

Research and Monitoring from  
Department of Marine Ecology,  
National Environmental  
Research Institute,  
for the period 1998 – 2003

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## Contents

<b>Introduction</b> .....	<b>3</b>
<b>1 The National Environmental Research Institute (NERI)</b> .....	<b>3</b>
1.1 NERI's field of expertise .....	4
1.2 NERI's strategy .....	4
<b>2 The Department of Marine Ecology (MAR)</b> .....	<b>5</b>
<b>3 MAR's research in marine eutrophication and oxygen deficiency</b> .....	<b>7</b>
<b>4 MAR's collaboration with national and international universities and institutes</b> .....	<b>9</b>
<b>5 Links and interactions between research and monitoring</b> .....	<b>11</b>
<b>6 Monitoring and advisory activities</b> .....	<b>12</b>
<b>7 The Marine Topic Centre</b> .....	<b>12</b>
7.1 National monitoring and advisory activities .....	13
7.2 The National Marine Database – MADS .....	15
7.3 Dissemination of scientific results .....	15
7.3.1 Traditional products .....	15
7.3.2 Internet activities .....	15
7.4 International advisory activities .....	16
<b>8 Analysis of Danish National Environmental Research Institute Publications 1998-2002</b> .....	<b>17</b>

Enclosure 1: List of publications 1998 to 2002

Enclosure 2: List of EU contracts covering 2002

Enclosure 3: List of publications in 2003 of relevance to oxygen deficiency and eutrophication

Enclosure 4: Copy of "Nutrients and Eutrophication in Danish Marine Waters"

Enclosure 5: Copy of "The State of the Environment in Denmark, 2001"

Enclosure 6: Summary of Danish thematic reports

Enclosure 7: Bibliographic analysis of publications

Enclosure 8: Examples of oxygen reports for 2002

# Introduction

NERI's research on marine eutrophication forms part of the scientific background for political decisions. Among other the research will form part of a knowledge base for a new Danish "Action Plan for The Aquatic Environment" (number 3 in a series) together with monitoring data and other research results. The new action plan, which may involve substantial restrictions on agriculture, is to be discussed by Parliament in the autumn 2003.

In 2002, long periods of extensive oxygen deficiency in Danish waters resulted in a debate in the media, in which the credibility of NERI's research in marine eutrophication was questioned in public. This led to a suggestion from political side to carry out an evaluation of NERI's research in the area.

NERI's Board of Governors responded positively to the suggestion and decided to initiate the present international evaluation of NERI's research on marine eutrophication, including oxygen deficiency.

In view of the background for the evaluation, the Board of Governors also invited critics to present their views on NERI's eutrophication research to the evaluation panel. The material, which may be supplied by the critics, is not as such subject to evaluation by the panel, but should serve only to facilitate the evaluation of NERI's research.

Below is an overview over the activities within the field of marine eutrophication from NERI's Department of Marine Ecology (MAR) for the period 1998 to 2003. In addition, the goals, frames and content of the research are described. The research prior to 1998 was evaluated as a part of an international evaluation of Danish fisheries research in 1997.

## 1 The National Environmental Research Institute (NERI)

Public research institutes in Denmark include universities with responsibility for basic research and education, and government research institutes with responsibility for strategic research and for providing data and consultancy within the sector, the institute is affiliated to.

The National Environmental Research Institute (NERI) is a government research institute affiliated to the Ministry of Environment. The institute was established in 1989 after an international review of Danish environmental research. As a research institute, NERI is independent of the political/administrative system when undertaking research and monitoring and presenting its findings. This independence is ensured by legislation. A Board of Governors representing the interests of both research and users is responsible for the general management of NERI.

NERI's objective is to help fulfil the Government's goal of an environmental policy based on knowledge. The Statutory Order governing NERI assigns the Institute's responsibility for research, consultancy, monitoring and information activities within the environment and nature areas.

**Research.** NERI undertakes both applied research, directed at alleviating specific environmental problems, and long-term strategic research. The research activities support NERI's scientific consultancy and monitoring work.

**Monitoring.** NERI undertakes monitoring in order to evaluate the effect of political/administrative measures, to fulfil Danish obligations according to EU Directives and international conventions and to facilitate the early identification of environmental problems. NERI has the responsibility for the National Environmental Monitoring Programme in Denmark as well as for SOE reporting.

**Consultancy.** NERI serves as scientific advisor to the Danish Parliament and the Ministry of the Environment, as well as to other public authorities, private organisations and enterprises. The advice is provided in the form of analyses, reports and replies to inquiries, as well as through the participation of NERI staff in various commissions and committees.

**Dissemination of information.** NERI targets dissemination of its research and monitoring findings primarily through NERI's homepage, but also through various channels ranging from scientific papers in international journals, to scientific reports and technical instructions, to popular scientific articles and reports in the mass media. In addition, NERI disseminates knowledge through participation in meetings and symposia.

**International co-operation.** NERI participates intensively in international research projects funded at the international level (EU, Nordic Council of Ministers, etc.), and is involved in the work of the European Environment Agency (EEA) as the Danish National Focal Point. Moreover, NERI is involved in tasks concerning transboundary environmental problems relating to air pollution, the Arctic environment, tropical rain forests, etc. Finally, NERI participates in professional committees and commissions under the EU and a number of other international organisations.

More information on NERI can be obtained from the [www.dmu.dk](http://www.dmu.dk)

## 1.1 NERI's field of expertise

NERI's scientific work is organized within six fields of expertise and includes research, monitoring and consultancy. These fields are interdisciplinary across NERI's nine scientific departments (eight departments after May 2003) and comprise key elements of its strategy and programme of work. The six fields of expertise include:

- Atmospheric environment
- Aquatic environment and nature
- Terrestrial environment and nature
- The Arctic and global environments
- Risk Assessment of chemical substances and biotechnological products
- Interdisciplinary research

## 1.2 NERI's strategy

NERI emphasizes three important aspects that permeate the institute's work:

- ensuring the relevance of the scientific work and the results
- ensuring high quality in the scientific work and consultancy work and results; and
- effective management and priority-setting

Relevance is ensured through priority setting based on a dialogue with the administrative and political systems. Scientific quality is ensured through publication in the international peer review system. NERI's consultancy work is restricted to the research areas. In this way scientific quality also becomes a key element in ensuring that NERI's consultancy is of high

quality and is independent of political and economic interests. On a national level, NERI is responsible for environmental monitoring in Denmark and has comprehensive databases on nature and the environment. These data comprise an important basis for the consultancy NERI provides to its clients. The quality of monitoring and data management are ensured in formalised quality assurance systems.

## 2 The Department of Marine Ecology (MAR)

MAR is a research department at NERI. MAR carries out research, monitoring and advisory activities in marine ecosystems. MAR consists of three research groups in Roskilde and one group in Silkeborg. The staff in 2002 included one research professor, one guest professor (Professor Frede Thingstad, Bergen University), 12 senior researchers, 2 senior advisers, 5 researchers, 4 research post-docs, 7 academics, 19 technicians, 6 support staff, 12 PhD students, and 5 master students.

The department's activities are financed through a basic contribution from the Danish State (2002: 18m DKK external research contracts and 3m DKK in the fields of monitoring and 3m DKK from monitoring and management of The Marine Topic Centre (M-FDC)). About 45% of the external research contracts originated from EU projects, which amounted to about 8m DKK in 2002. Normally, only a minor income originates from consultancy activities. However, during the establishment of the bridge over the Sound between Denmark and Sweden, MAR participated extensively in a special consortium (SEMAC) that conducted a monitoring and assessment program for the Danish and Swedish authorities. These activities ceased in year 2000. MAR conducts advisory activities in collaboration with other NERI departments related to the construction and operation of large-scale off-shore wind farms in the Baltic Sea and the North Sea. The potential effects of these large off-shore structures on marine mammals and bottom fauna are analysed through intensive monitoring and assessment. These activities are expected to increase with the growing demand for renewable energies.

MAR's overall strategic goal is to integrate marine research and monitoring activities in order to optimise the use of monitoring data in research activities, and to apply the latest research results in the monitoring activities. A special interest is devoted to the implementation of the Water Framework Directive and the Habitat Directive in Danish monitoring programs based on the latest knowledge on effects of nutrients, toxic substances and possible climate changes. In addition, MAR is currently establishing marine monitoring activities around Greenland.

The Danish marine monitoring and assessment programme (NOVA-2003), the habitat monitoring, the national marine database (MADS) and The Marine Topic Centre (M-FDC) are all elements in MAR's research and advisory activities. M-FDC has a central role in the formulation of the new monitoring program (NOVANA), in the European Topic Centre on Water (European Environment Agency/EEA): [http://eea.eu.int/European Topic Centre on Water/ETC-WTR](http://eea.eu.int/European%20Topic%20Centre%20on%20Water/ETC-WTR): <http://water.eionet.eu.int>) and in the technical implementation of the Water Framework Directive ([http://europa.eu.int/comm/environment/water/water-framework/index\\_en.html](http://europa.eu.int/comm/environment/water/water-framework/index_en.html)) and the Habitat Directive (<http://europa.eu.int/comm/environment/nature/hab-en.htm>). The work with the two Directives includes research and advisory activities on typology, classification, and reference conditions.

The main body of research in MAR is dedicated to the importance of nutrients for the structure and functioning of marine ecosystems. Nutrients are still the most important factor controlling e.g. biological structures and processes, oxygen deficiency, and potential for exceptional phytoplankton blooms. Also changes in the nutrient transport to Danish marine waters are expected, primarily as a result of increased precipitation due to climate changes

and continued efforts to regulate nutrient loading on both national and international levels. Therefore, the core research activities are concentrated within the following areas:

- population structures and regulation of benthic fauna and flora
- fate of pelagic production
- eutrophication and oxygen deficits
- benthic-pelagic interactions
- occurrence, distribution and importance of excessive phytoplankton blooms
- interactions and modelling of biogeochemical processes and internal loadings
- effects of climate changes on marine ecosystems

In 2003, a four-year competence-building project focusing on mathematical modelling of marine ecosystems will be completed. The overall goal has been to develop and strengthen the scientific profile within modelling as a complementary activity to the current research, the marine monitoring and the general advisory activities. A large part of the scientific staff will contribute to the model products, and four new modelling positions have been opened over the past two years. External funding from EU and other sources have been raised to continue these activities.

MAR's national and international networks have been significantly improved over the past 5-6 years. It is the intention to maintain these networks via projects, research schools, students, The Marine Topic Centre, seminars, courses, teaching at universities and other related activities.

A significant effort has been carried out to establish activities within the 6th European Framework Programme. In 2002, MAR's research included participation in and/or co-ordination of 15 EU projects (*Enclosure 2*) and co-ordination of a European research school in the 5th European Framework Programme. MAR is hosting a Marie Curie Training Site "Center for Research and Monitoring of the Marine Environment - CREAM" that is funded by the European Commission (<http://cream.dmu.dk>). The CREAM Center runs during the period 2001-2005 and trains PhD students to use data collected in monitoring programmes to gain knowledge about how marine systems operate in order to evaluate anthropogenic and climatic impacts upon the marine environment.

Other research projects are funded by a variety of sources, e.g. the Danish Natural Science Research Council, the Carlsberg Foundation, Nordic Council of Ministers, Nordic Arctic Research Programme, the Danish Environmental Research Programme, the Danish Forest and Nature Agency, the Danish Environmental Protection Agency, and the Danish Co-operation for Environment in the Arctic (Dancea). A list of funded research projects during 1998-2003 is available upon request.

