

# **Evaluation 1999-2004**

## **Royal Netherlands Institute for Sea Research (NIOZ)**



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# 1 Introduction

## 1.1 Scope and context of this evaluation

This assessment covers the research carried out at the Royal Netherlands Institute for Sea Research (NIOZ) since 1999. The evaluation was commissioned and organised by the Netherlands Organisation for Scientific Research (NWO).

NIOZ submitted a self-evaluation report covering the 1999-2004 period. This was received and accepted by the Governing Board of NWO in April 2005.

This external assessment follows the Standard Evaluation Protocol 2003-2009 for Public Research Organizations (SEP).

The aims of the assessment system are:

- Improvement of the quality of research through an assessment carried out according to international standards of quality and relevance;
- Improvement of research management and leadership;
- Accountability to higher levels of the research organisations and funding agencies, government, and society.

The committee was asked to produce a reasoned judgment on the mission, strategy and performance of the institute. The SEP calls for an evaluation both of the research institute itself and of the research programme(s) it conducts. The research institute submits details of the results that have been achieved in each research programme over the previous six years (including quantitative data about staff input, key publications and total publications), a short outline of the mission statement of each programme, and developments anticipated in the context of the research profile of the institute. Important elements of each review are site visits, which include interviews with the management and the programme leaders, and visits to various laboratories and facilities.

## 1.2 The evaluation committee

The evaluation committee was appointed in December 2004 by the Governing Board of NWO and formally inaugurated at the start of the site visit on 25 May. Its members were:

Prof. dr. W. Harder	(chair)
Prof. dr. J. Hayes	(Woods Hole Oceanographic Institution)
Prof. dr. M. Kastner	(Scripps Institution of Oceanography)
Prof. dr. D. Olbers	(Alfred Wegener Institute for Polar and Marine Research)
Prof. dr. D.G. Raffaelli	(University of York)

A short curriculum vitae of each of the members is included as Appendix 1.

The committee was supported by NWO staff (Dick van der Kroef (secretary), Ron Dekker and Els el Idrissi).

All members of the committee declared that their assessment had been free of bias, personal preference or personal interest, and that it had been reached without undue influence from the institute, the programme directors or other stakeholders. Any existing professional relationships between committee members and programmes under review were brought to the attention of the committee. The committee concluded that there were no conflicts of interest.

### 1.3 Data supplied to the committee

The evaluation committee received a detailed self-evaluation report provided by NIOZ. A number of key publications were specified in an appendix and copies of all key publications were available to the committee. At the request of the chair, the scientific director of NIOZ wrote a short management letter<sup>1</sup> that was handed to the committee on the evening preceding the site visit. This document was subsequently approved by the board of NIOZ. The management letter provided concise information on the follow-up to the previous evaluation, the change of directorate, the developments in late 2004 and early 2005, and four possible scenarios for the future.

The documentation included all the information required by the Standard Evaluation Protocol 2003-2009 and the answers to the additional questions put by NWO.

In addition to this material, NWO provided the results of a bibliometric study on NIOZ for the 1998-2002 period (21 March 2005, T.N. van Leeuwen, A.J. Nederhof, CWTS, Leiden University).

### 1.4 Procedures followed by the committee

The committee proceeded in accordance with the Standard Evaluation Protocol 2003-2009. The assessment was based on the documentation provided by the institute, the key publications, the bibliometric analyses and the interviews. The interviews took place during the site visit in May 2005. The programme of the site visit is included as Appendix 2.

The self-evaluation report, the selected papers and an explanatory letter were sent to the committee one month before the site visit.

The chair and secretary of the committee established a timetable for the site visit. The committee met on the afternoon preceding the site visit to discuss and plan the interviews with management, heads of departments, researchers, the Governing Board and the Scientific Advisory Committee. They also decided which PhD students, Post Doctorate Fellows and technicians to interview. Finally, the committee agreed the procedural matters and aspects of the assessment described in the following paragraphs.

At a formal dinner in Hotel Opduin on Texel, the committee had the opportunity to meet with prof. dr. C.H.C.M. Buys, vice-chair of the Governing Board of NWO.

The interviews with the management, Governing Board, Scientific Advisory Committee, senior research staff, PhD students and Post Doctorate Fellows and support staff took place during the site visit on 26 and 27 May 2005. Interviews and discussions were conducted by the entire committee. Individual committee members interviewed a selection of PhD students, Post Doctorate Fellows and technicians.

After the interviews, the committee discussed the scores and comments for the institute and the research programmes and determined the final assessment.

At the end of the site visit, there was a meeting with the institute's scientific director and the chair of the Governing Board, at which the main findings of the committee were reported.

A draft version of the report was sent to the scientific director of the institute in July 2005 for factual corrections and comments. The comments led to textual corrections and clarifications, with minor additions and some rephrasing. The report was subsequently submitted to the Governing Board of NWO.

<sup>1</sup> The Committee added the management letter, dated 19 May 2005, to the set of documents received in preparation for the site visit and it is referred to as part of that set in this evaluation report.

## 1.5 Aspects and assessment scale

The Standard Evaluation Protocol 2003-2009 requires the evaluation committee to assess four main aspects of the institute and its work, namely:

- Quality (international recognition and innovative potential)
- Productivity (scientific output)
- Relevance (scientific and socio-economic impact)
- Prospects (vitality and feasibility, management and leadership)

The ratings specified in the Protocol are:

### **Excellent (5 points)**

- Work that is at the forefront internationally, and which most likely will have an important and substantial impact in the field. The institute is considered to be an international leader.

### **Very good (4 points)**

- Work that is internationally competitive and is expected to make a significant contribution. The institute is considered to be an international player and a national leader.

### **Good (3 points)**

- Work that is competitive at the national level and will probably make a valuable contribution in the international field. The institute is considered to be internationally visible and a national player.

### **Satisfactory (2 points)**

- Work that is solid but not exciting, will add to our understanding and is in principle worthy of support. Nevertheless, it is considered of less priority than work in the above categories. The institute is nationally visible.

### **Unsatisfactory (1 point)**

- Work that is neither solid nor exciting, flawed in the scientific and or technical approach, repetitions of other work, etc. Work not worthy of pursuing.



## 2 NIOZ

### 2.1 Mission

The Royal Netherlands Institute for Sea Research (NIOZ) was founded in 1876. The institute has a board of governors, which includes members of the Dutch academic community, and an international multidisciplinary scientific advisory committee. It is located on the island of Texel.

The mission of NIOZ is *“to perform top level curiosity-driven and society-inspired research of marine systems that integrate the natural sciences of relevance to oceanology. NIOZ supports high-quality marine research and education at universities by initiating and facilitating multi-disciplinary and seagoing research embedded in national and international programmes”*.

During the review period there was a change in the directorate and organisational structure of NIOZ. The previous director, Prof. J.W. de Leeuw, was due to retire on 1 January 2004, but was asked to stay on for another six months when it proved difficult to find a successor. Since mid-2004, management has been the responsibility of a managing director and a (part-time) scientific director, both accountable to the Governing Board of NIOZ. Both were appointed on 1 July 2004 for a period of 2 years. On all matters that require a formal decision the directorate is advised by the Management Team (MT). All items pertaining to research and research management are discussed initially in the Science Council (SC) and then passed on to the MT. The Science Council is composed of the scientific director, the managing director and the five departmental heads. The Management Team is composed of the directors, two representatives of the (heads of) research departments, the head of the Facility Management and Personnel Affairs departments, and the co-ordinator of Marine Research Facilities (MRF).

In the opinion of the committee, this is an unusual organisational structure for a research institute. Such institutes are almost invariably led by a scientific director with the help of a management team composed of the heads of the research departments and the assistance of an adjunct-director responsible for organisational and financial matters and an HR/personnel officer.

### 2.2 Research

In the period covered by the review, the institute had five research programmes, each conducted by a (primarily discipline-based) research department. The programmes and corresponding departments were named as follows:

- Physical Oceanography
- Biological Oceanography
- Marine Ecology and Evolution
- Marine Biochemistry and Toxicology
- Marine Chemistry and Geology.

This is now changing. A new Science Plan has been drawn up, structured into the following four multidisciplinary programmes:

- 1 Open Ocean Processes
- 2 Benthic Boundary Layer Processes
- 3 Coastal Systems
- 4 Past Ocean Processes.

Since the institute is likely to retain its discipline-based research departments, a matrix organisation will be introduced.

## 2.3 Organisational structure

The institute can be divided into several broad units. Under the responsibility of the Governing Board and the directorate, it accommodates

- five research departments, sometimes responsible for one or more service laboratories or specialist group,
- four groups responsible for enabling services, and
- four groups responsible for support services.

A full organisational chart is included in the self-evaluation report.

## 2.4 Financial matters

The committee asked the managing director for information about the current financial situation of the institute. He reported that at the end of 2004 the institute had a balance of approximately M€ 47. Basic funding is around M€ 10.4 a year, plus approximately M€ 1.1 ad hoc basic funding. Total funding averages between M€ 18 and 20, including approximately M€ 3 for investments. Current funding for 2005 is M€ 18.7. The institute is sensitive to annual fluctuations in income because more than 85% of costs cannot be easily revised within a year. The variable (*i.e.* soft money) proportion of total income averages approx. 35%.

The financial projection for 2005 shows a deficit of M€ 0.75, a situation expected to deteriorate further over the coming years. Solutions to this situation were not proposed to the committee or discussed by it.

