \cdot \text{m}^{-2}$ Forties oil used in 1984. Mechanical removal had less impact, equalling the development in the controls.

The OPEX project proper, will be ended early in 1987. A new project, SEDEX, which deals with the effects of harbour sludge dumping on the intertidal mud flat environment, is in preparation.

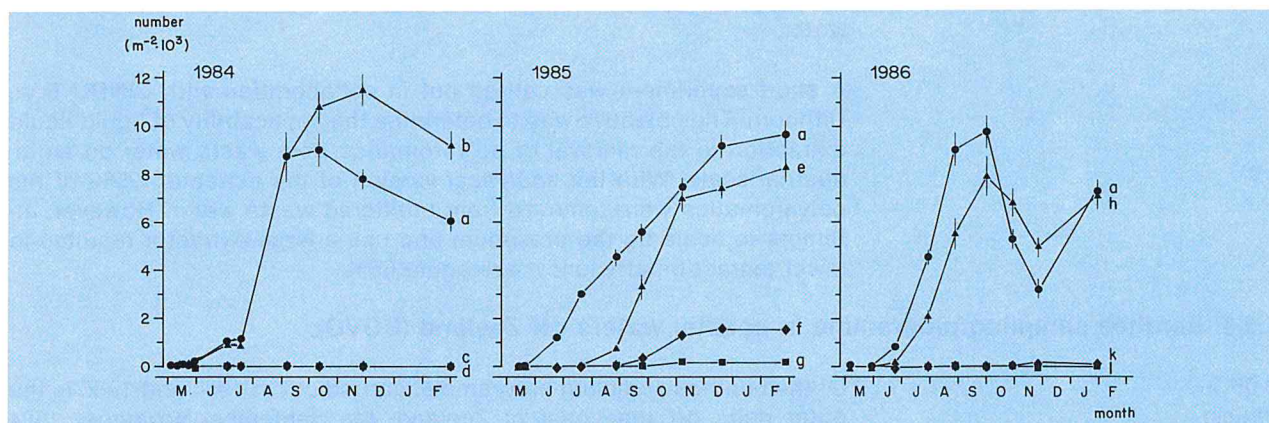


Combatting an oil spill on a Model Tidal Flat by burning.

1984
 c = control
 Fi = dispersant finasol
 F05.5 = forties oil .5 mm,
 5 day exposure
 F05 + Fi = forties oil .5mm
 + dispersant finasol

1985
 c = control
 F01.1 = forties oil .1 mm,
 1 day exposure time
 F01.3 = forties oil .1 mm,
 3 day exposure time
 F01 + Fi = forties oil .1mm
 + dispersant finasol

1986
 c = control
 F3m = F3 oil-gas mixture,
 after mechanical removal
 F3 = F3 oil-gas mixture
 Fire = F3 oil-gas mixture, after
 burning



1.5.5. Continuous liquid-liquid extraction

S-05
 M.Th.J. Hillebrand,
 J. van Heerwaarden

The continuous liquid-liquid extractor ISABELLA (Instrument Suitable for Aqueous Bulk Exposure to Liquid-Liquid Extraction), originally constructed at NIOZ for extraction of low concentrations of PCBs and other chlorinated compounds in water, has been used in 2 projects:

a) Removal of environmental contaminants from groundwater in the Volgermeerpolder.

The suitability of liquid-liquid extraction for cleaning up contaminated groundwater was tested in the Volgermeerpolder, a well-known illegal dumpsite of chemical waste. Because of the presence of high concentrations of volatile organochlorine compounds in the water, it became necessary to change the original approach and include an aeration step in the procedure before extraction. The aeration procedure itself led to a substantial reduction (at least 95%) of extractable organic chlorine. Of the remaining organic chlorine, 67% was removed by the liquid-liquid extraction procedure. Most of the components were identified by gas chromatography with mass spectrometry. The research was carried out under contract with Provinciale Waterstaat van Noord-Holland in collaboration with Hoogheemraadschap Uitwaterende Sluizen Kennemerland en Westfriesland at Edam.

b) Removal of polycyclic aromatic hydrocarbons from industrial waste water.

A short experiment was carried out in collaboration with CINDU B.V., Uithoorn. The objective was to determine the applicability of liquid-liquid extraction to the removal of polyaromatics from waste water on an industrial scale. With the *analytical* version of the extractor, 95% of the polyaromatics were removed from unfiltered waste water. However, attempts to scale up the procedure and use a large extractor resulted in lower extraction efficiency, averaging 65%.

1.5.6. Benthos sampling programme in coastal waters off Zeeland (BOVO)

S-06
P. Seip

Of the benthos sampling programme, carried out in 1984 and 1985 in the outer delta off the coast of Zeeland, the September-November 1984 sampling survey and the April-May 1985 sampling survey have been comprehensively described in a draft report. The September-October 1985 survey will be dealt with at a later stage.

The first two surveys have been subjected to a twin-span classification. This has led to the recognition of spatially differentiated groups of stations which, in both surveys, were consistent with each other, as well as with the abiotic parameters such as depth, median grain size, and mud content of the sediment.

The correlations between the occurrence and density of the individual species and diverse abiotic factors have received considerable attention.

Differences in catches obtained with a Van Veen grab sampler and with a Reineck box sampler have been analysed.

1.5.7. Influence of bioturbating deposit feeders on the nutrient exchange between sediment and water

S-07
J. Heringa

Contract research on the bioturbative abilities of *Arenicola marina* was started by order of the Tidal Waters Division (Dienst Getijdewateren) of Rijkswaterstaat. Pilot studies with lugworms in flow-through cuvettes were carried out at NIOZ, experiments and mathematical simulation in the field station of RWS at Sophia Haven and the Delft Hydraulic Laboratory.

S-08

Synoptic mapping of the North Sea (see 1.3.4.1.)

1.6. ADDITIONAL RESEARCH

1.6.1. Research at NIOZ by guests

- Prof. Dr. W. Ebenhöh (University of Oldenburg, F.R.G.) participated in the modelling of the EON group.
- Dr. H. Etcheber (Centre National de la Recherche Scientifique, Bordeaux, France) participated in the research of organic carbon fluxes in the western Wadden Sea.
- Dr. G. Gust (Department of Marine Science, University of South Florida, U.S.A.) spent two months of his sabbatical leave in the Department of Chemical Oceanography and Marine Pollution, introducing the subject of fluid mechanics to the members of the Department, setting up an experimental facility to study sediment-water interaction processes under known hydrodynamical conditions, and carrying out experiments designed to measure the time response of chemical reactions in sediments to changes in the boundary layer hydrodynamics.
- Dr. M.I. Jenness (Associate Professor Davis & Elkins College, West Virginia, U.S.A.) from May to August continued his studies on the effects of tidal currents on the chlorophyll *a* content of sandy sediments in the southern North Sea.
- Drs. M. van Katwijk (Catholic University, Nijmegen) from 1 April to 1 August worked on the application of classification programmes on benthic carnivore data from the southern North Sea (see 1.3.4.5.).
- Drs. Ruyitno (LON/LIPI, Jakarta, Indonesia) studied the bacterial biomass in the Banda Sea in cooperation with J.H. Vosjan.
- Mrs. K. Saraladevi (Institute of Oceanology, Cochin, Kerala, India) spent one year in the Department of Chemical Oceanography and Marine Pollution as a UNESCO Fellow, collaborating with J.M. Everaarts on the uptake and effects of heavy metals in various benthic organisms.
- Dr. N. Silverberg (Department of Oceanography, University of Quebec at Rimouski, Canada) is spending the 1986/87 academic year on sabbatical leave in the Department of Chemical Oceanography and Marine Pollution, where he collaborates with B. Sundby and W. Helder on projects related to sediment diagenesis and sediment-water exchange processes.
- Dr. C. Vale (Instituto Nacional de Investigacao das Pescas Lisbon, Portugal) completed a manuscript on the suspended sediment dynamics in the Tagus Estuary in collaboration with B. Sundby.

Dr. C.G.N. de Vooy carried out literature research for "Dienst Getijdewateren Rijkswaterstaat" on two subjects. First, the influence of macrobenthos on the exchange of nutrients between the bottom and the water column was investigated. The effect of bioturbation of the entire community as well as of single animal species was given. Animals with permanent bottom tubes turn out to be important for the exchange of nutrients between the bottom and water column. A second literature research was started on a carbon budget for some deposit feeders, with emphasis on the kind of food and possible food selection, and the occurrence of "gardening".

Mr. Chen Wey-yue (East China Normal University, Shanghai, China) cooperated with D. Eisma on tidal flat deposition rates in the Wadden Sea.

In connection with the Indonesian-Dutch Snellius II Expedition, the following Indonesian scientists were involved in the analysis of samples and data, and in the preparation of joint publications:

- Theme 1: M. Karmini (Marine Geological Institute, Bandung)
P. Kridoharto (Marine Geological Institute, Bandung)
D. Kusnida (Marine Geological Institute, Bandung)
S. Suprajitno (Lenigas, Jakarta)
Dr. Rha Sumantri Tahrir (Marine Geological Institute, Bandung)
S. Tjoksosapoetro (Marine Geological Institute, Bandung)
- Theme 2: Dr. Sujatno Birowo (LON/LIPI, Jakarta)
Memet Hermady (LON/LIPI, Jakarta)
Dr. R. Kastoro (LON/LIPI, Jakarta)
Drs. Muswerry Muchtar (LON/LIPI, Jakarta)
- Theme 3: Drs. O.H. Arinardi, M.Sc. (LON/LIPI, Jakarta)
Ir. Suhendro Budiardjo (BPPL, Semarang)
Drs. Hadikusumah (LON/LIPI, Jakarta)
Dr. A.G. Ilahude (LON/LIPI, Jakarta)
Dr. A. Nontji (LON/LIPI, Jakarta)
Ir. Duto Nugroho (BPPL, Semarang)
Ir. Soewito (DGF, Semarang)
Drs. Sutomo (LON/LIPI, Ambon)
A.B. Sutomo, M.Sc. (LON/LIPI, Jakarta)
Drs. Hatta (LON/LIPI, Ambon)
- Theme 3/5: Drs. W. Kastoro (LON/LIPI, Jakarta)
- Theme 5: Drs. Horas Hutagalung (LON/LIPI, Jakarta)
Deddi Moelyadi Moelyo B.Sc. (DPMA, Bandung)
Drs. Hamidah Razak (LON/LIPI, Jakarta)
Drs. Sudarmadji (DPMA, Bandung)
Ibrahim Sumanta (DPMA, Bandung)
Drs. Sumarno (Gadjah Madah University, Yogyakarta)

1.6.2. Participation in national and international programmes

The DORA project ended this year with the publication of a final report. This project forms the Dutch contribution to the Coordinated Research and Environmental Surveillance Program (CRESP). Within CRESP, member countries of the Nuclear Energy Agency (NEA) work together to yield the scientific basis for the evaluation of the dumping activities of radioactive waste in the N.E. Atlantic Ocean.

In April-May, NIOZ cooperated in a synoptic survey of the benthic fauna of the North Sea with R.V. "Tyro". Other participants were Rijkswaterstaat, Netherlands, State University of Ghent, Belgium, Alfred Wegener Institut, Bremerhaven,

Biologische Anstalt Helgoland and Institute für Hydrobiologie und Fischereiforschung, both in Hamburg, Institut für Meereskunde, Kiel, Institut für Meeresgeologie und Meeresbiologie, Wilhelmshaven, and Heriot-Watt University, Edinburgh (see 1.3.4.1.).

Moreover, during this cruise a survey was carried out to obtain data on the uptake (accumulation) of a number of selected pollutants (heavy metals: copper, zinc, cadmium and lead; organochlorine compounds: pesticides and PCB's) in benthic biota of the North Sea. Total body analyses were carried out of specimens representing a number of different animal groups: 1. Annelida, Polychaeta - *Nephtys hombergii*; 2. Arthropoda, Crustacea - *Pagurus bernhardus*, *Crangon crangon* and *Crangon allmanni*; 3. Mollusca, Bivalva - *Venus striatula*; 4. Echinodermata, Asteroidea - *Asterias rubens*, *Ophiura albida*, *Echinocardium* sp. At each sampling station (71), sediment samples were taken to analyse the above mentioned pollutants. This project was carried out in cooperation with Dienst Getijdewateren, Rijkswaterstaat, Groningen.

In May, J.H. Vosjan and G. Nieuwland participated in the German Antarctic Programme. They joined the Antarctic Winter Expedition ANT V/1 on board R.V. "Polarstern" and studied respiratory activity and biomass in Antarctic waters.

In September, October, November and December, H.G. Fransz, W.W.C. Gieskes and C. Veth participated in leg ANT V/3 of the Winter Weddell Sea Project (W.W.S.P. 86) on board R.V. "Polarstern" (Alfred Wegener Institut für Polar- und Meeresforschung, Bremerhaven, F.R.G.). This was an interdisciplinary study in the coastal polynyas in the eastern part of the Weddell Sea (Antarctica).

From September 25 to October 15, D. Eisma and J. Schilling took part in a research cruise in the Indonesian waters around the island of Sumbawa. The cruise, carried out with the R.V. "Die Sonne", was part of an Indonesian-German

Indonesian scientists staying at NIOZ and other Dutch institutes to cooperate in the analysis of samples and data from the Indonesian-Dutch Snellius II expedition visited the minister of Education and Science Drs. W.J. Deetman on 26 February 1986.



cooperative programme. The programme consisted of a geophysical part (seismic profiling with 3.5 Kc and airgun), sedimentology (box cores, piston cores, kastenlot) and water sampling. To complement the programmes carried out in the Flores Sea and Makassar Strait as part of Snellius II, short cores from box cores and water samples were collected for analysis in Texel.

Several staff members of the EON-Group participated in national working groups preparing future applied ecological research in the North Sea and the Wadden Sea.

J.W. Baretta and P. Ruurdij (EON-Group) participated in a preliminary research group due to develop an ecosystem model of the Faro estuary in Portugal.

At the request of Rijkswaterstaat, Department North Sea, H.J. Lindeboom (EON) participated in several national and international meetings on ocean dumping.

By order of Rijkswaterstaat, Department North Sea, investigations were carried out on the effects of dumping drill cuttings with oil-based mud on the bottom fauna around drilling platforms (EON, TECON programme).

In cooperation with the Fisheries Research Institute (RIVO), research was carried out on food conditions of herring larvae and recruitment of herring populations in the North Sea.

1.6.3. Visitors from abroad

Dr. S.M. Ali, Central Marine Fisheries Research Institute, Cochin, India.

Ir. E. Mulayadi Amin, BPPL, Jakarta, Indonesia.

Dr. M.P. Bacon, Woods Hole Oceanographic Institution, Woods Hole, U.S.A.

Prof. Dr. D. Baird, University of Port Elizabeth, South Africa.

Dr. Y. Benayahu, Dept. Zoology, Tel Aviv University, Israel.

J.J.E. van Beusekom, Universität Hamburg, F.R.G.

Dr. G. Billen, Université Libre, Brussels, Belgium.

Dr. Sujatno Birowo, PPPO, Ambon, Indonesia.

Dr. E.A. Blomquist, Åbo Akademi, Finland.

Dr. E. Bonsdorff, Åbo Akademi, Finland.

T. Bürgen, University of Basel, Switzerland.

K. Costopoulos, University of Athens, Greece.

Dr. Wayne Davis, E.P.A., Rhode Island, U.S.A.

C.D. Dayanghizang, Bureau of Mines and Geosciences, Manila, Philippines.

Dr. Muhammad Eidman, Faculty of Fisheries, Bogor, Indonesia.

Dr. R.N. Gibson, Dunnstafanage Marine Research Laboratory, Oban, Scotland.

Dr. W. Gunkel, Helgoland, F.R.G.

R.L. Haedrich, Memorial University of Newfoundland, St. John, Newfoundland, U.S.A.

Shen Jian, East China Normal University, Shanghai, P.R. China.

Dr. C. Lancelot, Université Libre, Brussels, Belgium.

Prof. Dr. J. Lenz, Université Libre, Brussels, Belgium.

Dr. Purwito Martosubroto, DGF, Jakarta, Indonesia.

L. Mayer, Dalhousie University, Halifax, Canada.

Prof. J.M. Miller, North Carolina State University, Raleigh, U.S.A.

Dr. Ch. Mizota, Faculty of Agriculture, Kyushu University, Fukuoka, Japan.

Dr. Isabel Moreno, Dpto. Zoología y Biología Marina, Univ. Balarica, Palma de Mallorca, Spain.

Dr. R. Neves, Institute Sup. Tec., Lisbon, Portugal.

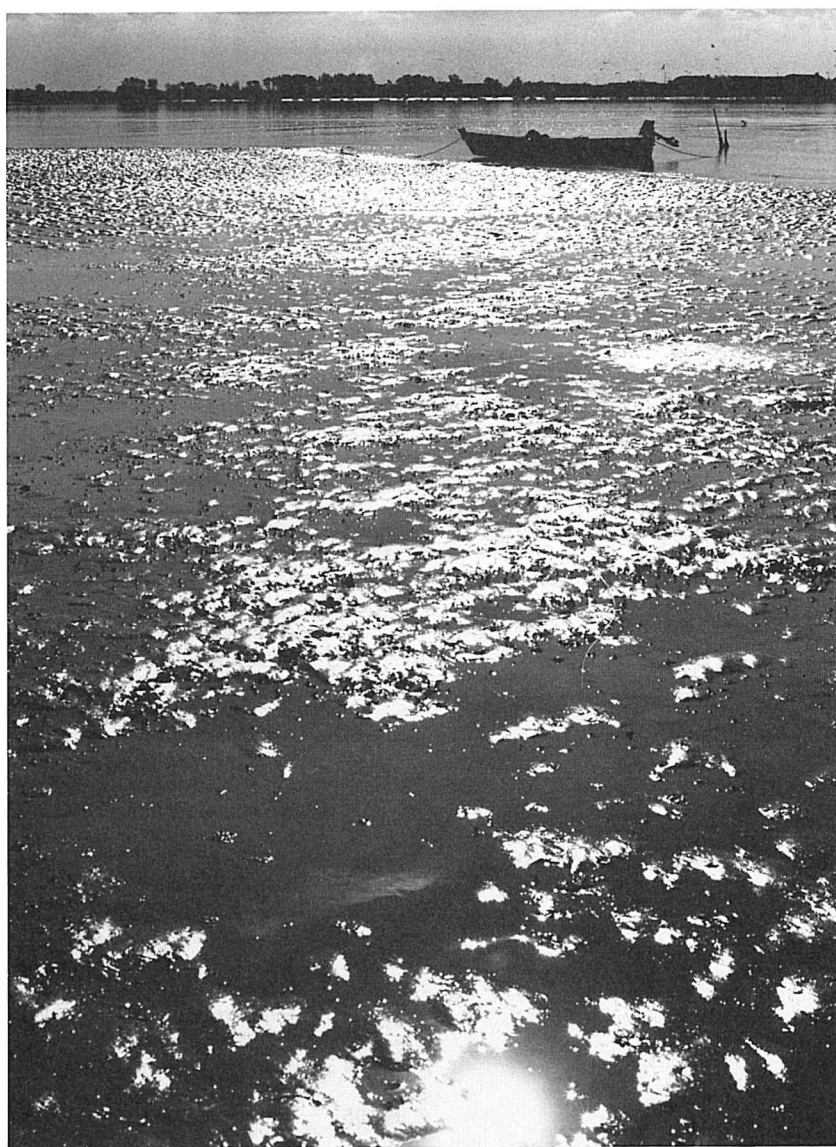
B. Onken, Institut für Biochemie und Lebensmittelchemie- Meeresforschung, Hamburg, F.R.G.

Dr. V.D. Ramamurthy, Agricultural & Marine Products, Indian Economic Mission to E.E.C., Brussels, Belgium.

Miss Olga Renones, Dpto. Zoología y Biología Marina, Univ. Balarica, Palma de Mallorca, Spain.

Dr. Kasyan Romimohtarto, PPPO, Jakarta, Indonesia.

Dr. S. Roy, Dalhousie University, Halifax, Canada.
Dr. Z. Scetenyi, University of Budapest, Hungary.
Dr. W. Silvert, Bedford Institute of Oceanography, Dartmouth, Canada.
Dr. F. Smayda, University of Rhode Island, U.S.A.
Dr. Aprilani Soegiarto, LIPI, Jakarta, Indonesia.
K. Speer, Woods Hole Oceanographic Institution, Woods Hole, U.S.A.
Dr. O. Svenson, Uppsala, Sweden.
J.C. Thomasen, Dept. Zoology, University of New Castle, U.K.
Dr. B. Vincent, Rimouski (Quebec), Canada.
Prof. Dr. R.E. Weber, Zoophysiological Laboratory, Odense, Denmark.