The benefits of the mutual interactions between the monitoring and research activities are beginning to appear in the department's scientific publications. Examples include articles nos. A7, A12, A33, A39, A40, A45, A50, A51, A55, A57, A59, A65, A76, A77, A83, A96, A97 (*Enclosure 1*). Previously, it has been difficult to raise the necessary funding to carry out research partly based on existing monitoring data, but now there has been some success to demonstrate the power of empirical relationships based on long time series and large spatial scales as tools to predict ecological functions.

A number of research activities are carried out on the routine monitoring cruises. In addition, a number of special research cruises have been carried out in Danish waters and in international seas. Researchers and technicians have over the years participated in a large number of international cruises around Greenland and the Arctic Canada, the North Atlantic, around Thailand and in the marine areas around Denmark. Specific cruise reports are

presented in the frame of the projects, and scientific products are an integrated part of the annual scientific publication lists (*Enclosure 1*).

Only the peer-reviewed articles in international journals and book chapters are submitted to the evaluation committee. However, other scientific products include posters, invited lectures and oral presentations at international meetings. A substantial part of the scientists in MAR act as subject editors, referees or members of the editorial boards of international journals. They also act as referees for research councils in a number of countries, contribute to the formulation of new research programmes, and have been invited to the U.S. National Academy of Sciences and the Gordon Conference in the U.S.A. A list of these activities can be provided upon request.

The scientific products in 2003 include articles of direct relevance to the oxygen and nutrient dynamics in the Danish waters (see *Enclosure 3*); only titles and abstracts are included, but copies of the material can be provided upon request. The average publication rate (international publications) per researcher man-year in MAR ranged between 0.86 to 1.38 during the period 1998 to 2002. The average for the five years was 1.14 publications per researcher man-year.

### **3 MAR's research in marine eutrophication and oxygen deficiency**

Eutrophication and oxygen depletion in marine environments result from a number of processes and interactions. These include nutrient loadings, hydrography, production and fate of organic matter, benthic-pelagic interactions, food web interactions and ecosystem responses. The enclosed presentation of the research, monitoring, and advisory activities represents an extract of the department's products (*Enclosure 1*). The selected publications represent the scientific documentation within eutrophication, nutrient transport, effects of nutrients, hydrography, growth and regulation of bottom fauna and vegetation, phytoplankton, zooplankton, oxygen consumption and transport, and population and ecosystem studies of marine ecosystems. Examples of research articles excluded from the enclosure include occurrence, transport and effects of environmental contaminants, ecological studies of marine animals, taxonomic studies, global modelling and other subjects of only limited relevance to the topic of the present evaluation.

The current research themes in MAR are based on the needs from the Ministry of the Environment and scientific progress.

Since 1969, eutrophication has remained the main issue in marine environmental policy in Denmark with an extensive need for documentation. The increasing loads of nutrients to the Danish marine environment have reduced dissolved oxygen concentrations, increased the frequency of periods with oxygen deficit, increased phytoplankton growth, decreased visibility, decreased growth of algae on stone reefs, increased frequency of bloom forming and sometimes harmful plankton algae, etc. Since the start of the first national monitoring and assessment programme in October 1988, much of the marine research in MAR has been concentrated on effects of nutrients on the structure and function of marine ecosystems with particular emphasis on organisms and processes. The purposes of the national monitoring and assessment programme include a description of the state and development of the environmental conditions, an evaluation of nutrient transport throughout the Danish marine environment and an evaluation of whether the targets have been met.

- The needs from the Ministry of the Environment have also been integrated in the national monitoring and assessment programme. A revised monitoring program (NOVANA) will start January 2004, including the first attempt to implement the Habitat Directive and the Water Framework Directive. Accordingly, part of the ongoing research on eutrophication of the marine environment is devoted to the implementation of the Habitat Directive and the Water Framework Directive (WFD). MAR is co-ordinator for the research project "Characterization of the Baltic Sea Ecosystem – CHARM" (Contract EVK3-CT-2001-00065) funded by the European Commission and by the Danish Environmental Protection Agency. CHARM has been developed to provide a scientific foundation for fulfilling the requirements of the WFD in Baltic coastal waters. The study will provide decision-makers with an internationally uniform system to identify appropriate type areas and reference conditions for the Baltic ecoregion based on a sound scientific foundation. The results will be used to identify the degree of variation from ideal reference conditions and the likely response of Baltic coastal ecosystems to reduced anthropogenic pollution. A key feature of this project is to ensure that the results are made available to all end-users, especially environmental decision-makers. A detailed description of the project is provided on the Internet (<http://charm.dmu.dk>).

Whereas the CHARM project focuses on the coastal zone and on nutrients, two other projects include work on the Danish waters and on contaminants. The first project "Reference conditions and typologies for aquatic vegetation and macrozoobenthos in the Skagerrak and Kattegat – RETRO" is funded by the Nordic Council of Ministers. The objectives of the WFD are e.g. to secure "good ecological status" in coastal waters and to prevent impairment of the state of the aquatic environment. Since there is a close and dynamic coupling between coastal and open marine water, it is important to take this into account when implementing the directive, especially with regard to reference conditions and typologies. The objectives of RETRO are to bridge the gap between coastal and open waters. RETRO will provide a basis for an informed implementation of Annex 5 of the directive, including operational ecological quality objectives. Focus will be on sessile organisms, mainly animals living in sediments and macroalgae living on stones. The results of RETRO will be utilised in connection to the implementation of the directive in national legislation, and within the international co-operation on the protection of the marine environment in the North Sea (OSPAR) and the Baltic (HELCOM). Taking the long view, the results are likely to be integrated in the process of defining critical loads for the marine environment. The second project is funded by the Nordic Council of Ministers and is centred around an evaluation and classification of the chemical state of contaminants in the Baltic Sea and Kattegat.

- Scientific progress has clearly influenced MAR's research priorities over the past five years: Increased research attention has been paid to e.g. pelagic food web dynamics, interactions between oxygen deficiency and the origin of dissolved organic matter, factors regulating benthic fauna and flora, and the role of alternative processes in the nitrogen cycle. Considerable progress has been obtained in quantitative results including improvements in the overall nutrient budgets, and ecosystem approaches using simple mathematical, empirical, dynamic and global models. Since 1998, a 3-D-physical model has been integrated in the monitoring program to provide nutrient transport in the Danish waters. A Danish institute DHI Water & Environment has been responsible for the model work. The quantitative research has a clear strategic focus.

Overall, the expertise in the department and the scientific volume in MAR provide a solid foundation to carry out the necessary strategic research and consultancy work. However, there are natural limits for MAR's own research capacity and constantly room for adjustments. The balance between MAR's research subjects and collaboration with external partners is continuously evaluated. For a number of reasons, there are currently scientific themes only partly covered by MAR. A few examples include:



- The transport and effects of contaminants on marine organisms and processes represent a huge and rapidly growing research area. MAR has initiated effect studies and ecological modelling on the pelagic food web, but much more is needed before a comprehensive evaluation of the importance of contaminants can be made.
- Knowledge on fish is not covered by MAR. Marine science in Denmark includes a division of labour where fish research is generally taken care of by the Danish Institute for Fisheries Research.
- Interactions between cell research and individual species in relation to e.g. nutrients and contaminants is only partly covered by MAR. Current studies include the species level in relation to phytoplankton, zooplankton, macroalgae and benthic fauna, but most often these aspects only cover the effects of nutrients and oxygen.
- Mathematical modelling of marine ecosystems. Although a number of modelling activities has been made on the species, populations and ecosystem levels, there is a growing need to strengthen MAR's 3-D-modelling activities on the local, regional and global scales. This initiated a competence building project, which started year 2000, and new positions were opened. Since then, funding for this area has been granted, and recently, two new positions were opened.

## **4 MAR's collaboration with national and international universities and institutes**

The majority of the national research projects are carried out together with scientists from universities (University of Copenhagen, University of Aarhus, Roskilde University, University of Southern Denmark, Technical University of Denmark), government research institutes (Geological Survey of Denmark and Greenland, Danish Institute for Fisheries), private research institutes (DHI Water & Environment), counties, Danish Meteorological Institute and other NERI departments.

The collaboration with the Danish universities also includes teaching and supervising Master and PhD students.

The 15 ongoing EU contracts include collaboration with a large number of European universities and research institutes. In addition, a number of research subjects are carried out in collaboration with a substantial number of international universities and research institutes. A few examples of particular importance are listed below:

- The arctic research in the North Atlantic, around Greenland and in the Northern part of Canada have given rise to extensive collaboration with the Canadian Arctic Shelf Exchange Study (CASES), and MAR is member of IAPP Scientific Co-ordination Group for the International Arctic Polynya Programme.
- Collaboration on ecosystem modelling with particular emphasis on sediment processes includes intensive joint research with Department of Environmental Sciences, University of Virginia, U.S.A., Max-Planck Institute for Marine Microbiology, Bremen, Germany, Department of Systems Ecology, Stockholm University, Cawthron Institute, Nelson, New Zealand, and Centre for Coastal Biogeochemistry, School of Environmental Science and Management, Southern Cross University, Lismore, Australia.
- MAR's work on the production, fate and importance of dissolved organic matter is carried out together with Université Laval, Québec, Canada and Institute for Water and Air,

Hamilton, New Zealand, College of Marine Science, University of South Florida, School of Ocean Sciences, University of Bangor, Wales, Department of Limnology, University of Uppsala, Sweden, and Laboratoire d'Océanographie Biologique, CNRS-ARAGO Laboratory, France.

- Nutrient budgets involve comprehensive collaboration with Horn Point Laboratory, University of Maryland, U.S.A., Université Pierre et Marie Curie, UMR Sisyphe, CNRS, Paris, France, Institut Universitaire Européen de la Mer, Brest, France, Norwegian College of Fishery Science, University of Tromsø, Norway, Instituto Mediterraneo de Estudios Avanzados, CSIC-University Illes Balears, Islas Baleares, Spain, Finnish Environment Institute, Helsinki, Finland, and Rutgers, The State University of New Jersey, Institute of Marine and Coastal Sciences, New Brunswick, NJ, U.S.A.
- Nitrogen cycling and novel alternative pathways include extensive collaboration with Centro de Investigación en Ciencias del Mar y Limnología, CIMAR, University of Costa Rica, Marine Sciences Research Center, State University of New York at Stony Brook, New York, U.S.A., Department of Microbiology, University of Nijmegen, The Netherlands, and Department of Oceanography, Florida State University, Tallahassee, Florida, U.S.A.
- The ecological importance of microphytobenthos includes collaboration with Instituto de Oceanographa, Universidade de Lisboa, Lisboa, Portugal and Institute for Marine Ecology, University of Gothenburg, Sweden.
- Work on trend analyses and statistical work on environmental data include extensive collaboration with University of Linköping, Sweden.
- Research on *Thalassia* in relation to gas transport and sulfide intrusion includes collaboration with Department of Virginia, Charlottesville, VA, USA.
- Theoretical and applied modelling on pelagic food webs includes a longstanding and ongoing collaboration with Department of Microbiology, University of Bergen, Norway.

**Indicators for international activities:** The importance of the international collaboration activities can be measured as the number of publications with contributions from international authors and as exchange of scientists from other countries and/or MAR scientists working in other countries. Below is presented a list of the publications with foreign authors during the periods 1998-2002 and 2003. The numbers of scientific publications with foreign authors corresponded to 46% in 1998-2002 and 54% in 2003 of the total number of publications in *Enclosure 1* and *Enclosure 3*, respectively.