## 2.5 Staff

Total NIOZ staff declined from 221 FTE in 1999 to 195 FTE in 2004. Tenured research staff positions remained virtually unchanged in three of the departments, while two departments – Biological Oceanography (11 to 6.6 FTE) and Marine Ecology and Evolution (11.4 – 9.2 FTE) – appear to have been significantly downsized.

## 3 Programme assessments

The assessment of the research programmes takes account of:

- Leadership, strategy and policy of/for the research programme
- Quality of the research staff, (human) resources, funding policies and facilities
- Quality and quantity of the publications and of the publication strategies
- Academic reputation of the group/programme
- Relevance of the programme from an academic perspective and from the broader perspective of society at large
- Assessment of the future prospects of the group/programme.

The committee decided to evaluate the five programmes in place over the review period, reflecting the five NIOZ departments, on the basis of the main aspects of assessment described in the Standard Evaluation Protocol (see 1.5) and with specific reference to their past performance. The committee also evaluated the Marine Research Facilities and Technology (MRF&T) branch of NIOZ and the proposed new Science Plan.

### 3.1 Physical Oceanography (FYS)

#### 3.1.1 General remarks and assessment

The physical oceanography (FYS) research programme combines studies of large-scale ocean circulation, internal waves, and transport processes in the coastal zone. It uses field observations of large-scale currents and hydrography, theoretical models of wave propagation and wave-induced mixing, and laboratory experiments on wave processes and tides to increase knowledge of various oceanic and coastal processes which are relevant to the Earth's climate.

The following assessment is based on the written material supplied to the committee, the tour of Marine Technology, the interview sessions conducted by the panel, and additional interviews with the tenured staff of FYS and two PhD students and two Post Doctorate Fellows.

#### 3.1.2 Quality

The committee was impressed with the overall quality of the research being conducted in FYS. The science of the group is at the forefront of the ocean research community and its work is of significant national and international importance. The output and impact measured in terms of publications is well above international standards. The group enjoys a very good reputation, has extensive national and international contacts and is active in important research programmes (WRCP-CLIVAR, LOCO). The overall rating of the FYS research programme and the quality of research is VERY GOOD to EXCELLENT.

The leading scientists in the group and their research results are highly regarded in the international ocean research community. This is particularly true of their observational work in the North Atlantic and the theoretical and observational investigations of internal and tidal wave processes. The investigations of circulation and physical processes being done by FYS in cooperation with IMAU/KNMI in the Agulhas retroflexion are seen by the international research community as top research in this field. The use of reduced models to study the physics of large-scale ocean overturning has attracted much attention and is viewed by physicists and applied mathematicians as highly innovative and mathematically attractive. The observational programme on the ferry between Den Helder and Texel must be judged not only as a means of long-term assessment of environmental changes, but also as an outstanding chance to increase the visibility of NIOZ to the general public.

### 3.1.3 Productivity

Over the past 6 years the group has produced 66 research papers, 1 book chapter and 3 PhD theses. At an integrated strength of 70 FTE-years (total research staff) over this period, this amounts to 1.0 scientific paper per FTE per annum. The very uneven distribution of effort among its scientists is a significant problem for the department. The topics of the PhD theses seem to be well embedded into current research. The number of PhD students (FTEs) has increased remarkably over the years (peaking in 2002); however, it is currently quite low: available positions should be filled promptly.

### 3.1.4 Relevance

Observing the current ocean climate and understanding fundamental physical processes in the ocean and the coastal zone are national and international priorities for science and society. Improved predictions of climate and sea level require advances in these areas. The committee welcomes the strategy of FYS to embed its work in national and international collaborations on overarching climate research issues.

### 3.1.5 Prospects

The panel recognized a strong spirit of collaboration among FYS scientists. This spirit is, however, not fully evident in joint publications within FYS, since the observational and theoretical subgroups tend to publish their work separately. It was also difficult to identify any interdepartmental publications.

FYS plays a central role in the institute by providing supplementary marine physical observations and technology-maintenance services to other groups and departments. It also assists and houses the data-processing group. These arrangements seem to work well.

FYS has a large proportion of externally funded research activities. Direct funding has averaged 55% of the total over the last 6 years, the remainder coming through external funds and contracts. In fact, observational studies requiring ship-time and personnel can be performed only with the help of external funds. Even though the number of permanent staff positions in the department has been constant over the last six years, it is only barely adequate to sustain such activities.

A comparison of FYS with corresponding departments at other large oceanographic institutes reveals the lack of numerical modelling (computer models of ocean circulation and oceanic processes) at FYS. The situation is to a large extent remedied by the intensive cooperation of NIOZ/FYS with the excellent research groups at Utrecht University (IMAU) and the Royal Netherlands Meteorological Institute (KNMI). These groups have a very high international reputation in relation to all components of climate numerical experimentation. FYS benefits from such external modelling activities in shared (and to a large extent externally funded) research projects with IMAU and KNMI. The cooperation bridges the gap between the field observations (of FYS) and data-oriented modelling (of IMAU / KNMI). This strategy requires close coordination between the centres involved. The committee was convinced that the arrangement is working very well in relation to present research. In the long run, however, (in particular if greater emphasis is given to Wadden Sea research) it may be necessary to start an in-house modelling project on circulation and mixing physics with regionally oriented research topics in the North Sea and the local Wadden Sea.

A further deficiency in the research structure of the institute was pointed out to the committee by leading scientists from FYS and other departments. A modern, multidisciplinary ocean research institute – in particular with programmes dealing with shallow-water regions (such as the North Sea and Wadden Sea area) – must address processes in and near the benthic boundary. Sedimentation, sediment transport and near-bottom mixing are now important to many research programmes within the institute and will require increased attention if greater

emphasis is given to Wadden Sea research in future. This capability need not necessarily be located within FYS, but could be made available in MCG (see 3.5.7).

### 3.1.6 Assessment of future plans

The Science Plan outlined in the self-evaluation documents is very ambitious. It calls for NIOZ to address simultaneously a wide range of issues in a multidisciplinary framework with great potential for innovative research. Some of the planned work is a continuation of previous, disciplinary research (mostly located in Programme 1: Open Ocean Systems). This is necessary to prevent a loss of focus and competence in physical oceanography. But the committee also found that the high scientific level of FYS in observational techniques and theoretical methods could be strengthened by intensifying collaboration with other groups in the institute. The panel welcomes the involvement of FYS in Programme 2 (Benthic Boundary Layer Processes), where the understanding of physical processes is a prerequisite for a holistic approach, and Programme 3 (Coastal Systems), where an input of knowledge from physics and mathematical system analysis is required. Strong and consistent leadership of the FYS research group is needed in order to ensure that its small size and limited resources do not cause it to become too thinly spread over too many unrelated research topics.

### 3.1.7 Recommendations

- 1 The committee recommends that a Wadden Sea modelling capability should be established. Topics to be addressed could include circulation around islands, exchange of waters and substances between the Wadden area and the open sea, sediment transport, bottom mixing, and the effects of all of these processes on the Wadden Sea ecology. The focus must be extracted from the most urgent research questions in the new Science Plan.
- 2 Vacancies created by retirement over the coming years should remain in this group and should be filled promptly, preferably by appointing excellent young scientists to tenure-track positions.

### 3.1.8 Overall programme assessment

Quality	Very good, in some cases excellent
Productivity	Good - excellent
Relevance	Very good
Vitality	Good
<b>Overall</b>	<b>Very good</b>

## 3.2 Biological Oceanography (BIO)

### 3.2.1 General remarks and assessment

During the review period, the department was engaged in research on the structure and dynamics of planktonic food webs and related biogeochemical fluxes. Its work encompassed studies on the behaviour and life strategies of the components of the lower food web, elucidation of intra- and interspecific interactions, and identification of key species for specific ecological conditions and ecosystem functioning. Experimental work was conducted both in the lab under controlled conditions and at sea, and included a modelling component. The research was structured in 3 BIO-themes:

- 1 Planktonic activity as the major driver of the upper ocean biogeochemistry
- 2 Ecology of harmful algal blooms and invasive species
- 3 Functional stability and phylogenetic diversity of plankton systems.

In addition the department was responsible for two service laboratories working for the whole of NIOZ, namely the Molecular Biology Laboratory and the Radioisotope Laboratory.

### 3.2.2 Quality

The evaluation committee was impressed by the way the research themes had been tackled by the department. Most of the research effort was directed at attempts to quantify numbers of functional groups of organisms (both producers and consumers) within the planktonic food web. As a result of the development of new molecular methods, notably FISH and microautoradiography, it is now possible to establish the identities and activities of prokaryotic and eukaryotic pico- and nanoplankton. This makes it possible to estimate the importance of these organisms in the cycling of nutrients in the sea and to relate specific prokaryotic communities to distinct water masses. Significant progress has also been made on other themes, some of it partly as a result of the application of advanced methodology.

The result of the evaluation of past performance is VERY GOOD, ranging from GOOD to EXCELLENT. In particular, the work on bacteria and archaea and the studies of the importance of marine viruses are at the forefront of science. The work on algae is also good science. The previous evaluation noted a lack of coherence in the research themes being pursued in the department but, due to the efforts of the head of the department, the situation has clearly improved. In fact there is no doubt that the prominence of the department in national and international networks derives to a large extent from his efforts; his leadership has been crucial to the current position of the department, as has his role in attracting external funds and enthusiastic PhD students and Post Doctorate Fellows. Moreover, his contribution to the scientific production of the department has been considerable.