1.7. LIST OF RESEARCH PROJECTS AND RESEARCH WORKERS

1.7.1. Hydrography (H)

Chemical Oceanography and Marine Pollution department (B. Sundby)

- H1-01 Nutrient, oxygen and carbon investigations in the Wadden Sea, the North Sea and the open ocean (S.B. Tijssen, C. Westra, assistants F. Wetsteyn, J.W. Rommets)
- H1-02 Nitrogen cycling in the marine environment (W. Helder, P. Keskamp, assistant R.T.P. de Vries)
- H1-03 Diagenetic processes of N-compounds in marine sediments under conditioned circumstances (W. Helder, P. Keskamp, assistant R.T.P. de Vries)
- H1-04 Carbon dioxide research (H. Postma, J.M.J. Hoppema, assistant J.W. Rommets)
- H1-05 Exchange of trace metals between sediment and water (L. Gerringa, B. Sundby, assistant R. Nolting)
- H1-06 Identification of chlorinated hydrocarbons and their behaviour in the marine environment (J.M. Everaarts, K. Booy, assistant M.Th.J. Hillebrand)
- H1-07 Investigation of the distribution of metals in Jakarta Bay (R. Nolting)
- H1-08 Sublethal effects of heavy metals on marine organisms (J.M. Everaarts)
- H1-09 Uptake, distribution and elimination of PCB components and chlorinated hydrocarbon pesticides in marine organisms (J.M. Everaarts, assistant M.Th.J. Hillebrand)
- H1-10 Sublethal effects of selected chlorinated hydrocarbons on marine organisms (J.M. Everaarts, assistant M.Th.J. Hillebrand)
- H1-11 Exchange of organic micropollutants between sediment and water (K. Booy, assistant M.Th.J. Hillebrand)
- H1-12 Early diagenesis of trace metals and the biogeochemistry of the benthic boundary layer (B. Sundby)

Physical Oceanography department (C. Veth)

- H2-01 Marine optics 1: the euphotic zone of oceanic waters (D. Spitzer, assistant M.R. Wernand)
- H2-02 Marine optics 2: remote sensing of coastal waters (D. Spitzer, R.M.J. Dirks, assistant M.R. Wernand)
- H2-03 Experimental dynamical oceanography (C. Veth, J.J.M. van Haren, L.R.M. Maas, J.T.F. Zimmerman, assistants S. Ober, M.W. Manuels)
- H2-04 Small-scale turbulence, mixing layers and thermocline studies (C. Veth, assistant S. Ober)
- H2-05 Theoretical dynamical oceanography (J.T.F. Zimmerman, L.R.M. Maas)

Marine Geology and Geochemistry department (D. Eisma)

- H3-01 Sediment transport and sedimentation in the North Sea area (D. Eisma, T.C.E. van Weering, assistants G.W. Berger, S.J. van der Gaast, J. Kalf, J. van Iperen)
- H3-02 The marine silica cycle (A.J. van Bennekom, J.H.F. Jansen, assistants G.W. Berger, S.J. van der Gaast, J. van Iperen)
- H3-03 Sedimentology and palaeoceanography of the Angola Basin and Zaire deep-sea fan (J.H.F. Jansen, A.J. van Bennekom, T.C.E. van Weering, assistants G.W. Berger, S.J. van der Gaast, J. Kalf, J. van Iperen)
- H3-04 Palaeoceanography and silicate accumulation of deep-sea sediments (J.H.F. Jansen, A.J. van Bennekom, assistants G.W. Berger, S.J. van der Gaast, J. Kalf, J. van Iperen)
- H3-05 Conversion of clay minerals in the sea (S.J. v.d. Gaast)
- H3-06 Transport and sedimentation of suspended matter under the influence of the Scotland-Greenland Ridge flow system (D. Eisma, assistants S.J. van der Gaast, J. Kalf, J. van Iperen)
- H3-07 Sedimentation processes along continental margins (T.C.E. van Weering, assistants G. W. Berger, S.J. van der Gaast, J. Kalf, J. van Iperen)
- H3-08 Geology and geochemistry of the floor of southern Indonesian deep-sea basins (T.C.E. van Weering, J.H.F. Jansen, D. Eisma, assistants G.W. Berger, S.J. van der Gaast, J. Kalf, J. van Iperen)
- H3-10 Dating with naturally occurring isotopes (A.J. van Bennekom, D. Eisma, assistant G.W. Berger)

1.7.2. Biology (B)

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

- B1-01 Experimental systems (J.H. Vosjan, P.A.W.J. de Wilde, R.P.M. Bak, assistants E.M. Berghuis, A. Kok, E. Pauptit, G. Nieuwland)
- B1-02 The activity of micro-organisms (J.H. Vosjan, assistants E. Pauptit, G. Nieuwland)
- B1-03 Bioturbation as environmental factor (J.H. Vosjan, P.A.W.J. de Wilde, assistants E. Pauptit, G. Nieuwland)
- B1-04 Energy consumption and production in dominant benthic faunal elements; community respiration (P.A.W.J. de Wilde, J.H. Vosjan, S. Cramer, assistants E.M. Berghuis, A. Kok, E. Pauptit, G. Nieuwland)
- B1-05 Coral research (R.P.M. Bak)
- B1-06 Microzooplankton (R.P.M. Bak, assistant G. Nieuwland)
- B1-07 Synoptic Mapping of the North Sea (P.A.W.J. de Wilde, F. Creutzberg, G.C.A. Duineveld, B.R. Kuipers, J.M. Everaarts, J.H. Vosjan, assistants A. Kok, E.M. Berghuis, E. Pauptit)

Autecology (F. Creutzberg)

- B2-01 The role of carnivores in the tidal area
 - c Energy budget and growth experiments (M. Fonds, assistant P. v.d. Puy)
 - d Mortality in plaice eggs and larvae (F. Hovenkamp, J.J. Zijlstra)
- B2-02 The role of the benthic fauna in the ecosystem of the southern North Sea

- a-c The role of carnivores in the benthic system (F. Creutzberg, G.C.A. Duineveld, assistant G.J. v. Noort)
- d The energy budget of benthic carnivores (M. Fonds, assistant P. v.d. Puyl)
- e The role of secondary producers in the benthic system (G.C.A. Duineveld)
- f Comparative research on benthos in boundary systems (R.P. Heyman)
- B2-03 Carnivores in the pelagic system (B.R. Kuipers, R. Daan, assistant H.J. Witte)
- B2-04 Vision in Odontocetes (A.D.G. Dral)

Benthic systems (J.J. Beukema)

- B3-01 *In situ* production and input of organic matter (G.C. Cadée, assistant J. Hegeman)
- B3-02 a Secondary production and population dynamics in bivalves and other bottom fauna in the Wadden Sea (J.J. Beukema, assistants W. de Bruin, J. Zuidewind)
- b Ecology of bottom fauna in sediments along the coasts of western Europe (J.J. Beukema, assistants W. de Bruin, J. Zuidewind)
- B3-03 a The role of sea-birds in the food chain and population dynamics in the Wadden Sea and adjacent North Sea (C. Swennen, assistants P. Duiven, J. Zuidewind)
- b Comparison of the food system of sea-birds in tropical areas and the Wadden Sea (C. Swennen, assistants P. Duiven, J. Zuidewind)
- B3-04 Ecophysiology of benthic crustaceans (D.H. Spaargaren)
- B3-05 Variability in annual recruitment of benthic invertebrates living on tidal flats in the Dutch Wadden Sea (R. Dekker)

Pelagic systems (H.G. Fransz)

- B4-01 The pelagic system of the non-stratified shelf area (H.G. Fransz, W.W.C. Gieskes, F.A.C. Kouwets, 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, M.J.M. Reichert, assistants G.W. Kraay, S.R. Gonzalez, S.S. Oosterhuis, N. Schogt)
- B4-03 The pelagic system of the permanently stratified sea (M.A. Baars, W.W.C. Gieskes, P.H. Schalk, W. Zevenboom, assistants G.W. Kraay, S.S. Oosterhuis, J.I.J. Witte, N. Schogt)
- B4-04 Experimental investigations on zooplankton (W.C.M. Klein Breteler, M.J.M. Reichert, assistant S.R. Gonzalez)

1.7.3. Special projects (S)

H.J. Lindeboom

- S-01 Ecological Research North Sea and Wadden Sea (EON) (M.A. van Arkel, J.W. Baretta, M.J.N. Bergman, A.C. Bol-den Heijer, B. van Dessel, F. van Duyl, R. Kloosterhuis, A.J. Kop, R.W.P.M. Laane, W.E. Lewis, H.J. Lindeboom, H. Malschaert, M. Mulder, W. van Raaphorst, H. Ridderinkhof (also WAWAMO) P. Ruardij, A. Stam, H.W. van der Veer)
Stationed at the University of Groningen:
W. Admiraal, M.J.W. Veldhuis, L.A.H. Venekamp, L.A. Villerius, F. Colijn (allied scientist, University of Groningen)

- S-01 a Water movement Model of the western Wadden Sea (WAWAMO)
(H. Ridderinkhof)
- 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)
- S-04 Oil Pollution Experiments (OPEX) (P.A.W.J. de Wilde, G.W.N.M. van
Moorsel, L. van der Laag, P. Kamermans, H. Welleman, assistants
W.M. Berghuis, A. Kok (EC Brussels, Dienst Getijdewateren RWS,
NAM, TNO, RIN, NIOZ).
- S-05 Continuous liquid-liquid extraction (M.Th.J. Hillebrand, J. van Heer-
waarden)
- S-06 Benthos sampling programme in Zeeland coastal waters (P. Seip (sta-
tioned at Dienst Getijdewateren, Rijkswaterstaat, Middelburg), assis-
tant R. Brand)
- S-07 Effect deposit-feeding bottom fauna on sediment-water exchange (J.
Heringa (stationed at Dienst Getijdewateren, Rijkswaterstaat, Mid-
delburg))
- S-08 Synoptic Mapping of the North Sea
Biology programme: assistants Y. Bakker, G.J. Zigterman (see B1-07)
Chemistry Programme: assistants C. Fischer, A. de Jong (stationed
at Dienst Getijdewateren, Rijkswaterstaat, Groningen)



2. Publications, lectures, etc.

2.1. PUBLICATION

2.1.1. Netherlands Journal of Sea Research and other series issued

In 1986 volume 20 appeared in 3 issues, viz. no. 1 in June with 9 papers, no. 2/3 in August with 21 papers and no. 4 in December with 6 papers. The combined no. 2/3 was dedicated to Prof. Dr. H. Postma on the occasion of his 65th birthday and was presented at his retirement as director of the Netherlands Institute for Sea Research. It was edited by P. de Wolf, J.T.F. Zimmerman and J.J. Zijlstra.

Out of the 36 papers published in vol. 20, 19 were on marine biology, 7 on marine chemistry, 4 on marine sedimentology, 3 on physical oceanography and 3 on other marine research topics. Among the 36 first authors, 15 are from outside the Netherlands. The time lag between the receipt of an acceptable (*i.e.* generally a revised) manuscript and its publication varied between 3 and 8 months, with an average of 4.5 months.

In the series Special Publications, 2 issues were published, viz. the Annual Report 1985 of the Netherlands Institute for Sea Research (no. 12) and the Abstracts of the Jubilee Meeting of the Neth. Oceanographic Society (no. 13).

2.1.2. PUBLICATIONS NIOZ 1986

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2. ADMIRAAL, W. & L.A.H. VENKAMP. Significance of tintinnid grazing during blooms of *Phaeocystis pouchetii* (Haptophyceae) in Dutch coastal waters.—*Neth. J. Sea Res.* **20**: 61-66.
3. ANDERSON, L., P. HALL, A. IVERFELDT, M. RUTGERS VAN DER LOEFF, B. SUNDBY & S. WESTERLUND. Benthic respiration measured by total carbonate production.—*Limnol. Oceanogr.* **31**: 319-329.

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5. ARKEL, M.A. VAN & M. MULDER. Preliminary conclusions of an investigation of the macrobenthic fauna in a discharge area for TiO₂ waste acid in the North Sea.—Environm. Mon. Assess. **7**: 285-286.
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7. BAARS, M.A. The Snellius II Expedition. 2. Biological oceanography in the eastern Banda Sea and western Arafura Sea in relation to the monsoons.—Plankton Newsletter **5**: 19-23.
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10. BARETTA, J.W. & P. RUARDIJ. The Ems-Dollard ecosystem model. In: F.J.A. SARIS & T. ALDENBERG Ecosysteemmodellen: mogelijkheden en beperkingen. PUDOC, Wageningen: 73-84.
11. BERGMAN, M.J.N. Antarctica: koud continent met tropisch verleden.—Zenith **13**: 30-33.
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14. ——. Characterization of the individual suspension particles in the Ems estuary. In: S.Y. WANG, H.W. SHEN & L.Z. DING. River Sedimentation. 3rd Int. Symp. Univ. Mississippi: 488-494.
15. BEUKEMA J.J. & G.C. CADÉE. Zoobenthos responses to eutrophication of the Dutch Wadden Sea. —Ophelia **26**: 55-64.
16. BEUKEMA, J.J. & M. DESPREZ. Single and dual growing seasons in the tellinid bivalve *Macoma balthica* (L.).—J. exp. mar. Biol. Ecol. **102**: 35-45.
17. BEUKEMA, J.J. & K. ESSINK. Common patterns in the fluctuations of macrozoobenthic species living at different places on tidal flats in the Wadden Sea.—Hydrobiologia **142**: 199-207.
18. BEWERS, J.M., P.A. YEATS, S. WESTERLUND, B. MAGNUSSON, D. SCHMIDT, H. ZEHLE, S.S. BERMAN, A. MYKYTIUK, J.C. DUINKER, R.F. NOLTING, R.G. SMITH & H.L. WINDOM. Comparison of filtration procedures. In: Reports on the ICES fifth round intercalibration on trace metals in sea water. ICES cooperative research report 136: 5-26.
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 26. CREUTZBERG, F. Distribution patterns of two bivalve species (*Nucula turgida*, *Tellina fabula*) along a frontal system in the southern North Sea.—Neth. J. Sea Res. **20**: 305-311.
 27. CREUTZBERG, F. & G.C.A. DUINEVELD. The role of the lesser weever *Trachinus vipera* and the dab *Limanda limanda* in the benthic system of the southern North Sea.—ICES, C.M. 1986/L:4.
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 31. DIEL, S. & W.C.M. KLEIN BRETELER. Growth and development of *Calanus* spp. (Copepoda) during spring phytoplankton succession in the North Sea.—Mar. Biol. **91**: 85-92.
 32. DUINEVELD, G.C.A. & G.J. VAN NOORT. Observations on the population dynamics of *Amphiura filiformis* (Ophiuroidea: Echinodermata) in the southern North Sea and its exploitation by the dab, *Limanda limanda*.—Neth. J. Sea Res. **20**: 85-94.
 33. DUURSMA, E.K. Marine chemistry or chemical oceanography.—La Mer **24**: 1-2
 34. DUURSMA E.K. & J.M. BEWERS. Application of K_d s in marine geochemistry and environmental assessment. C.E.C. Commission of the European Communities. Directorate General for Science, Research, and Development Radiation Protection Programme: 1-24.
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 36. DUURSMA, E.K., J. NIEUWENHUIZE, J.M. VAN LIERE & M.TH.J. HILLEBRAND. Partitioning of organochlorines between water, particulate matter and some organisms in estuarine and marine systems of the Netherlands.—Neth. J. Sea Res. **20**: 239-251.
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84. VEER, H.W. VAN DER & M.J.N. BERGMAN. Development of tidally related behaviour of a newly-settled O-group plaice (*Pleuronectes platessa*) population in the western Wadden Sea.—Mar. Ecol. Prog.Ser. **31**: 121-129

85. VELDHUIS, M.J.W., W. ADMIRAAL & F. COLIJN . Chemical and physiological changes of phytoplankton during the spring bloom, dominated by *Phaeocystis pouchetii* (Haptophyceae): Observations in Dutch coastal waters of the North Sea.—Neth. J. Sea Res. **20**: 49-60.
86. VELDHUIS, M.J.W., F. COLIJN & L.A.H. VENEKAMP . The spring bloom of *Phaeocystis pouchetii* (Haptophyceae) in Dutch coastal waters.— Neth. J. Sea Res. **20**: 37-48.
87. Vooy's, C.G.N. de. De invloed van het macrozoöbenthos op de uitwisseling van nutriënten tussen de bodem en het water in het mariene milieu. Een literatuuronderzoek. NIOZ rapport in opdracht van de Dienst Getijdewateren Rijkswaterstaat: 1-26.
88. VOOYS, C.G.N. DE & D.A. HOLWERDA. Anaerobic metabolism in sublittoral living *Mytilus galloprovincialis* Lam. in the Mediterranean. 3. The effect of anoxia and osmotic stress on some kinetic parameters of adductor muscle pyruvate kinase.—Comp. Biochem. Physiol. **85**: 217-221.
89. WESTERLUND, S., L. ANDERSON, P. HALL, A. IVERFELDT, M. RUTGERS VAN DER LOEFF & B. SUNDBY. Benthic fluxes of cadmium, copper, nickel, zinc, and lead in the coastal environment.—Geochim. cosmochim. Acta **50**: 1289-1296.
90. WILDE, P.A.W.J. DE, E.M. BERGHUIS & A. KOK. Biomass and activity of benthic fauna on the Fladen Ground (northern North Sea).—Neth. J. Sea Res. **20**: 313-323.
91. YASUDA H. & J.T.F. ZIMMERMAN. Tide induced residual currents with Stokes and Ekman layers over an undulating sea floor.—J. Oceanogr. Soc. Japan. **42**: 276-293.
92. ZEVENBOOM, W. Tracing red-pigmented marine Cyanobacteria using *in vitro* absorption maxima in the Banda Sea, August 1984, Snellius II Expedition. FEMS Microbiology Ecology **38**: 267-275.
93. ZIJLSTRA, J.J. Preface.—Neth. J. Sea Res. **20**: 95-97.
95. ZIMMERMAN, J.T.F. The tidal whirlpool: a review of horizontal dispersion by tidal and residual currents.—Neth. J. Sea Res. **20**: 133-154.
96. ——. Principal differences between 2d and vertically averaged 3d models of topographic tidal rectification.—Lect. Notes Estuar. Coastal Sci. **16**: 120-129.



2.1.3. Internal Reports NIOZ 1986

1. ANON. Publicationlist of the Biological Research Group Ems-Dollard Estuary (1972 - 1984). 1986-2.
2. GROENEWOLD, A. De invloed van de plaatselijke dichtheid van oude kokkels op vestiging en groei van kokkelbroed. 1986-4.
3. KEUS, B. De predatie van de garnaal (*Crangon crangon*) op het broed van het non-netje (*Macoma balthica*). 1986-5.
4. NOORT, G.J. VAN, F. CREUTZBERG & G.C.A. DUINEVELD. "Aurelia"-cruise report on the benthic fauna of the southern North Sea. Report 9: Trawl survey May and July 1980. 1986-3.
5. RAJENDRAN, A. Trace metals geochemistry in three sediment cores from the Skagerrak (North Sea). 1986-6.
6. STROO, D. A method for validation. 1986-1.

2.1.4. Cruise Reports 1986

1. BAARS, M.A., H.G. FRANSZ, C. VETH & P.A.W.J. DE WILDE. Verslag van de vaartochten in het kader van het Frisian Front Project; R.V. "Tyro" 7 mei t/m 26 juni 1986, R.V. "Aurelia" 7 mei t/m 10 juli 1986. NIOZ-NRZ rapport: 1-115.
2. BERGER, G. & D. EISMA. ²¹⁰Pb metingen in water en gesuspendeerd materiaal in de Nederlandse kustwateren in januari 1986. Rapport NIOZ: 1-22.
3. DUINKER, J.C., J.M. EVERAARTS, M.TH.J. HILLEBRAND & J.H.J. TERWINDT. River inputs into ocean systems. Progress Report, The Snellius-II expedition: 1-52.
4. EISMA, D. & G. LIEBEZEIT. Chemistry of dissolved and particulate compounds in the water column. Cruise report "Die Sonne" 45 - B, 25 September - 15 October, 3 p.
5. MAAS, L.R.M. & J.J.M. VAN HAREN. Data report of currents, temperature and pressure observations, stratified central North Sea 1980-1982. Rpt. 86-14, Inst. Met. Oceanogr. State Univ. Utrecht.
6. SCHILLING, J.S. Coring techniques used onboard R.V. "Die Sonne". Cruise report "Die Sonne" 45 - B, 25 September - 15 October, 4 p.
7. WEERING, T.J.C.E. VAN. Snellius II - Progress Report. Geology and Geophysics of the Banda Arc and adjacent area. Cruise G1c, G2, G6.
8. ZIJLSTRA, J.J. & M.A. BAARS. The Snellius-II Expedition. Progress Report Theme III Pelagic Systems. Biological oceanography in the eastern Banda Sea and northern Arafura Sea in relation to the monsoons. Cruises RV "Tyro", RV "Samudera" and RV "Tenggiri", August 1984, February-March 1985. NRZ rapport.

2.2. LECTURES, etc.

2.2.1. Colloquia and lectures at the institute

(titles translated)

17 January	H. Ridderinkhof (NIOZ): (A two-dimensional numerical model to study water movement in the western Wadden Sea.)
31 January	A. Zehnder (L.H. Wageningen): (Anaerobic methane oxidation: dream or reality.)
7 February	Phaeocystis colloquium: F. Colijn (R.U. Groningen): Introduction M.J. Veldhuis (R.U. Groningen and NIOZ) and G.C. Cadée (NIOZ): Phaeocystis research in the Netherlands.
12-13 February	Antarctica colloquium (Alfred-Wegener-Institut für Polar- und Meeresforschung, Bremerhaven, F.R.G.): G. Hempel (A.W.I.): Recent advances in German Antarctic Research. A. Behrens (A.W.I.): Coastal currents in the Weddell Sea. S. Schnack (A.W.I.): Plankton studies in the Weddell Sea. J. Plötz (A.W.I.): Feeding ecology of Weddell Seals. M. Spindler (A.W.I.): Sea ice biota. P. Marschall and I. Hempel (A.W.I.): Early life history of krill.
21 February	E. Kristensen (Odense University, Denmark): The influence of Nereid polychaetes on C and N transformations and fluxes in estuarine sediments.
7 March	G. de Lange (R.U. Utrecht): Porewater profiles in mixed pelagic-turbidite sediments. J. Smit (University of Southern California, U.S.A. and V.U., Amsterdam): The Cretaceous — Tertiary boundary; out with a bang — not with a whimper.
21 March	Biological interaction governing recruitment of benthic animals: J.J. Beukema (NIOZ): Variability in recruitment success of bivalves on Balgzand during a 17-year period of observation. R. Dekker (NIOZ): Field experiments on the influence of infaunal components on recruitment success of bivalves. B. Keus (R.U. Groningen): Brown shrimps (<i>Crangon crangon</i>) as predators of bivalves on tidal flats. E. Bonsdorff (Åbo, Finland): Biological interactions in the benthic ecosystem of the northern Baltic.
21 April	M.P. Bacon (Woods Hole Oceanographic Institution, U.S.A.): Scavenging of radionuclides in the ocean.