**International scientific publications (ref. *Enclosure 1*) with foreign writers (1998 - 2002):**  
A2, A3, A8, A11, A15, A16, A17, A18, A21, A22, A24, A26, A28, A29, A30, A34, A35, A37, A38, A42, A44, A47, A48, A53, A54, A56, A58, A59, A61, A63, A69, A71, A73, A76, A79, A80, A86, A87, A88, A89, A90, A91, A94, A95, A98, A102.

**Publications in 2003 (ref. *Enclosure 3*) with foreign writers:**  
3.3, 3.4, 3.5, 3.6, 3.9, 3.10, 3.11, 3.12, 3.16, 3.19, 3.21, 3.22, 3.23.

**Visiting scientists in MAR and sabbaticals for MAR scientists 1998 - 2003:**

Visiting scientists		Period	Months
Frede Thingstad	Norway	1/8-1999 – 31/7-2002	4 months
Lene Buhl Mortensen	Norway	1/9-2000 – 28/2-2001	7 months

Visiting scientists		Period	Months
Angela Wulff	Sweden	3/4 – 30/9-2000	6 months
		(Oct. 2000 – March 2001 part time in Sweden)	(6 months)
Miko Sayama	Japan	24/9 – 14/12-2002	3 months
Kaire Torn	Estonia	1/9 – 31/12-2002	4 months
Pia Engström	Sweden	1/3 – 1/5-2001	2 months
Bradley Eire	Australia	1/9 – 15/12-2000	3.5 months
Peter Berg	Virginia, USA	1998-2001	5 months
Frank Wenzhöfer	Germany	1/6 – 1/9-1999	3 months
Rodney Roberts	New Zealand	1/5 – 1/10-1999	5 months

Sabbaticals		Period	Months
Jacob Carstensen	USA	1999	3 months
Daniel Conley	France	2002	12 months
Stiig Markager	New Zealand	24/11-2001 – 6/5-2002	5.5 months
Anja S. Hansen	The Netherlands	13/2-1998 – 13/6-1998	4 months
	The Netherlands	21/6-1999 – 5/8-1999	1.5 months
Peter Stæhr	Scotland	6/1-2000 – 1/6-2000	5 months
Colin Stedmon	USA	1/3-2002 – 1/5-2002	2 months
Nina Reuss	USA	10/5-2002 – 16/11-2002	6 months
Tina Greve	USA	2000 and 2001	1 month

## 5 Links and interactions between research and monitoring

The coupling between research and monitoring has been a fundamental issue in MAR's strategic plan since 1996. During the period 1998 to 2003, there have been a number of activities demonstrating a mutual exchange of knowledge between the research activities and the marine monitoring and assessment programme. Some examples are presented below:

- Monitoring data are beginning to appear in the scientific publications. Monitoring data are integrated in 17 publications (see details on page 5) of the 102 international publications in Enclosure 1. In 2003, 11 out of 24 publications include monitoring data (publication nos. 3.1, 3.2, 3.4, 3.5, 3.9, 3.10, 3.11, 3.15, 3.16, 3.17, and 3.18), *see Enclosure 3*.
- Research progress and scientific analyses are presented by The Marine Topic Centre for the Danish counties responsible for an important part of the marine monitoring and assessment programme.
- International research activities are carried out on the implementation of the Water Framework Directive and the Habitat Directive, which are tightly coupled to the Danish marine monitoring and assessment programme.
- An international research school "Center for Research and Monitoring of the Marine Environment" has been established for European PhD students (see further page 5).
- MAR participates in international organisations, working groups, and in writing of international status reports (see further section 7.4 International advisory activities).
- Results from research and monitoring activities represent an important part of the teaching activities at the Danish universities (see section 7.1.6 Other advisory activities).

## 6 Monitoring and advisory activities

NERI is responsible for the marine monitoring programme, which represents a subprogramme of NOVA-2003. The marine sub-programme is co-ordinated by The Marine Topic Centre (M-FDC) ([http://www.dmu.dk/1\\_om\\_dmu/2\\_tvaer-funk/3\\_fdc\\_mar/default.asp](http://www.dmu.dk/1_om_dmu/2_tvaer-funk/3_fdc_mar/default.asp)), and an overview of the programme description, methodological descriptions, and paradigms for reporting, etc. are found at: [http://ovs.dmu.dk/0english/programme\\_description\\_overview.doc](http://ovs.dmu.dk/0english/programme_description_overview.doc).

A Program Management Board runs NOVA-2003, and an international evaluation of NOVA-2003 was carried out in November 2002. The outcome of the evaluation is presented at: <http://ovs.dmu.dk>

The marine sub-programme includes monitoring by the Danish counties in estuaries and near-coastal regions and by MAR in the Danish open waters. MAR's laboratories participate in the routine proficiency test programme for marine monitoring QUASIMEME, and all chemical analyses used in the monitoring programme are performed according to the International Standard DS/EN ISO/IEC 17025 controlled by the Danish Accreditation Body, DANAK. Reporting of data and quality assurance are communicated to the counties along with the quality assurance data. The counties are responsible for their own quality assurance. The overall strategy of the marine sub-programme is to combine extensive monitoring at wide variety of locations with intensive investigations at few selected sites. The sampling methodologies are consistent with recommended methods from HELCOM, OSPAR and ICES. The STANDAT procedure is used to transfer most of the data from the counties to The Marine Topic Centre (M-FDC). Data are stored in a master database (MADS) situated at NERI. MADS can be accessed by the public via the Internet (<http://mads.dmu.dk>).

## 7 The Marine Topic Centre

For the last 15 years the Danish Ministry of the Environment has appointed MAR as the responsible authority for The Marine Topic Centre (M-FDC). As The Marine Topic Centre, MAR is responsible for monitoring and assessments of the ecological quality of estuaries, coastal waters and open waters. In addition, M-FDC has the following tasks: (1) obligations in relation to the Danish National Aquatic Monitoring and Assessment Programme 1998-2003, and (2) obligations as national focal point in relation to the European Environment Agency. Most of the activities within M-FDC are based on agreements laid down in the national monitoring programme. M-FDC also participates in the international collaboration on protection, monitoring and assessment of the marine environment in the Baltic Sea (HELCOM) and the Northeast Atlantic (OSPAR).

The monitoring programme is carried out in close collaboration with the Danish counties, and is described in NOVA-2003. *Programbeskrivelse for det nationale program for overvågning af vandmiljøet 1998-2003. - Redegørelse fra Miljøstyrelsen, 1/2000* ([http://ovs.dmu.dk/2NOVA\\_2003\\_ov./novaarkivet/NOVA-program-version4.doc](http://ovs.dmu.dk/2NOVA_2003_ov./novaarkivet/NOVA-program-version4.doc)). The description of the marine monitoring programme includes the following elements: technical-scientific background, strategies, parameters, frequencies, samples, location of stations, etc. All methods for sampling and analysis are described in the "Technical Guidelines", which are all in accordance with the methods agreed within HELCOM, OSPAR and ICES. The guidelines include description of quality control procedures.

Data formats, time tables for exchange of data and guidelines on reporting are described in "Paradigm on reporting" which is updated every year. The paradigm focuses on the annual reporting to be done by the Danish counties and M-FDC, respectively. The latter has been changed over the last 2-3 years. Currently, the annual nationwide assessment of the state of

the marine environment in Denmark consists of (i) how the past year deviates from a normal year, (ii) the temporal trends, including indexes adjusted for natural climatic variation by empirical models, (iii) 3-4 thematic articles on specific marine issues, (iv) improved understanding of marine systems, and (v) fulfilment of environmental objectives.

The Danish contributions to EEA, HELCOM and OSPAR assessments are based on the above mentioned annual nationwide assessments of the state of the marine environment.

M-FDC runs a web page on marine monitoring in Denmark and neighbouring countries (<http://m-fdc.dmu.dk>). Links to relevant partners and organisations and to relevant documents and publications can be found here.

## 7.1 National monitoring and advisory activities

MAR is responsible for

1. **the NOVA-2003 monitoring cruises** in open waters including nutrients, oxygen levels, benthic abundance on soft bottoms and stone reef vegetation. Reports from the monitoring cruises using the research vessel Gunnar Thorson during the period from 1995 to 2002 are presented on the Internet at the following address: [http://www.dmu.dk/1\\_om\\_dmu/2\\_afdelinger/3\\_hav/CruiseReports/index.htm](http://www.dmu.dk/1_om_dmu/2_afdelinger/3_hav/CruiseReports/index.htm). The reports represent an integrated part of the annual reporting to the Danish Parliament.
2. **routine oxygen deficit cruises. Oxygen reports** are presented in Danish only on the Internet at the following address: [http://www.dmu.dk/1\\_viden/2\\_Miljoe-tilstand/3\\_vand/4\\_iltsvind/default.asp](http://www.dmu.dk/1_viden/2_Miljoe-tilstand/3_vand/4_iltsvind/default.asp) (see *Enclosure 8* for a presentation of examples of reports for 2002). The frequency of these cruises and reports has changed over the years. During 2002, monthly cruises and reports were presented for August, September, October and November and detailed maps showing areas exposed to oxygen deficits were presented as well. In autumn 2002 MAR launched a new initiative for visualizing the extent of oxygen deficiency in Danish waters. A geostatistical interpolation method was applied to monitoring data, and an interactive map showing the areas affected by low oxygen concentrations was presented on the Internet ([http://www.dmu.dk/1\\_Viden/2\\_Miljoetilstand/3\\_vand/4\\_iltsvind/iltsvindskort.asp](http://www.dmu.dk/1_Viden/2_Miljoetilstand/3_vand/4_iltsvind/iltsvindskort.asp)). Six semi-monthly maps were produced. This initiative will be pursued in autumn 2003 as well.
3. **observations on occurrence, distribution and effects of excessive algal communities in Danish waters.** Reports on occurrence of excessive phytoplankton blooms in the Danish marine areas are presented at: [http://www.dmu.dk/1\\_om\\_dmu/2\\_afdelinger/3\\_hav/Alger/aktuelt.asp](http://www.dmu.dk/1_om_dmu/2_afdelinger/3_hav/Alger/aktuelt.asp). The reports are presented on the Internet during periods with excessive phytoplankton growth. The data for the reports include data from the counties, observations from MAR, satellite information and data and information from other countries. The objective is to present the status to the administrative authorities and the public. A forecast of the spatial distribution of cyanobacteria was presented in 2002 and broadcast by the Danish national TV.
4. **special cruises** to monitor effects of oxygen deficits on the bottom fauna. During 2002, a cruise was carried out during November in order to examine the effects of oxygen deficits on bottom fauna. The results will be published June 2003. During 2003, two cruises will be carried out to monitor the reestablishment of the bottom fauna. Reports on these activities will be presented on the Internet during 2004.
5. **annual reports** on the status of the Danish marine environment to the Danish Parliament which are published on 1 December every year, [http://www.dmu.dk/1\\_viden/2\\_Publikationer/3\\_fagrappporter/default.asp](http://www.dmu.dk/1_viden/2_Publikationer/3_fagrappporter/default.asp). The reports are in Danish with an English summary. The re-

ports include the results of the monitoring carried out by the Danish counties and by MAR. Data on nutrient loadings from various terrestrial sources are provided by the Department of Freshwater Ecology (NERI) and data on atmospheric nitrogen deposition are provided by the Department of Atmospheric Environment (NERI). A 3D-dynamic model was included in the monitoring programme NOVA-2003. The model has been in operation since 1998, but governmental financial reductions reduced the activities in 2002 and 2003. During the period 1998-2002, input to the model included on-line data from 5 buoys situated in the Danish waters. The Danish Institute DHI Water & Environment carried out the modelling activities for the NOVA programme. In addition to the 3D-modelling of the water and nutrient transport used in the NOVA-2003 programme, a more simple Swedish model has also been used (*Gustavson, B.G. 2000. Time-dependent modelling of the Baltic Entrance area. Part 1. Quantification of circulation and residence times in the Kattegat and the straits of the Baltic Sea. - Estuaries 23: 231-252*). A number of thematic issues have been published in the annual reports. In the report published in 2001, an analysis of oxygen dynamics in the Danish waters covering the period from 1975 to 2000 was presented. In the report published in 2002, a budget for the bioavailable nitrogen for the Danish waters was presented. Documentation of these issues is underway in the international literature (see *Enclosure 3* on scientific products in 2003). The budget for the bioavailable nitrogen is currently under preparation for an international journal. The information on the monitoring and status of the marine environment is integrated into a comprehensive report "The State of the Environment in Denmark, 2001" - NERI Technical Report No. 409 - published by the NERI Department of Policy Analysis (*Enclosure 5*).