### 3.2.3 Productivity

The overall productivity of the department in terms of scientific publications is a point of concern. Over the past 6 years the group has produced 83 research papers, 9 chapters in books and 7 PhD theses. At an integrated strength of 117.4 FTE-years (total research staff) over this period, this amounts to 0.8 scientific paper per FTE per annum. There are also significant differences in productivity (and success rates in terms of winning external grants in competition with others) between the individual members of the permanent research staff. In fact, three of them published only one peer-reviewed scientific paper each over the entire period of the review. The evaluation committee considers this unacceptable and recommends that urgent measures be taken to improve this situation. The requirement for each staff member to acquire external grant support should also be taken into account.

### 3.2.4 Relevance

The three research themes of the department are scientifically challenging and address important issues in contemporary marine biological sciences. Clearly the emphasis on the behaviour and life strategies of the components of the lower food web (which is now possible because of the development of novel molecular methods) is directed at open ocean processes (themes 1 and 3) and is a national and international research priority. Theme 2, directed at coastal systems, carries an important additional element of societal relevance because it addresses the ecology of harmful algal blooms and other planktonic invasive species in the North Sea and Wadden Sea.

### 3.2.5 Prospects

The department is endeavouring to advance its scientific expertise in Biological Oceanography and at the same time to participate in the new Science Plan of the institute. This is quite an ambitious undertaking which requires strong scientific leadership and appropriate management. While the committee welcomes the increasing collaboration between BIO and other departments in three of the four new research programmes that have been defined at the level of the institute, it is important that it should maintain competence in its own discipline. In this respect, the existing relationship between the department and the

Dutch universities (in particular the University of Groningen) continues to be important. A point of concern relates to expertise in micro- and mesozooplankton. While the recent transfer of Prof. de Baar's group (theme 1 of MCG) to BIO has significantly strengthened the phytoplankton group, the expertise in zooplankton has diminished and the last expert is due to retire soon. It is essential to maintain expertise in this area, particularly in view of the new Science Plan. Accordingly the committee recommends as a matter of urgency the appointment of at least one excellent young scientist with expertise in this area to a tenure-track position.

The committee had an opportunity to visit the Molecular Biology service laboratory and talked to the part-time head of the laboratory. The presence of such a facility at NIOZ is essential for the type of biological work that is increasingly being done at the institute. The current instrumentation is state-of-the-art and the working procedures are satisfactory; the unit produces interesting results but the lab requires urgent renovation. The future position of this facility requires some thought, since the work load appears to be steadily increasing. The radioisotope laboratory was not visited.

The department's laboratory equipment is up to modern standards, but the physical infrastructure of the laboratory space and offices is below standard. Renovation of this part of the building is urgent.

### 3.2.6 Recommendations

- 3 The current imbalance in productivity and success rate in winning external grants among the tenured research staff is unacceptable and must be addressed.
- 4 Expertise in micro-and mesozooplankton must be strengthened by appointing at least one excellent young scientist in a tenure-track position.
- 5 The infrastructure of laboratory space and offices is below standard; renovation of this part of the building is urgently needed.

### 3.2.7 Overall programme assessment

Quality	Very good, in some cases excellent
Productivity	Good – excellent
Relevance	Very good – excellent
Vitality	Good – excellent
Overall	Very good

## 3.3 Marine Ecology and Evolution (MEE)

### 3.3.1 General remarks and assessment

The following assessment is based on the written material provided by the institute (Quality of Assessment of Research 1999-2004), an interview session involving the head of department and another senior scientist with the peer review group, and interviews with 4 additional tenured staff in the group (two of whom were until recently Post Doctorate Fellows at NIOZ) and 4 current PhD students (2 Dutch, 2 from overseas). In addition, the peer review group was given a guided tour and demonstration of the group's behavioural ecology facilities.

### 3.3.2 Quality

The research staff are of high quality. All have a national/international reputation and good quality outputs, and one is a world-leader in behavioural ecology. The group attracts external funding comprising on average 21% of its income over the past 6 years. However, in 2003 and 2004, this decreased to 12% and 9% respectively, with a heavier reliance on direct funding

(currently 65%). Contract research declined from 36% to 26% in the same period. This trend calls for internal reflection by the group. The number of non-tenured research staff (including PhD students) has declined from 14.6 to 9.2 FTE and that of tenured staff from 11.4 to 9.2 FTE, so that the total research FTE has declined from 26 to 18.4. The group is largely field-based, much of its work is inshore, and it does not require extensive or sophisticated laboratory facilities. However, the behavioural ecology component of the programme has EXCELLENT facilities appropriate to its research needs and is unique in Europe.

All the tenured scientists have national/international reputations and this is reflected in their membership of national and international working groups, as well as editorial panel memberships of international journals. The programme itself is well-known on the European scale. This is especially true of the work on seabirds and shorebirds, and of the Wadden Sea benthos studies. The continued focus on these research areas is to be welcomed, since they provide a sound foundation for the group to build a truly international reputation for NIOZ.

### 3.3.3 Productivity

Over the past 6 years the group has produced 263 research papers, 22 chapters in books and 12 PhD theses. At an integrated strength of 141.6 FTE-years (total research staff) over this period, this amounts to 2.1 scientific papers per FTE per annum. Many of these publications are in high-impact international journals in the marine biology and mainstream ecology fields. In terms of publication strategy, therefore, the group is succeeding in reaching audiences both in its specific subject areas and in the broader ecological scientific community, thereby promoting NIOZ widely. Whilst average publication output has been reasonably healthy over the 6-year period, publication output was lowish in 2004 (33) and a dip may be expected in 2006 or 2007 given the reduced FTE. However, the committee was pleased to hear from the head of department that outputs are buoyant and that, if any dip does occur, it is likely to be temporary.

### 3.3.4 Relevance

The group is working at the leading edge of behavioural ecology and invertebrate community dynamics. It also possesses internationally recognized expertise in flatfish ecology and seabird ecology. One of its particular attributes is the philosophy of individual-based approaches to population biology, and a desire to extend this to the community level, and hopefully eventually to the ecosystem level. This demonstrates an astute awareness and reflection of current trends and advances in modern ecology. In that sense, the group is at the forefront of mainstream ecology. The geographical focus of much of the research in the Wadden Sea and the North Sea gives the work of this group great societal relevance to the Netherlands.

### 3.3.5 Prospects

The group is in good shape. The overall score for the programme was GOOD to VERY GOOD (the same as in 1999). Since the last review, this department has seen a number of major changes, including the departure of three staff members with high external profiles and reputations, and the absence of a head of department for a period of 18 months in the middle of the review period. Despite this, the group is vibrant and energetic. Over this period, they have moved from an emphasis on descriptive and correlative studies to approaches which represent the very best in modern science: programmes based on rigorous hypothesis testing and falsification through field and laboratory experiments and quantitative modelling.

The leadership of the programme is currently the responsibility of the head of department, whose expertise and experience in ecological modelling and Popperian approaches to science have allowed him to take a holistic and rigorous approach to the recent and proposed future research activities of the group. The diversity of experience, background and expertise within the group means that this larger vision will need to be promoted vigorously to maintain coherence, especially as the diverse elements of the new Science Plan are realized.

Three MEE-themes have emerged over the last 6 years: (1) The structuring role of top predators, (2) Competition and life history strategies, and (3) Recruitment dispersal. These foci have proved to be productive, especially in permitting a real integration between the different research interests of vertebrate behavioural ecology, benthic invertebrate dynamics and ecological modelling. Much of this work is focused locally (on the Wadden Sea) and regionally (on the North Sea), but some elements are tropical (including coral reef ecology). Whilst the latter has delivered some first class science and prestigious publications, it does not sit easily with the rest of the programme and may reduce its overall coherence.

### 3.3.6 Assessment of future plans

As part of a NIOZ-wide plan to deliver more multidisciplinary science, the Marine Ecology and Evolution group is expected to contribute to Benthic Boundary Layer Processes and Coastal Systems. The group is well placed to deliver within these areas, but this will involve developing new working arrangements and relationships within the existing group as well as with staff of other departments. Recent and future changes of particular relevance are the financing of the long-term time series monitoring activity now apparently successfully using external (non-NIOZ) resources (despite the fact that the future of the activity was a subject of concern in the 1999 review, where it was rated no more than "satisfactory") and the gradual phasing out of work on coral reef ecology to increase the overall coherence of the programme (although tropical links will be retained via the important shorebird theme).

Of major interest to the wider ecological community is the increased emphasis on producing a unified approach to modelling individual, population and community processes, possibly through focusing on size-based attributes. This approach also has the potential to enhance the coherence of the overall programme.

Relationships with other laboratories in the Netherlands are good and are likely to be improved still further by the implementation of the new plan. This is particularly true of relations with NIOO-CEME at Yerseke (benthic systems) and with the University of Amsterdam (modelling).

### 3.3.7 Recommendations

- 6 The group needs to reflect on how it can reverse the present trend of increasing reliance on direct funding.
- 7 While there is no urgent need to expand the group at present, careful consideration should be given to the eventual replacement of staff currently engaged in work on tropical ecology and due to retire over the next few years; the opportunity should be taken to appoint new staff with expertise in areas more congruent with those of the rest of the group.
- 8 The new Science Plan specifically acknowledges the need to continue collecting long-term data on invertebrates in the Wadden Sea. Such data sets are rare internationally and are vital to the establishment of links between shorebirds, benthic productivity and global change. The group should be encouraged to continue to develop the kinds of links which they have already successfully established with other agencies and institutions in order to ensure the continuance of these monitoring programmes.