3 September	K. Speer (Woods Hole Oceanographic Institution, U.S.A.): Modelling deep water circulation in the Angola Basin.
8 September	W.R. Davis (E.P.A., Rhode Island, U.S.A.): The role of benthic biotic processes in sediment entrainment. G. Gust (University of South Florida, U.S.A.): <i>In situ</i> measurements of entrainment rates of undisturbed natural sediments by SEAFUME.
12 September	D. Baird (University of Port Elisabeth, South Africa): A network analysis of the Chesapeake Bay. H.J. Lindeboom (NIOZ): (Modelling of pelagic microbial activities in the carbon cycle of an estuarine ecosystem.)
19 September	G. Gust (University of South Florida, U.S.A.): Flow features of benthic boundary layers — an interdisciplinary overview.
26 September	W. van Raaphorst (NIOZ): Phosphorus fluxes across the sediment-water interface. G. Gust (University of South Florida, U.S.A.): Hydrodynamic driving forces of fluxes across the sediment-water interface.
10 October	F. Kouwets (NIOZ): (Research on factors limiting the phytoplankton growth in Dutch coastal waters.) M. Reichert (NIOZ): (The influence of food composition on food uptake in some copepods.)
22 October	H. Benayahu (Tel Aviv University, Israel): Community organization in Red Sea soft corals (Alcyonaria). J. Varekamp (Wesleyan University, Connecticut, U.S.A.): Kalium-rich volcanism and subduction zone: results Snellius II expedition, Volcanology group.
24 October	C. Westra (NIOZ): (O ₂ -content, temperature and salinity determination in connection with the Frisian Fronts.) R. Heyman (NIOZ): (Benthic front systems round the Dogger Bank: a set-up.) F. Hovenkamp (NIOZ): (Mortality, growth and recruitment of plaice-larvae in the North Sea.)
14 November	L. Gerringa (NIOZ): (Cu and Cd speciation.) K. Booy (NIOZ): (Transport of mass at the sediment-water interface.) S. Cramer (NIOZ): (Frisian Front Project: some aspects of <i>in situ</i> determinations of benthic respiration with bell-jars.)
21 November	K. van der Borg (R.U. Utrecht): (¹⁰ Be and ¹⁴ C datings with the tandem-accelerator in Utrecht.)
24 November	L. Legendre (Villefranche-sur-Mer, France): Mechanisms of biological production at marine interfaces. N. Silverberg (University of Quebec, Canada): Problems of spatial and temporal variability in early diagenesis studies.
28 November	OPEX: Research on the influence of dispersants on the fate of oil and its ecotoxicological effects, with Model Tidal Flats (MOTIFS): M. Scholten (TNO, Den Helder): (Introduction.) G. van Moorsel and R. Dekker (NIOZ): (The benthic macrofauna.) C. Brouwer (RIN, Texel): (The meiofauna.) H. van het Groenewoud (TNO, Den Helder): (The fate of oil.) M. Scholten (TNO, Den Helder): (The plankton.)

- 4 December W. Silvert (Bedford Institute of Oceanography, Canada): Modelling the Grand Banks ecosystem.
- 11 December P. Kierskamp (NIOZ): (Some aspects of N₂O production and water-sediment exchange.)
M. Hoppema (NIOZ): (The CO₂ problem.)
L. Maas and H. van Haren (NIOZ): (Observations on the vertical structure of tidal currents in the central North Sea.)
- 16 December Sun Shuncai (Nanjing Institute of Geography, Academia Sinica, China): Sea level changes and the Holocene history of the Chang Jiang delta area.
- 19 December Ch. Hemleben and M. Spindler (Universität Tübingen, F.R.G.): Film: Life cycle of the planktonic foraminiferan *Hastigerina pelagica*. Followed by: Ch. Hemleben: Ecology of plankton Foraminifera.

SEON workshop

The Steering Committee Ecological Research North Sea and Wadden Sea (SEON) visited NIOZ on 14 February. Members of the EON working group organized a series of lectures to inform this government committee about the scientific results of past projects and future research plans.

Lectures:

J.J. Zijlstra: Introduction.
J.W. Baretta: (Construction and results of the ecosystem model of the Ems-Dollard estuary).
R.W.P.M. Laane: (Set-up of the ecosystem model of the western Wadden Sea).
J.J. Beukema: (Eutrophication of the western Wadden Sea)
M.A. Baars: (Introduction preliminary research North Sea).
M.A. van Arkel: (The results of applied ecological research North Sea).
The lectures were followed by a discussion on lines of policy with regard to the western Wadden Sea and the North Sea.

Phaeocystis workshop

A "Phaeocystis" workshop was held from 19 to 21 March (organized by W.W.C. Gieskes, NIOZ, and C. Lancelot, Vrije Universiteit, Brussels), in which 26 Dutch and foreign scientists participated.

Lectures:

A. Sournia (Station Biologique Roscoff, France): Geographical distribution and life forms.
T. Smayda (University of Rhode Island, U.S.A.): Onset of colonial forms.
C. Lancelot (Vrije Universiteit Brussel, Belgium): Growth of Phaeocystis colonies: estimation and control.
T. Weisse (Institut für Meereskunde, Kiel, F.R.G.): Grazing zooplankton.
T. Thingstad (University of Bergen, Norway): Bacterial utilization.
J. Lenz (Institut für Meereskunde, Kiel, F.R.G.): Sedimentation and benthic mineralization.
H.G. Fransz (NIOZ, the Netherlands): Main characteristics of the working of Phaeocystis-dominated marine ecosystems.
W. Admiraal (NIOZ, the Netherlands): Utilization of nucleotides as P-source by *Phaeocystis*.
M.J.W. Veldhuis (NIOZ, the Netherlands): Growth of *Phaeocystis*: influence of phosphate.

“Interdepartementale Commissie” meeting

An informative meeting was held on 16 April with the “Interdepartementale Commissie”, the government committee on Wadden Sea and North Sea research. Members of ICONA (Interdepartementale Commissie voor Noordzee Aangelegenheden), IWC (Interdepartementale Waddenzee Commissie), ICZO (Interdepartementale Commissie voor Zeeonderzoek) and SEON (Stuurgroep Ecologisch Onderzoek Noordzee) were invited.

Lectures:

H. Postma: (Introduction).
H.J. Lindeboom: (The modelling of marine ecosystems).
J.J. Beukema: (Possible effects of eutrophication of the Wadden Sea).
D. Eisma: (Sediment transport in Dutch coastal waters).
F. Creutzberg: (North Sea bottom fauna - results of research and future research).
C. Veth: (Research on North Sea fronts).
The lectures were followed by discussions.

Workshop Belle W. Baruch Institute - NIOZ

From 11 to 16 May, 14 scientists from the Belle W. Baruch Institute for Biology and Coastal Research, University of South Carolina, U.S.A., visited NIOZ to participate in a workshop on the comparison of two estuarine areas, North Inlet, South Carolina, U.S.A., and the Dutch Wadden Sea. To detect analogues and differences in the general functioning of the ecosystems in the two areas comparisons were made of physical oceanography, nutrients, sediment, primary and secondary production, zooplankton, benthos, fish, physiology, remote sensing and modelling.

Lectures:

J.J. Zijlstra: Formal opening.
H. Postma: General description Wadden Sea.
F.J. Vernberg: General description North Inlet.
H. Ridderinkhof: Physical parameters Wadden Sea.
B. Kjerfve: Physical parameters North Inlet.
W. Helder: Nutrient dynamics Wadden Sea.
E. Blood: Nutrient dynamics North Inlet.
D. Eisma: Sedimentology Wadden Sea.
L.R. Gardner: Sedimentology North Inlet.
C.G. Cadée: Primary production Wadden Sea.
R.G. Zingmark and J. Morris: Primary production North Inlet.
D. Spitzer: Remote sensing Wadden Sea.
R.F. Dame: Remote sensing North Inlet.
H.J. Lindeboom: Decomposers (microbiology) Wadden Sea.
Th. Chrzanowski: Decomposers (microbiology) North Inlet.
B.R. Kuipers: Zooplankton Wadden Sea.
S.E. Stanczyk: Zooplankton North Inlet.
P.A.W.J. de Wilde: Benthos Wadden Sea.
B.C. Coull and R.J. Feller: Benthos North Inlet.
H.W. van der Veer: Fish and larger invertebrates Wadden Sea.
D.M. Allen: Fish and larger invertebrates North Inlet.
D.H. Spaargaren: Physiological aspects Wadden Sea animals.
J.M. Dean: Physiological aspects North Inlet animals.
P. Ruurdij: Estuarine system models Wadden Sea.
E. Blood: Estuarine system models North Inlet.

ICES Working Group on Primary Production

Organized by chairman K. Richardson (Danish Institute for Fisheries and Marine Research) and W.W.C. Gieskes (NIOZ), the meeting was held at NIOZ on 4 and 5 September. The major task facing the group at this meeting was to plan an intercalibration workshop for the ^{14}C incorporation method of estimating primary production.

The following scientists participated in the meeting:

K. Richardson, G. Ærtebjerg, L.M. Jensen (Denmark)
M. Gilbricht, J. Lenz (F.R.G.)
O. Lindahl, L. Edler (Sweden)
K. Gudmundsson, T. Thórdardóttir (Iceland)
F. Rey (Norway)
W.W.C. Gieskes (Netherlands)

Workshop of Theme 3 "Pelagic Systems" (Snellius II Expedition)

Organized by Dr. J.J. Zijlstra and Dr. M.A. Baars, a workshop was held from 25 to 30 September to discuss the results obtained so far. Data of R.V. "Tyro" from the Banda Sea were successfully combined with data of R.V. "Samudera" from the Arafura Sea, and joint publications are forthcoming.

The meeting was attended by the NIOZ participants and the Indonesian theme-coordinators together with their assistants:

Dr. Purwito Martosubroto (Ind. theme-coordinator) - Dir. Gen. Fish, Jakarta
Dr. Sujatno Birowo - LON Ambon
Dr. H. Mohammad Eidman - IPB, Bogor
Dr. Kasijan Romimoharto - LON, Jakarta
Dr. Abdul Gani Ilahude - LON, Jakarta
Drs. A.B. Sutomo - LON, Jakarta
Ir. Edi Mulyadi Amin - BPPL, Semarang
Ir. Soewito - DGF, Semarang
Drs. O.H. Arinardi - LON, Jakarta
Drs. Witarsih Kastoro - LON, Jakarta
Drs. Ruyitno - LON, Jakarta
Drs. Quraisyun Adnan - LON, Jakarta
Dr. Semirandi Teyol - LON, Jakarta

2.2.2. Lectures and posters

2.2.2.1. Lectures by NIOZ scientists

(titles translated)

- ADMIRAAL, W.: Interactions of ammonium, nitrate, and amino acids in the nitrogen assimilation of two species of estuarine benthic diatoms. Symposium American Society for Limnology and Oceanography and Phycological Society of America, University of Rhode Island, Kingston, U.S.A., 24 June.
- BAK, R.P.M.: Variations in numbers of protists in a pollution experiment measured with a live counting technique. University of Århus, Denmark, 25 July.
- : Do oil refineries kill coral reefs? Ann. Meeting Int. Soc. Reef Studies. Philipps University, Marburg, G.F.R., 13 December.

- BAARS, M.A.: (An example of the Snellius II Expedition: the cruises of Theme 3). Kon. Inst. v. Ingenieurs, the Hague, 4 March.
- : Spatial and seasonal patterns of phytoplankton and zooplankton in the eastern Banda Sea in relation to the monsoons. Agricultural University, Bogor, Indonesia, 27 November.
 - : Monsoon-induced changes in the pelagic ecosystem of the Banda Sea (Snellius II, first results) IOC WESTPAC Symposium, Townsville, Australia, 2 December.
- BENNEKOM, A.J. VAN: The influence of aluminium on the solubility and the dissolution rate of diatom frustules. Université de Bretagne Occidentale, Brest, France, 11 September.
- : The influence of aluminium on the solubility and the dissolution rate of diatom frustules. Nederlands-Vlaamse Diatomisten Kring, Leersum, 24 October.
- BEUKEMA, J.J.: Eutrophication: reasons for satisfaction or concern? 2nd North Sea Seminar, Rotterdam, 1 October.
- CADÉE, G.C.: Ecology of Dutch coastal waters. RGD/RWS Management Course, Texel, 17 April.
- : (Comparison of biocoenosis and thanatocoenosis, the fossilisation potential). Course in marine biology, Geology Department Free University, Amsterdam, Texel, 23 April.
 - : (Marine organisms in the Wadden Sea). Nederlandse Vereniging voor Geneeskruidenonderzoek, Texel, 5 June.
 - : Biodeposition and bioturbation, introduction to field trip. Petroleum Geologische Kring of the Koninklijk Nederlandse Geologisch en Mijnbouwkundig Genootschap, Texel, 21 June.
 - : The shallow soft-bottom bryozoan fauna of the Java Sea and Banda Sea. 7th Conference International Bryozoologist Association, Bellingham, Washington, U.S.A., 4 August.
 - : The Ecosystem of the Dutch Wadden Sea. Institute of Coastal and Estuarine Research, East China Normal University, Shanghai, China, 5 September.
 - : Biological processes in sediments and sedimentation. Institute of Coastal and Estuarine Research, East China Normal University, Shanghai, China, 6 September.
 - : Carbon budgets in the sea. Central Laboratory of Petroleum Geology, Wuxi, China, 12 September.
 - : Carbon budgets in the sea. Institute of Coastal and Estuarine Research, East China Normal University, Shanghai, China, 17 September.
- CREUTZBERG, F. & G.C.A. DUINEVELD: The role of the lesser weaver *Trachinus vipera* and the dab *Limanda limanda* in the benthic system of the southern North Sea. ICES, Copenhagen, Denmark, 11 October.
- DEKKER, R.: The importance of the subtidal macrobenthos as a food source for the Wadden Sea ecosystem. 5th International Wadden Sea Symposium, Esbjerg, Denmark, 29 September - 3 October.
- DUURSMA, E.K.: Aménagement de l'environnement du Delta du Rhin, de la Meuse et de l'Escaut; aspects écologiques. Paris, France, 5 May.
- EISMA, D.: Geology of the North Sea Basin. Kon. Maatschappij van Natuurkunde 'Diligentia', Den Haag, 20 January.
- : The North Sea. An overview. Meeting on Environmental effects of North Sea oil and gas developments, the Royal Society, London, 19 February.
 - : Sedimentology of the Dutch Wadden Sea. Free University, Amsterdam, 6 March.
 - : Mud transport in the North Sea. RGD/RWS Management Course, Texel, 17 April.
 - : Flocculation of suspended matter in coastal waters. Meeting on Particle Flux in the Ocean. Izmir, Turkey, 21 June.
 - : Sedimentology of the Wadden Sea. East China Normal University, Shanghai, China, 5 September.

- : Sediment transport and deposition in the North Sea. East China Normal University, Shanghai, China, 6 September.
- : Geology of the North Sea Basin. Central Laboratory for Petroleum Geology, Wuxi, China, 12 September.
- EVERAARTS, J.M.: Cadmium in sea water, marine sediment and the benthic invertebrate *Arenicola marina* (Annelida, Polychaeta): an experimental approach. 21st European Marine Biology Symposium, Gdansk, Poland, 15 October.
- FONDS, M.: (The development of sea-fish eggs and larvae.) Ned. Bond Zee-aquariumhouders, Amsterdam, 19 April.
- FRANZ, H.G.: Simulation of aging in ecosystem models. Workshop on Models for Physiologically Structured Populations, Texel, 1 September.
- : Estimation of mortality and development rate in populations with continuous reproduction. Workshop on Models for Physiologically Structured Populations, Texel, 4 September.
- HELDER, W.: (Nitrogen cycling in marine sediments.) Agricultural University, Wageningen, 16 May.
- HEYMAN, R.P.: (The marine ecology of the central North Sea.) University of Amsterdam, 9 April.
- HILLEBRAND, M.TH.J.: (Determination of chlorinated hydrocarbons and heavy metals in sea water: sampling techniques, precautions against contamination and analytical advances). Eucchem Conference, Bilthoven, 22 January.
- IPEREN, J.M. VAN: Aluminium-rich opal; an intermediate in the preservation of biogenic silica. Polar diatom workshop, University of Bristol, U.K., 20 August.
- JANSEN, J.H.F.: Sedimentological compounds in marine sediments as indicators of paleoclimate: an example from the Zaire deep-sea fan. Symposium Changements globaux en Afrique durant le Quaternaire, Passé- Présent-Futur. International Union for Quaternary Research (INQUA) - Association sénégalaise pour l'Etude du Quaternaire africain (ASEQUA), Dakar, Sénégal, 22 April.
- : Paleooceanography and sedimentology of the Zaire deep-sea fan. Petroleum Geologische Kring of the Koninklijk Nederlands Geologisch en Mijnbouwkundig Genootschap, Texel, 21 June.
- : Sedimentation processes and sedimentary structures in the Wadden Sea. Petroleum Geologische Kring of the Koninklijk Nederlands Geologisch en Mijnbouwkundig Genootschap, Texel, 21 June.
- : (Marine Geology). Lecture series, Hogere Zeevaartschool, Amsterdam, March.
- LINDEBOOM, H.J.: Modelling of pelagic microbial activities in the carbon cycle of an estuarine ecosystem. Workshop on the Measurement of Microbial Activities in the Carbon Cycle in Aquatic Ecosystems, Utrecht, 18 August.
- : (Eutrophication of the sea, effects and possibilities for ecological management.) Symposium on Integral Water Management: a new approach, Amsterdam, 5 November.
- KLEIN BRETELIER, W.C.M.: (Experimental Research on food uptake and growth in copepods). Symposium over voedselopname en energiehuishouding, Ned. Bond Zeeaquariumhouders, Texel, 15 November.
- KRAAY, G.W.: Pigment measurements at sea, with emphasis on analysis by HPLC. SCOR Working Group 78, Imer, Plymouth, U.K., 19 March.
- KUIPERS, B.R., H.W. VAN DER VEER & J.J. ZIJLSTRA: Interaction between juvenile plaice (*Pleuronectes platessa*) and benthos in a tidal flat area. ICES, Copenhagen, Denmark, 11 October.
- MAAS, L.R.M.: Observations on the vertical structure of tidal and inertial currents. U.K.-Oceanography, Southampton, U.K., 17 September.
- : Tide topography interaction in a stratified shelf sea. IOS-Bidston, U.K., 23 September.

- : Observations on tides and fronts in the stratified central North Sea. U.C.N.W.-Menai Bridge, U.K., 25 September.
- : (Observations on the vertical structure of tidal currents in the central North Sea). Overleggroep Getijden, W.S.T.(Waterstanden, Stromingen en Transport-verschijnselen), Rijswijk, 18 December.
- RIDDERINKHOF, H.: (Residual flows in the Wadden Sea.) Rijkswaterstaat Dienst Informatieverwerking, Rijswijk, 12 March.
- RUTGERS VAN DER LOEFF, M.M.: The merits of benthic flux-chambers in determining the flux of solutes across the sediment-water interface. Lamont-Doherty Geological Observatory, New York, U.S.A., 13 January.
- : Behaviour of trace metals in marine sediments and implications for the mobility of radionuclides. Laboratory for Radiation Research, Rijks Instituut voor Volksgezondheid en Milieuhygiëne, Bilthoven, 29 January.
- SUNDBY, B.: The importance of oxygen in the release and uptake of trace metals at the sediment-water interface. Graduate School of Oceanography, University of Rhode Island, U.S.A., 21 January.
- : Sediment-water exchange processes concerning trace metals. Department of Geological Sciences, University of Cambridge, U.K., 3 February.
- : Exchange of metals between sediments and water. Limnological Institute, Nieuwersluis, 22 April.
- : Cadmium diagenesis in anoxic sediments. International Meeting on the Chemistry and Physics of the Black Sea and other Anoxic Environments, Gothenburg, Sweden, 4 June.
- : Manganese geochemistry in the Gulf of St. Lawrence, Canada. Institute of Earth Sciences, Free University, Amsterdam, 10 October.
- : Lecture series on Chemical Oceanography. Free University, Amsterdam, December.
- VEER, H.W. VAN DER: The nursery function of the Wadden Sea: consequences for management and policy. 5th Wadden Sea Symposium, Esbjerg, Denmark, 30 September.
- VELDHUIS, M.J.W.: The influence of phosphate depletion on the growth and colony formation of *Phaeocystis pouchetii*. Symposium American Society for Limnology and Oceanography and Phycological Society of America, University of Rhode Island, Kingston, U.S.A., 24 June.
- : The advantage of living in a colony. Symposium Oldenburg, F.R.G., 15 September.
- VOSJAN, H.J.: The ATP and ETS method in a study about diel rhythm in ATP concentration in the euphotic zone and metabolism in deep-sea basins of east Indonesian waters. 3rd Int. Workshop on the measurement of microbial activities in the carbon cycle in aquatic ecosystems, Utrecht, 20 August.
- : (Marine Microbiology). Course in Marine Biology, Geology Department Free University, Amsterdam, Texel, 22 April.
- WEERING, T.C.E. VAN: The Lombok and Savu fore-arc basin, Indonesia. Duke University, Durham, U.S.A., 23 September.
- : Sedimentary processes related to subduction, examples from the Lombok and Savu Basins, Indonesia. Free University, Amsterdam, 30 October.
- WILDE, P.A.W.J. DE: (Food uptake and energy budget of the benthic fauna of the Wadden Sea.) Symposium Ned. Bond Zeeaquariumhouders, Texel, 15 November.
- ZIMMERMAN, J.T.F.: (Dynamical Oceanography). Lecture series, University of Utrecht, January-June.
- : (Physical Oceanography). Lecture series, Inst. Hydraul. Envir. Eng., Delft, June.
- : (Wind Waves). Lecture series, University of Utrecht, September-December.
- : Dispersion by residual currents. Int. Symp. Physics of Shallow Bays, Estuaries and Continental Shelves, Qingdao, China, 4 November.

2.2.2.2. Posters

- ADMIRAAL, W.: Degradation of nucleotides in sea water measured by HPLC; effect of alkaline phosphatase in algal cultures. 4th International Symposium on Microbial Ecology ICOME Conference, Ljubljana, Yugoslavia, 24-29 August.
- HELDER, W. & M. VAN RYSEL: Direct coupling of nitrification and denitrification by N_2O ? Gordon Conference on Estuarine Research, Plymouth, New Hampshire, U.S.A., 9-14 June.
- JANSEN, J.H.F. & A. KUIPERS: A mid-Brunches climatic event: Long-term change of ocean and atmosphere circulation. Symposium Changements globaux en Afrique durant le Quaternaire, Passé-Présent-Future. International Union for Quaternary Research (INQUA) - Association sénégalaise pour l'Etude du Quaternaire africain (ASEQUA), Dakar, Sénégal, 21-15 April.
- JANSEN, J.H.F. & S.J. VAN DER GAAST: Clay minerals as paleoclimatic indicators in Quaternary sediments of the Zaire (Congo) fan. 2nd International Conference on Paleoceanography, Woods Hole, U.S.A., 6-13 September.
- JANSEN, J.H.F., A.J. VAN BENNEKOM & S.J. VAN DER GAAST: Al-rich opal: an intermediate in the preservation of biogenic silica in the Zaire (Congo) deep-sea fan. 2nd International Conference on Paleoceanography, Woods Hole, U.S.A., 6-13 September.
- SCHALK, P.H.: Monsoon influences on zooplankton populations of the Indonesian Archipelago. Poster presentation IOC WESTPAC, Symposium The Indo-Pacific Convergence, Townsville, Australia, 1-6 December.
- SHAH, L. & T.C.E. VAN WEERING: Morphodynamics of the Marsdiep tidal inlet and ebb tidal delta. SEM Mid-year Meeting, Raleigh, U.S.A., 26-28 September.
- WEERING, T.C.E. VAN: Sedimentary processes related to fore-arc developments; the Lombok and Savu basins, eastern Indonesia. IOC WESTPAC Symposium, Townsville, Australia, 1-6 December.