The quality of the annual reports and other consultancy work is a key element to ensure that the consultancy work is of the highest possible quality and without political and/or economic interests. The quality is ensured by internal reviewers (scientists in MAR) and external reviewers (most often a university professor), and the reports are restricted to the department's research areas. There are no major scientific gaps between the consultancy work and MAR's research activities. The data quality, data handling and statistical quality are ensured by the individual scientists and by a MAR senior scientist having a PhD degree in statistics. The technical quality of the reports is ensured by an experienced technical person in the department in collaboration with a graphical workshop at NERI. The quality of the monitoring reports is also ensured through external reviewers from the counties. Specific issues on e.g. nutrient transport and modelling activities include data from other NERI departments and other countries and include collaborations and discussions with scientists from the countries surrounding Denmark.

- 6. Other advisory activities.** The advisory products from MAR are most directly communicated in the Danish annual reports to the Danish Parliament and in Danish publications and reports. The scientific staff in MAR meets regularly with the Danish Environmental Protection Agency and the Danish Forest and Nature Agency on issues related to the marine environment. MAR participates in the preparation of documents and reports on marine scientific issues for administrative and/or political authorities. This includes technical contributions to answers to questions from the Danish Parliament to the Minister of the Environment, meetings and presentations for the counties, agricultural organisations and other public bodies, public exhibitions, hearings in the Danish Parliament, and in the public media debate in newspapers, radio and television programs. MAR scientists have recently participated in committees initiated by the Parliament, e.g. the Wilhjelm Committee on a strategy for the Danish nature, the Hjortnæs Committee on environmental pressures and fishery resources, and the Hjortnæsudvalget on aquaculture.

A substantial part of the scientific staff participates in teaching activities at the Danish universities and also at international universities and research institutes. The teaching at Danish universities includes lectures, seminars, etc. It also includes work as associated lecturers or professors.

## 7.2 The National Marine Database – MADS

Data collected within the national marine monitoring program as well as data from regional monitoring programs and research projects are stored in the national database for marine data (MADS). It is a relational database consisting of numerous tables and parameter code lists linked in a structured design with constraints on unique natural primary keys, preventing ambiguity in the data. MADS is implemented on an Oracle Rdb platform running on the VMS operating system. All data are identified by their specific location and time of sampling. MADS has an overall structure common to all types of data and a variety of different data groups linked to these, including CTD data, hydrochemistry, primary production, plankton, benthic vegetation and fauna, sediment chemistry, contaminants, biotic effects as well as quality standards for laboratories conducting hydrochemistry measurements. A subset of MADS is publicly accessible on the Internet (<http://mads.dmu.dk>) that includes all national monitoring data either as raw measurements or aggregated values for more complex types of data such as plankton samples. A full description of the database structure is available in Danish and can be provided upon request.

## 7.3 Dissemination of scientific results

NERI has an obligation to disseminate results and knowledge to the public at large including the educational sector. Traditionally NERI has fulfilled this obligation by producing reports in Danish and by making special thematic reports on selected topics directly aimed at high schools or under-graduate levels. Recently, also Internet activities have been included.

### 7.3.1 Traditional products

The public dissemination of science includes a number of activities, e.g. newspaper articles, radio and television contributions, seminars, exhibitions and popular articles in national journals. A list of these activities can be provided upon request. More formal products include contributions to a thematic report series published by NERI. The thematic reports represent a more broad presentation in Danish of subjects designed for teaching at the senior school level. A list of the thematic reports from MAR is presented below and in *Enclosure 6*:

- 1999: Report no. 27. Giftige alger og algeopblomstringer, 64 pp.  
[Toxic algae and algal blooms]
- 1999: Report no. 28. Dyreplankton i danske farvande, 64 pp.  
[Zooplankton in Danish waters]
- 1999: Report no. 30. Bundmaling til skibe – et miljøproblem, 48 pp.  
[Antifouling paint for ships - an environmental problem]
- 2002: Report no. 42. Stofomsætning i havbunden, 62 pp.  
[Organic matter dynamics in marine sediments]

### 7.3.2 Internet activities

#### **Nature and Environment in Denmark on the Internet (<http://www.natur.dk>)**

Compared to publishing on the Internet, written reports or booklets have, however, some limitations even if PDF-files are made accessible on the web. By publishing directly on the Internet, you can use a variety of illustration tools ranging from pictures to animations, sound, video and on line cameras. Further the use of hypertext (links) allows for dynamic entrance to various aspects of different topics. Finally, the circulation number is limitless and the information can be updated regularly. The basic idea in [www.natur.dk](http://www.natur.dk) is to distribute information about Danish nature and environment through the Internet. The site is divided into different major biota: air, sea, land, etc. and within each biota there will be information on organisms and their habitats. A special section in each habitat is devoted to environ-

mental issues, where broader descriptions of emerging problems or general themes are collected as stories. The site was initiated in MAR, where the technical solution and the current pilot version of the site have been developed. In addition, the department has contributed with a number of major environmental stories on oxygen depletion, toxic algal blooms and antifouling agent in boat paint. Completion of the site, as originally intended, awaits additional external funding, which is currently being applied for.

#### **7.4 International advisory activities**

MAR participates in a number of international organisations, in working groups, and in writing of international status reports. MAR scientists participate in meetings and working groups in HELCOM (e.g. MONAS, Periodical assessment reports, New assessment procedures, Indicators, Background concentrations, Abnormal events), OSPAR (e.g. MON, SIME, ASMO, and EUC), The European Environment Agency, (ETC), Nordic Council of Ministers, (Working Group for the Atmosphere and Ocean), the Swedish Energy Agency, relevant working groups within ICES, and the European Commission (referees for scientific proposals).

A number of advisory reports and contributions to books are presented on statistics, monitoring programmes, assessment of habitats and species, general status on the aquatic environment, modelling phytoplankton dynamics, vegetation studies, Wadden Sea Quality Status, atmospheric loads of ammonia to the sea, and toxic phytoplankton blooms. A list of these contributions is provided in *Enclosure 1*.

As an example, MAR scientists contributed to several chapters in "Environment of the Baltic Sea Area 1994-1998" published in Baltic Sea Environment Proceedings No. 82B, pp. 215 by HELCOM in 2002. The chapters include 1) Kattegat and the Belt Sea, 2) Benthic vegetation, and 3) Zoobenthos.

MAR has recently produced an assessment on eutrophication in Danish marine waters in order to fulfil the Danish obligations in relation to the OSPAR Common Procedure (Ærtebjerg, Andersen & Hansen (Eds.): Nutrients and Eutrophication in Danish Marine Waters. A Challenge for Science and Management. Ministry of the Environment. Danish Environmental Protection Agency & National Environmental Research Institute. 128 p., 2003). For practical reasons, the assessment covers not only the OSPAR areas: the North Sea, the Skagerrak and the Kattegat, but all Danish marine waters, including the Sound and the Belt Sea, between the Kattegat and the Baltic Sea, as well as the western parts of the Baltic Sea. This is due to the fact that 1) the outflow from the Baltic Sea has a large influence on the Kattegat – Belt Sea ecosystems, and 2) the eutrophic state and development of the Kattegat and Belt Sea run in parallel and are interrelated. The assessment report describes and documents the effects and degree of nutrient enrichment and eutrophication status in all Danish marine waters with focus on the factors and parameters that cause, control or respond to eutrophication. Special attention is put on ecological status and temporal trends. The assessment is an extended summary of more than 13 years of monitoring and subsequent production of different assessment reports on the state of the marine environment within the framework of the Danish National Monitoring and Assessment Programme (1988-2003), see *Enclosure 4*.



## 8 Analysis of Danish National Environmental Research Institute Publications 1998-2002

A bibliographic analysis of NERI's international research activities during the period 1998 to 2002 is presented in *Enclosure 7*. The analysis includes also MAR's oxygen-depletion related publications for the period 1998-2003. The analysis employs three Journal Impact Factor (JIF) variables, which are defined on page 3 (*Enclosure 7*). A number of precautions have to be taken, when such data are evaluated. On the other hand, based on a number of assumptions, the results represent a quantitative measure of the quality of the science.

As an example of the results, the JIF values for the subject categories "Marine & Freshwater Biology", "Environmental Sciences", "Ecology", "Environmental Studies" range between 0.730 and 1.544 (*see page 19 and 20 in Enclosure 7*). The relative JIF is defined as the actual JIF divided by the average value of the JIF for each category. If the relative JIF value is greater than 1.0, then the journal is cited more frequently than the other journals in the same category. If it is less than 1.0, then it is cited less often. The relative JIF factor for MAR varied from 1.42 to 1.78 for the period 1998 to 2003 (*see page 23 in Enclosure 7*). In the same table, NERI's total values during the same period varied from 1.22 to 1.36. In the relative JIF values for 2003 (*see page 23 in Enclosure 7*) one Nature article published in 2003 (*see 3.12 in enclosure 3*) has been excluded from the calculations.