### 3.3.8 Overall programme assessment

Quality	Good – very good
Productivity	Very good – excellent
Relevance	Very good
Vitality	Very good
<b>Overall</b>	<b>Very good</b>

## 3.4 Marine Biogeochemistry and Toxicology (MBT)

### 3.4.1 General remarks and assessment

Research in the department is focused on two themes: marine biogeochemistry and marine toxicology. The vast majority of human and other resources are devoted to the first of these.

Much effort is devoted to studies of microbial products and processes. By studying the structures and isotopic compositions of lipids produced by marine microorganisms, the group has learned how to recognize the presence of specific microorganisms and can, with increasing success, quantify their activities in natural environments. Their work on the "ladderane" lipids produced by the anammox bacteria (which catalyze the combination of nitrite and ammonia to produce N<sub>2</sub>) is an outstanding example. These products are unique in that they contain linked, four-membered rings: ladders of carbon atoms. The MBT group has successfully solved this unprecedented structural puzzle. Abundances of these products in seawater have recently been used to demonstrate that losses of nitrate in the Benguela upwelling zone are due to anammox rather than denitrifying bacteria. This discovery, which sharply revises conventional wisdom, is likely to be extended throughout the world ocean. If so, a major paradigm of global biogeochemistry will have been overturned and a path opened to greatly improved understanding of oceanic processes.

The MBT group's earlier studies of archaeal lipids led to the discovery of crenarchaeol, a distinctive product that has provided much of the evidence for the recently discovered prominence of archaea in ocean waters below the photic zone. Related studies showed that the organisms which produce these compounds can use bicarbonate as their carbon source and are capable of growing autotrophically.

Molecular biomarkers can also be significant paleoenvironmental indicators. The MBT group has shown, for example, that the relative abundances of various structurally related lipids in crenarchaea depend on the temperature of growth. The compounds are all cyclic tetraethers containing 86 carbon atoms. The numerical parameter quantifying the variation has been named the tetraether index. A reasonable choice of letters leads to the abbreviation TEX<sub>86</sub>, nicely pointing to Texel as the birthplace of a tool that is sure to be used widely. The compounds can be recovered from sediments with ages as great as 100 million years, thus providing indications of ocean temperatures over at least that period of time. Characteristically, the group's exploitation of this paleoceanographic signal has been marked both by analytical virtuosity and elegant scholarship and is providing new information of unprecedented quality regarding the temperature and circulation patterns of ancient oceans.

### 3.4.2 Quality

The results in marine biogeochemistry are EXCELLENT by any standard. In terms of the quantity and significance of its findings and their integrated impact on the field, the group can now be compared only to the British group led by Geoffrey Eglinton and James Maxwell at Bristol from 1968 until 2001. The group's work on microbial lipid biomarkers is of fundamental significance and is setting the world standard for molecular studies of microorganisms in natural environments.

Results in marine toxicology, though less numerous, are VERY GOOD. Members of the department have studied in particular the transport and fate in the ocean of brominated flame retardants and organotin compounds (antifouling compounds). Their reports have played key roles in the establishment of new regulations by the European Union and the International Maritime Organization.

All members of the tenured research staff are highly regarded. The head of department is exceptionally well-qualified and is recognized as an international leader. He has just become the second member of the NIOZ staff (after Prof. dr. Jan W. de Leeuw, the founder of the

Marine Biogeochemistry group) to receive the Alfred Treibs Medal, the Geochemical Society's award for lifetime achievement in organic geochemistry. Fortunately, that "lifetime" is still far from over since the head of department is surely the award's youngest ever recipient. His exceptional abilities and contributions were also recognized in 2004 by the award of the Spinoza Prize by the Netherlands Organisation for Scientific Research (NWO).

### 3.4.3 Productivity

Over the past 6 years the group has produced 161 research papers, 10 chapters in books and 11 PhD theses. At an integrated strength of 91.5 FTE-years (total research staff) over this period, this amounts to 2.0 scientific papers per FTE per annum. Especially taking into account the relative small number of tenured-track positions, this is regarded as an EXCELLENT level of productivity. Results obtained in marine toxicology (31 papers, 2 PhD theses, and 3 book chapters) would predominate were it not for the much greater volume in microbial biogeochemistry. In fact, this level of production amounts to 2.2 publications per FTE-year. Many derive from multilaboratory collaborations, but the level is on a par with that in marine biogeochemistry.

The bibliometric study indicates clearly that NIOZ as a whole is publishing its results at a VERY GOOD rate and in journals with high impact. However, an analysis of that kind cannot do justice to cases in which the logic should be reversed. Over the past few years, MBT has published a number of papers which open up entirely new lines of investigation. These generate the citations on which the reputations of journals are based. From the list of publications, these include no. 32, "Widespread occurrence of structurally diverse tetraether membrane lipids: evidence for the ubiquitous presence of low-temperature relatives of hyperthermophiles" [*Proc.Nat.Acad.Sci.U.S.*]; no. 52, "Massive expansion of marine archaea during a mid-Cretaceous oceanic anoxic event" [*Science*]; no. 88, "Distributional variations in marine crenarchaeal membrane lipids: a new organic proxy for reconstructing ancient sea water temperatures?" [*Earth Planet. Sci.Lett.*]; no. 90, "Linearly concatenated cyclobutane (ladderane) lipids form a dense bacterial membrane" [*Nature*]; and no. 062 (joint publication list), "The rise of rhizosolenid diatoms" [*Science*]. Submissions of this kind would bring a smile to the face of any editor. Their abundance places MBT at the forefront of marine biogeochemistry.

### 3.4.4 Relevance

The department's research is highly relevant to problems of great priority and interest. These include the global climate (via investigations of sea-surface temperature and thus global heat budgets); the structure, function and health of marine ecosystems (via investigations of marine microbial processes and thus oceanic nutrients); and marine pollution (via studies of the distribution and fates of man-made chemicals in the ocean). In all of these fields, the department's contributions form key parts of syntheses which are shaping global environmental policy. Widespread recognition of this relevance is indicated by the department's high level of external funding which, at present, exceeds that of any other department in the institute.

### 3.4.5 Prospects

The size of the senior research staff has shrunk from 4.5 to 4.0 FTE. Given the scope and vigour of the department's investigations, this is surely too small. There is a danger that the energies of those leading the research may be overstretched and that the quality of the science or the quality of life within the department (and probably both) will suffer. The appointment of an additional tenure-track scientific appointee is not only desirable but also prudent as a means of protecting the investments that have, up to now, yielded outstanding progress and quality. In terms of long-term vitality, the principal challenge to research programmes in biogeochemistry is adaptation to a landscape that is increasingly influenced by molecular biological evidence and lines of thought. To meet this challenge, the department has not only engaged in extensive collaborations with biologists but has been working actively to develop an in-house programme in molecular biology. Without question, members of the department understand

the importance of this task and have excellent ideas about how to manage it. Unfortunately, an excellent junior scientist who was being groomed for a tenure-track appointment in this area has been lured away.

MBT is extensively involved in multidisciplinary and cross-departmental projects. Between 1999 and 2004, 33 papers and 1 PhD thesis were published in partnership with other NIOZ departments. These included work with FYS on paleoclimatic records and on the movement of water masses and the associated transport of organic compounds; with BIO on the processing of organic compounds within food chains, on algal evolution, and on the culturing of marine micro organisms; with MEE on the identification of avian natural products, on Wadden Sea ecology, and on fisheries; and with MCG on bioaccumulation of metals and organic molecules in marine organisms, on algal physiology, and on paleoclimatic records.

External collaborations are numerous and document productive interactions with outstanding research groups throughout the world.

The department attracts excellent postdoctoral research associates and doctoral students from around the world. Alumni are now, for example, members of research staffs and faculties at the University of Bremen, the University of Bristol (U.K.), the University of Minnesota, Woods Hole Oceanographic Institution, the Max Planck Institute for Marine Microbiology, and the Massachusetts Institute of Technology.

#### **3.4.6 Assessment of future plans**

Future plans for the department will lead to a deep involvement in NIOZ research themes dealing with "Dark Ocean Processes" (studies of microbial populations and activities), "Open Ocean Monitoring" (distribution of anthropogenic products and their significance for ocean circulation), "Benthic Boundary Layer Processes" (studies of methane cycling), "Coastal Systems" (toxicity of treated ballast water), and "Past Ocean Processes" (continuing development and exploitation of paleoclimatic proxies). In all cases, the capabilities of the department have already been well demonstrated and the results can confidently be expected to be significant.

#### **3.4.7 Recommendations**

- 9 Without doubt, the department's highest priority is, and should be, to develop its strengths at the interface with molecular biology. This will definitely require a new, tenure-track appointment within the department. The committee unreservedly endorses this objective.
- 10 In recognition of the anticipated shift in emphasis from toxicological work to studies of the transport and fate of anthropogenic products in the marine environment, the department proposes to change its name from Marine Biogeochemistry and Toxicology to Marine Geobiological and Environmental Chemistry (MGE). In February 2004, the Science Committee of NIOZ considered this proposal and recommended "further discussion", feeling that the department would be confused with Marine Chemistry and Geology (MCG). The evaluation committee shares its reservations concerning the particular name proposed. The term "geobiological chemistry" will not be readily understood. It will not be clear whether this is different from biogeochemistry. As an alternative, Marine Biogeochemistry and Environmental Chemistry (MBE) might be preferable, despite the repetition of "chemistry".