Posters presented by NIOZ scientists at the Jubilee Meeting of the Netherlands Oceanographic Society, Amsterdam, 3-8 November 1986:

Estuarine research:

- RUARDIJ, P. & J.W. BARETTA: Modelling of a benthic-pelagic interaction. Application of an ecosystem model.
- VALE, C. & B. SUNDBY: Suspended sediment fluctuations in the Tagus estuary on semi-diurnal and fortnightly time scales.

Biological Oceanography:

- BEUKEMA, J.J.: Benthos responses to eutrophication of the Dutch Wadden Sea.
- CADÉE, G.C.: Eutrophication of the Dutch Wadden Sea.
- KUIPERS, B.R. & F. CREUTZBERG: A remarkable frontal zone in the southern North Sea.
- LEOPOLD, M.F., B.R. KUIPERS & C. SWENNEN: Seabird concentrations at a tidally induced front in the southern North Sea.
- MULDER, M., W.E. LEWIS & M.A. VAN ARKEL: Effects of drill cuttings with adhering oil on the macrobenthic fauna in the North Sea.
- SCHALK, P.H.: Monsoon related changes in zooplankton and micronekton populations in the eastern Banda Sea and western Arafura Sea.
- STARINK, M.: Combined ETS-activity and respiration measurements on size-fractionated plankton samples.
- SWENNEN, C.: Long-term recruitment failure in eiderducks; an oceanographic mystery.

VOSJAN, J.H.: Ecosystem response to monsoonal wind direction changes in the Banda Sea.

VOSJAN, J.H., G. NIEUWLAND & B. VAN DER WERF: Respiratory activity and ATP of microorganisms in the North Equatorial Current of the Atlantic Ocean.

Physical Oceanography:

HAREN, H. VAN & L. MAAS: Influence of friction on tidal currents.

MAAS, L.: Geostrophical front in the North Sea.

SPITZER, D. & M.R. WERNAND: Determination of spectral signatures of natural water by optical airborne and shipborne instruments.

Chemical Oceanography:

BENNEKOM, A.J. VAN: Dissolved silica in Antarctic surface water; spatial and temporal patterns in the Atlantic sector.

EPPING, E., P. KIESKAMP, P. LOCK, M. VAN RYSEL & W. HELDER: Nitrous oxide (N_2O), an important intermediate in nitrogen cycling in marine sediments.

KRAMER, C.J.M.: Chemical speciation for copper in Indonesian waters compared with results from European waters.

RUTGERS VAN DER LOEFF, M.M.: Dissolved oxygen and the diagenesis of trace metals and REE in deep-sea carbonate sediments.

Geological Oceanography:

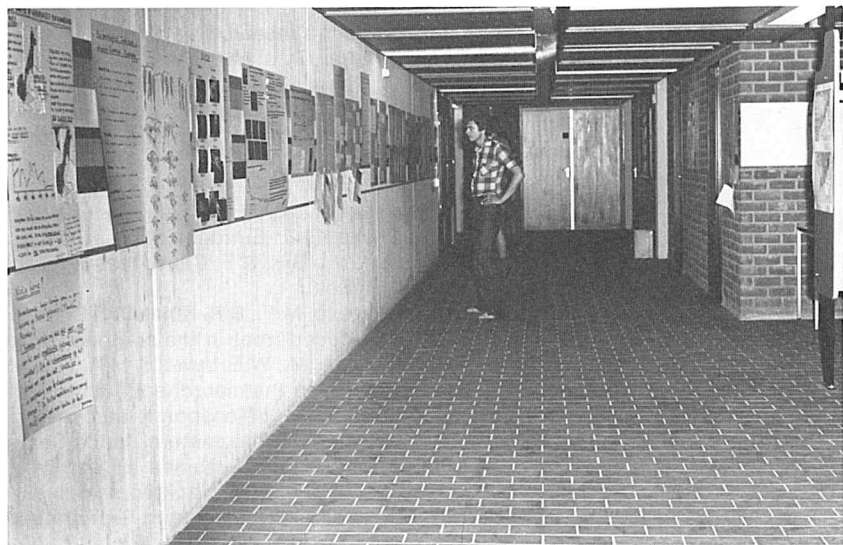
JANSEN, J.H.F., A.J. VAN BENNEKOM & S.J. VAN DER GAAST: Accumulation and preservation of biogenic opal in Quaternary sediments of the Zaire (Congo) fan.

JANSEN, J.H.F. & S.J. VAN DER GAAST: Clay minerals as paleoclimatic indicators in Quaternary sediments of the Zaire (Congo) fan.

KLAVER G. & T.C.E. VAN WEERING: Trace-element distribution in surface sediments of the Skagerrak, northeastern North Sea.

WEERING, T.C.E. VAN: Slumping, sliding and the occurrence of acoustic voids in the Savu Basin, Indonesia.

WEERING, T.C.E. VAN, G.W. BERGER & J. KALF: Recent sediment accumulation in the Skagerrak: application of ^{210}Pb -dating.



2.2.3. Advice offered

- On behalf of the Ministry of Foreign Affairs and Development Cooperation, an evaluation was made of the functioning of motor research launches of the Geological Survey of India (June).
- At the request of UNESCO, a visit was paid to the Geological Survey of Bangladesh in Dacca and the Marine Sciences Division of the University of Chittagong (December).
- Advice was given to R.W.S., Delfzijl, on sampling apparatus benthos.
- Advice was given to Drs. P. Klein Breteler, Ministry of Agriculture and Fisheries, the Hague, on the mariculture of sea-bait organisms.
- Advice was given to R.E. de Thouars, Delta Business International, on shrimp cultures in southern Spain.
- Advice was given to the Government of Aruba on the status of the coral reefs along the south-west coast of the island.
- Advice was given to several Dutch working groups on the disposal of dredging material in the North Sea, January - April.
- Advice was given to MER (Milieu Effect Rapportage) on the construction of Dollardhaven in the Dollard.
- At the request of Rijkswaterstaat, North Sea Directorate, a short note was made for the Working Group on Oil Pollution (Oslo, Norway) due to prepare a compendium of monitoring methods.
- Advice was given to Servicio Nacional de Parques e Reservas, Lisbon, Portugal, on ecosystem modelling of the Ria de Faro.
- Advice was given to Okeanos Aquaculture, Yerseke, on the possibility of growing trout in RIN basins.

3. Nederlandse samenvatting van de wetenschappelijke resultaten

3.1. INLEIDING

3.1.1. Onderzoek in de Waddenzee en andere estuaria

In toenemende mate wordt aandacht besteed aan (bio)chemische processen in het sediment, onder meer in verband met uitwisselingsprocessen tussen sediment en bovenstaand water. Deze processen treden in alle gebieden van de wereldzee op, maar zijn het sterkst in kustzones, waar vaak steile redox-gradiënten optreden door relatief hoge gehalten aan organisch materiaal in het sediment.

Studies van de stikstofcyclus in Waddenzee-sedimenten lieten een relatief hoog N_2O -maximum zien op de overgangszone tussen aeroob en anaeroob sediment. Dergelijke hoge N_2O -concentraties konden in experimentele opstellingen niet bereikt worden in batch cultures, wel echter in doorstroomcultures waaraan sulfide was toegevoegd. De natuurlijke productie van N_2O in mariene sedimenten kan een bijdrage leveren aan de afbraak van de ozonlaag in de stratosfeer.

De afgifte van de metalen Cd en Cu van sediment aan water bleek sterk afhankelijk te zijn van de aerobe afbraak van organisch materiaal in het sediment. Hierbij zijn beide metalen in hoge mate gebonden aan organische verbindingen, al is de binding van Cd anders van aard dan die van Cu en is zij ook minder sterk.

In experimenten over de uitwisselingssnelheid van organische microverontreinigingen van sediment naar bovenstaand water werd gebruik gemaakt van een benthische klok, vergelijkbaar met het type waarmee op zee de *in situ* zuurstofopname van het sediment wordt gemeten. Hierbij bleek de uitwisselingssnelheid sterk afhankelijk te zijn van de verdeling van de bodemweerstand in de klok, die de waterbeweging nabij de bodem bepaalt. Er werd daarom een nieuw roermechanisme ontwikkeld, dat een grotere en meer homogene turbulentie in het water nabij de bodem moet regelen en dat gevarieerd kan worden.

In samenwerking met het Instituto Nacional de Investigação das Pescas in Lissabon (Portugal) werd gesuspendeerd materiaal bestudeerd in het estuarium van de Taag, in het bijzonder de afhankelijkheid van de getijcycli en de seizoensvariaties. De concentratie van gesuspendeerd materiaal bleek samen te hangen met de half-dagelijkse getijcyclus, maar vooral met de 14-daagse getijcyclus (dood en springtij), die de sterkte van de bodemstroom bepalen. De hoeveelheid gesuspendeerd materiaal die betrokken is bij deze sedimentatie-erosie cyclus was vrijwel gelijk aan de jaarlijkse afvoer van de rivier.

In verband met ^{210}Pb studies ter bepaling van de ouderdom van sedimenten werd de industriële verontreiniging van de Nederlandse kustwateren met dit isotoop onderzocht met financiële steun van het Ministerie van VROM. Aanwijzingen voor een dergelijke verontreiniging werden gevonden nabij de Rijnmond, het Noordzeekanaal en de buiten-haven van IJmuiden.

Onderzoek van sedimentatiesnelheden in de Waddenzee met behulp van ^{210}Pb gaven aan dat in de Dollard deze methode goed bruikbaar is door een regelmatige afzetting, maar dat op de getijplaten van de open Waddenzee erosie- en redepositieprocessen de interpretatie van de metingen bemoeilijken. In het kader van een internationale samenwerking namen twee Chinese collega's uit Shanghai aan dit werk deel, en werkten enkele NIOZ-stafleden aan vergelijkbaar onderzoek in China.

Het werk aan flocculatie (vlokvorming) in kustwateren werd dit jaar versterkt door de ingebruikname van een onderwatercamera die een beeld geeft van deeltjes *in situ*. Gevonden werd dat vermoedelijk voortdurend deflocculatie en reflocculatie optreedt, waarschijnlijk door veranderingen in de organische matrix die de vlokken bijeen-houdt.

In het kader van CO_2 -onderzoek werd de CO_2 - O_2 relatie in de Waddenzee onderzocht. Hierbij bleek de O_2 -concentratie in dat gebied sterk variabel: oververzadiging treedt vooral op in mei en onderverzadiging tussen juni en september.

Teneinde mogelijke sublethale effecten van enkele metalen op mariene organismen te onderzoeken werd de opname van Cu en Cd door sediment en in drie compartimenten - darm, lichaamswand en bloed - van de wadpier *Arenicola marina* bestudeerd. Hierbij bleek de hoogste concentratie van Cu steeds in het bloed aanwezig, waarbij in jonge dieren hogere concentraties werden gevonden dan in oudere exemplaren. Voor Cd werd in experimentele opstellingen gevonden dat dit metaal voornamelijk uit het water werd opgenomen en nauwelijks uit het sediment.

Voortgezet onderzoek over het effect van eutrofiëring op het fytoplankton in de Waddenzee liet een verdere toename van diatomeeën en flagellaten zien, waarbij echter vergeleken met het vorige jaar de *Phaeocystis*-bloei geringer van omvang was.

Metingen van de anaerobe omzetting van organisch materiaal in wadsediment met behulp van radioactief sulfaat gaven vooral in de zomer vrij hoge omzettingssnelheden te zien.

Enkele jaren geleden werd aan onderzoek van mariene planktonische Protozoa begonnen, een verwaarloosde groep bij ecosysteemstudies. Hiertoe werden protozoën uit het Marsdiep levend geteld, omdat fixatie

van deze organismen op moeilijkheden stuit. In het Marsdiep blijken protozoën een lage winterdichtheid te hebben, een duidelijke voorjaarspiek in april-mei en een wat lagere zomerdichtheid. In grote lijnen blijkt het verloop van pelagische bacteriën hetzelfde te zijn. Uit studies in de OPEX-bakken, waarbij een olieverontreiniging werd aangebracht, bleek bij protozoën een grote gevoeligheid voor detergentia te bestaan, maar niet bij bacteriën.

Tijdens een 15-jarige waarnemingsperiode bleek de dichtheid en productie van het macrobenthos in de westelijke Waddenzee op een hoog niveau te blijven, hetgeen in verband kan worden gebracht met eutrofiëring van het gebied (zie vorig jaarverslag). Verdere analyse van één soort - *Macoma balthica* - gaf aan dat dit zowel door een toenemende groei van de individuen als door een hogere recrutering werd veroorzaakt. Vergelijkend onderzoek van deze soort in Franse estuaria laat naast een voorjaarsgroeiperiode een najaarsgroei zien die in de Waddenzee geheel ontbreekt.

In het kader van het EEG project COST 647 werd gevonden dat de dichtheidsvariëaties van een aantal geselecteerde soorten in de gehele Waddenzee sterk synchroon verlopen, met uitzondering van enkele gebieden, die verstoord zijn door een sterke verontreiniging. Deze synchronisatie hangt vermoedelijk samen met het optreden van strenge winters. Uit experimenteel veldonderzoek aan larvale en juveniele stadia van tweekleppige mollusken bleek het vestigingssucces sterk samen te hangen met de bezetting door andere dieren, terwijl de aanvankelijke vestiging altijd hoger was op de zandige delen dan op het slibrijker gebied van de getijzone.

In samenwerking met een Amerikaanse gast (Prof. P.A. Haefner) werd een studie gemaakt van de glucosehuishouding van de garnaal *Crangon crangon*, waaruit onder meer bleek dat glucoseconcentraties afhankelijk zijn van grootte, geslacht en voortplantingsstadia.

Het voortplantingssucces van in het Waddengebied broedende eidevenden in de periode 1962-1986 bleek sterk verminderd tussen 1971 en 1978, hetgeen waarschijnlijk verband houdt met een geringe voedseldichtheid van jonge dieren in de betrokken periode. Omdat in diezelfde periode de haringrecrutering faalde in de Noordzee, de sprotstand sterk toenam en de jaarlijkse bloei van *Phaeocystis pouchetii* sterk terugliep wordt gedacht aan een complex van factoren dat in een groot gebied invloed had op de voedselketen.

Op bescheiden schaal werd medewerking verleend aan een onderzoek naar de betekenis van Pattani Bay (Thailand) voor trekkende palaeoarctische steltlopers. Dit onderzoek, dat plaatsvindt in het kader van het Interwader-project (World Wildlife Fund en ICBP), wordt uitgevoerd in samenwerking met de Thaise Prince of Songkla Universiteit.

3.1.2. Noordzee

In het voorjaar en het begin van de zomer 1986 heeft de eerste meetcampagne in het kader van het Friese Front Projekt plaatsgevonden. De fysische waarnemingen zijn gedaan met behulp van een grote serie

verankerde instrumenten waaronder stroommeters, getijprikkers en thermistorchains. Vanaf enkele schepen zijn quasi-synoptische C.T.D. opnamen gemaakt van het zeegebied waarin de fronten verwacht werden. Daarnaast zijn turbulentiewaarnemingen verricht in de nabijheid van stroommeterverankeringen. In dit project is samengewerkt met diverse Nederlandse instituten (K.N.M.I., R.W.S., Hydrografie, I.M.O.U. en W.L.) die apparatuur, mankracht, schepen en know-how inbrachten.

Dank zij een ZWO-beurs kon worden gewerkt aan de interpretatie van drijfboeimetingen. Bij vergelijking van de Lagrangiaanse scheringsmetingen met de Eulerse (verkregen uit stroommetingen) is gebleken dat beide omgekeerd evenredig zijn met de separatie tussen drifters, dat de componenten van de Eulerse scheringsmatrix sterk gecorreleerd zijn, en dat waarschijnlijk ten gevolge van topografieëffecten de Lagrangiaanse deformaties sterkere hoogfrequente componenten bevatten dan de Eulerse.

Een volledige theorie die de vorming beschrijft van interne zwaartekrachtsgolven en vorticeitsgolven door getijstroom over een veranderlijke topografie in een gelaagde shelfzee is dit jaar voltooid. Hetzelfde geldt voor een theorie over gelijkrichting in laterale visceuze grenslagen. Samen met het Staats Instituut voor Industrieel Onderzoek in Kure (Japan) is een studie voltooid naar de verticale structuur van reststromen over een golvend zeebed. De resultaten hiervan kunnen van belang zijn voor sedimenttransportproblemen.

Een nadere bewerking van gegevens van gesuspendeerd materiaal uit Noordzee en Skagerrak, verzameld in de jaren 1980-1984, liet karakteristieke verschillen in concentratie, afmeting en samenstelling zien tussen een groot aantal bemonsterde gebieden, samenhangend met de bronnen van het zwevend materiaal en de mate van uitwisseling met de bodem. Gelijktijdig verzamelde bodemonmonsters toonden een duidelijke samenhang tussen korrelgrootte van het sediment en de verdeling van sporen-elementen.

In het onderzoek van het planktonstelsel langs de Nederlandse kust werden praktische moeilijkheden ondervonden bij het opzetten van experimenten ter verklaring van het instorten van de fytoplankton-bloei in de zomer. Dit instorten bleek echter wel de voornaamste oorzaak te zijn van de snelle achteruitgang van het herbivore zoöplankton, belangrijker dan predatie op eieren, larven en adulte copepoden zoals werd vermeld in het jaarverslag 1985. Een onderzoek naar de bloei van *Phaeocystis pouchetii*, uitgevoerd in samenwerking met de Vakgroep Mariene Biologie van de R.U. Groningen, werd afgerond. Uit deze studie bleek onder meer het belang van anorganisch en organisch P voor deze fytoplanktonsoort. Op grond van nieuwe gegevens werd het SEAWAQ-model, dat de dynamiek van het fytoplanktonstelsel in het oostelijk deel van de Zuidelijke Bocht beschrijft, uitgebreid met een submodel voor herbivoor zoöplankton.

De analyse van sedimentsvalgegevens, verzameld tijdens REFLEX 1983, laat zien dat ca. 1% van de primaire productie tijdens de voorjaarsbloei in de noordelijke Noordzee sedimenteert, hetgeen aanzienlijk minder is dan de 20-35% geschat tijdens het FLEX 1976 project in hetzelfde gebied.

In het experimentele planktonwerk werden met wisselend succes diverse nieuwe algensoorten in cultuur genomen. Uit experimenten met de herbivore copepode *Pseudocalanus elongatus* bleek dat de ontwikkeling en groei zowel door temperatuur als voedselbeschikbaarheid beheerst worden.

In het voorjaar (2e helft april) werd het Nederlandse deel van het Synoptic Mapping project uitgevoerd, waarin schepen van een aantal Noordzeelanden met onderling vergelijkbare methoden de benthische fauna bemonsterden en in kaart brachten. Hierbij werd onder andere gebruik gemaakt van de "Tyro" (NRZ), waarmee op 71 stations praktisch het gehele Nederlandse deel van de Noordzee met box-cores, Van Veen-happers, boomkoren en verticale netten werd bemonsterd. De gegevens kunnen vergeleken worden met een serie boomkorgegevens die over een aantal jaren verzameld zijn in het gebied zuidelijk van ca. 56° NB. Het voorkomen van 23 talrijke crustacea-soorten, verzameld tijdens deze tochten, blijkt in de zomer meer kustwaarts en in de winter meer in de centrale Noordzee geconcentreerd te zijn, waarmee onder meer wordt bereikt dat de jaarlijkse temperatuurgang wordt gereduceerd. Van 2 algemene vissoorten, de schaar en de kleine pieterman, werd de voedselopname bepaald. In het geval van de schaar bestaat die vrijwel geheel uit benthische organismen (*Amphiura filiformis*), maar voor de kleine pieterman vooral uit grondels, die op hun beurt weer planktonische organismen consumeren.

Een groter, multidisciplinair programma werd uitgevoerd rondom het Friese Front, een zone 40 tot 50 km ten noorden van de Waddeneilanden, die het verticaal gemengde kustnabije water scheidt van het in de zomer gestratificeerde centrale Noordzeewater. Rondom deze zone werden gedurende de maanden mei en juni fysische, chemische en biologische eigenschappen van water en bodem bepaald. Speciale aandacht werd besteed aan de watercirculatie en aan het transport loodrecht op het front, waartoe verscheidene series stroommeters werden uitgelegd en een uitgebreide CTD survey werd uitgevoerd. Het project maakte deel uit van het nationale "Vaarplan" en werd grotendeels uitgevoerd met het M.S. "Tyro" met steun van M.S. "Aurelia". Gedurende de waarnemingsperiode werd het front langzaam opgebouwd, al trad in tijden van hoge windsnelheden afbraak op. De reststroom in het gebied bleek sterk afhankelijk van de wind. De chlorofylconcentraties waren hoog; tijdens ruw weer waren ze gelijkmatig over de waterkolom verdeeld en bij zwakke wind vond ophoping bij de bodem plaats. In het front werd een verlaagde chlorofylconcentratie gemeten en hoge phaeophorbidegehalten, wat een indicatie geeft voor een hoge graasdruk door copepoden. Copepoden (*Temora longicornis*) uit de frontzone bleken veel eieren te produceren, althans in mei. In juni, toen het front eenmaal gevormd was, bleken weinig verschillen in activiteit tussen de watermassa's voor te komen. De planktonische larven van *Echinocardium cordatum*, een benthische echinoderm, bleken aan weerszijden van het front grote verschillen in verspreiding en verschijningsdatum te geven.