Roskilde, 7 April 2003

Bo Riemann

Director of Research Department

## Enclosure 1

### List of publications 1998 to 2002

	Page
<b>A — INTERNATIONAL SCIENTIFIC PUBLICATIONS (ENGLISH).....</b>	<b>2</b>
1998.....	2
1999.....	3
2000.....	4
2001.....	5
2002.....	6
<b>B — OTHER SCIENTIFIC PUBLICATIONS AND BOOK CHAPTERS (ENGLISH) .....</b>	<b>9</b>
1999.....	9
2000.....	9
2001.....	9
<b>C — CONSULTANCY REPORTS (ENGLISH) .....</b>	<b>11</b>
1998.....	11
1999.....	11
2000.....	12
2001.....	12
2002.....	13
<b>D — CONSULTANCY REPORTS (DANISH) .....</b>	<b>15</b>
1998.....	15
1999.....	15
2000.....	16
2001.....	17
2002.....	18
<b>E — CONSULTANCY ARTICLES AND BOOK CHAPTERS (ENGLISH)..</b>	<b>19</b>
1998.....	19
1999.....	19
2001.....	19
2002.....	20
<b>F — CONSULTANCY ARTICLES AND BOOK CHAPTERS (DANISH) ....</b>	<b>21</b>
1998.....	21
1999.....	21
2000.....	21
2001.....	21
2002.....	22
<b>G — POPULAR ARTICLES AND BOOK CHAPTERS (DANISH).....</b>	<b>23</b>
1998.....	23
1999.....	23

## A — International scientific publications (English)

1998

- A1. Baretta-Bekker, J.G., Baretta, J.W., Hansen, A.S. & Riemann, B. 1998: An Improved Model of Carbon and Nutrient Dynamics in the Microbial Food Web in Marine Enclosures. - *Aquatic Microbial Ecology* 14: 91-108.
- A2. Berg, P., Risgaard-Petersen, N. & Rysgaard, S. 1998: Interpretation of Measured Concentration Profiles in Sediment Pore Water. - *Limnology & Oceanography* 43(7): 1500-1510.
- A3. Buck, K.R., Nielsen, T.G., Hansen, B.W., Grastrup-Hansen, D. & Thomsen, H.A. 1998: Infiltration Phyto- and Protozooplankton Assemblages in the Annual Sea Ice of Disko Island, West Greenland, Spring 1996. - *Polar Biology* 20: 377-381.
- A4. Conley, D.J. 1998: An Interlaboratory Comparison for the Measurement of Biogenic Silica in Sediments. - *Marine Chemistry* 63: 39-48.
- A5. Gundersen, J.K., Ramsing, N.B. & Glud, R.N. 1998: Predicting the Signal of O<sub>2</sub> Microsensors from Physical Dimensions, Temperature, Salinity, and O<sub>2</sub> Concentration. - *Limnology & Oceanography* 43(8): 1932-1937.
- A6. Hansen, L.B., Finster, K., Fossing, H. & Iversen, N. 1998: Anaerobic Methane Oxidation in Sulfate Depleted Sediments. Effects of Sulfate and Molybdate Additions. - *Aquatic Microbial Ecology* 14: 195-204.
- A7. Josefson, A.B. 1998: Resource Limitation in Marine Soft Sediments - Differential Effects of Food and Space in the Association Between the Brittle-Star *Amphiura filiformis* and the Bivalve *Mysella bidentata*?. In: Baden, S., Pihl, L., Rosenberg, R., Strömberg, J.-O., Svane, I. & Tiselius, P. (eds.): *Recruitment, Colonization and Physical-Chemical Forcing in Marine Biological Systems*. Kluwer Academic Publishers. - *Hydrobiologia* 375/376: 297-305.
- A8. Kjørboe, T., Tiselius, P., Mitchell-Innes, B., Hansen, J.L.S., Visser, A.W. & Mari, X. 1998: Intensive Aggregate Formation with Low Vertical Flux During an Upwelling-Induced Diatom Bloom. - *Limnology and Oceanography* 43(1): 104-116.
- A9. Krause-Jensen, D. & Sand-Jensen, K. 1998: Light Attenuation and Photosynthesis of Aquatic Plant Communities. - *Limnology and Oceanography* 43(3): 396-407.
- A10. Markager, S. 1998: Dark Uptake of Inorganic <sup>14</sup>C in Oligotrophic Oceanic Waters. - *Journal of Plankton Research* 20(9): 1813-1836.
- A11. McGlathery, K.J., Risgaard-Petersen, N. & Christensen, P.B. 1998: Temporal and Spatial Variation in Nitrogen Fixation Activity in the Eelgrass *Zostera marina* Rhizosphere. - *Marine Ecology Progress Series* 168: 245-258.
- A12. Middelboe, A.L., Sand-Jensen, K. & Krause-Jensen, D. 1998: Patterns of Macroalgal Species Diversity in Danish Estuaries. - *Journal of Phycology* 34: 457-466.
- A13. Nielsen, T.G. & Munk, P. 1998: Zooplankton Diversity and the Predatory Impact by Larval and Small Juvenile Fish at the Fisher Banks in the North Sea. - *Journal of Plankton Research* 20(12): 2313-2332.
- A14. Richardson, K., Nielsen, T.G., Pedersen, F.B., Heilmann, J.P., Løkkegaard, B. & Kaas, H. 1998: Spatial Heterogeneity in the Structure of the Planktonic Food Web in the North Sea. - *Marine Ecology Progress Series* 168: 197-211.
- A15. Risgaard-Petersen, N., Dalsgaard, T., Rysgaard, S., Christensen, P.B., Borum, J., McGlathery, K. & Nielsen, L.P. 1998: Nitrogen Balance of Temperate Eelgrass *Zostera marina* Bed. - *Marine Ecology Progress Series* 174: 281-291.

- A16. Rysgaard, S., Thamdrup, B., Risgaard-Petersen, N., Fossing, H., Berg, P., Christensen, P.B. & Dalsgaard, T. 1998: Seasonal Carbon and Nutrient Mineralization in a High-Arctic Coastal Marine Sediment, Young Sound, Northeast Greenland. - *Marine Ecology Progress Series* 175: 261-276.
- A17. Vähätalo, A., Søndergard, M., Schlüter, L. & Markager, S. 1998: Impact of Solar Radiation on the Decomposition of Detrital Leaves of Eelgrass *Zostera marina*. - *Marine Ecology Progress Series* 170: 107-117.

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- A18. Gustavson, K., Petersen, S., Pedersen, B., Stuer-Lauridsen, F., Pedersen, S. & Wängberg, S.-Å. 1999: Pollution-Induced Community Tolerance (PICT) in Coastal Phytoplankton Communities Exposure to Copper. - *Hydrobiologia* 416: 125-138.
- A19. Hansen, B.W., Nielsen, T.G. & Levinsen, H. 1999: Plankton Community Structure and Carbon Cycling on the Western Coast of Greenland during the Stratified Summer Situation. III. Mesozooplankton. - *Aquatic Microbial Ecology* 16: 233-249.
- A20. Levinsen, H., Nielsen, T.G. & Hansen, B.W. 1999: Plankton Community Structure and Carbon Cycling on the Western Coast of Greenland during the Stratified Summer Situation. II. Heterotrophic Dinoflagellates and Ciliates. - *Aquatic Microbial Ecology* 16: 217-232.
- A21. Lundsgaard, C., Olesen, M., Reigstad, M. & Olli, K. 1999: Sources of Settling Material: Aggregation and Zooplankton Mediated Fluxes in the Gulf of Riga. - *Journal of Marine Systems* 23(1-3): 197-210.
- A22. Markager, S., Vincent, W.F. & Tang, E.P.Y. 1999: Carbon Fixation by Phytoplankton in High Arctic Lakes: Implications of Low Temperature for Photosynthesis. - *Limnology and Oceanography* 44(3): 597-607.
- A23. Møhlenberg, F. 1999: Effect of Meteorology and Nutrient Load on Oxygen Depletion in a Danish Micro-Tidal Estuary. - *Aquatic Ecology* 33: 55-64.
- A24. Nausch, G., Nehring, D. & Aertebjerg, G. 1999: Anthropogenic Nutrient Load of the Baltic Sea. In: Schiewer, U. & Paerl, H.W. (eds.): Sustainable Development in Coastal Regions - A Comparison between North Atlantic Coast and Baltic Sea. Proceedings of a WVU-Symposium, Rostock, Germany, April 15-20, 1996. Urban & Fischer. - *Limnologica* 29(3): 233-241.
- A25. Nielsen, T.G. & Hansen, B.W. 1999: Plankton Community Structure and Carbon Cycling on the Western Coast of Greenland during the Stratified Summer Situation. I. Hydrography, Phytoplankton and Bacterioplankton. - *Aquatic Microbial Ecology* 16: 205-216.
- A26. Olesen, M., Lundsgaard, C. & Andrushaitis, A. 1999: Influence of Nutrients and Mixing on the Primary Production and Community Respiration in the Gulf of Riga. - *Journal of Marine Systems* 23(1-3): 127-143.
- A27. Rysgaard, S., Nielsen, T.G. & Winding Hansen, B. 1999: Seasonal Variation in Nutrients, Pelagic Primary Production and Grazing in a High-Arctic Coastal Marine Ecosystem, Young Sound, Northeast Greenland. - *Marine Ecology Progress Series* 179: 13-25.
- A28. Sand-Jensen, K., Riis, T., Markager, S. & Vincent, W.F. 1999: Slow Growth and Decomposition of Mosses in Arctic Lakes. - *Canadian Journal of Fisheries and Aquatic Sciences* 56: 388-393.
- A29. Thingstad, T.F., Havskum, H., Kaas, H., Nielsen, T.G., Riemann, B., Lefevre, D. & Williams, P.J. le B. 1999: Bacteria-Protist Interactions and Organic Matter Degradation under P-Limited Conditions: Analysis of an Enclosure Experiment using a Simple Model. - *Limnology and Oceanography* 44(1): 62-79.
- A30. Tuomi, P., Lundsgaard, C., Ekebom, J., Olli, K. & Künnis, K. 1999: The Production and Potential Loss Mechanisms of Bacterial Biomass in the Southern Gulf of Riga. - *Journal of Marine Systems* 23(1-3): 185-196.

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- A31. Christensen, P.B., Rysgaard, S., Sloth, N.P., Dalsgaard, T. & Schwærter, S. 2000: Sediment Mineralization, Nutrient Fluxes, Denitrification and Dissimilatory Nitrate Reduction to Ammonium in an Estuarine Fjord with Sea Cage Trout Farms. - *Aquatic Microbial Ecology* 21(1): 73-84.
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- A33. Conley, D.J., Kaas, H., Møhlenberg, F., Rasmussen, B. & Windolf, J. 2000: Characteristics of Danish Estuaries. - *Estuaries* 23(6): 820-837.
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- A37. Hoffmann, C.C., Rysgaard, S. & Berg, P. 2000: Denitrification Rates Predicted by Nitrogen-15 Labeled Nitrate Microcosm Studies, In Situ Measurements, and Modeling. - *Journal of Environmental Quality* 29(6): 2020-2028.
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- A42. Levinsen, H., Turner, J.T., Nielsen, T.G. & Hansen, B.W. 2000: On the Trophic Coupling between Protists and Copepods in Arctic Marine Ecosystems. - *Marine Ecology Progress Series* 204: 65-77.
- A43. Lisbjerg, D. & Petersen, J.K. 2000: Clearance Capacity of *Electra bellula* (Bryozoa) in Seagrass Meadows of Western Australia. - *Journal of Experimental Marine Biology and Ecology* 244: 285-296.
- A44. Markager, S. & Vincent, W.F. 2000: Spectral Light Attenuation and the Absorption of UV and Blue Light in Natural Waters. - *Limnology and Oceanography* 45(3): 642-650.
- A45. Middelboe, A.L. & Sand-Jensen, K. 2000: Long-Term Changes in Macroalgal Communities in a Danish Estuary. - *Phycologia* 39(3): 245-257.
- A46. Møller, E.F. & Nielsen, T.G. 2000: Plankton Community Structure and Carbon Cycling off the Western Coast of Greenland, with Emphasis on Sources of DOM for the Bacterial Community. - *Aquatic Microbial Ecology* 22: 13-25.