### 3.4.8 Overall programme assessment

Quality	Excellent
Productivity	Excellent
Relevance	Very good – excellent
Vitality	Good – very good (very good if staffing were increased)
<b>Overall</b>	<b>Very good – excellent</b>

## 3.5 Marine Chemistry and Geology (MCG)

### 3.5.1 General remarks and assessment

During this review period, the MCG department consisted of three groups focusing on research on the following themes:

- Biochemical Processes in Water Column and Air-Sea Exchange;
- Export and Settling from Upper Ocean and Early Diagenesis;
- Sedimentation and Paleoceanography.

In addition, the department was running the national facilities for nutrient analyses and X-Ray Fluorescence (XRF) scanning of cores and providing support for the sediment trap and seismic profiling studies.

The committee was impressed not only with the high overall quality of the research in marine chemistry and geology, but also with the strong external support for this department (especially in groups 1 and 3), with the innovative technology developed, and with the strong seagoing research. The fact that the technology was utilized by both this and other departments helped to promote interdisciplinary research. Having three distinct research groups in one department caused some strains. The recent transfer of the highly active group 1 (which clearly did not belong in MCG) to the BIO department has greatly improved cooperation between the remaining two groups in MCG. During the review period, every group conducted high-quality work on significant research projects and overall productivity was high, although somewhat unevenly distributed between the groups. The recent reduction in staff members presents a threat both to the long-term viability of this active department and to the success of the new interdisciplinary Science Plan at NIOZ.

### 3.5.2 Quality

The research conducted in the first subgroup focused on key processes involved in ocean-climate interaction (the biological pump and CO<sub>2</sub> exchange across the ocean-atmosphere, and export to the deep ocean) and the main field areas were in the Southern Ocean and North Sea. This group had a particularly strong programme on the Fe-fertilization hypothesis, the bioavailability of Fe and the possible relationship to the remarkable glacial/interglacial atmospheric CO<sub>2</sub> record obtained from ice cores. It had investigated the relative importance of Fe availability versus light penetration and wind intensity, concluding that the latter parameters are the more important. The ocean uptake of anthropogenic CO<sub>2</sub> and the impact on coccolithophoroids was also being studied. This group was working on significant research projects, was well funded from external sources, was highly active and productive, and had VERY GOOD publication and citation records.

Because the above research is more closely linked to the research being done in the BIO department than to that conducted by the other two groups in the MCG department, the transfer of this group to the BIO department in January 2005 was a constructive move. Since then, internal cooperation between the remaining two groups in the MCG department has already improved.

The research in the second subgroup focused on biogeochemical cycling of elements in the benthic environment with an emphasis on recycling and preservation of organic matter, biogenic Si, and carbonates. The mass flux studies utilized sediment traps, autonomous benthic landers for solid-water exchange processes, and radioactive tracers ( $^{234}\text{Th}$ ,  $^{210}\text{Pb}$ ) for sedimentation rates. Interesting results included the observed positive relationship between diatom productivity and Si concentration in ocean margin sediments off Somalia, but not in the Southern Ocean. An interesting question as yet to be pursued is what controls this relationship, or what is the significance of the contrasting observations in the two oceans. In the Somalia margin this positive relationship should help to reconstruct the upwelling history in the Indian Ocean. Another new finding in the Somalia margin was that sediment focusing and oxic diagenesis, but not monsoon-related export production, provide the important controls on organic matter accumulation. Some numerical modelling was used for the data analysis. The diagenesis research concentrated on the role of Al in biogenic silica preservation; it showed that, in addition to post mortem surface adsorption of Al, some Al is incorporated into the silica phase structures. An important study on the role of submarine canyons in sediment transport from the shelf was conducted in collaboration with the third group in MCG. This provided evidence that canyons are critical sites for organic matter burial and for intense sediment diagenesis.

The main focus of the third group and its most active area of research was on sediment transport and processes across continental margins and their impact on and relationship with past and present ocean circulation, especially current activity, and hence on the evolution of unconformities. This research was carried out in cooperation with national and international scientists and programmes; the extent of activity and the external funding level were EXCELLENT. In addition to seismic and other imaging techniques, the research involved seabed sampling, *in situ* observations, and monitoring techniques. Geochemical tracers, such as the radio-tracers  $^{14}\text{C}$  (AMS), and U-Th isotopes, were used in addition to established paleoproxies. The focus was primarily on the European margins. Another significant activity centred on documenting the history of the Indian-Atlantic Paleo-Water-Exchange intensity during the last glacial versus the interglacial. Finally, this group was also active in an international (mostly European) comparative study of the origins of carbonate mounds and associated benthic communities. This research looked at the mostly fossil Rockall Trough versus the active Gulf of Cadiz carbonate mounds and led to an International Ocean Drilling Project mini-leg. To sum up, this group was highly active and very well funded, and its publication and citation records are VERY GOOD.

The laboratory facilities of all three subgroups in MCG need to be improved, and quantitative data analysis should also be strengthened.

### 3.5.3 Productivity

Over the past 6 years, the group has produced 114 research papers, 19 chapters in books and 10 PhD theses. At an integrated strength of 106.7 FTE-years (total research staff) over this period, this amounts to 1.3 scientific paper per FTE per annum.

Over the review period, several significant events have affected the MCG department: the department had four different leaders, it lost two experienced staff members (one, a previous leader, through retirement, and one through an accident) and one experienced technician (through retirement). By 2003, two of these vacancies had been filled. Most recently, the whole Biogeochemical Processes in Water Column and Air-Sea Exchange group, including the technical support staff, PhD students, and Post Doctorate Fellows, has been transferred to the Biological Oceanography department (BIO). Thus, the present MCG department consists of just two groups (groups 2 & 3), with a total of only 4.5 permanent staff members and three permanent technicians. In 2002 MCG experienced its largest loss of tenured research staff. The total research staff has decreased by 41%, from 19.80 to 11.60; half of this loss occurred in 2003-2004 (reduction from 15.60 to 11.60). Furthermore, the MCG department has a lower percentage of direct funding than any other department in NIOZ.

- Despite these perturbation and the very low level of direct funding, the overall quality of research and productivity in the department remained VERY GOOD.
- The MCG department has the highest percentage of research funds relative to permanent funds at NIOZ (59% + 13% contracts).
- Publications are highly cited (well above average) and the publications are in journals with high impact levels (based on the bibliometric analysis).
- Geochemistry & Geophysics (partly belonging to MCG) is among the top three NIOZ fields in terms of output (p. 16, figure 2, CWTS bibliometric analysis).
- Out of 62 joint publications with other research departments (summarized in part IIB document), 35 (=57%) are with MCG scientists, indicating the high level of interdisciplinary research.

#### 3.5.4 Relevance

The department members work on scientifically challenging projects at oceanographic locations with a high national and international priority. The emphases on air-sea CO<sub>2</sub> exchange, on biogeochemical cycling of elements in the benthic environment with an emphasis on organic C and biogenic Si cycling, and on sediment transport and processes across the continental margins and its relationship to ocean circulation and paleoceanography have both scientific and societal relevance, because they address climate change problems and processes in continental margins, where most people on Earth reside.

#### 3.5.5 Prospects

The removal of Group 1 from this department in January 2005 has proved beneficial to both parties. Since then, the interim leader of the MCG department has been fairly successful in improving internal coherence in MCG and establishing closer interaction between the two remaining groups. Staff members, technical personnel, Post Doctorate Fellows, and PhD students appreciate the motivation and dedication of the interim head of department and the recent improvement in the research environment. They are looking forward to expanding the interdisciplinary research further, not only within the department, but also with colleagues in FYS and BIO. The new Science Plan will require increasing cooperation within MCG and NIOZ.

High-quality PhD students and Post Doctorate Fellows are being attracted to the MCG department, and the existing close cooperation with universities in the Netherlands and Europe is likely to be strengthened by the development of the new interdisciplinary programme.

#### 3.5.6 Assessment of future plans

The department excels in the development of innovating research equipment for *in situ* observations and interactive experiments. Such capabilities are essential for its research activities and important to the research being done by colleagues in other NIOZ departments. With the implementation of the new interdisciplinary Science Plan, these technological innovations may become even more central to NIOZ. Among the most visible of them are static and mobile benthic landers capable of long- and short-term high-resolution chemical and biological measurements. Examples include microelectrodes for high-resolution studies of biochemical reactions in and just below the benthic boundary layer; time-series recovery of water and sediment samples for shore-based analyses; and, for the landers, on-line communication by satellite. An Avaatech XRF Core Scanner covering the mass range from Al to U has been adapted for rapid, high-resolution records of sediment chemical composition on split sediment cores. Sediment traps for studies of particle transport and of the cycling of biochemical components, such as C and Si, have also been developed.

### 3.5.7 Recommendations

The main problem facing the present MCG department is the small number of permanent staff members. The overall level of activity is VERY GOOD, but it is unevenly distributed among the permanent staff. The size of the present staff is below the necessary critical mass for a department conducting essential research in the only oceanographic research institute in the Netherlands. Marine chemistry and geology are essential fields in any oceanographic institute. The uncertainty about the future of the geology positions, especially in view of the recent loss of staff, has produced an unhealthy level of anxiety in this department.