3.1.3. Oceaanonderzoek

Uit de samenstelling van kleimineralen uit bodemkernen ("piston cores") verzameld in de Zaire rivier en haar diepzee delta kunnen over een zeer lange periode (ca. 500.000 jaar) klimaatsveranderingen in het stroomgebied van de rivier worden afgeleid, waarbij droge, glaciële perioden afgewisseld werden met vochtige interglaciële tijden. Bovendien worden aanwijzingen gevonden voor uitbreiding van de Namibische woestijn tijdens glaciële periodes, terwijl tijdens de interglaciëlen het stroomgebied vermoedelijk bedekt was met tropisch regenwoud.

Uit de kernen van de Zaire diepzee delta kon worden afgeleid dat biogeen opaal, afkomstig van schaaltes van diatomeeën en radiolariën, vooral geproduceerd wordt nabij de rand van het continentaal plat. In het algemeen is de produktie het hoogst tijdens glaciële perioden, waarbij in het geval van het laatste glaciaal uit de soortensamenstelling blijkt dat kustopwelling opgetreden moet zijn.

Veel aandacht werd besteed aan vorming en omzetting van kleimineralen, waartoe belangrijke verbeteringen in de bestaande poeder diffractie meetapparatuur werden aangebracht, die sterk de aandacht trekken van de fabrikant. Enerzijds werd aandacht besteed aan nieuwvorming van kleimineralen uit basalt, die reeds vlak na het stollen en gedurende de vroege verwerking een belangrijke bijdrage levert aan kleien. Hiertoe werden onder meer experimenten opgezet om de vorming van kleimineralen te volgen door basalt fijn te maken in water en in cyclohexaan. Voorts werd onderzoek verricht naar de structuur van smectiet, allofaan en imogoliet. Smectiet is een mineraal dat veel voorkomt in bodems gevormd uit vulkanische as in centraal Afrika en derhalve ook in de Zaire diepzee delta.

In de noordoostelijke Atlantische Oceaan werd in het gebied van de Schotland-IJsland rug in samenwerking met het I.M.O.U. (R.U. Utrecht) een studie gemaakt van de watermassa's.

In de Golf van St. Lawrence werd op een viertal stations de sulfaatreductiesnelheid in bodemonsters bepaald, die hier buiten-gewoon laag bleek. Desondanks werd geschat dat de sulfaatreductie verantwoordelijk was voor de afbraak van 5-26% van het gesedimenteerde organisch materiaal. Uit onderzoek naar het voorkomen van Cd en Mn in sediment en poriënwater in bodemonsters, verzameld in de Laurentian Trough (Golf van St. Lawrence) bleek vooral het gedrag van Cd bijzonder complex, met hoge concentraties nabij het oppervlak en dieper in het sediment. De Mn-concentratie daarentegen bleek met de diepte af te nemen. In hetzelfde gebied, op een diepte van 325 meter, werden de sedimentatiesnelheid en de snelheid van bioturbatie bepaald met behulp van de radionucliden ^{210}Pb , ^{137}Cs en ^{14}C , waarbij bleek dat de biologische menging weliswaar gering was, maar toch een grote invloed had op de bepaling van de sedimentatiesnelheid.

In 1986 namen 8 personeelsleden van het instituut deel aan Antarcisch onderzoek, waarbij gastvrijheid werd genoten aan boord van het Duitse onderzoekvaartuig "Polarstern" van het Alfred Wegener Institut für Polar- und Meeresforschung. De gehalten aan voedingsstoffen in het

poriënwater duiden er op dat zeer weinig biogeen materiaal in het sediment werd gemineraliseerd. Si vormt hierop een uitzondering gezien de grote concentratieverschillen tussen de verschillende gebieden. Opgelost Al bleek nauwelijks aantoonbaar in de waterkolom en vertoonde lage concentraties in het poriënwater. Op grond van zes Radon-profielen werd geconcludeerd dat de verticale diffusiecoëfficiënt hoog was vergeleken met andere oceaangebieden.

Gedurende een expeditie nabij de Zuid Shetland eilanden in mei-juni, het begin van de Antarctische winter, werd microbiologisch onderzoek verricht in de waterkolom. Uit ETS en ATP waarnemingen werd afgeleid dat de biomassa van in watermonsters verzamelde organismen in de bovenste 200 meter $3.5 \text{ g C} \cdot \text{m}^{-2}$ bedroeg, met een omzettingssnelheid (respiratiesnelheid) van eens per 8 dagen. In tropische gebieden was de omzettingstijd 1 dag, in de Noordzee 2 dagen. De biomassa bleek, zoals gebruikelijk, snel met de diepte af te nemen.

In de overgang naar het voorjaar (oktober-november), de periode van de grootste ijsuitbreiding, werd meegedaan met een expeditie naar de oostzijde van de Weddell Zee, onder andere ter bestudering van de vroege voorjaarsbloei van het plankton in zogenaamde polynyas, grote open zeegebieden temidden van het ijs. Er werden zeer lage slib- en chlorofyl concentraties gevonden, waardoor de zichtdiepte van een Secchi-schijf tussen 70-80 meter lag, wat een record betekent. Door de geringe deeltjesdichtheid kon het laser-doppler apparaat ter bepaling van de kleinschalige turbulentie niet worden gebruikt. In november begon de bloei geleidelijk op gang te komen. Grote hoeveelheden algen werden waargenomen aan de onderzijde van het ijs. Turbulentiemetingen in november, toen voldoende deeltjes in het water aanwezig waren, vertoonden een sterke samenhang met de windkracht.

Studies aan zware metalen in enkele Oostjavaanse rivieren en in de kustwateren van Java en Bali gaven concentraties aan die vergelijkbaar zijn met die van niet-verontreinigde rivieren elders in de wereld. De concentraties in het natte seizoen waren 2 maal zo hoog als in de droge tijd.

Gesuspendeerd materiaal en bodemsediment in de Straat van Makassar en het Flores Bekken blijken grotendeels van mariene oorsprong, met een zeer laag aandeel van terrestrisch materiaal. In kernen blijkt de invloed van vulkanische erupties zeer lokaal aanwezig. In het Savu bekken werden aanwijzingen gevonden voor een zeer frequent afglijden ("slumping") van bodemmateriaal. Op koraalriffen werd op diverse plaatsen een schimmelinfectie gevonden, die merkwaardigerwijs de groeisnelheid in het koraal niet blijkt aan te tasten.

Een verdere analyse van het pelagische systeem in de Banda Zee en Arafura Zee maakt waarschijnlijk dat er naast een langzame opwelling in het hele gebied nutriëntenrijk bodemwater in het noordwesten de Arafura Zee binnendringt, hetgeen de hoge algendichtheid in dat gebied kan verklaren. Voorts bleek uit pigmentanalyses dat de algensamenstelling in het gebied sterk verandert onder invloed van de moesson.

In een studie aan walvisogen werden aanwijzingen gevonden dat het gezichtsvermogen bij baleinwalvissen slechter ontwikkeld is dan bij tandwalvissen.

3.1.4. Speciale projecten

Het EON (Ecologisch Onderzoek Noordzee) project, door verscheidene ministeries gefinancierd, wordt in opdracht van 1984 tot 1987 uitgevoerd met een 17-tal speciaal voor het project aangestelde personeelsleden. Naar verwachting zal de documentatie van het Eems-Dollard model (DED-MOD) in 1987 in druk verschijnen. Ten aanzien van het ecologisch model van de westelijke Waddenzee (EMOWAD) werd aanvullend onderzoek op vele gebieden uitgevoerd, waarbij onder meer nieuwe suggesties naar voren kwamen over het mogelijk ontstaan van een *Phaeocystis*bloei. Onder tusschen werd de opstelling van het ecosysteem model op gang gebracht. Het fysisch deel van dit model, ontwikkeld onder een speciaal contract, vorderde goed. Het voorspelde een reststroom van het Vlie naar het Marsdiep. Voorts was de EON staf betrokken bij het opzetten van een coördinatiestructuur voor toegepast onderzoek in de Noordzee (VONZEE-project). Tenslotte werd toegepast ecologisch onderzoek uitgevoerd in de Noordzee (TECON-project) door middel van een studie over de gevolgen van olie- en gasexploratie op boorplatforms voor de bodemfauna in het gebied.

Het diepzeeonderzoek naar het effect van de dumping van radioactief afval, het DORA-project dat in 1982 voor een 4-jarige periode was begonnen, werd afgesloten met een uitvoerig rapport. De voornaamste conclusies van de studie zijn dat de mate van verspreiding van een aantal belangrijke radionucliden in feite bepaald wordt door de snelheid waarmee organische deeltjes in het sediment worden opgenomen.

Een project betreffende de biologische gevolgen van olieverontreiniging in een Waddengebied, het Oil Pollution Experiment (OPEX), werd samen met TNO en RIN uitgevoerd. Een belangrijke conclusie tot dusver is dat de structuur van het ecosysteem verandert onder invloed van olieverontreiniging en dat de schadelijke effecten verergerd worden door het gebruik van dispergentia. De geringste verandering treedt op bij mechanische verwijdering van de olie. Het project wordt in 1987 afgesloten, maar wordt mogelijkerwijs gevolgd door nieuwe contracten.

De op het NIOZ ontwikkelde vloeistof-vloeistof extractor ISABELLA voor het verwijderen van lage concentraties PCB's en andere chloorkoolwaterstoffen uit (zee)water werd onder meer getest aan het grondwater van de sterk verontreinigde Volgermeerpolder (contract met Provinciale Waterstaat Noord-Holland en Hoogheemraadschap Uitwaterende Sluizen, Edam) en aan industrieel afvalwater. Dit geschiedde in samenwerking met CINDU BV, Uithoorn.

Een bemonsteringsprogramma van de bodemfauna in de nieuw ontstane voordelta voor Zeeland, uitgevoerd in opdracht van de Dienst Getijdewateren, werd met een rapport afgesloten. Eveneens in opdracht van de Dienst Getijdewateren werd onderzoek verricht aan de bioturbatieactiviteit van *Arenicola marina*.

3.2. BEZOCHTE CONGRESSEN

Gordon Conference on Chemical Oceanography, Oxnard, California, U.S.A, 5-11 januari: M.M. Rutgers van der Loeff, B. Sundby.

American Geophysical Union and American Society of Limnology and Oceanography Joint Ocean Sciences Meeting, New Orleans, U.S.A, 13- 17 januari: B. Sundby, P.A.W.J. de Wilde.

Joint Monitoring Group Oslo and Paris Convention, Kopenhagen, Denemarken, 20-24 januari: H.J. Lindeboom

NIBI Cursus Onderzoekersmanagement, Stevensbeek, Nederland, 28-31 januari: H.G. Fransz.

Geology and Geochemistry of Abyssal Plains, The Geological Society, Londen, Engeland, januari: J.H.F. Jansen.

Euromar Meeting, Bonn, West-Duitsland, 2 februari: P.A.W.J. de Wilde.

U.K. Global Ocean Flux Study Meeting, Londen, Engeland, 4 februari: B. Sundby.

Meeting on Environmental effects of North Sea oil and gas developments, The Royal Society, Londen, Engeland, 19-20 februari: D. Eisma.

PAON course 'Electro-chemical Methods', Veldhoven, 4-7 maart : K. Booy.

PSG-studiedag over Mathematische Ecosysteemmodellen, Den Haag, 13 maart: J.W. Baretta, P. Ruurdij.

SCOR Working group 78, Plymouth, Engeland, 17-20 maart: G.W. Kraay.

SCOR/IABO/UNESCO workshop Coastal-offshore ecosystem relationships, San Francisco, U.S.A., 7-11 april: J.J. Zijlstra.

Meeting of the Marine Chemistry Discussion Group of the U.K., Liverpool, Engeland, 17-18 april: L. Gerringa.

Symposium Changements globaux en Afrique durant le Quaternaire, Passé-Présent-Futur. International Union for Quaternary Research (INQUA) - Association sénégalaise pour l'Etude du Quaternaire africain (ASEQUA), Dakar, Sénégal, 21-25 april: J.H.F. Jansen.

Scientific Group on Dumping, London Convention, Londen, Engeland, 28-30 april: H.J. Lindeboom.

Eureka Symposium, Utrecht, 7 mei: P.A.W.J. de Wilde.

ICES Meeting Benthos Ecology Working Group, Ostende, Belgium, 12-15 mei: F. Creutzberg, G.C.A. Duineveld.

Workshop on Ria Formosa, Faro, Portugal, 17-27 mei: P. Ruurdij, J.W. Baretta.

International Meeting on the physics and chemistry of the Black Sea and other anoxic environments, Gothenburg, Zweden, 1-4 juni: B. Sundby.

Steering Committee EROS 2000, Brussel, België, 4-6 juni: D. Eisma.

CRESP (Coordinated Research and Environmental Surveillance Program) meeting, georganiseerd door de Nuclear Energy Agency (NEA), Neuchatel, Zwitserland, 2-5 juni: M.S.S. Lavaleye, M.M. Rutgers van der Loeff.

Gordon Conference on Estuarine Research, Plymouth, N.H., U.S.A, 9-14 juni: W. Helder.

ASLO/PSA, University of Rhode Island, Kingston, U.S.A., 22- 26 juni: W. Admiraal, M.J.W. Veldhuis.

American Society for Limnology and Oceanography Summer Conference, University of Rhode Island, R.I., U.S.A, 23-28 juni: W. Helder.

Meeting on Particle Flux in the Ocean, Izmir, Turkije, 23-28 juni: D. Eisma.

7th International Bryozoology Conference, Bellingham, U.S.A., 4-9 augustus: G.C. Cadée.

Euromar Meeting, Bremerhaven, West-Duitsland, 9-10 augustus: P.A.W.J. de Wilde.

SCOPE/UNEP Meeting on carbon in estuaries and lakes, Fairbanks, Alaska, U.S.A., 10-16 augustus: G.C. Cadée, D. Eisma.

3rd Int. Workshop on the measurement of microbial activities in the carbon cycle in aquatic ecosystems, Utrecht, 18-21 augustus: R.P.M. Bak,, F. van Duyl, W. Helder, H.J. Lindeboom, J.H. Vosjan.

9th International Symposium on living and fossil diatoms, Bristol, Engeland, 21-29 augustus: J.M. van Iperen.

4th International Symposium on Microbial Ecology ICOME Conference, Ljubljana, Jugoslavië, 24-29 augustus: W. Admiraal, F. van Duyl.

EBSA-16, Plymouth, Engeland, 1-5 september: J.W. Baretta, P. Ruardij.

Texel Workshop Models for Physiologically Structured Populations, Texel, 1-5 september: H.G. Fransz.

2nd International Conference on Paleoceanography, Woods Hole, U.S.A., 6-13 september: J.H.F. Jansen.

International Symposium on Physical Processes in Estuaries, Delft, 8-12 september: B. Sundby.

Symposium 'Physical processes in Estuaries', Noordwijkerhout, 9-12 september: K. Booy, H. Ridderinkhof.

21st European Marine Biology Symposium, Gdansk, Polen, 15- 20 september: J.M. Everaarts.

U.K. Oceanography, Southampton, Engeland, 15-19 september: L.R.M. Maas.

5th International Wadden Sea Symposium, Esbjerg, Denemarken, 29 september-3 oktober: R. Dekker, H.W. van der Veer.

2nd North Sea Seminar, Rotterdam, 1 oktober: J.J. Beukema, H. Lindeboom.

ICES 74th Statuory Meeting, Kopenhagen, Denemarken, 9-17 oktober: F. Creutzberg, B.R. Kuipers, J.J. Zijlstra.

Workshop Subtidal Mesocosms, Oslo, Norwegen, 18-21 oktober: P.A.W.J. de Wilde.

Meeting Fundamental and Applied Marine Ecology, Vrije Universiteit, Brussel, België, 21 oktober: J.H. Vosjan.

Int. Symposium on Physics of Shallow Bays, Estuaries and Continental Shelves, Qingdao, China, 2-6 november: J.T.F. Zimmerman.

IOC WESTPAC Symposium 'Marine Science in the Western Pacific : the Indo-Pacific Convergence', Townsville, Australië, 1-6 december: M.A. Baars, H. Postma, P.H. Schalk, J.J. Zijlstra.

COST-647 Intercalibration workshop on intertidal soft sediment macrobenthos, Valéry-sur-Somme, Frankrijk, 7-10 december: J.J. Beukema, R. Dekker.

International Society for Reef Studies Annual Meeting, Marburg, West-Duitsland, 11-14 december: R.P.M. Bak, W.F. Hoppe.

3.3. BESTUURSFUNCTIES

- M.A. van Arkel
 - lid begeleidingscommissie Monitoring Titaandioxide Afvalzuur
 - lid werkgroep Monitoring rond Mijnbouwinstallaties
 - toegevoegd lid Thema I van het Directeuren Overleg Noordzee
- M.A. Baars
 - lid Technische subcommissie Snellius-II, Nederlandse Raad voor Zeeonderzoek
 - assistent coördinator Pelagische Systemen Snellius-II
 - coördinator discussiegroep zoöplankton-FRIENDS
- R.P.M. Bak
 - lid redactieraad Marine Ecology Progress Series
 - lid redactieraad Coral Reefs
 - adviseur wetenschappelijke studiering Nederlandse Antillen
 - treasurer International Society for Reef Studies
 - docent (ad-honorem) University of Puerto Rico
 - lid Committee Scientific Reference Assessment Caribbean
- A.J. van Bennekom
 - lid werkgroep Antarctica van IUCN-ledencontact
 - lid planningsgroep klimaatgericht oceaanonderzoek
 - plaatsvervangend lid Commissie Antarctisch Onderzoek NRZ
- M. Bergman
 - toegevoegd lid Thema II van het Directeuren Overleg Noordzee
- J.J. Beukema
 - coördinator van de sectie "Intertidal soft bottoms" van het EG-project COST-647 (Coastal marine benthos)
 - hoofdredacteur van het Netherlands Journal of Sea Research
- G.C. Cadée
 - lid commissie voor buitenlandse marien-biologische stations KNAW
 - lid DORA commissie (diepzee opberging radioactief afval)
 - bestuurslid BION werkgemeenschap aquatische oecologie
- F. Creutzberg
 - lid ICES Benthos Ecology Working Group
- G.C.A. Duineveld
 - lid ICES Benthos Ecology Working Group
- E.K. Duursma
 - adviseur Provinciale Raad van het Milieu, Zeeland
 - voorzitter Nederlandse Raad voor Zeeonderzoek
 - voorzitter NRZ commissie Antarctica
 - redactielid Oceanologica Acta, Marine Chemistry, Thethys en Journal of Environmental Radioactivity
 - scientific supervisor aan het Nakdong Environmental NEDECO Programme van het door de Wereldbank gefinancierde barrageproject in Korea.
 - directeur Delta Instituut
- F. van Duyl
 - toegevoegd lid Thema I van het Directeuren Overleg Noordzee

- D. Eisma
 - lid ICES working group on marine sediments in relation to pollution
 - lid adviesgroep marien aardwetenschappelijk onderzoek van de Koninklijke Nederlandse Akademie (NRZ)
 - lid SCOR working group 46, river input into the ocean systems
 - lid projectgroep slibeigenschappen en coördinatiecommissie slib van de Raad van Overleg fysisch oceanografisch onderzoek Noordzee
 - voorzitter AWON werkgroep mariene geologie
 - lid commissie geologische wetenschappen van de KNAW
 - lid beheerscommissie ZWO laboratorium Isotopengeologie
 - lid werkgroep Afvalgips en Vliegass Gezondheidsraad
 - lid gebruikerscommissie Laser-korrelgrootte bepalingen
 - adviserend hoogleraar East China Normal University, Shanghai
 - docent oceanografie Rijksuniversiteit Utrecht
- J.M. Everaarts
 - lid contactgroep water van de commissie TNO/CNB voor onderzoek inzake nevenwerkingen van bestrijdingsmiddelen
 - lid projectgroep Biologische Toxicologie; BION werkgemeenschap Stofwisselingsfysiologie
- lid werkgemeenschap mariene monitoring (NRZ)
- lid themagroep "microverontreiniging" in kader Directeuren overleg (Ecologisch Onderzoek Noordzee/Waddenzee).
- M. Fonds
 - lid ICES Mariculture Committee
- H.G. Fransz
 - lid beoordelingscommissie werkgemeenschap theoretische biologie (BION)
 - lid commissie mariene biologie NRZ, L. Gerringa
 - lid NNI subcommissie Chemisch Onderzoek in het kader van bodemkwaliteit
 - lid NNI werkgroep Monsterneming in het kader van bodemkwaliteit
- W.W.C. Gieskes
 - lid werkgroep remote sensing van de Nederlandse Raad voor Zeeonderzoek
 - lid SCOR-UNESCO werkgroep 78 bepaling pigmenten voor fotosynthese in zee-water
- R.P. Heyman
 - secretaris Stichting ter Bevordering Nederlandse Oceanografie
- J. van Iperen
 - bestuurslid Nederlands-Vlaamse Kring van Diatomisten
- J.H.F. Jansen
 - penningmeester Sedimentologische Kring, Koninklijk Nederlands Geologisch Mijnbouwkundig Genootschap
- W.C.M. Klein Breteler
 - coördinator BION-werkgroep Zooplankton-FRIENDS
- lid begeleidingscommissie Flow-cytometer
- R.W.P.M. Laane
 - lid begeleidingscommissie Balans Seston kwaliteit (DGW)
- M.S.S. Lavaleye
 - lid taakgroep biologie van het Coordinated Research and Surveillance Programme (CRESP) van de Nuclear Energy Agency (NEA)
- H.J. Lindeboom
 - lid Memorandum of Understanding (MOU) group IV
- lid stuurgroep OPEX
- lid Themagroepen II en IV Directeuren Overleg Chemie en - Biologie van Noord zee en Waddenzee
- lid Crest Ad-Hoc Working Group on Marine Science and Technology