- A47. Pesant, S., Legendre, L., Gosselin, M., Bjornsen, P.K., Fortier, L., Michaud, J. & Nielsen, T.G. 2000: Pathways of Carbon Cycling in Marine Surface Waters: the Fate of Small-Sized Phytoplankton in the Northeast Water Polynya. - *Journal of Plankton Research* 22(4): 779-801.
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- A49. Sejr, M.K., Jensen, T.K. & Rysgaard, S. 2000: Macrozoobenthic Community Structure in a High-Arctic East Greenland Fjord. - *Polar Biology* 23: 792-801.
- A50. Stedmon, C.A., Markager, S. & Kaas, H. 2000: Optical Properties and Signatures of Chromophoric Dissolved Organic Matter (CDOM) in Danish Coastal Waters. - *Estuarine, Coastal and Shelf Science* 51: 267-278.
- A51. Stæhr, P.A., Pedersen, M.F., Thomsen, M.S., Wernberg, T. & Krause-Jensen, D. 2000: Invasion of *Sargassum muticum* in Limfjorden (Denmark) and its Possible Impact on the Indigenous Macroalgal Community. - *Marine Ecology Progress Series* 207: 79-88.
- A52. Søndergaard, M., Borch, N.H. & Riemann, B. 2000: Dynamics of Biodegradable DOC Produced by Freshwater Plankton Communities. - *Aquatic Microbial Ecology* 23: 73-83.
- A53. Søndergaard, M., Williams, P.J. le B., Cauwet, G., Riemann, B., Robinson, C., Terzic, S., Woodward, E.M.S. & Worm, J. 2000: Net Accumulation and Flux of Dissolved Organic Carbon and Dissolved Organic Nitrogen in Marine Plankton Communities. - *Limnology and Oceanography* 45(5): 1097-1111.

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Available at: [http://www.dmu.dk/1\\_viden/2\\_Publikationer/3\\_fagrappporter/rapporter/FR391.pdf](http://www.dmu.dk/1_viden/2_Publikationer/3_fagrappporter/rapporter/FR391.pdf)
- D44. Nielsen, K., Krause-Jensen, D., Sømod, B. & Ellegaard, C. 2002: Metoder til at vurdere referencetilstanden i kystvande - eksempel fra Randers Fjord. Vandrammedirektiv - projekt, Fase II. Danmarks Miljøundersøgelser. - Faglig rapport fra DMU 390 (elektronisk): 43 s.  
Available at: [http://www.dmu.dk/1\\_viden/2\\_Publikationer/3\\_fagrappporter/rapporter/FR390.pdf](http://www.dmu.dk/1_viden/2_Publikationer/3_fagrappporter/rapporter/FR390.pdf)
- D45. Rasmussen, M.B. 2002: Vegetation i farvandet omkring Fyn 2001. Danmarks Miljøundersøgelser. - Faglig rapport fra DMU 413 (elektronisk): 140 s.  
Available at: [http://www.dmu.dk/1\\_viden/2\\_Publikationer/3\\_fagrappporter/rapporter/FR413.pdf](http://www.dmu.dk/1_viden/2_Publikationer/3_fagrappporter/rapporter/FR413.pdf)
- D46. Stæhr, P.A., Vang, T., Angantyr, L.A., Holm, I.H., Pedersen, V. & Boel, B. 2002: Interkalibrering af marine målemetoder 2002. Danmarks Miljøundersøgelser. - Faglig rapport fra DMU 425 (elektronisk): 88 s.  
Available at: [http://www.dmu.dk/1\\_viden/2\\_Publikationer/3\\_fagrappporter/rapporter/FR425.pdf](http://www.dmu.dk/1_viden/2_Publikationer/3_fagrappporter/rapporter/FR425.pdf)
- D47. Ærtebjerg, G., Andersen, J., Carstensen, J., Christiansen, T., Dahl, K., Dahllöf, I., Fossing, H., Greve, T.M., Hansen, J.L.S., Henriksen, P., Josefson, A., Krause-Jensen, D., Larsen, M.M., Markager, S., Nielsen, T.G., Pedersen, B., Petersen, J.K., Risgaard-Petersen, N., Rysgaard, S., Strand, J., Ovesen, N.B., Ellermann, T., Hertel, O. & Skjøth, C.A. 2002: Marine områder 2001 - Miljøtilstand og udvikling. NOVA-2003. Danmarks Miljøundersøgelser. - Faglig rapport fra DMU 419 (elektronisk): 94 s.  
Available at: [http://www.dmu.dk/1\\_viden/2\\_Publikationer/3\\_fagrappporter/rapporter/FR419.pdf](http://www.dmu.dk/1_viden/2_Publikationer/3_fagrappporter/rapporter/FR419.pdf)

## E — Consultancy articles and book chapters (English)

### 1998

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- E1. Carstensen, J. 1998: On the Application of the Kalman Filter for Smoothing and Trend Detection. Report of the Working Group on Statistical Aspects of Environmental Monitoring, Mont-Joli, Quebec, Canada, 30 March-3 April 1998. International Council for the Exploration of the Sea. - ICES CM 1998/E:8. : Annex 5, pp. 44-49.

### 1999

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- E2. De Jong, P.D., Dahl, K., Neudekker, T., Knust, R. & van Berkel, C.J.M. 1999: Selected Fish Species and Brown Shrimp. In: De Jong, F., Bakker, J., van Berkel, C., Dahl, K., Dankers, N., Gätje, C., Marencic, H. & Potel, P. (eds.): 1999 Wadden Sea Quality Status Report. Common Wadden Sea Secretariat, Trilateral Monitoring and Assessment Group & Quality Status Report Group. - Wadden Sea Ecosystem 9: 148-152.
- E3. Forbes, T.L. 1999: Understanding Small-Scale Processes Controlling the Bioavailability of Organic Contaminants to Deposit-Feeding Benthos. In: Gray, J.S., Ambrose Jr, W. & Szaniawska, A. (eds.): Biogeochemical Cycling and Sediment Ecology. Kluwer. - NATO Science Partnership Sub-Series 59: 125-136.
- E4. Geernaert, L.L.S., Pedersen, B. & Larsen, S.E. 1999: Atmospheric Load of Ammonia to Coastal Waters. In: Borrell, P.M. & Borrell, P. (eds.): Proceedings of EUROTRAC Symposium '98, Garmisch-Partenkirchen, Germany, 23rd-27th March 1998. Transport and Chemical Transformation in the Troposphere. Volume 2. WIT Press. pp. 327-330.
- E5. Horstmann, U., Lu, D., Göbel, J., Davidof, A., Dahl, E. & Kaas, H. 1998: Tracing a Toxic Algal Bloom of *Chattonella* around Southern Norway and West of Juetland, using MOS and SeaWiFS Satellite Data. In: Institute of Space Sensor Technology (ed.): 2nd International Workshop on MOS-IRS and Ocean Colour. Berlin: Wissenschaft und Technik Verlag. pp. 303-311.
- E6. Larsen, M.M., Pritzl, G., Jensen, J. & Bak, J.L. 1999: Monitoring of Heavy Metals in Denmark. Heavy Metals in the Environment and Electromigration Applied to Soil Remediation. 2nd Symposium. July 7-9th 1999. Technical University of Denmark. pp. 1-8.
- E7. Loke, E., Rauch, W., Carstensen, J. & Harremoes, P. 1999: A Methodology Overview for Water Quality Problems. In: Joliffe, I.B. & Ball, J.E. (eds.): Proceedings of the Eighth International Conference on Urban Storm Drainage. Sydney Hilton Hotel, Sydney, Australia, 30 August - 3 September 1999. Volume 2. Institution of Engineers, Australia. pp. 665-673.

### 2001

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- E8. Carstensen, J., Conley, D., Danielsson, Å., Rahm, L., Toompuu, A. & Müller-Karulis, B. 2001: STAMP - Statistical Analysis and Modelling of Phytoplankton Dynamics. Phase C Technical Report - Modelling Phytoplankton Dynamics on Reconstructed Data and Indicator Development. Nordisk Ministerråd. Nordiska Miljöovervaknings- och Datagruppern (NMD). - ANP 2001:715: 74 pp.
- E9. Carstensen, J., Conley, D., Danielsson, Å., Rahm, L., Toompuu, A. & Müller-Karulis, B. 2000: STAMP - Statistical Analysis and Modeling of Phytoplankton Dynamics. Phase B Technical Report - Spatial Heterogeneity and Temporal Reconstruction of Data for Phytoplankton Modelling. Nordisk Ministerråd. Nordiska Miljöovervaknings- och Datagruppern (NMD). - INS 2000:301: 66 pp.
- E10. Karlson, B., Håkansson, B. & Sjöberg, B. (eds.). With contributions from Foverskov, S., Hansen, O.S., Pedersen, B. & Ærtebjerg, G. 2001: The Skagerrak - Environmental State and Monitoring Prospects. Forum Skagerrak. 117 pp.

- E11. Lophaven, S., Carstensen, J. & Holst, H. 2001: Reconstruction of Data from the Action Plan on the Aquatic Environment. In: Jensen, N.-E. & Linde, P. (red.): Symposium i Anvendt Statistik, København, 22.-24. januar 2001. Økonomisk Institut og Danmarks Statistik. pp. 239-252.

## 2002

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- E12. Lophaven, S., Carstensen, J. & Rootzen, H. 2002: Methods for Estimating the Semivariogram. In: Høg, E. & Høst, V. (red.): Symposium i Anvendt Statistik, Århus, 21.-23. januar 2002. Handelshøjskolen i Århus. Institut for Informationsbehandling. pp. 128-144.
- E13. Ærtebjerg, G. & Dave, G. (Eds.) 2002: Kattegat and the Belt Sea. In: Niilonen, T. (ed.): Environment of the Baltic Sea Area 1994-1998. Helsinki Commission. - Baltic Sea Environment Proceedings 82 B: 99-116.

## F — Consultancy articles and book chapters (Danish)

### 1998

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- F1. Larsen, M.M., Langtofte, C. & Bak, J. 1998: Tungmetaller i jord og vand. - Vand & Jord 5(1): 10-15.
- F2. Rasmussen, B. 1998: Koncentrationen af uorganisk næringsssalte som funktion af salinitet. Åbne farvande langs Vestkysten. Vandmiljøovervågning. Nordjyllands Amt, Viborg Amt, Ringkjøbing Amt & Ribe Amt. Appendiks s. 123-131.
- F3. Sandbeck, P. 1998: Datakataloger over miljødata. - Vand & Jord 5(3): 97-98.

### 1999

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- F4. Petersen, J.K. 1999: Overvågning af fauna og vegetation på hårde bunde. I: Støttrup, J.G. (red.): Kortlægning af stenrev, stenfiskeri og fiskeri på hårbund samt metoder til videnskabelige undersøgelser af rev og hårbund. Danmarks Fiskeriundersøgelser. - DFU-rapport 63-99: 39-47.