- 11 The committee recommends that permanent positions vacated due to retirements over the next 2-4 years should be kept within this department. For the sake of continuity, some overlap should be considered between scientists retiring and those newly appointed to tenure-track positions. Appointing young leading scientists in the fields of sediment transport and dynamics and in paleoceanography (the latter with some focus on short-term time-scale processes during the Pleistocene and Holocene) will greatly enhance the viability of this department and interactivity both within the department and between MCG and (particularly) FYS, BIO and MEE. To discontinue geology research at NIOZ following the retirement of the only two scientists involved in it, and instead to support such research elsewhere (a possibility suggested by one Board member) would be ill-advised and would impact negatively on the marine research and scientific reputation of NIOZ. It would also weaken the new interdisciplinary Science Plan, in which marine geology is crucial to three of the four programmes.
- 12 Renovation of lab facilities is required.

### 3.5.8 Overall programme assessment

Quality	Very good
Productivity	Very good – excellent
Relevance	Very good
Vitality	Good (could be very good if staffing were increased)
<b>Overall</b>	<b>Very good</b>

## 3.6 Marine Research Facilities and Technology (MRFT)

### 3.6.1 General remarks and assessment

Marine Research Facilities and Technology (MRF&T), together with the library and literature search function, form the so-called enabling services at the institute (since 01/01/2005). The role and significance of the MRF&T service exceeds that of the institute itself, because it has a function in facilitating marine research and education for the whole oceanographic community in the Netherlands.

NIOZ is the owner and operator of the oceanographic research vessel Pelagia and two smaller research vessels. It also operates and maintains the national pool of marine research equipment. MRF&T is responsible for cruise scheduling in the international framework of the Ocean Facilities Exchange Group (OFEG), provides technical and analytical support including data management, and is active in the development and construction of new seagoing equipment and the maintenance of existing equipment. It has a staff complement of approx. 45 FTE (excluding the library), 13.5 of which are formally dedicated to National Programme activities.

### 3.6.2 Quality

Overall, the performance of MRF&T has been VERY GOOD. The group enjoys EXCELLENT facilities, is run in an efficient manner and holds a strong position. This is due in part to active participation in relevant national and international committees and organisations, but also

to the fact that it provides VERY GOOD services. Customer satisfaction is measured after each cruise and is benchmarked against similar services abroad. The role of OFEG in sharing ship-time with other operators appears to be increasing and this is a welcome opportunity to increase the efficiency and efficacy of seagoing research.

### 3.6.3 Productivity

During the period under review, productivity – as measured by the number of sailing days of Pelagia and the output of new equipment – was VERY GOOD. In 2004 the number of sailing days decreased sharply and this trend seems set to continue in 2005. A steady-state situation may be reached when NIOZ and other contractors (*i.e.* NWO-ALW, EU and others) each occupy approximately 50% of the available Pelagia ship-time (*i.e.* 280-300 days). Integration of the three separate technical departments into Marine Technology (MTc; motto: Effective Technology for Excellent Marine Science) was a wise move and has led to a more efficient contribution to the development, construction, testing and commissioning of new devices. The productivity of the cruise analytical staff and data management group has also been VERY GOOD.

### 3.6.4 Relevance

The contribution made by MRF&T to the seagoing research capability of the Netherlands has been absolutely essential. The group provides the oceanographic research community in the country with large, complex, state-of-the-art equipment and associated services for marine research and has thereby greatly contributed to recent major successes as a result of the national research effort in marine sciences. However, it could do more to gain the appreciation and support of the general public through appropriate PR and outreach and by promoting small business development through the transfer of newly developed technology/equipment to commercial partners.

### 3.6.5 Assessment of future plans

There is no doubt that MRF&T continues to play a key role in the research programmes both of NIOZ and of the entire Dutch oceanographic research community. Its international significance (particularly in N.W. Europe) in coordinating and sharing facilities and equipment with sister institutes will probably become more important and a strong national base is essential to this. It appears to be in EXCELLENT shape to carry out these functions in the years to come.

Although outside the remit of the evaluation committee, a few remarks about the organisational and financial situation must be made. Currently, MRF&T appears to be an integral part of the NIOZ organisation and finances. The institute owns all the facilities and has assumed full (financial) responsibility for running MRF&T. Consequently, MRF&T personnel (approx. 45 FTE) appear on the payroll of NIOZ and the institute will have to absorb the projected operating loss in 2005. NWO-ALW, universities and the EU function as arm's-length customers, buying ship-time and providing funds for the national pool of equipment.

The wisdom of the current organisational arrangement is open to question. Its financial consequences for NIOZ are clearly negative. It is not clear to the committee that these consequences are off-set by any advantages accruing to NIOZ as a result of providing a financial and organisational home for MRF&T. If MRF&T is regarded as a national facility with a number of different customers, it would be much more transparent (in both operational and financial terms) to regard NIOZ as one of those customers. To accomplish this, MRF&T could be turned into a separate (financial and legal) entity, perhaps owned by a consortium of users, and the full cost of all its activities (personnel, infrastructure and vessels) budgeted. As in the past, NIOZ and NWO-ALW would probably share most of the financial burden through annual purchases of ship-time and technical services. For NIOZ, the advantages of such a structure would be that it could concentrate on science without fearing that portions of its budget would be pre-empted by losses beyond its control.

### 3.6.6 Recommendations

- 13 As part of the current review of MRF&T following the recommendations made by CNTZ, the evaluation committee recommends exploring the possibility of turning MRF&T into a separate organisational, financial and legal entity, preferably owned by a consortium of users of this essential facility.

### 3.6.7 Overall programme assessment

Quality	Very good – excellent
Productivity	n.a./ very good
Relevance	Very good – excellent
Vitality	Very good
<b>Overall</b>	<b>Very good – excellent</b>

## 4 Assessment of the institute

### 4.1 Overall assessment of the institute

Evaluation of the institute with respect to:		Score
1	Leadership	Very good
2	Mission and goals	Very good
3	Strategy and policy	Good – very good
4	Adequacy of the resources	Good – very good
5	Funding policies	Good – very good
6	Facilities	Excellent
7	Academic reputation of the institute	Very good – excellent
8	Societal relevance of the institute	Very good
9	Balance of the strengths/weaknesses of institute	Good – very good
10	Overall assessment of the institute	Very good

### 4.2 Leadership

The leadership structure of the institute is currently in a complex transitional state. The future of the institute depends critically on the resolution of this situation. The committee believes that NIOZ should have a single full-time scientific director. That individual should be a marine scientist who is highly respected both nationally and internationally. Only a leader at that level will be able to both shape and implement the overall mission of NIOZ. He/she should preferably be assisted by a vice-director with responsibility for operational and financial management.

During the review period (1999-2004), the *scientific* leadership of the institute as a whole was VERY GOOD to EXCELLENT. NIOZ has high visibility and continues to maintain its good scientific reputation nationally and internationally. The scientific impact of NIOZ is truly international, as indicated by its citation record, which shows that almost 98% of its citation impact occurred outside the Netherlands (p. 33, CWTS bibliometric study). All the important indicators in the bibliometric analysis are significantly above the world average for each of the main research fields at NIOZ.

There are, however, aspects of general management that should have received more attention. These relate to the need to involve all staff in strategic decision-making processes, to improve operational management through appropriate planning and budgeting and by decentralizing budget accountability, and to increase awareness within the institute of the need to communicate knowledge of all aspects of marine sciences to the general public. These aspects all have to do with the “culture” of the institute and require specific, urgent attention to launch the inevitably long-term process of change.

The interim scientific leadership is a problem. The former director retired in 2004. Subsequently, two interim directors were appointed (a part-time scientist and a full-time manager). The intended term is two years. At present, the institute’s Governing Board is also playing a significant role. It operates with little input from the scientists at NIOZ, communicating mostly with the two interim directors. Occasionally, the Board meets with the Workers’ Council. The search for a new director is an urgent and difficult challenge for NIOZ. It requires the full and immediate attention of all concerned with the future of the institution. Timely completion of this task is essential to ensure that the new director will be able to participate in finalizing and implementing the new interdisciplinary Science Plan.

### 4.3 Mission and goals

The NIOZ mission (see 2.1) is still adequate and challenging enough to secure the future of the institute. In view of the recommendation on MRF&T (see 3.6), it follows that NIOZ's mission may need to be divided between two separate entities, one focusing on research and the other on coordinating national support and facilities.

### 4.4 Strategy and policy

A new Science Plan with four interdisciplinary themes that cut across all the NIOZ departments has been developed by the interim scientific director and the senior staff, following earlier recommendations to improve interdisciplinary research in the institute. The Board has decided to adopt it (see NIOZ management letter, May 2005, scenario 4) but the committee could not evaluate the viability of this plan. Its implementation is likely to require the development of a matrix organisation compatible with the departmental structure at NIOZ. This is a difficult task in which the involvement of the new scientific director is essential. That person, rather than either of the interim directors or any of the Board members, will have to manage the outcome.

An increasingly important aspect of NIOZ's research is the recruitment and training of young researchers (in particular, postgraduates). Many of these come from outside the Netherlands and their needs should be recognized and catered for at the institute. A particular issue for overseas PhD students is the need for better support on arrival. Not being able to speak Dutch was a major problem. Many of the forms and documents the new arrivals had to deal with were available only in Dutch. The committee urges the management of NIOZ to pay attention to these barriers to young researchers. Given the isolation of Texel and the limited social opportunities available to overseas postgraduate students there, it is really important that the institute should try harder to help them to integrate. Otherwise, it will not be able to compete with English-speaking institutes for this student base.