- M. Mulder
 - lid begeleidingscommissie Monitoring Titaandioxide Afvalzuur
 - lid werkgroep Monitoring rond Mijnbouwinstallaties
- H. Postma
 - lid Nederlandse Raad voor Zeeonderzoek
 - lid Scientific Committee on Oceanic Research (ICSU)
 - lid Raad van Overleg fysisch oceanografisch onderzoek van de Noordzee
 - lid Nederlandse UNESCO-commissie
 - lid Koninklijke Akademie van Wetenschappen
 - voorzitter Nederlandse Commissie voor SCOPE (Scientific Committee on Problems of the Environment)
 - lid deskundigencommissie BOEDE
 - lid "Comité de perfectionnement" van het Institute Océanographique, Parijs en Monaco
 - voorzitter bestuur Beyerinck-Popping fonds
 - lid Waddenzee-adviesraad
 - lid CO₂-commissie van de gezondheidsraad
 - voorzitter wetenschappelijke commissie Biologische Anstalt Helgoland, Hamburg
- W. van Raaphorst
 - toegevoegd lid Thema II van het Directeuren Overleg Noordzee
- 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 Surveillance Programme (CRESP) van de Nuclear Energy Agency (NEA)
- D.H. Spaargaren
 - secretaris van de commissie voor buitenlandse marien-biologische stations van de KNAW, D. Spitzer
 - lid werkgroep remote sensing van de NRZ
 - lid werkgroep zichtbaar licht in open water van Rijkswaterstaat
 - lid gebruikerswerkgroep CAESAR-project 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 van Verkeer en Waterstaat.
- B. Sundby
 - Adjunkt professor, Université du Québec à Rimouski (Canada)
 - lid Commissie voor Chemische oceanografie (NRZ)
 - lid ICES Working Group on Sediments in relation to Marine Pollution
 - lid ICES Marine Environmental Quality Committee
 - lid Environmental Quality Committee, ICES
- C. Swennen
 - lid werkgroep bijlage VEG-vogelrichtlijn
 - lid Nederlandse sectie International Council of Birds Preservation (ICBP)
 - nationaal kontaktpersoon sea duck branch van het International Waterfowl Research Bureau (IWRB)
- S.B. Tjissen
 - lid Hydrography Committee, 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
- Nederlands correspondent voor de International Association of Sedimentologists
- lid Technische subcommissie Snellius-II, NRZ
- 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 ICES North Sea Benthos Ecology Working Group
- voorzitter Euromar Mesocosm Working Group
- voorzitter, D.O. Themagroep I, inventarisatie Noordzee Onderzoek
- P. de Wolf
- lid voorlopige commissie voor de milieueffectrapportage
- J.T.F. Zimmerman
- voorzitter a.i. commissie fysische oceanografie van de Nederlandse Raad voor Zeeonderzoek
- lid dagelijks bestuur werkgemeenschap MFO-ZWO
- lid programmaraad werkgemeenschap MFO-ZWO
- lid redaktieraad Continental shelf research
- IAPSO vertegenwoordiger nationaal UGGI comité
- lid van de Rijkscommissie voor Geodesie
- 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 Wetkunde en Informatica, Amsterdam
- correspondent van Natuur en Techniek
- lid werkgroep ROWA van de BCRS
- lid werkgroep radar altimetrie TH Delft
- J.J. Zijlstra
- lid bestuur Nederlandse Raad voor Zeeonderzoek
- voorzitter commissie mariene biologie van de Nederlandse Raad voor Zeeonderzoek
- lid planningscommissie Snellius-II
- lid commissie antarctisch onderzoek NRZ
- lid Koninklijke Nederlandse Akademie van Wetenschappen
- vice-voorzitter van de Biologische Raad
- lid Directeuren Overleg Chemie/Biologie Noordzee
- lid ZWO-adviescommissie gebiedsraad-in- oprichting Biologie
- lid wetenschappelijke commissie van het Rijksinstituut voor Natuurbeheer (RIN)
- lid biological oceanography committee ICES
- voorzitter SCOR-UNESCO werkgroep 65: coastal-offshore interactions
- lid European Polar Study-group (ESF)

3.4. STUDENTENONDERZOEK

Als onderdeel van hun doctoraalstudie of als stagiaire namen de volgende personen deel aan het onderzoek. De nummers verwijzen naar de projecten in sectie 1.7.

M. Addink	R.U. Leiden	B2-02c
K. Beets	V.U. Amsterdam	H3-03
G. van den Bergh	R.U. Utrecht	H3-08
W. van Boekel	R.U. Groningen	EON
W. de Boer	H.L.S. Groningen	B1-02
K. Buis	L.H. Wageningen	B1-02
H. Dignum	G.U. Amsterdam	B2-03
F. van den Endel	R.U. Groningen	EON
E. Epping	R.U. Groningen	H1-03
R. van Haren	L.H. Wageningen	EON
H. Heinis	V.U. Amsterdam	H3-12
E. Hoekstra	T.H. Delft	H1-06
T. Ietswaart	R.U. Groningen	EON
J. Joordens	L.H. Wageningen	B4-02
P. Kamermans	R.U. Groningen	OPEX
W. Kuipers	T.U. Eindhoven	H1-03
L. van der Laag	R.H.L.S. Groningen	OPEX
P. Lock	R.U. Utrecht	H1-03
L. Moodley	V.U. Amsterdam	B2-03
T. Nauta	L.H. Wageningen	H1-12
P.H. Nelissen	G.U. Amsterdam	B4-01
H. Nijkamp	R.U. Groningen	B1-04
B. Noort	H.T.S. Enschede	B1-02
J. Oe	R.H.L.S. Groningen	B1-03
A. Oost	R.U. Utrecht	H3-08
E. Otter	R.U. Groningen	H1-09
M. Peersman	R.U. Utrecht	H3-12
P.J. Pestman	R.U. Utrecht	H3-03
M. van Ryssel	R.U. Groningen	H1-03
E. Spijker	S.O.L. Utrecht	H1-08
J. Stefels	G.U. Amsterdam	B4-01
K. Taai	Bakhuys Roozeboom Inst. Beverwijk	H1-06
F. Tamis	S.O.L. Utrecht	H1-08
E. Ufkes	R.U. Utrecht	H3-08
H. Welleman	R.U. Groningen	OPEX
O. Werver	R.U. Utrecht	H3-03
Th. Westerhof	R.U. Groningen	B1-03
J. Wiemers	R.U. Utrecht	H3-12
A. Wijnkoop	Laboratoriumschool Rijnland	H1-06
W.P. de Winter	L.H. Wageningen	B4-01
R. Witbaard	G.U. Amsterdam	B1-04

3.5. CURSUSSEN, VERGADERINGEN EN EXCURSIES

3.5.1. NIOZ cursussen

De cursus "Inleiding in de Oceanologie" werd gegeven van 10 februari tot 6 maart. Er waren 28 deelnemers, van wie het grootste deel afkomstig was van de R.U. Groningen. Deze cursus is een onderdeel van het tweedejaars curriculum mariene biologie in Groningen. De studenten verbleven voor het praktische gedeelte van de cursus van 17 tot 28 februari op het NIOZ. De geplande vaardagen konden ten gevolge van ijsgang maar gedeeltelijk doorgang vinden.

De cursus "Mariene Oecosystemen" werd gegeven van 16 tot 17 juni. Er namen 26 studenten aan deel. De cursus vormde het praktische gedeelte van de algemene cursus "Marine Biologie" die in samenwerking met de R.U. Groningen is opgezet. In verband met de activiteiten van vooral de werkgroep Pelagische Systemen in het Friese Front gebied werd de nadruk tijdens de cursus dit jaar gelegd op het bentische systeem. Naast het gebruikelijke onderwerp, stofkringloop, kwamen de onderwerpen verspreidingspatronen van bodemdieren, statistische problemen bij de monsternamen, en diversiteit in verschillende milieus uitgebreid aan de orde. Het DIHO leverde dit jaar een waardevolle bijdrage aan het opstellen van een koolstofbudget door het meten van primaire productie en bodemrespiratie op het Balgzand voor haar rekening te nemen.

3.5.2 Andere cursussen gehouden op het NIOZ

17-21 maart	Cursus Geologie van de Universiteit van Amsterdam o.l.v. W. Schlager.
17 april	RGD/RWS management course.
23 april	Cursus biologie Universiteit van Amsterdam o.l.v. R. Tjissen (35 personen).
19-22 mei	Cursus HLO biologie o.l.v. H. de Wilde. Dr. Ir. Ghyse-ninstituut, Utrecht.
1-6 september	Workshop Theoretische Biologie (Models for Physiologically Structured Populations) o.l.v. O. Diekmann en H. Metz.
15 november	Symposium Ned. Ver. Zeewater Aquarium Houders.

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

21 januari	Han Fortmann College, Heerhugowaard.
6 februari	3e klas Hogere Landbouwschool, Groningen.
3 maart	Dr. Abs, Ruhr Universiteit te Bochum, West-Duitsland
26 maart	Stichting Opleiding Leraren. Inleiding: H. Lindeboom
26 maart	Hoger Rijksinstituut voor Tuinbouw (België). Inleiding: J. Everaarts.
27 maart	Rijks Middelbare Landbouw School, Utrecht.
4 april	InterStudie (Leraaropleiding) bijscholingscursus de Jong, Nijmegen.
8 april	2e kl. Milieukunde Hogere Landbouwschool, Groningen.
9 april	M.T.S., Gouda, afd. weg- en waterbouw 4e klas o.l.v. de Hr. C. vd. Perk.
14-15 april	V.W.O, Leiden, door M. Lavaleye.
21 april	Cursus Biologie Univ. Amsterdam.
1 mei	HLO Leeuwarden o.l.v. H. Kattenberg.
7 mei	American School, Den Haag.
14 mei	Stichting Opleiding Leraren. Inleiding: W. Helder.
15 mei	Chr. LEAO, Lisse.
20 mei	Analisten HLO biologie, Utrecht.
23 mei	Burgemeesters en Wethouders van de Waddeneilanden.
29 mei	Fysische Chemie doctoraal assistenten, Nijmegen.
30 mei	Bernhardus MAVO o.l.v. Mevr. v. Beek.
3 juni	GYVO-vereniging, de Koog.
4 juni	Directeuren van het LBO uit Kop van Noord-Holland.
4 juni	Lagere school Cocksdorp o.l.v. Mevr. Hoven.
5 juni	Plantenziektekundige Dienst te Wageningen
6 juni	Ned. Ver. v. Geneeskruidenonderzoek.
10 juni	Landbouw Hogeschool Wageningen .
17 juni	Daalderschool Oosterend o.l.v. A. Hoven.
21 juni	Koninklijke Nederlandse Geologisch en Mijnbouwkundig Genootschap. Inleidingen en excursie J.H.F. Jansen en G.C. Cadée.
25 juni	Waddenadviesraad.
19-20 augustus	Electrotechnische School Amsterdam.
24 september	Universiteit van Helsinki.(Finland)
29 september	Wenkenbach MTS, Beverwijk.
21 oktober	Scholieren uit Krefeld o.l.v. U. Rosheck. (West-Duitsland)
23 oktober	Scholieren Gymnasium Wuppertal, West-Duitsland o.l.v. H. Jacob.
19 november	Personeelsleden Landbouw Hogeschool Wageningen, afdelingen bodemkunde en geologie
23 december	Burgermeester en Wethouders Texel.

4. Hulpafdelingen

4.1. BIBLIOTHEEK

In 1986 werden 64 boeken en 1 atlas aangeschaft.

Met ingang van 1986 heeft de bibliotheek abonnementen op de volgende tijdschriften:

- Marine Geodesy vol. 10 (1), 1986
- Paleoceanography vol. 1 (1), 1986
- Polar Biology vol. 1 (1), 1982
- Polar Record 142, 1986
- Tweekbericht 1986

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

- Thalassas, Revista de Ciencias del Mar Santiago de Compostela 1 (1) 1983
- Collected Contributions Florida Institute Technology vol. 2, 1983
- Oceanographical Cruise Report Indonesian and Adjacent seas no. 40, 1985
- Publications of the US Geological Survey Circular 936
- Waste Management Research Abstracts 14, 1983
- Balans, Nota 1985 no. 16 - Papers on Oceanography and Hydrology Geophysical Inst. Kyoto Univ. 1981
- Cuadernos de Investigacion Biologica Bilbao vol. 5, 1984
- CO₂ United State Department of Energy DOE/ER-235, 1985
- Smithsonian Tropical Research Institute Contributions no. 1, 1984
- Stralen/Bescherming Ministerie Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, 1985 nr. 5
- Bulletin of the Institute of Zoology Academia Sinica 25(1), 1986
- Overzicht van de Meetresultaten KNMI/RIV-Project 2e kwartaal 1982
- Estudios Oceanologicos Inst. Oceanologicas Univ. Antofagasta no. 1, 1965
- Document Scientifique Centre Rech. Oceanogr. Dakar 96, 1985
- Plankton Newsletter vol. 4, 1986
- Shell Venster 9, 1986
- IAEA Newsbriefs vol. 1 (1), 1986 - Nieuwsbrief Milieu & Economie vol. 1 (1), 1986
- Bulletin Atomic Energy Agency, Vienna vol. 28 (3), 1986
- Yearbook International Council of Scientific Unions, 1986

4.2. REKENCENTRUM

Het jaar 1986 heeft zich op het rekencentrum gekenmerkt door een toename van de werkdruk en het aantal gebruikers van de rekenapparatuur. Veel reken- en simulatiewerk kon verricht worden door de NORD-530, terwijl de NORD-100 voornamelijk voor tekstverwerking werd ingezet. Het aantal beeldschermen aangesloten op de beide computers bleef groeien. De mogelijkheid om IBM pc's te koppelen aan de NORD vergrootte het aantal in de toekomst te verwachten gebruikers.

Het vele en intensieve rekenwerk bracht aan het licht, dat het interne geheugen van de NORD-530 aan de krappe kant werd; de responsetijd liep schrikbarend terug. Na een ingreep van Norsk Data, het bijplaatsen van 2 mb memory, werd de responsetijd sterk verkort.

De samenwerking tussen NIOZ en DIHO krijgt in 1987 zijn vervolg op de rekencentra. Besloten is voor beide instituten te zorgen voor adequate NORD apparatuur. Zowel het NIOZ als het DIHO kan zich na de transactie verheugen op de beschikbaarheid van snelle rekenapparatuur.

4.3. REPROGRAFISCHE AFDELING

Tijdens het verslagjaar is bij het NIOZ vertrokken G. de Schipper die werkzaam was als fotozetster. De hierdoor ontstane vacature is opgevuld door N. Krijgsman.

De afdeling heeft een bijdrage geleverd voor de expositie van Rijkswaterstaat "Kijk op de zee" in het Kurhaus te Scheveningen.

Tevens is een uitgebreide NIOZ-expositie gerealiseerd in het Reddingsmuseum te Den Helder.

De productie van de film "Noordzee" is na enige stagnatie opnieuw ter hand genomen.

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.

Ten opzichte van het voorgaande jaar bleek de vraag naar gefixeerd materiaal groter te zijn. De levering van levend materiaal nam echter aanzienlijk af, hetgeen kennelijk veroorzaakt werd door bezuinigingen en inkrimpingen bij met name de landelijke dierentuinen. Circa 51.000 levende of gefixeerde dieren werden verkocht, alsmede 47.500 liter zeewater.

De aankoop van materiaal verliep moeilijker dan in voorgaande jaren. Enerzijds kwam dit door de verregaande stilligeregelingen van de diverse visserijorganisaties, anderzijds door de afstemming van de aankoop op de vraag teneinde kwaliteitsverlies tegen te gaan.

4.5. WERKPLAATSEN

Onderhoudsafdeling.—Evenals in voorgaande jaren hebben de werkzaamheden ten behoeve van de Nederlandse Raad voor Zeeonderzoek een zware druk gelegd op het totale functioneren van de technische dienst.

Het m.s. "Tyro" werd voorzien van een nieuwe 2 tons stuurboordkraan en een man-overboord-boot kraan. De diepzee vislier kreeg een nieuwe kabel en voorspoelinrichting terwijl de CTD lier van een dikkere kabel werd voorzien. De "Tyro" werd uitgerust voor het Friese Fronten Projekt waarbij veel mankracht moest worden ingezet.

Voor de reis van de Vrije Universiteit werd op de "Tyro" de lier van de Rijks Geologische Dienst geplaatst.

Er werden twee nieuwe containers aangeschaft voor de N.R.Z.

Voor het Antarctisch onderzoek van de N.R.Z. werd voor gebruik aan boord van de "Polarstern" een nieuw liertje gebouwd.

De "Tydeman" werd beladen voor een reis van het Rijksmuseum van Natuurlijke Historie.

Het m.s. "Heffesant" van Rijkswaterstaat werd i.v.m. frequent EON-onderzoek uitgerust met 2 containers en een zeewaterinlaatpomp.

Op de "Navicula" werd een zwaardere hijslier geplaatst en werd het A-frame verlengd in verband met het werken met de vibracorer.

Onder toezicht van de technische dienst werden voor Rijkswaterstaat en het Delta Instituut 2 boxcorers gebouwd.

Er werd een sedimenttrap met acoustic release geplaatst in de Middellandse Zee (Rhône monding). Tevens werden pistoncorer monsters genomen met eigen apparatuur tijdens een Duitse expeditie bij de Tambora in Indonesië.

De pomp van het afvalwaterbassin werd vervangen. De elektrische werkplaats is naast alle normale onderhoudswerkzaamheden zwaar belast met het installeren van een nieuw energie beheersingssysteem.

Instrumentmakerij.—In de instrumentmakerij zijn diverse ondersteunende werkzaamheden verricht.

Veel werk is besteed aan de R.V.S. meetklokken, die bestemd zijn voor onder andere zuurstofopname metingen. De gastonderzoeker Dr. G. Gust heeft een onderzoek gedaan naar het stromingspatroon in deze klokken; hiervoor zijn diverse roersystemen ontwikkeld.

Met de bouw van de diepzee suspensiecamera's is een begin gemaakt. Hiervoor zijn 3 Nikon F3P camera's met motordrive en een 250 opname-achterwand en diverse lenzen aangeschaft. De motordrives zijn verbouwd zodat ze kleiner zijn geworden. Hierdoor past de camera nu in een onderwaterhuis van inwendig $\varnothing$ 15 cm, hetgeen een enorme besparing is (anders 23 cm). In de 250 opnamen achterwand is een datawand gebouwd. De bouw van de onderwaterhuizen is voor een gedeelte uitbesteed.

Een motorgestuurde computergecontroleerde preparaattafel voor de SEM 505 (scanning electron microscope) is op het NIOZ ontwikkeld. Met deze preparaatbesturing kan elk punt op een 9 mm groot preparaat tot op 0,1 μm nauwkeurig en reproduceerbaar teruggevonden worden. Deze besturing zal gekoppeld worden aan een EDXA (energy dispersive X-ray analysis) systeem waardoor automatisch chemische analyses van grote aantallen sedimentdeeltjes gedaan kunnen worden. De firma's Philips en Vector hebben interesse getoond in deze apparatuur.

Experimenteer Aquarium.—Naast de diverse werkzaamheden voor onderzoekers en studenten is er in het experimenteer aquarium een begin gemaakt met de verbouwing van de wadbak tot Noordzeebak. Hiervoor is het leidingensysteem gewijzigd. De eb- en vloedregeling is bij de nieuwe opstelling niet meer nodig. De centrifugaalpompen moeten worden vervangen door membraanpompen; deze pompen zullen het in het zeewater aanwezige plankton naar verwachting niet beschadigen.

De oude overkapping is gesloopt omdat er geen licht in de Noordzeebak mag komen. De bak komt nu in een "donkere kamer" te staan. Het dak van deze ruimte wordt afneembaar zodat men met de hijsinstallatie in de bak kan komen om er Noordzeesediment in aan te brengen.

Doordat de staat van de betonnen bak zeer slecht was, en een betrouwbare betonrenovatie niet mogelijk was, is de bak van een polyester laag voorzien. Hierdoor treedt nu geen lekkage meer op.

Electronica.—Het jaar 1986 stond voor de afdeling electronica in het teken van vernieuwing en automatisering. Velen in dit instituut vonden via deze afdeling de weg naar de personal computer. IBM en IBM-compatible hebben binnen een jaar de bestaande orde van Hewlett Packard computers overvleugeld. De keus van deze nieuwe standaard bleek juist te zijn, gezien het aantal nieuwe apparaten binnen het instituut dat bij aanschaf reeds is voorzien van een IBM (compatible) computer ofwel van hiervoor geschikte software.

De toename van opdrachten en het gebrek aan mankracht voor deze specifieke taken—de vacature HTS-er informatica die sinds 1 januari 1986 bestaat is dit jaar slechts 5 maanden op MTS niveau vervuld geweest—zorgen voor een constante wachtlijst.

De ondersteuning van het vaarplan begint routinematig te worden maar kost, gezien het verlangen van de onderzoekers voortaan met 2 electronici te varen, nog te veel tijd en mankracht.

De verhuizing en vernieuwing van het instrumentarium zijn tot tevredenheid verlopen.

4.6. HAVEN EN VAARTUIGEN

De "Aurelia" heeft 184 vaardagen gemaakt en 255 opstappers vervoerd. In het stuurhuis is een plotting converter geplaatst die digitaal de positie in lengte en breedte coördinaten aangeeft. Van het achterdek zijn 2 luiken verwijderd om meer ruimte te krijgen voor de kastengreifer en watercontainers.

De "Navicula" heeft 149 vaardagen gemaakt. Door de werkplaats is zowel in de machinekamer als aan het A-frame een zwaardere hydraulische waterlier gemonteerd ten behoeve van kastengreifer. Bovendien is in het stuurhuis een A.P. NAVICATOR (digitaal positie l./ba) en een auto-pilot geplaatst.

De "Griend" heeft 113 vaardagen gemaakt en er is een S.S.B. radio-ontvanger voor scheepsberichten gemonteerd. Bovendien is in de machinekamer extra isolatiemateriaal aangebracht.

In de haven zijn bij de R.I.N.-steiger 2 bolders aan de wal geplaatst ten behoeve van het afmeren van de schepen en de wadtoren.

Aan de kop van de dijk kwamen gaten voor onder de basaltkeiën. Die zijn opgestopt en de kop is met asfaltemulsie versterkt.

In de schuur zijn hardhouten kozijnen geplaatst en in de vissorteer-ruimte is een aluminium schuifdeur gemonteerd.



4.7. LOGEERGEBOUW "IN DEN POTVIS"

De bezettingsgraad van de huisjes en de eenpersoonskamers is ten opzichte van 1985 gestegen. In 1986 bedroeg hij voor de huisjes 87,5% en kwam voor de kamers neer op 96%.