### 2000

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- F5. Dalsgaard, T., Christensen, P.B., Rysgaard, S. & Risgaard-Petersen, N. 1999: Kvælstoffjernelse i danske kystnære farvande. Betydning og regulering. I: Lomstein, B. Aa. (ed.): Havmiljøet ved årtusindskiftet. Fredensborg: Olsen & Olsen. 102-118.
- F6. Henriksen, P., Utkilen, H. & Gjølme, N. 2000: Blågrønalg toksiner i drikkevand - intracellulære levertoksiner frigives kun delvist ved nedfrysning af vandprøver. - Vatten 56: 111-113.
- F7. Krause-Jensen, D., Christensen, P.B., Middelboe, A.L. & Sand-Jensen, K. 2000: Store datasæt giver ny viden om ålegræs.. - Vand & Jord 7(3): 114-119.
- F8. Larsen, M.M. 2000: Frigivelse af kobber fra bundmalinger skal begrænses. - Ny Viden fra Miljøstyrelsen 2(2): 39-42.
- F9. Riemann, B. & Havskum, H. 1999: Den økologiske betydning af mixotrofe flagellater i kystnære marine områder. I: Lomstein, B. Aa. (red.): Havmiljøet ved årtusindskiftet. Fredensborg: Olsen & Olsen. 119-130.
- F10. Riemann, B., Markager, S. & Carstensen, J. 2000: Overvågning af vandmiljøet i Danmark - det kan gøres bedre. - Vand & Jord 7(4): 122-124.
- F11. Riemann, B. 2000: Bioteknologi i landbruget. - Miljøforskning 43: 6-7.

### 2001

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- F12. Andersen, J., Munk, L.M. & Pedersen, S. 2001: Vandrammedirektivet, indhold og perspektiver (1). - Vand & Jord 8(1): 17-21.
- F13. Fossing, H. 2001: Betydningen af iltforbruget i fjordbunden og vandsøjlen for iltvind i bundvandet på Mariager Fjords lavvandede områder. Rapport til Nordjyllands Amt og Århus Amt. Danmarks Miljøundersøgelser. 8 s.
- F14. Le Thi, T.D., Madsen, H., Rasmussen, B. & Sømod, B. 2001: Modellering og analyse af kvælstof i Randers Fjord. Danmarks Tekniske Universitet. Institut for Informatik og Matematisk Modellering. - Technical Report IMM-REP-2001-1: 61 s.

- F15. Markager, S. 2001: Miljøovervågning og forskning - to sider af samme sag. - Vand & Jord 8(2): 76-78.
- F16. Sand-Jensen, K., Middelboe, A.L., Krause-Jensen, D., Christensen, P.B. & Nielsen, K. 2001: Isefjordens makroalger under krigen og idag. - Vand & Jord 8(1): 36-39.

## 2002

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- F17. Christensen, P.B. 2002: Fiskenes rolle i økosystemet. Kystnære områder som opvækstplads for fiskeyngel: Betydning af eutrofiering og vegetationsforhold. Slutrapport. Direktoratet for FødevareErhverv. Forskningskontoret. 25 s.
- F18. Dalsgaard, T. 2002: Marine områder. I: Refsgaard, J.C., Henriksen, H.J., Nilsson, B., Rasmussen, P., Kronvang, B., Skriver, J., Jensen, J.P., Dalsgaard, T., Søndergaard, M. & Hoffmann, C.C.: Vidensstatus for sammenhængen mellem tilstanden i grundvand og overfladevand. Miljøstyrelsen. - Arbejdsrapport fra Miljøstyrelsen 21: Bilag A (5 s.) (elektronisk).  
Available at: [http://www.geus.dk/program-areas/water/denmark/rapporter/grundv\\_overfladev\\_2002\\_marine\\_omraader.pdf](http://www.geus.dk/program-areas/water/denmark/rapporter/grundv_overfladev_2002_marine_omraader.pdf)
- F19. Dolmer, P., Dahl, K., Frederiksen, S., Berggren, U., Prüssing, S. Støttrup, J. & Lundgren, B. 2002: Udvalget om Miljøpåvirkninger og fiskeriressourcer. Delrapport vedr. habitatpåvirkninger. Danmarks Fiskeriundersøgelser. - DFU-Rapport 112-02 (elektronisk): 56 s.  
Available at: [http://www.dfu.min.dk/dk/publikationer\\_fr.htm](http://www.dfu.min.dk/dk/publikationer_fr.htm)
- F20. Hansen, O.S. & Henriksen, P. 2002: Blågrøn alger i badevand. Et litteraturstudie af allergiske reaktioner ved kontakt med blågrøn alger. Miljøstyrelsen. - Miljøprojekt 721 (elektronisk): 32 s.  
Available at: <http://www.mst.dk/default.asp?Sub=http://www.mst.dk/udgiv/publikationer/2002/87-7972-264-4/html/>
- F21. Markager, S. 2002: Danmarks andel. - Jord og Viden 23: 12-14.
- F22. Markager, S., Hansen, A.S., Broch, K., Ellegaard, C., Fossing, H., Hansen, L.E., Larsen, J.E., Petersen, J.K. & Sørensen, H.M. 2002: Empirisk modellering af Mariager Fjord. - Vand & Jord 4: 110-114.
- F23. Møllergaard, S., Pedersen, B., Forbes, V., Fabech, B. & Aagaard, A. 2002: Udvalget om Miljøpåvirkninger og fiskeriressourcer. Delrapport vedr. miljøfremmede stoffer. Danmarks Fiskeriundersøgelser. - DFU-Rapport 111-02 (elektronisk): 58 s.  
Available at: [http://www.dfu.min.dk/dk/publikationer\\_fr.htm](http://www.dfu.min.dk/dk/publikationer_fr.htm)

## **G — Popular articles and book chapters (Danish)**

### **1998**

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- G1. Kaas, H. 1998: Algeopblomstringer, skadelige alger og giftige alger. - Faktuelt 12: 1-6.  
Available at: <http://www.mem.dk/faktuelt/fak12.htm>
- G2. Markager, S., Conley, D., Hertel, O. & Skov, H. 1998: Sådan påvirker luftbåren kvælstof havet. - Ingeniøren 31: 4.

### **1999**

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- G3. Dahl, K. 1999: Stenrevne - havbundens biologiske skatkammer. - Miljø- og vandpleje 23: 2-5.
- G4. Petersen, J.K. 1999: Kan naturen begrænse næringstilførslen i danske fjorde?. - Ny Viden fra Miljøstyrelsen 4: 79-82.
- G5. Petersen, J.K. 1999: Kunstige rev - formål og anvendelse. - Miljø- og vandpleje 23: 12-14.



## Enclosure 2

### List of EU contracts covering 2002

1. Contract No. EVK1-CT-1999-00034  
Composition of dissolved organic matter and its interaction with metals and ultraviolet radiation in river-ocean systems: impact on the microbial food web (COMET)  
2000 - 2003
2. Contract No. EVK2-2001-00006  
Origin and Fate of biogenic particle fluxes in the Ocean and their Interaction with the atmospheric CO<sub>2</sub> concentration as well as the marine sediment (ORFOIS)  
2001 - 2004
3. Contract No. MAS3-CT98-0178  
Assessment of antifouling agents in coastal environments (ACE)  
1999 - 2002
4. Contract No. EVK3-CT-1999-00014  
Marine Effects of Atmospheric Deposition (MEAD)  
2000 - 2003
5. Contract No. EVK3-CT-2000-00034  
Dissolved organic matter (DOM) in coastal ecosystems: transport, dynamics and environmental impact (DOMAINE)  
2001 - 2003
6. Contract No. EVK3-CT-2000-00031  
Monitoring long-term trends in eutrophication and nutrients in the coastal zone:  
Creation of guidelines for the evaluation of background conditions, anthropogenic influence and recovery (MOLTEN)  
2001 - 2004
7. Contract No. FAIR CT98 4201  
Effects of Shellfish Culture and Options for Sustainable Exploitation (ESSENSE)  
1999 - 2002
8. Contract No. EVK3-CT-2001-00065  
Characterisation of the Baltic Sea Ecosystem: Dynamics and Function of Coastal Types (CHARM)  
2001 - 2004
9. Contract No. EVK3-CT-2001-00049  
Detection and Analysis of Nutrient Limitation: Impacts of Loading on Coastal Plankton Communities across a Hierarchy of Temporal and Physiological-Systemic Scales (DANLIM)  
2002 - 2004
10. Contract No. HPMT-CT-2001-00265  
Center for Research and Monitoring of the Marine Environment (CREAM)  
2002
11. Contract No. EVK3-CT-2002-00071  
Managing Benthic Ecosystems in Relation to Physical Forcing and Environmental Constraints (MaBenE)  
2002 - 2005
12. Contract No. EVR1-CT-2002-40029  
Creating a long term infrastructure for Marine Biodiversity research in the European economic area and the Newly Associated states (Marbena)  
2002

13. Contract No. Q5RS-2001-02456  
Effects of nutrient release from Mediterranean fish farms on benthic vegetation in coastal ecosystems (MedVeg)  
2001 - 2004
14. Contract No. EVK3-CT-2000-00044  
Managing and Monitoring of European Seagrass Beds (M&MS)  
2001 - 2003
15. Contract No. EVK3-CT-2002-00080  
METHane fluxes in ocean margin sediments: microbiological and geochemical control. (METROL)  
2002 - 2005

## Enclosure 3

### List of publications in 2003 of relevance to oxygen deficiency and eutrophication

#### International publications, published or in press

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- 3.1. Hansen, J.L.S. & Josefson, A. 2003: Accumulation of algal pigments and live planktonic diatoms in aphotic sediments during the spring bloom in the transition zone of the North and Baltic Seas. - *Marine Ecology Progress Series* 248: 41-54.
- 3.2. Rasmussen, B. & Gustafsson, B.G. 2003: Computation of nutrient pools and fluxes at the entrance to the Baltic Sea, 1974-1999. - *Continental Shelf Research* 23: 483-500.
- 3.3. Brotas, V., Risgaard-Petersen, N., Serodio, J., Ottosen, L., Dalsgaard, T. & Ribeiro, L. 2003: In situ measurements of photosynthetic activity and respiration of intertidal benthic microalgal communities undergoing vertical migration. - *Ophelia* 57. *In press*.
- 3.4. Rasmussen, B., Gustafsson, B.G., Stockenberg, A. & Ærtebjerg, G. 2003: Nutrient loads, advection and turnover at the entrance to the Baltic Sea. - *Journal of Marine Systems* 39: 43-46.
- 3.5. Rasmussen, B., Gustafsson, B.G., Ærtebjerg, G. & Lundsgaard, C. 2003: Oxygen concentration and consumption at the entrance to the Baltic Sea from 1975 to 2000. - *Journal of Marine Systems*. *In press*.
- 3.6. Christensen, P.B., Glud, R.N., Dalsgaard, T. & Gillespie, P. 2003: Impact of longline mussel farming on oxygen and nitrogen dynamics and biological communities of coastal sediments. - *Aquaculture* 218: 567-588.
- 3.7. Risgaard-Petersen, N. 2003: Coupled nitrification-denitrification in autotrophic and heterotrophic estuarine sediments: On the influence of benthic microalgae. - *Limnology and Oceanography* 48: 93-105.
- 3.8. Greve, T., Borum, J. & Pedersen, O. 2003: Meristematic oxygen variability in eelgrass (*Zostera marina*). - *Limnology and Oceanography* 48: 210-216.
- 3.9. Clarke, A., Juggins, S., & Conley, D. J. 2003: A 150-year reconstruction of the history of coastal eutrophication in Roskilde Fjord, Denmark. - *Marine Pollution Bulletin*. *In press*.
- 3.10. Danielsson, Å., Rahm, L., Conley, D.J. & Carstensen, J.C. 2003. Identification of characteristic regions and representative stations: a study of water quality variables in the Kattegat. *Environ. Monitor*. *In press*.
- 3.11. Carstensen, J., D. J. Conley, and B. Müller-Karulis. 2003: Spatial and temporal resolution of carbon fluxes in a shallow coastal ecosystem, the Kattegat. - *Marine Ecology Progress Series*. *In press*.
- 3.12. Dalsgaard, T., Canfield, D.E., Petersen, J., Thamdrup, B. & Acuna-Gonzales, J. 2003: N<sub>2</sub> production by anamox in the anoxic water column of Golfo Dulce, Costa Rica. - *Nature*. *In press*.
- 3.13. Jensen, M.M., Thamdrup, B., Rysgaard, S., Holmer, M. & Fossing, H. 2003: Rates and regulation of microbial iron reduction in sediments of the Baltic-North Sea transition. - *Biogeochemistry*. *In press*.
- 3.14. Rysgaard, S., Vang, T., Stjernholm, M., Rasmussen, B., Windelin, A. & Kiilsholm, S. 2003: Physical conditions, carbon transport and climate change impacts in a NE Greenland fjord. - *Arctic, Antarctic and Alpine Research*. *In press*.
- 3.15. Krause-Jensen, D., Pedersen, M.F. & Jensen, C. 2003: Regulation of eelgrass *Zostera marina* cover along depth gradients in Danish coastal waters. - *Estuaries*. *In press*.
- 3.16. Boström, C., Baden, S.P. & Krause-Jensen, D. 2003: The Seagrasses of Scandinavia and the Baltic Sea. - In: Green, E.P., Short, F.T. & Spalding, M.D. (Eds.); *World Atlas of Seagrasses: Present status and future conservation*. *In press*.
- 3.17. Middelboe, A.L., Sand-Jensen, K., & Krause-Jensen, D. 2003: Spatial and interannual variations with depth in eelgrass populations. - *Journal of Experimental Marine Biology and Ecology*. *In press*.