### 4.5 Adequacy of the resources

The financial resources of the institute are often inadequate (see 2.4). This situation is due, at least in part, to absorption of deficits in MRF&T, but also to inadequate operational management (see 4.10). The financial projection for 2005 shows a deficit of M€ 0.75, a situation likely to deteriorate further over the coming years. Possible solutions to this situation were not suggested to the committee or discussed. As a result of the limitations, NIOZ has been unable to address some of the recommendations on career prospects and reinforcement of research staff made during the previous review, six years ago.

This situation also bears on the new Science Plan, which is ambitious and obviously dependent on adequate funding. If that is not available, the institute is likely to overreach itself during the next plan period. Some research groups will survive on project-specific funding but the institute as a whole will deteriorate despite the strengths of individual groups. The viability of the institute depends heavily on a throughput of highly talented researchers and on the availability of financial resources to offer tenure-track positions to some of the very best of them. The requested management letter (see 1.3) also identifies these problems and concludes that *"the implementation of the new Science Plan should be accompanied by a solid scenario to ensure its feasibility in terms of finances and well-qualified personnel"*. If the present inability to maintain staffing persists, NIOZ will deteriorate significantly in many vital areas of marine research.

Based on the above, the committee is concerned that it has to recommend that *"NWO and NIOZ work together to achieve a healthy steady state involving the personnel and logistical resources in which the respective roles and responsibilities are clear"*. It should be stressed

that this recommendation is exactly quoted from recommendation 4 for “NIOZ as a whole”, given in the evaluation report six years ago. Whereas the division of roles and responsibilities between NWO and NIOZ may have become clearer in the past 6 years (resulting in significant ad hoc direct specific funding for NIOZ), the roles, responsibilities and accountabilities of the various management levels and indeed of all staff within NIOZ have yet to be formalized and implemented. The committee was surprised to learn that job descriptions detailing tasks, responsibilities and accountabilities of various management functions do not appear to exist. It is a matter of urgency for the institute to start formulating these, if only because they are crucial to the management of the matrix organisation that will be introduced when the Science Plan is implemented.

#### 4.6 Funding policies

The committee noticed that there are great differences in the success rate of individual tenured-track scientists in acquiring external funding. Each tenured-track scientist is entitled to forward one (PhD/ Post Doctorate Fellow) proposal each year to NWO (e.g. ALW – NWO Council for Earth and Life Sciences) and various other possibilities exist to attract outside funding. NIOZ should encourage all senior staff to make maximum use of these opportunities.

#### 4.7 Facilities

The committee commends NIOZ on its facilities. During the tours provided, the committee was impressed by the seagoing and lab facilities. It noted that the efficient and practical design of the new building solved many problems that had built up in the institute over the years. However, management will clearly need to pay attention to the remaining problems of staff accommodated outside this new building, including their lab facilities. This will require further capital investments. Further comments are made in section 3.6 on MRF&T.

#### 4.8 Academic reputation of the institute

The reputation is VERY GOOD to EXCELLENT. The bibliometric<sup>2</sup> analyses show a sound institute of high repute. NIOZ is highly visible, nationally and internationally, and continues to maintain its outstanding scientific position. Its impact is truly international. Almost 98% of its citations come from outside the Netherlands and all bibliometric indicators are significantly above the world average.

#### 4.9 Societal relevance of the institute

The bond between the Netherlands and the sea is organic, historic and inescapable. At present, the ocean and, accordingly, its environmental and economic benefits are extraordinarily vulnerable. NIOZ provides fundamental knowledge about the marine environment on the Netherlands' own doorstep and in the wider world. The institute's new Science Plan shows an ongoing commitment to highly relevant research themes such as coastal management and global and climate change. Maintenance of excellence in research of this kind is a strategic imperative for the nation. One of the roles of the new director of NIOZ should be to promote awareness of this relevance at all appropriate levels, both within the Netherlands and internationally.

<sup>2</sup> Bibliometric study on the Royal Netherlands Institute for Sea Research for the 1998-2002 period (21 March 2005, T.N. van Leeuwen, A.J. Nederhof, CWTS, Leiden University).

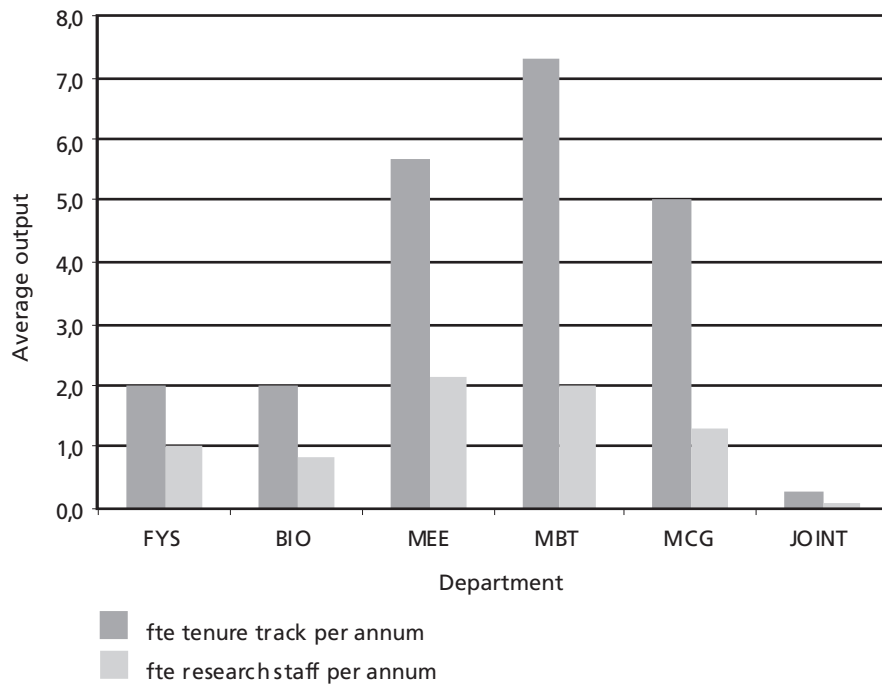
#### 4.10 Balance of the strengths and weaknesses of the institute

Taking the SWOT analyses of the NIOZ departments as a benchmark, it becomes clear that many of the identified weaknesses relate to a perceived lack of funding and, almost as a consequence, to the inability to retain and/or attract excellent young researchers. Most of the identified funding initiatives seemed to be inward-looking – few of them were oriented towards raising funds externally. This situation is in strong contrast to the identified threats and weaknesses in relation to funding, where it is implied that more funding will automatically solve all the problems. Unless more initiatives are taken to look outside the present “funding box” and to improve operational management through appropriate planning and budgeting and by decentralizing budget accountability, the problem will remain.

It is unclear what contribution the individual departments think they can make to countering the threats and weaknesses; do they feel part of the problem or part of the solution?

The figure below gives an overview of the output per NIOZ department (1999-2004) as reported by NIOZ in part II of the self-evaluation (parts B7 and B9). Joint departmental publications for all NIOZ tenure-track positions average 0.3 publication per annum. The figure also shows that MBT is the most productive department, with more than 7 publications per annum (white bar) per tenure-track position. Based on total research staff (black bar), MEE is slightly more productive than MBT. Strengths and weaknesses in this respect are unevenly distributed over the departments.

**Royal NIOZ output (1999 -2004)**



#### 4.11 Overall assessment of the institute

	FYS	BIO	MEE	MBT	MCG	MRF&T	Overall
Quality	vg-exc	vg-exc	g-vg	exc	vg	vg-exc	vg-exc
Productivity	g-exc	g-exc	vg-exc	exc	vg-exc	n.a/vg.	vg-exc
Relevance	vg	vg-exc	vg	vg-exc	vg	vg-exc	vg
Vitality	g	g-exc	vg	g-vg	g-vg	vg-exc	g-vg
<b>Overall</b>	<b>vg</b>	<b>vg</b>	<b>vg</b>	<b>vg-exc</b>	<b>vg</b>	<b>vg-exc</b>	<b>vg</b>

The overall assessment of the institute is VERY GOOD.



## 5 Conclusions and recommendations

- 14 The board must immediately, as a matter of urgency, begin a well-organized and thorough search for a director of international standing in marine science. This should be handled aggressively, preferably using the services of a professional agency with a record of success in identifying and attracting people of this quality.
- 15 In the interim, there should be a regular schedule of meetings between the Governing Board, the interim directors and heads of department to ensure the successful prosecution of NIOZ science and to prevent any loss of coherence, collegiality and ethos within the institute.
- 16 Serious consideration should be given by the Governing Board and the heads of department as to when the new Science Plan can best be introduced and implemented, recognizing the tension that exists between the problem of implementing a plan of which the new director has no ownership and the urgent need to redress the current financial position.
- 17 The new Science Plan must be underpinned by a sound business plan. In this respect it will be necessary both to change the inward-looking culture of many of the research staff with respect to funding and to make them more accountable for expenditure within their projects.



## 6 Additional questions put by NWO

### 6.1 General questions

- 1 What is and what could be the position of the institute in the near future, compared to leading institutes in the world that operate within the same field?**

There are two tiers of marine institutions internationally. Tier 1 is exemplified by institutions such as Woods Hole, Scripps and Southampton. Tier 2 institutions are generally smaller and have less impact internationally. NIOZ has historically enjoyed a place within Tier 1, but is not at the top of that tier and may in fact be in danger of slipping down into Tier 2 if the present recommendations are ignored.