Dertien personen die normaliter voor een eenpersoonskamer in aanmerking zouden zijn gekomen verbleven wegens overbezetting op 4 slaapzalen, hetgeen neerkwam op 1140 overnachtingen.

Het aantal losse overnachtingen bedroeg 3546 waaronder 2236 voor de groep Indonesische onderzoekers.

Degenen die op kosten van het NIOZ in de Potvis verbleven, maakten in totaal 738 maal van deze accommodatie gebruik.

5. Sociaal jaarverslag

5.1. ALGEMEEN

In de rechtspositie van het instituut, zoals beschreven in het jaarverslag 1984, kwam in 1986 geen verandering. De besprekingen betreffende de overkoepeling van de para-universitaire instituten hebben geleid tot nader overleg met de Koninklijke Akademie voor Wetenschappen (KNAW). Ook in 1987 zal deze materie de aandacht krijgen van directie en ondernemingsraad.

In augustus 1986 is de direktiestructuur aangepast aan het in 1985 goedgekeurde organisatieschema. De gelijkwaardige tweehoofdige directie is gewijzigd in een algemeen directeur, een wetenschappelijk directeur en een technisch-administratief directeur.

5.2. BEHEER

Het beheer van het instituut berust nog steeds bij de Nederlandse Dierkundige Vereniging. De Commissie van Toezicht verloor met ingang van 1 augustus één lid in verband met het aanvaarden van het wetenschappelijk directeurschap van het NIOZ door Dr. E.K. Duursma.

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

Bestuur (per 1-12-1986)

Commissaris:	Prof. Dr. W. Scharloo
Commissie van toezicht:	Prof. Dr. W. Scharloo Dr. J.G.D. Lambert (penningmeester NDV) Prof. Dr. J. Lever Prof. Dr. W. Mook vacature
Financiële commissie:	Prof. Dr. W. Scharloo Dr. J.G.D. Lambert Prof. Dr. J. Lever Prof. Dr. W. Mook P. Buys (Ministerie van O en W)

Wetenschappelijke commissie

Prof. Dr. J. Lever (voorzitter)	Biologisch Laboratorium Vrije Universiteit, Amsterdam
Dr. G.M. Lokhorst (secretaris)	Rijksherbarium Rijksuniversiteit Leiden
Prof. Dr. N. Daan	Rijksinstituut voor Visserij- onderzoek, IJmuiden
Dr. H. van Gernerden	Vakgroep Microbiologie Rijksuniversiteit Groningen
Prof. Dr. J.E. van Hinte	Instituut voor Aardweten- schappen Vrije Universiteit, Amsterdam
Prof. Dr. C. van den Hoek	Vakgroep Mariene Biologie Rijksuniversiteit Groningen
Prof. Dr. J. Joosse	Biologisch Laboratorium Vrije Universiteit, Amsterdam
Dr. J. van der Land	Rijksmuseum van Natuurlijke Historie, Leiden
Mw. Drs. W. de Ligny	Shell Int. Petr. Mij., Den Haag
Dr. Ir. L. Otto	Afd. Oceanografie KNMI De Bilt
Dr. R.C. Peters	Laboratorium voor Vergelij- kende fysiologie Rijksuniversiteit Utrecht
Prof. Dr. R.A. Prins	Rijksinstituut voor Natuurbe- heer, Leersum
Prof. Dr. W. Scharloo	Vakgroep Populatie- en Evo- lutiebiologie Rijksuniversiteit Utrecht
Prof. Dr. P.A. Schenk	Afd. Scheikundige Tech- nologie Technische Universiteit Delft

5.3. WERKOVERLEG

Met de ondernemingsraad werden regelmatig en op constructieve wijze besprekingen gevoerd over diverse actuele zaken en toekomstige ontwikkelingen (zie verder het jaarverslag van de ondernemingsraad). Het overleg tussen directie en hoofden van dienst kreeg een ander accent door de werkgroepleidersvergadering te splitsen in een algemeen beleidsgedeelte en in een wetenschappelijk gedeelte. Het overleg in de afdeling vond op de gebruikelijke manier plaats.

5.4. PERSONEELSBELEID

Bevorderingen

In 1986 werden onderstaande personen bevorderd:

E. v. Abs	W. Helder
M.A. Baars	J.W. Rommets
S.D. Groot	Tj.C.E. v. Weering
J. Hart-Stam	J.J. Zijlstra

Mutaties

In dienst:

Drs. A. Cramer	a.i.o.	exp. biologie	01-01
Drs. C. Westra	a.i.o.	chem. biologie	01-01
Dr. H.J. Lindeboom	h.s.p.	spec. projecten	01-02
Drs. R. Heyman	a.i.o.	autecologie	01-03
P.C. Vooys	h.a.a./p.c.	hulpafd.	01-03
J.M. Pieterse	2e machinist	haven en vaart	01-04
N. Krijgsman	publ. ass.	reprografie	01-05
Ing. R. Schmidt	electronicus	electronica	01-05
Ing. S. Ober	fys. ass.	fys. ocean.	01-08
Dr. E.K. Duursma	wet. directeur	directie	01-09

Uit dienst

W.M.L. Lambrechts	lab. ass.	fys. ocean.	01-02
C. Leverington	secretaresse	directie	01-02
E. Sebens	2e machinist	haven en vaart	01-03
Ing. J.A.P. Leijtens	electronicus	electronica	01-04
G.E. de Schipper	publ. ass.	reprografie	06-04
Dr. D. Spitzer	wet. ond.	fys. ocean.	01-06
Prof. dr. H. Postma (pensioen)	wet. directeur	directie	01-08

Overplaatsing

geen

5.5. PERSONEELSLIJST (per 31-12-86)

Direktie:

Wet. dir. Dr. E.K. Duursma
Alg. dir. Prof. Dr. J.J. Zijlstra

Secretaresse:

J. Hart-Stam
J.W. Schröder-
ter Avest
C. Leverington

Assistentie:

J.W. Rommets
J.I.J. Witte

Tech.- Adm. dir. Ing. E. van Abs

Onderzoekafdelingen

afd. chemische oceanografie en
onderzoek zeeverontreiniging

Onderzoeker:

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

Assistentie:

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

afd. fysische oceanografie

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

M.R. Wernand
M.W. Manuels
S. Ober

afd. mariene geologie en geochemie

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

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

afd. experimentele systemen

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

Drs. A. Cramer

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

afd. autecologie

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

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
Drs. M. Reichert
Drs. F. Kouwets

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

afd. benthische systemen

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

W. de Bruin
J. Hegeman

P. Duiven
J. Zuidewind

Rekencentrum

F. Eijgenraam
R. Dapper

Hulpafdelingen

Hoofd administratieve hulpafdelingen tevens personeelschef: P.C. Vooy

publikatie en bibliotheek	(Dr. J.J. Beukema, redactie) J. v.d. Wal-Doornekamp (bibliotheek)	B. Bak-Gade J.P. Mulder-Starreveld M. Bruining-du Porto
administratie	G. Goslinga	D.J. Bruin E.C. Lanser I. Wernand-Godée
reprografie	H. Hobbelink	B. Verschuur R. Nichols R.P.D. Aggenbach N. Krijgsman
telefoon/receptie	M. Zonnenberg	
biologisch studiemateriaal (Den Helder)	J.M. Nieuwenhuizen	
huishoudelijke dienst en logeergebouw "de Potvis"	G.H. Steenhuizen T. Steenhuizen-Borkulo	G.C. Weijdt-Eelman H. Spigt
onderhoudsafdelingen	T. Verveer	
werktuigbouwkunde	T. Buisman	S.D. Groot F.J. Parlevliet H.H. de Porto J. Visser S. Gieles
houtbewerking	L. Heerschap	R.M. Daalder
electrotechniek	F.J. Schilling	
magazijn	A. Ran	S.W. de Porto
instrumentmakerij/aquariumtechnische afdeling	H.J. Boekel	A. Vaars J. van Heerwaarden R. Lakeman T. Kuip
elektronica	Ing. R.L. Groenewegen	G.M. Manshanden Ing. H. Franken Ing. R. Schmidt
haven en vaartuigen	C. van Zwieten C. Wisse C. Gerssen	W.P. Jongejan J.C. Tuntelder A.J. Souwer A. Boon J.C. Groot E. Adriaans R.J.R. Anthonijsz G.L. de Vries J. Pieterse C. Mozes W.J.M. Koomen R. Rebel

5.6. TIJDELIJKE PERSONELE ONDERSTEUNING

W. Polman	matroos	haven en vaart	01-02 tot 31-12
E. Niersman	analist	chem. ocean.	01-10 tot 31-12
Drs. H. v. Garderen	assistent	exp. biologie	01-10 tot 31-12
Drs. M. Leopold	wet. ass.	benth. syst.	01-09 tot 01-12
Drs. M. Haver	analist	benth. syst.	01-08 tot 01-11

	R. v.d. Brink A. Gieles-Witte	techn. ass. analist	werk.bwk. afd. geologie	01-09 tot 31-12 01-01 tot 01-07, 01-09 tot 01-10
	Drs. R.W.J. Dirks N. Schogt	prom. ass. analist	fys. ocean. pel. syst.	01-02 tot 31-12 01-01 tot 31-12
vakantiehulpen	M. Berger	23-06 tot 23-07		
	J. Derksen	30-06 tot 23-08		
	G. v.d. Gaast	12-05 tot 12-06		
	M. v.d. Gaast	12-06 tot 12-07		
	H. v.d. Hoek	16-06 tot 01-08		

Onderzoekers met een ZWO-beurs:

Drs. J.J.M. van Haren	fysische oceanografie	01-01 tot 31-12
Drs. L.R.M. Maas	fysische oceanografie	01-01 tot 31-12

Werken met behoud van uitkering

Het aantal personen dat in 1986 op vrijwillige basis op het instituut werkzaam is geweest met behoud van uitkering, is t.o.v. 1985 teruggelopen. Aansluitend is men werkzaam geweest t.b.v. project-onderzoek of op een gesubsidiëerde plaats.

Met een amtenaar van het Ministerie van Sociale Zaken heeft een gesprek plaatsgevonden over o.a. de voorwaarden van plaatsing. Ook met de gemeente en het arbeidsbureau is hierover overleg gevoerd.

	vrijwillig	
M. Tijssen	01-01 tot 01-08	01-08 tot 31-12 M.O.A. regeling ('maatregel ondersteuning arbeids- inpassing')
Y. Bakker	01-01 tot 01-06	01-06 tot 01-12 project benthic mapping
A. de Graaf	01-01 tot 31-12	via G.M.D. Alkmaar

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

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

Projecten:

EON	
Dr. W. Admiraal	tot 01-09
Drs. M.A. van Arkel	
Drs. J.W. Baretta	
Drs. M. Bergman	vanaf 01-07

Dr. F. v. Duyl	vanaf 01-08
A.C. Bol-den Heijer	
R. Kloosterhuis	
Dr. R.W.P.M. Laane	tot 01-05
H. Lindeboom	vanaf 01-02
H. Malschaert	
M. Mulder	
Dr. Ir. W. v. Raaphorst	vanaf 01-08
Drs. P. Ruardij	
Dr. H. v.d. Veer	
Drs. M. Veldhuis	vanaf 01-11
L.A.H. Venekamp	
L. Villerius	vanaf 01-03
B. v. Dessel	gewetensbezwaarde
gedetacheerd door TNO	
A.J. Kop	
A. Stam	
P. de Wolf	
BOVO/RWS	
Drs. P. Seip	01-01 tot 21-08
R. Brand	01-01 tot 16-07
DORA	
Drs. M. Lavaleije	01-01 tot 01-05
C. Oomens-Meeuwssen	01-01 tot 01-05
Dr. M. Rutgers v.d. Loeff	01-01 tot 01-05
G.J. Zigterman	01-01 tot 01-05
OPEX	
Drs. A. de Gee	01-01 tot 01-06
Drs. G. v. Moorsel	01-01 tot 31-12
RWS	
Drs. C.G.N. de Vooy	01-01 tot 15-02
	15-09 tot 31-12
BOORSPOELING	
A. Kikkert	01-01 tot 01-03
	01-10 tot 31-12
W. Lewis	01-01 tot 01-02
	01-03 tot 31-12
WAWAMO	
Drs. H. Ridderinkhof	01-01 tot 31-12
N.R.Z.—Antarctisch Onderzoek	
Drs. A. Buma	01-11 tot 31-12
Deposit etende bodemfauna	
Drs. J. Heringa (gew. bezw.)	01-07 tot 31-12
Benthic Mapping (chemie)	
A.S. de Jong	01-09 tot 31-12
Drs. C.V. Fischer	01-10 tot 31-12

Benthic Mapping (biologie)	
G.J. Zigterman	01-06 tot 01-12
Y. Bakker	01-06 tot 01-12
Shell int.	
Drs. C.V. Fischer	01-01 tot 01-04
	01-05 tot 01-10
N.R.Z.—vaarplan	
P.R. Alkema	01-01 tot 31-12
A.A. Balk	01-01 tot 31-12
H. v. Veen	01-01 tot 31-12
R.J.C. Witte	01-01 tot 31-12
J. Nieuwenhuis	01-06 tot 31-12
J. de Ridder	01-01 tot 31-12
H. Lasker	09-06 tot 31-12

Stagiaires

Evenals in voorgaande jaren is aan een aantal studenten uit het Hoger en Middelbaar Beroepsonderwijs gelegenheid gegeven een stage te volgen in het kader van de opleiding. Over het algemeen kan worden gesteld, dat zowel voor het instituut als voor de studenten de ervaringen positief zijn.

Lijst van stagiaires in 1985:

M.J.H. Baars	03-03 tot 13-06	M.T.S. Alkmaar	en. techn.
R.M. Bakker	01-03 tot 12-06	M.T.S. West Friesland	werktuigb.k.
S.J. v.d. Belt	12-01 tot 15-06	H.T.S. Alkmaar	electronica
R.F. de Boer	18-08 tot 31-12	H.T.S. Alkmaar	electronica
W. de Boer	09-01 tot 15-04	R.H.L. Groningen	exp. biologie
M. Haver	01-01 tot 01-07	v.d. Broek Inst. Amsterdam	benth. syst.
J. Hayma	01-01 tot 01-02	Nautisch college Den Helder	electronica
J. Hoedjes	01-12 tot 31-12	M.T.S. West Friesland	werktuigb.k.
H. v.d. Hoek	01-03 tot 14-06	M.T.S. Alkmaar	en. techn.
A. Hulsebos	01-01 tot 01-03	M.T.S. West Friesland	werktuigb.k.
S.L.v. Kooten	25-08 tot 01-12	IJmond MTS	instr. makerij
L.v.d. Laag	13-01 tot 01-05	R.H.L. Groningen	exp. biologie
R. de Leeuw	18-08 tot 29-11	Nautisch college Den Helder	en. techn.
J. Moeus	01-03 tot 13-06	M.T.S. West Friesland	inst. makerij
B.M. Noort	03-03 tot 15-06	H.B.O. de Maere Enschede	exp. biologie
B. Riesebosch	01-12 tot 31-12	M.T.S. Alkmaar	en. techn.
T. Rikse	04-08 tot 31-12	IJmond M.T.S.	electronica
J. Rozeboom	01-01 tot 01-03	M.T.S. Alkmaar	electronica
J.A. Stringer	11-08 tot 29-11	M.T.S. Alkmaar	en. techn.
C. Taai	01-09 tot 31-12	H.L.O. Leiderdorp	chem. ocean.
W. v. Veev	11-08 tot 01-12	M.T.S. West Friesland	werktuigb.k.
A. Wijnkoop	01-01 tot 01-05	H.L.O. Leiderdorp	chem. ocean

5.7. DEELTIJD

Onderstaande personeelsleden vervulden in 1986 een part-time dienstverband.

M. Bruining-du Porto	33.25 uur	bibliotheek-assistente
G.C. Weijdt-Eelman	9.97 uur	kantine-assistente
W. Klein Breteler	32 uur	bioloog
E.C. Lanser	26.6 uur	administratie-assistente
G.E. Schipper	34.2 uur	repro-med. (tot 6/4)
J. van der Wal-Doornekamp	33.25 uur	bibliotheecaresse
I. Wernand-Godée	30 uur	adm. med./telefoniste
J.T.F. Zimmerman	22.8 uur	fysicus
M. Zonnenberg	35.15 uur	telefoniste
T. Steenhuizen-Borkulo	19 uur	huishoudelijke dienst
J.P. Mulder-Starreveld	19 uur	redactie
B. Bak-Gade	19 uur	redactie
J.W. Schröder-ter Avest	36 uur	directie-secr.
R. Dekker	32 uur	AIO
L. Gerringa	32 uur	AIO
F.A.C. Kouwets	32 uur	AIO
F. Hovenkamp	32 uur	AIO
W.M. Kieskamp	32 uur	AIO
J.M.J. Hoppema	32 uur	AIO
A. Cramer	32 uur	AIO
R. Heyman	32 uur	AIO
C. Westra	32 uur	AIO
P. Kieskamp	32 uur	AIO

5.8. VERSLAG VAN DE PERSONEELSVERENIGING

Activiteiten voor en door het personeel:

—In het voorjaar zijn twee films vertoond in het logeergebouw “in den Potvis”, te weten “Carmen” en “The blues brothers”.

—In februari is een pannekoekenfeest georganiseerd met dit keer als speciale attractie de goochelaar Jan van Woelik.

—Op 29 mei werd een personeelsreisje gemaakt. Bezocht werd de SPACE-tentoonstelling in de jaarbeurs te Utrecht en in Lunteren werden de tuinen van Rob Herwig bezichtigd. Een koud-buffet werd genuttigd in Huize Wormshoef, ook in Lunteren.

—Op 29 augustus is een groots afscheidsfeest georganiseerd door de p.v. voor onze directeur H. Postma. Het feest omvatte o.a. een koud-buffet voor het gehele personeel en een aantal genodigde, een toneeluitvoering door de Comedia de la NIOZ met de eenakter “De overledene” van René de Obaldia en een cabaretprogramma door een twintigtal personeelsleden. Verder werd de muziek voor deze avond verzorgd door het Hongaarse zigeunerorkest van Andrei Serban en de band “Alexis”.

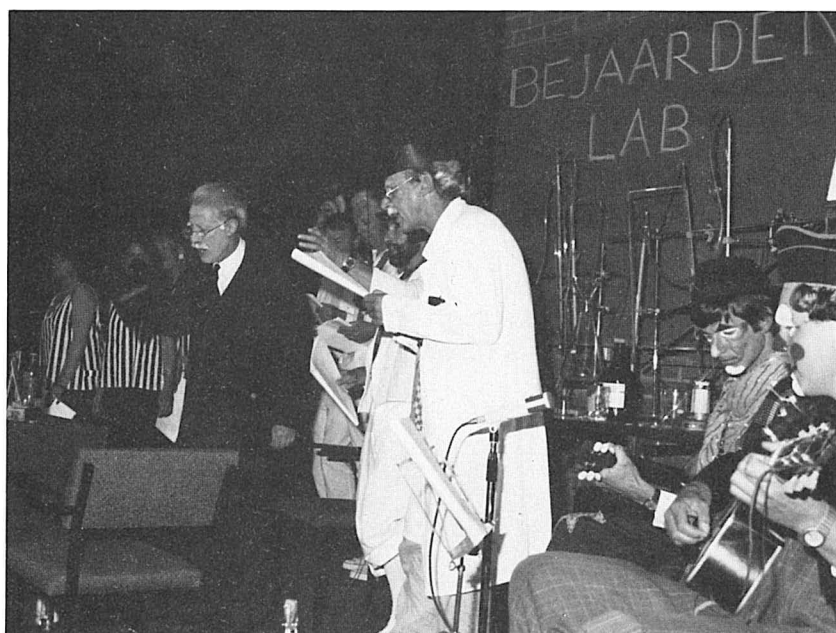
—Financiële bijdragen van de p.v. gingen naar het biologentoernooi, het zaalvoetbal en het volleybal.

5.9. AFSCHEID PROF. DR. H. POSTMA

Bij het bereiken van zijn 65e verjaardag verliet Prof. Dr. H. Postma ons instituut als directeur. Bij zijn afscheid werd hem een speciaal nummer van het Netherlands Journal of Sea Research (Vol. 20 no 2/3) aangeboden, waarin een bio- en bibliografie waren opgenomen. De foto's tonen iets van de feestelijkheden die hiervoor op het NIOZ georganiseerd werden. Zij duurden twee dagen en velen ook van buiten het instituut namen er aan deel.



De twee oud-directeuren G.P. Baerends en H. Postma feliciteren elkaar.



6. Jaarverslag Ondernemingsraad 1986

6.1. ALGEMEEN

Het jaar 1986 werd gekenmerkt door de start van de nieuwe organisatiestructuur. In het begin van het jaar werden een hoofd speciale projecten en een hoofd administratieve afdelingen (tevens personeelschef) aangetrokken, en in de zomer trad de nieuwe directie-structuur in werking. Alhoewel de algemene discussies over het reorganisatieplan in 1985 verregaand waren afgerond, was ook tijdens de uitvoeringsfase de reorganisatie een steeds weerkerend gespreksonderwerp op de overlegvergaderingen van directie met ondernemingsraad. Met name de aan de veranderingen in de directionele top gekoppelde schaalverhogingen bleven punt van discussie, omdat het Ministerie van Onderwijs en Wetenschappen deze aanpassingen wel fiatteerde maar het personeelsbudget niet dienovereenkomstig verhoogde. De directie verdedigde het invoeren van de nieuwe schalen met verwijzing naar de extra gelden die op andere begrotingsterreinen structureel verkregen werden en vond daarom het risico om dit deel van een nieuw op te stellen formatieplan reeds uit te voeren alleszins acceptabel, aangezien de directie tegenwoordig door het Ministerie gemachtigd is om overschrijdingen op een begrotingscategorie te dekken uit onderbestedingen op andere categorieën.

Het huidige formatieplan dateert uit 1982 en werd eenzijdig door het Ministerie vastgesteld. Omdat het ruwweg een beschrijving van de op dat moment bestaande situatie betrof, werd de laatste jaren steeds sterker de behoefte gevoeld om een nieuwe versie, gebaseerd op algemene functieomschrijvingen, te ontwerpen. Bij het bevorderingsbeleid richtte de directie zich vrijwel uitsluitend op verdiensten en kwaliteiten van personeelsleden, waardoor momenteel een aanzienlijk aantal personen volgens een hogere schaal gesalarieerd wordt dan hun maximumschaal volgens het oude formatieplan. Deze zogenaamde "doorbraken" traden ook op als gevolg van kleine interne reorganisaties waarbij overplaatsingen geschieden met behoud van het oorspronkelijke salaris. In de jaren 1981-1985 vonden bevorderingen met name plaats in de niet-academische rangen, slechts 2 van de in totaal 56 bevorderingen van het vaste personeel betroffen wetenschappers. In 1986 vonden in die geding, buiten de 3 directiebevorderingen, echter 3 schaalverhogingen plaats en ook voor 1987 valt te verwachten dat een aantal bevorderingen van wetenschappers plaats zal vinden, waarmee steeds meer doorbraken

ten opzichte van het oude formatieplan zullen optreden. Op dit moment heeft ca. 15% van het vaste personeel een hogere schaal dan de eind-schaal volgens het formatieplan, terwijl ca. 70% zich in die schaal bevindt (waarbij een grote meerderheid tevens op het maximum van de betreffende schalen beland is). Voor de overigen lijkt de bevorderingsruimte op papier nog aanwezig maar het door het Ministerie toe te kennen personeelsbudget bedraagt ruwweg slechts 94% van het bedrag waarbij alle personeelsleden op hun maxima volgens het formatieplan staan. Het is duidelijk dat bij een ongewijzigde situatie het bevorderingsbeleid na 1986 onder zware druk komt te staan. Het geringe verloop, de toenemende vergrijzing (momenteel ligt de gemiddelde leeftijd van het vaste personeel rond de 45 jaar), en de onmiskenbare toename van de werkbelasting in de afgelopen jaren maken het gewenst dat voor zoveel mogelijk personeelsleden enig toekomstperspectief in stand wordt gehouden. Het nieuwe formatieplan zou in de ogen van de ondernemingsraad daarom niet alleen de reeds gerealiseerde doorbraken moeten formaliseren, maar ook nieuwe bevorderingsruimte, gebaseerd op degelijke functieomschrijvingen, moeten gaan bevatten.

De eerste hoofdtak die de nieuwe personeelschef in 1986 van de directie opgedragen kreeg omvat het opstellen van die functieomschrijvingen. Dit werk vorderde langzamer dan verwacht, eind 1986 waren alleen de omschrijvingen van de directieleden, de werkgroepleiders en de onderzoekers gereed, en waren die van de analisten in ontwerp. De oorspronkelijke doelstelling om een op de functieomschrijvingen gebaseerd formatieplan in de herfst van 1986 bij het Ministerie in te dienen werd daarmee niet gerealiseerd. Te voorzien is dat de vertraging zeker een jaar zal gaan bedragen. De ondernemingsraad kreeg van de directie de toezegging dat het nieuwe plan, alvorens het ingediend wordt, met hem besproken zal worden.

Op het terrein van de steeds omvangrijker wordende groep tijdelijk personeel (overwegend uit externe gelden gefinancierd) wist de directie 2 grote verbeteringen te bewerkstelligen. In de eerste plaats betrof dat een overeenkomst tussen het eigen Ministerie en een aantal financierende ministeries (met name van Verkeer & Waterstaat en Volkshuis vesting, Ruimtelijke Ordening & Milieu) waarbij de EON-projectgroep vanaf 1 januari 1988 structureel in de formatie van het NIOZ zal worden opgenomen. Deze groep, voor toegepast oecologisch onderzoek in Noordzee en Waddenzee, is medio 1984 ontstaan uit de voormalige BOEDE-groep en kreeg toen een contract van 3,5 jaar ten behoeve van de ontwikkeling van een model van de westelijke Waddenzee. De raamovereenkomst tussen de ministeries voorziet in de vorming van een permanente onderzoeksgroep van ca. 15 personen, waardoor het overgrote deel van de huidige contractanten in vaste dienst kan worden genomen. Daarmee behoort het onzekere leven van contract naar contract, voor sommigen al een periode van 14 jaar beslaand sinds de start van het werk in het Eems-Dollard estuarium in 1972, binnen afzienbare tijd tot het verleden.

In de tweede plaats lijkt ook een meerderheid van de technici in dienst van de Nederlandse Raad voor Zeeonderzoek (N.R.Z.) en gedetacheerd op het NIOZ in de loop van 1987 of uiterlijk 1988 in vaste dienst te kunnen worden aangenomen. In de plannen tot reorganisatie van de N.R.Z. is voorgesteld deze plaatsen structureel bij het NIOZ onder te brengen. Het betreft in totaal 7 werknemers, waarvan sommige op contractbasis al in dienst zijn vanaf 1981.

Ook het aantal formatieplaatsen voor promotieonderzoekers nieuwe stijl, de zogenaamde Assistenten-in-Opleiding (AIO's) of tegenwoordig ook Onderzoekers-in-Opleiding (OIO's) getiteld, zal in 1987 uitbreiding ondergaan. Het Ministerie heeft buiten de 10 oorspronkelijke plaatsen, waarvan de meeste in de loop van 1985 en begin 1986 bezet raakten, nog eens 4 van dergelijke plaatsen aan het NIOZ toegezegd. Als gevolg van bovenstaande formatieuitbreidingen komt het NIOZ-personeelsbestand, na jaren van stagnatie op 110-120 vaste plaatsen, in de nabije toekomst op ca. 160 personen, een eindweegs naar de 190 formatieplaatsen zoals 20-25 jaar geleden gepland bij de toenmalige gedachtenuitwisselingen met het Ministerie over de nieuwbouw op Texel.

Vergeleken met de universitaire kommer en kwel vanwege de aanhoudende bezuinigingen maakt het NIOZ nog steeds een zeer positieve ontwikkeling door op financieel en personeel gebied, mede dankzij de vele inspanningen van de directie op allerlei niveaus in binnen-en buitenland. De dynamiek van het instituut lijkt nog steeds toe te nemen door de immer aanhoudende stroom van oceaanprogramma's, een groeiend aantal tijdelijke projecten, de aankoop van nieuwe grote apparatuur, de vele kleine reorganisaties binnen afdelingen en werkgroepen, de plannen tot "poolen" van assistentie en apparatuur, een toenemende betrokkenheid bij landelijke overleggroepen en samenwerkingsverbanden, een gestage uitbreiding van de internationale contacten en programma's, de vele verzoeken om bijdragen aan al dan niet populair-wetenschappelijke overzichten en manifestaties, etc. Achter dit bruisend beeld gaan echter een aantal kwalen schuil, waarbij het verontrustend is dat onder de toenemende werkdruk het optreden van overspannenheid lijkt toe te nemen. De observatie verwoord in het Jaarverslag Ondernemingsraad 1985 dat de directie weinig tijd en aandacht kan besteden aan de interne gang van zaken, ondermeer doordat een aantal landelijke ontwikkelingen op het gebied van de oceanografie en de positie van para-universitaire instituten als het NIOZ haar sterk in beslag nemen, was ook op 1986 van toepassing. De ondernemingsraad heeft de directie erop gewezen dat de abrupte sterke toename van het aantal promotie-onderzoekers grote druk op organisatie, assistentie, labruimtes, vaartijd, exploitatiegelden en algemene apparatuur heeft gelegd. Anderzijds krijgen deze promotie-onderzoekers juist door de vele andere beslommingen van onderzoekers en assistenten soms minder mogelijkheden of begeleiding dan wenselijk kan worden geacht. Naar de mening van de ondernemingsraad zullen de leidende personen binnen het NIOZ de komende jaren de blik sterker op het instituutsgebeuren moeten richten, het aantal ingrijpende interne veranderingen moeten beperken, en selectief te werk moeten gaan met het aangaan van nieuwe nationale en internationale samenwerkingsverbanden en verplichtingen.

6.2. PUNTEN VAN AANDACHT

De OR was, of raakte, betrokken bij een groot aantal personeelszaken. Begin 1986 was de procedure van de aanstelling van de nieuwe wetenschappelijke directeur een punt van discussie binnen de OR. Net als bij de eerdere aanstelling van het hoofd speciale projecten hanteerde de directie een gesloten procedure en werden periodiek twee leden van de OR vertrouwelijk ingelicht over de stand van zaken van de gesprekken tussen kandidaat en benoemingscommissie (bestaande uit Zijlstra, Scharloo, Lever en Mook). Desalniettemin was de naam van de kandidaat in brede kring binnen en buiten het instituut bekend, en ervaarde de OR het als frustrerend dat er met de achterban niet open over het verloop van de gesprekken kon worden gediscussieerd. Vlak na de toezegging van de directie dat in geval de kandidaat de functie niet zou aanvaarden vervolgens een open sollicitatieprocedure gestart zou worden, kwam maart 1986 het bericht af dat Dr. E.K. Duursma zijn benoeming per 1 september 1986 had aanvaard. De OR ging met de aanstelling akkoord (al vond men het leeftijdsverschil met de algemeen directeur wat gering) maar was teleurgesteld over de onduidelijkheid van de financiële consequenties plus het feit dat Duursma net als Zijlstra "aan de overkant" ging wonen vanwege de vele landelijke vergaderingen. De OR had via Zijlstra de benoemingscommissie laten weten het op prijs te stellen als de nieuwe directeur net als zijn voorganger op het eiland zou gaan wonen, maar dit verzoek bleek Duursma nooit bereikt te hebben.

Ook de gang van zaken rond de opvulling van een andere academische vacature, in de werkgroep Fysische Oceanografie, bracht de nodige frustratie. Alhoewel de uitgangspunten van de betreffende onderhandelaars zeer acceptabel waren, werden noch de werkgroep leider en de werkgroep leden noch de personeelschef vroegtijdig geraadpleegd, zodat dezen zich door de gang van zaken overvallen voelden.

Een andere kwestie die niet vlekkeloos verliep was de afhandeling van de bevorderingsvoorstellen die door de werkgroep leider en afdelingshoofden waren ingediend. Niet al deze hoofden van dienst werden tijdig door de directie op de hoogte gebracht welke voorstellen wel en welke niet bij Den Haag waren ingediend. Dit gebrek aan informatie vergrootte de ergernis bij de voor bevordering afgewezen personeelsleden en leidde zelfs bijna tot vertrek van één van hen. De directie zegde toe de nieuwe personeelschef een grotere rol in deze procedures toe te vertrouwen en hoopt dat daarmee dit soort communicatie-stoornissen tot het verleden zullen gaan behoren.

Aan het eind van het jaar werd het functioneren van de personeelschef zelf door de OR aangekaart. Zijn eerste taak, het personeelswerk, kostte zoveel tijd dat hij aan zijn tweede basisfunctie, hoofd administratie en algemene afdelingen, niet of nauwelijks toekwam. De directie verklaarde begin 1987 deze dubbelfunctie met de betrokkene te willen evalueren. De aanstelling van een hoofd technische diensten, een eveneens uit de reorganisatie voortvloeiende nieuwe functie, werd in 1986 niet gerealiseerd. Een eerste kandidaat kreeg unanieme instemming van de technici maar werd door de directie afgewezen, terwijl een latere kandidaat, die men

speciaal voor het gesprek uit het buitenland had laten overkomen, voor alle betrokken partijen acceptabel was, maar zelf zijn sollicitatie introk. De aanstelling van een HTD is nu voor langere tijd opgeschort, en zal pas weer aan de orde komen bij het vertrek van de huidige bedrijfschef van de werkplaatsen.

De positie van de grote groep tijdelijk personeel en vrijwilligers op het NIOZ was continu onderwerp van gesprek tussen OR en directie. De toewijzing van vrijwilligers stokte door de houding van Sociale Zaken - Noord-Holland, maar de beheerder kon het veronderstelde misbruik van de regeling ontzenuwen, door aan te tonen dat 2/3 van de vrijwilligers die sinds 1982 voor kortere of langere tijd op het NIOZ verbleven hadden, er in geslaagd waren op het instituut of elders een betaalde baan (zij het soms slechts tijdelijk) te verkrijgen. Voor wat betreft de contracten van het tijdelijk personeel benaderde de OR de ABVA/KABO voor nadere informatie over de gang van zaken elders in den lande bij vergelijkbare instellingen. Een bezoek van de bestuurder voor de wetenschappelijke instituten van deze organisatie werd bijgewoond door veel personeelsleden, zowel wel als niet vakbondsleden. Alhoewel op de bijeenkomst de indruk werd gewekt dat de NIOZ-politiek bij het afsluiten van tijdelijke contracten voortaan minder op het vermijden van wachtgeldverplichting en pensioenbijdrage gericht zal zijn, bleef de problematiek van de tijdelijke aanstellingen actueel. Vragen en klachten van tijdelijk personeel over hun rechten en plichten en de manier waarop hun baan afloopt hielden aan, en men kreeg soms valse verwachtingen wanneer men aan het eind van een contract geen ontslagbrief ontving. De OR vroeg de directie om duidelijker voorlichting en om een overzicht met alle tijdelijke constructies die op het NIOZ gespeeld hadden. Dit verzoek werd door de technisch-administratief directeur geweigerd, omdat naar zijn oordeel door de complexe wetgeving geen simpel overzicht van de regels te maken valt. De OR besloot om in 1987 te trachten zelf een dergelijk overzicht samen te stellen, te meer omdat hij betrokken raakte bij moeilijkheden rond de afloop van een verlengd tijdelijk contract. De directie wilde deze contractant niet vast op de betreffende, inmiddels definitief open lijkende te vallen, formatieplaats benoemen, ondanks gebleken geschiktheid, waarna de tijdelijke werknemer niet akkoord ging met zijn ontslag. Eind 1986 was nog niet duidelijk of de noodzakelijke ontslagvergunning door het Arbeidsbureau verleend zou worden, en dacht de directie aan een ruil in formatieplaatsbezetting om de kwestie eventueel minnelijk te schikken. Naar aanleiding van deze zaak stelde de directie tegenover de OR dat vanaf 1987 alle aanvragen tot verlenging van tijdelijke contracten afgewezen zullen worden.

De OR werd geraadpleegd over en ging akkoord met de procedure van de beoordelingsgesprekken van de EON-personeelsleden, die eind 1986 werden gehouden met het oog op een eventuele vaste aanstelling binnen deze projectgroep per 1 januari 1988. Het resultaat van deze, overwegend prettig verlopende, gesprekken was dat alle betrokkenen op één na voor functies in aanmerking komen. De OR gaf de directie in overweging dit type beoordelingsgesprekken ook voor andere geledingen in het instituut te organiseren.

De overwerkregeling zoals die voor de vaartochten in 1984 en 1985 tijdens de Snellius-II Expeditie had gegolden, werd door de N.R.Z. ook van toepassing verklaard op de vaartochten vanaf 1986. Tevens werd bereikt dat voor Noordzeevaartochten binnen het oceaanprogramma, waarbij naast het N.R.Z.-vaartuig ook het NIOZ-schip betrokken is, N.R.Z.-overwerkgelden ook aan bemanning en opstappers van de Aurelia uitbetaald worden.

Op organisatorisch vlak was de OR in 1986 betrokken bij zowel interne als externe ontwikkelingen. De nieuwe directiestuctuur ging onaangekondigd per 1 augustus in en in september werd de eerste werkgroepleidersvergadering "nieuwe stijl" gehouden. Deze vergadering kreeg een algemeen organisatorisch en een wetenschappelijk gedeelte. Ondanks een eerdere afspraak dat de OR een waarnemer naar deze vergadering mocht blijven afvaardigen bleek dit in het uiteindelijke directievoorstel niet opgenomen te zijn en pas na verdere discussie werd de OR-waarnemer voor het algemeen organisatorische vergaderdeel geaccepteerd.

Zowel in de werkgroepleidersvergadering als op de overlegvergadering rapporteerde de directie regelmatig over haar gesprekken, samen met de NDV, met KNAW en ZWO vanwege de door de Minister opgelegde verplichting om het NIOZ bij een koepelorganisatie te doen aansluiten. De directie vroeg de OR voor deze onderhandelingen een zelfde mandaat als voor de aanstellingsprocedure van de wetenschappelijk directeur, met periodieke ruggespraak met twee leden van de OR onder geheimhoudingsplicht. Gezien de eerdere onbevredigende ervaringen met deze constructie verwierp de OR dit voorstel, waarna de directie zelf moest beoordelen wat ze in elke fase van de onderhandelingen aan informatie kwijt wilde. Begin augustus ontving de OR een afschrift van de condities die NDV en NIOZ aan de koepelorganisatie wilden stellen, inhoudende een verregaande consolidatie van de huidige taken, bevoegdheden en subsidievoorwaarden. Met name de KNAW leek bereid op de voorwaarden in te willen gaan en er werd een liëring voorgesteld waarbij NIOZ en het KNAW-instituut DIHO tezamen in een Stichting Estuarien en Zeeonderzoek Nederland (SEZON) onder de Akademie zouden vallen. Over de inhoud van de discussies met ZWO was de directie weinig mededeelzaam, maar zij maakte wel duidelijk dat de voorgestelde relatief losse verbintenis voor ZWO, een strak georganiseerde koepel, minder acceptabel was. Bovendien werd bij de eventuele oprichting van een nieuwe Stichting Oceanografie, waarin zowel het huidige N.R.Z.-bureau als een deel van de reeds bestaande ZWO-Stichtingen en Werkgemeenschappen op zouden gaan, het in brede kring ongewenst geacht dat ook het NIOZ naar een dergelijke stichting zou overgaan. Formeel was eind 1986 echter de knoop over de koepelkeuze nog niet doorgemaakt, temeer omdat de realisatie van andere plannen als de reorganisatie van de N.R.Z. en de KNAW meer tijd vergden dan oorspronkelijk gedacht werd.

De koepelkwestie leefde binnen het NIOZ nauwelijks, mede omdat het onderhandelingspel zich buiten het gezichtsveld in een kleine kring van topbestuurders in de landelijke wetenschap afspeelde, maar gaf op het gelijksoortige instituut in Yerseke veel stof voor discussie omdat in alle

opties een eventuele fusie tussen NIOZ en DIHO als min of meer vanzelfsprekend werd gezien. De dienstcommissie van het DIHO nodigde de OR voor een bezoek uit om de wederzijdse posities en standpunten te bespreken. De ontmoeting, op 9 september, werd gekenmerkt door een openhartige sfeer en afgesproken werd om te trachten gezamenlijke reacties te geven op plannen en voorstellen die beide instellingen aangaan. Eén van de punten die een fusie op korte termijn praktisch onmogelijk maken is het verschil in ambtenarenstatus tussen beide instellingen, B1 voor de DIHO personeelsleden en B3 voor NIOZ'ers.

Intern stond de tweede helft van 1986 sterk in het teken van de eventuele oprichting van het Servicelab of later geheten het Poollab: een verzameling van bestaande en nog aan te schaffen apparatuur die door een vaste bezetting van 2-3 analisten onderhouden en verbeterd wordt en waarop voor of door de "klanten" monsters worden verwerkt. De behoefte aan een dergelijke instelling leek eerst onomstreden alhoewel er nooit een degelijke inventarisatie was geschied. Op de plannen voor de ruimtelijke en personele bezetting kwam onvoldoende respons, zodat de directie besloot eerst nader met alle wetenschappelijke assistenten te gaan overleggen en de oprichting van het Poollab voorlopig op te schorten.

Een andere zaak die een deel van de wetenschappelijke afdelingen bezig hield was de in 1987 uit te voeren reorganisatie van de biologische werkgroepen, van 4 naar 3 en de daarmee samenhangende verhuizingen binnen het instituut. De OR drong er bij de directie op aan niet alleen de wetenschappers bij de definitieve besluitvorming te betrekken maar ook de analisten over een nieuwe indeling van de werkgroepen te raadplegen.

6.3. SAMENSTELLING OR EN VERGADERINGEN

In mei 1986 betroffen de jaarlijkse verkiezingen 3 van de 7 OR-leden. De vertegenwoordigers van de groepen "administratie en algemene diensten" en "biologische analisten" stelden zich herkiesbaar en verzamelden het reglementaire aantal handtekeningen. Er waren geen tegenkandidaten en op 2 mei werden ze herkozen verklaard. Veel moeizamer verliep de opvolging van de aftredende vertegenwoordiger van de onderzoekers van de werkgroepen Geologie, Fysische Oceanografie en Chemische Oceanografie. Voor en op de verkiezingsdag lukte het niet een kandidaat te vinden, maar toen een maand later permanente "niet-vertegenwoordiging" dreigde bleek althans één persoon bereid de betreffende geleiding voor de duur van 2 jaar te willen representeren. Het geringe animo van wetenschappers om aan de ondernemingsraad deel te nemen heeft o.a. te maken met de tijdsbelasting van de vergaderingen en het bijbehorende nawerk. Gezien hun ervaring op schrijfg gebied fungeerde de afgelopen jaren steeds een wetenschapper als secretaris van de OR en om deze druk wat te verlichten heeft de OR voorgesteld dat de personeelschef als ambtelijk secretaris de Overlegvergadering gaat notuleren. Dit verzoek werd door de directie voorlopig echter afgewezen.

In 1986 waren er 6 Overlegvergaderingen tussen directie en OR, vaak voorafgegaan door een OR-werklunch om het overleg voor te bereiden, en vonden 7 OR-vergaderingen plaats. Vanaf midden 1986 had de OR de volgende samenstelling:

Rob Dapper (voorzitter), voor het administratief personeel en personeel in algemene dienst
Martien Baars (secretaris), voor het biologisch wetenschappelijk personeel
Eilke Berghuis, voor het biologisch laboratoriumpersoneel
Jan Everaarts, voor het "hydrografisch" wetenschappelijk personeel (geologen, fysici, chemici)
Siem Groot, voor het technisch personeel
Wim Jongejan, voor het varende en havenpersoneel
Rinus Manuels, voor het hydrografisch laboratorium personeel.
Maarten van Arkel, als waarnemer afgevaardigd door het projectpersoneel

Voor personeelszaken en financiële zaken werden 2 commissies uit de ondernemingsraad gevormd, respectievelijk bestaande uit 1) Jan Everaarts en Rinus Manuels en 2) Martien Baars en Eilke Berghuis. Laatstgenoemde woonde tevens als OR-waarnemer de werkgroepvaardersvergaderingen bij.