- 2 Should NWO continue to support the mission of the institute and for what reasons?**

It is extremely important for the Netherlands to support NIOZ. Not only is the science VERY GOOD to EXCELLENT, but there are pressing strategic reasons for continuing support. Firstly, NIOZ is the natural institutional base for work on the Wadden Sea and North Sea. Secondly, the Netherlands has concentrated its seagoing infrastructure at the institute and it is difficult to imagine equally good facilities elsewhere in the country for this activity.

- 3 Are there more effective ways for NWO to support the same type of research and/or facility?**

No, the committee does not believe there are, unless it is at a European scale, outside the Netherlands.

- 4 What is your view of the analyses (made by the management of the institute) of the consequences if these institutional activities were to be discontinued?**

The Netherlands needs a national centre of this nature and an institute like NIOZ is probably the only possibility.

### 6.2 Specific questions

- 5 Is NIOZ preparing in its strategic planning for the implementation of the recommendations of the Hermans Committee, including those regarding the (big) research facilities? If not, why not?**

The committee notes that the institute's interim management has made a start on the implementation of most of the recommendations of the Hermans Committee. Full implementation will take quite some time and require dedicated commitment on the part of the new director.

- 6 How important are NIOZ's activities and portfolio of projects to the Dutch research community?**

Extremely important. See 6.1.2.

- 7 How is the transfer of knowledge to the research community and to society organized, and does NIOZ pay attention to 'valorisation'?**

Historically, NIOZ scientists have tended to pursue curiosity-driven research, without reference to societal needs. Indeed, until recently this was their mission statement (a fact which the committee finds incredible, but probably a true reflection of how staff members view themselves). In the past NIOZ was given a great deal of freedom to undertake curiosity-driven research but has now, like all institutions, to be more accountable and at least try to place its efforts so far as possible within a societal context. From its discussions with a sizeable sample of the staff, the committee received the distinct impression that they did not yet feel the need to justify themselves in this way. This is, in fact, one reason for the urgency attached to the search for a dynamic new director. Good directors not only provide internal leadership, but are also able to present institutes and their activities to the outside world. This does a great deal to promote the societal relevance and value of the institutes' work.

**8 What dilemmas is the institute expected to face in seeking to attract and retain excellent researchers from the Netherlands and abroad and to offer career prospects to research talent in its own organisation?**

Several factors currently conspire against the ability of NIOZ to attract and retain staff. Firstly, there is the lack of consistent vision and leadership at the top, which means that senior scientists quickly become disaffected. Maintenance of an attractive and stimulating scientific environment at an institute requires the creative development of goals and expectations that are shared by the various research groups. Secondly, the continued pressure from the financial manager will lead to further disaffection. Thirdly, there is little in the way of a tenure-track system for young scientists or for technical staff and career prospects are poor all round. Fourthly, all of these issues make it more difficult to attract the right person to the post of director (which is the key to putting all this right).

**9 How does NIOZ think it will resolve the expected dilemmas?**

The committee feels that the Governing Board, the directors and, to some extent, the research staff are rather naïve and unrealistic in their ideas about how the problems can be solved. The Board shows little sense of urgency in head-hunting a new director and seems to have few ideas about how to put together an offer sufficiently attractive to counterbalance all the current problems. The decision to initiate the implementation of the Science Plan in the absence of the director who will have to see it through illustrates the dilemma facing the current leadership. The committee's view is that, while implementation of the Science Plan may restore the finances of the institute, it may have a bad effect on morale, so that the new director may find himself facing a problem that is even more difficult to solve.

# Appendix 1: Curricula vitae of the committee members

## Wim Harder

Is Emeritus Professor of Microbiology at the University of Groningen. He studied chemistry and biochemistry in Groningen and microbiology in Wageningen and received his PhD in 1969 for a study of obligately psychrophilic marine bacteria. After a post-doc with Professor John Quayle FRS in the UK, he returned to the university of Groningen to start a research group on microbial (eco)physiology and worked on various aspects of one-carbon metabolism in bacteria and yeasts. He was visiting professor at the Gulbenkian Institute in Oeiras (Portugal), Concordia University in Montreal (Canada) and the University of Marburg (Germany) and published approx. 350 scientific papers, was (co-)supervisor of 46 PhD theses and editor of *The Prokaryotes* (2nd edition). From 1989 to 1999 he was director of the TNO Institute of Environmental Sciences in Delft and scientific director of the TNO Institute of Environmental Sciences, Energy Research and Process Innovation in Apeldoorn. During this period he maintained a part-time appointment at the University of Groningen. He served on several national and international committees, was vice-chairman of the European Environmental Research Organisation, a member of the Royal Holland Society of Arts and Sciences and Fellow of the International Institute of Biotechnology. More recently, he has been chairman of the NWO Council for Earth and Life Sciences and has served as a member of CTNZ (the Hermans Committee) and on the boards of Biomade, Biopartner and DCO. He is currently chairman of the NWO Committee on Large Investments and of the Board of Biomade, and a member of the China Committee of the KNAW.

## John Hayes

Studied chemistry at Iowa State University (BS) and analytical chemistry at Massachusetts Institute of Technology (PhD). After occupying several international positions, he now works at Woods Hole Oceanographic Institution. His research interests are: factors controlling the isotope composition ( $^{13}\text{C}$ ,  $^{14}\text{C}$ ,  $^2\text{H}$ ,  $^{15}\text{N}$ ,  $^{34}\text{S}$ ) of organic materials in marine environments; construction of ancient conditions ( $\text{pCO}_2$ , trophic structure) from isotopic compositions of organic compounds in sediments; development of the global carbon cycle over geologic time; techniques of isotope analysis; the cycling of carbon in modern and ancient environments and its relation to the development of the global environment; molecular aspects of biogeochemistry and microbial geochemistry, specifically the distributions of the stable carbon, hydrogen, nitrogen, oxygen and sulphur isotopes between and within organic and inorganic compounds in sediments and in organisms; the technology of isotope ratio measurements (C, H, N, O) in organic materials; organic compounds in ground water as hydrologic tracers; and organic cosmochemistry.

## Miriam Kastner

Studied at the Hebrew University of Jerusalem (BS, MS) and at Harvard University (PhD). She now works at Scripps Institution of Oceanography. Her research interests are: the role of fluids in the transport of heat and solutes, and the ocean, atmosphere, and mantle in subduction zones; gas hydrates and global change; chemical paleoceanography; sedimentary geochemistry and diagenesis: mineralogical, chemical, and isotopic studies of recent and older sediments; and processes responsible for the formation of submarine hydrothermal deposits, phosphorites, dolomites, and cherts. The research involves seagoing expeditions and chemical and isotopic (C, O, Li, Cl, Sr) measurements.

## **Dirk Olbers**

Studied physics and mathematics in Hamburg, where he also received his PhD (1973) and Habilitation in Physical Oceanography (1981).

He has held research positions at the Institute for Geophysics, Hamburg University (1971-78), Institute for Marine Research, Kiel University (1978-79) and Max Planck Institute for Meteorology, Hamburg (1979-85).

Since 1985, he has been Professor of Ocean-Atmosphere Physics at the University of Bremen and Head of Department at the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven.

His fields of research are: data oriented modelling, inverse models, geophysical fluid dynamics, oceanic circulation, theoretical and numerical modelling, and physics of climate.

## **Dave Raffaelli**

Appointed to a chair in Environment at the University of York in February 2001. He has broad interests in community and ecosystem ecology in marine, freshwater and terrestrial systems. These include marine food web dynamics; the relationships between catchment land-use, water quality and impacts on coastal receiving systems; the application of manipulative field experiments to large-scale conservation and management issues, biodiversity and ecosystem function; the influence of species body-size in community dynamics; issues of communication in environmental debate; and inter-disciplinary approaches to environmental management. He enjoys collaborative, multidisciplinary projects, working extensively with other European colleagues and in North America, New Zealand and Australia.

## Appendix 2: Programme of the site visit

### Timetable/programme of the NIOZ site visit

25 May 2005		Wednesday				
1	17:00	Closed session at hotel				
2	19:00					
3	19:00	Welcome dinner (introductions)				
4	20:30	Close				
26 May 2005		Thursday				
1	7:45	Transport hotel - NIOZ				
2	8:00	Scientific director				
3	9:00	Tour 1 of the institute				
4	10:00	Department 1				
5	11:00	Break				
6	11:30	Department 2				
7	12:30	Lunch				
	13:30	Department 3				
	14:30	Department 4				
	15:30	Department 5				
	16:30	Break				
11	17:00	Tour 2 of the institute				
	18:00					
12	18:10	Transport to hotel				
13	18:30	Closed session at hotel				
14	20:00	Dinner (committee only)				
	22:00	Close				
27 May 2005		Friday				
1	7:45	Transport hotel - NIOZ				
2	8:00	Governing Board and chairman of Advisory Committee				
Committeemember:		1	2	3	4	5
8	9:00	Selected researchers and subjects				
9						
10						
4	12:00	Marine Research Facilities/Infra/Investments, fin. director				
7	13:00	Lunch (committee only)				
8	13:30	Closed session committee				
		Adoption Agenda				
		General (institutional level)				
		Management/TOR				
		Departments 1 - 5				
		Recommendations				
9	17:00	Closure with scientific director and chairman of the Governing Board				