- 3.18. Nielsen, K., Sømod, B., Ellegaard, C. & Krause-Jensen, D. 2003: Assessing reference conditions according to the European Water Framework Directive - an example from Randers Fjord, Denmark. - *Ambio. In press.*
- 3.19. Pinhassi, J., Winding, A., Binnerup, S.J., Zweifel, U.L., Riemann, B. & Hagström, Å. 2003: Spatial variability in bacterioplankton community composition at the Skagerrak-Kattegat front. - *Marine Ecology Progress Series. In press.*
- 3.20. Stedmon, C.A. & Markager, S. 2003: Behaviour of the optical properties of coloured dissolved Organic Matter (CDOM) under conservative mixing. - *Estuarine Coastal and Shelf Science. In press.*
- 3.21. Tiselius, P., Petersen, J.K., Nielsen, T.G., Maar, M., Møller, E.F., Satapoomin, S., Tönnesson, K., Zervoudaki, T., Christou, E., Giannakourou, A., Sell, A. & Vargas, C. 2003: Functional response of *Oikopleura dioica* to house clogging due to exposure to algae of different sizes. - *Marine Biology* 142: 253-261.
- 3.22. Hansen, A.S., Nielsen, T.G., Levinsen, H., Madsen, S., Thingstad, T.F. & Hansen, B.W. 2003: Impact of changing ice cover on pelagic productivity and food web structure in Disko Bay, West Greenland: a dynamic model approach. - *Deep-Sea Research* 50(I): 171-187.
- 3.23. Maar, M., Nielsen, T.G., Stips, A. & Visser, A.W. 2003: Microscale distribution of zooplankton in relation to turbulent diffusion. - *Limnology and Oceanography. In press.*
- 3.24. Munk, P., Hansen, B.W., Nielsen, T.G. & Thomsen, H.A. 2003: Distribution of plankton and fish larvae communities across hydrographic fronts of West Greenland. - *Journal of Plankton Research. In press.*

#### **National publications, published or in press**

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- 3.25. Christensen, P.B. 2003: Hyppige iltsvind vælter havmiljøet. - *Geografisk Orientering* 1: 28-33.
- 3.26. Dahl, K. et al. 2003: Stenrev – havets oaser. Gads Forlag. - Temahæfte fra DMU, 84 p. *Expected publication in May 2003.*
- 3.27. Ærtebjerg, G. et al. 2003: Iltsvind. Gads Forlag. - Temahæfte fra DMU. *Expected publication in August 2003.*
- 3.28. Lomstein, B.Å., Riemann, B. & Andersen, P. 2003: Havet og samfundet. - *Miljøforskning* 54: 24-28.

## **Enclosure 4**

**Copy of "Nutrients and Eutrophication in Danish Marine Waters"  
by Gunni Ærtebjerg, Jesper H. Andersen & Ole S. Hansen (Eds.)**

Available on NERI's homepage: [http://www.dmu.dk/1\\_viden/2\\_Publikationer/3\\_Ovrige/rapporter/ospar.asp](http://www.dmu.dk/1_viden/2_Publikationer/3_Ovrige/rapporter/ospar.asp)

## **Enclosure 5**

### **Copy of "The State of the Environment in Denmark, 2001 " NERI Technical Report No. 409**

Available on NERI's homepage:

[http://www.dmu.dk/1\\_viden/2\\_Miljoe-tilstand/3\\_samfund/tilstandsrapport\\_2001\\_eng/default.asp](http://www.dmu.dk/1_viden/2_Miljoe-tilstand/3_samfund/tilstandsrapport_2001_eng/default.asp)

## Enclosure 6

### Summary of Danish thematic reports

- 27/1999      Gifte alger og algeopblomstringer  
[Toxic algae and algal blooms]  
Available on NERI's homepage:  
[http://www.dmu.dk/1\\_viden/2\\_Publikationer/3\\_temarapporter/rapporter/87-7772-476-3.pdf](http://www.dmu.dk/1_viden/2_Publikationer/3_temarapporter/rapporter/87-7772-476-3.pdf)
- 28/1999      Dyreplankton i danske farvande  
[Zooplankton in Danish waters]  
Available on NERI's homepage:  
[http://www.dmu.dk/1\\_viden/2\\_Publikationer/3\\_temarapporter/rapporter/87-7772-469-0.pdf](http://www.dmu.dk/1_viden/2_Publikationer/3_temarapporter/rapporter/87-7772-469-0.pdf)
- 30/1999      Bundmaling til skibe - et miljøproblem  
[Antifouling paint for ships - an environmental problem]  
Available on NERI's homepage:  
[http://www.dmu.dk/1\\_viden/2\\_Publikationer/3\\_temarapporter/rapporter/87-7772-502-6.pdf](http://www.dmu.dk/1_viden/2_Publikationer/3_temarapporter/rapporter/87-7772-502-6.pdf)
- 42/2002      Stofomsætning i havbunden  
[Organic matter dynamics in marine sediments]  
Available on NERI's homepage (3 files):  
[http://www.dmu.dk/1\\_viden/2\\_Publikationer/3\\_temarapporter/rapporter/tema42\\_01-19.pdf](http://www.dmu.dk/1_viden/2_Publikationer/3_temarapporter/rapporter/tema42_01-19.pdf)  
[http://www.dmu.dk/1\\_viden/2\\_Publikationer/3\\_temarapporter/rapporter/tema42\\_19-37.pdf](http://www.dmu.dk/1_viden/2_Publikationer/3_temarapporter/rapporter/tema42_19-37.pdf)  
[http://www.dmu.dk/1\\_viden/2\\_Publikationer/3\\_temarapporter/rapporter/tema42\\_37-62.pdf](http://www.dmu.dk/1_viden/2_Publikationer/3_temarapporter/rapporter/tema42_37-62.pdf)

## **Enclosure 7**

### **Bibliographic analysis of publications**



Please note that this is a translation of a document originally written in Danish. The translation was made by a bureau and subsequently read by the original author.

## Analysis of Danish National Environmental Research Institute Publications 1998–2002

This report presents an analysis of publications under the category *international scientific publications* published by the National Environmental Research Institute in Denmark in 1998-2002. It also includes selected results from previous surveys of publications by the Danish National Environmental Research Institute (NERI).

Objective of analysis .....	1
Method of analysis .....	2
Results of analysis .....	4
Appendix A – NERI publications by department, 1998–2002.....	9
Appendix B – JCR journals , ranked by relative JIF .....	11
Appendix C – JCR journals , ranked alphabetically .....	15
Appendix D – JCR subject category categories .....	19
Appendix E – Journals not found in the JCR 2000.....	21
Appendix F – Publications on oxygen-depletion related subjects, 1998–2003 .....	23

### Objective of analysis

The objective of this analysis of publications is to compile a presentation using tables and figures which show the trends in the pattern of publications by the Danish National Environmental Research Institute (NERI). The analysis covers articles, proceedings, books, and other publications within the category *international scientific publications* during the period 1998-2002 and includes selected results from previous surveys of NERI's publications.

The analysis builds on two earlier analyses that were compiled for the periods 1989-1998 and 1998-2001, thereby updating the tables and figures with the results for 2002. The tables for the period 1998-2002 have been compiled according to NERI's new departmental structure.

The analysis includes the following:

- Numerical and typological evaluation of NERI's publications for 1989-2002 in the category *international scientific publications*.
- Determination of the extent of JCR coverage for 1989-2002, i.e. the number of articles that are published in journals indexed in *Journal Citation Reports* by the Institute for Scientific Information.
- Evaluation of the Journal Impact Factor (JIF) for JCR journals used and their relative JIF values in relation to the subject categories of the journals.
- Evaluation of the journals used which are not indexed in the JCR.
- Evaluation of developments in the relative JIF values.
- A separate evaluation of publications on subjects related to oxygen-depletion, evaluated across departments for the period 1998-2003.

## Method of analysis

The analysis was carried out in March 2003 by librarian Rasmus Bruun at the request of Head of Public Relations and Information Jens C. Pedersen, NERI.

The section of the analysis covering the period 1998-2002 is based on publication lists of NERI's publications in the category *international scientific publications* taken from NERI's publication database. The publications are grouped according to NERI's new departmental structure. A separate evaluation was made of publications relating to oxygen-depletion, compiled across departments for the period 1998-2003. The categorisation used in the analysis was chosen by staff at NERI. The analysis of publications in 2003 was based on a foregoing evaluation of publications in that year. For the period 1989-1997 information from the original analysis was used in compiling this report.

The journal titles were taken from publication lists and then searched for in the *Journal Citation Reports 2000 (JCR-Web at www.isinet.com)*, initially in the *Science Edition* and the remaining titles in the *Social Sciences Edition*. Any remaining journals were searched for manually in *Ulrich's Periodical Directory (www.ulrichsweb.com)* and in NERI's online publication database. Following this procedure they were grouped according to different categories.

Five journals were found in the JCR 2000 Social Sciences Edition:

- American Behavioral Scientist
- Energy Economics
- Environmental & Resource Economics
- Sociologia Ruralis
- Transportation Research Part D-Transport and Environment

Publications in the analysis were divided into three groups:

*JCR articles*

This group includes articles published in journals that were found in the Journal Citation Reports 2000.

*Non-JCR articles*

This group contains articles published in journals that were *not* found in the Journal Citation Reports 2000.

*Proceedings, books, etc.*

This group contains proceedings, books, book contributions, and other publication types. Proceedings that were published either in an individual number of an ordinary journal, or in a publication that is indexed in Journal Citation Reports, were placed in one of the two groups above.

The Journal Impact Factor (JIF) is a quantitative measure of the prominence a journal has for a publication, measured by the number of citations of articles that a journal receives. The JIF is an expression of the number of citations an article can on average be expected to receive in a given year.

The analysis employs three Journal Impact Factor variables:

*JIF – Journal*

This is the actual Journal Impact Factor, determined by counting the number of citations in a given year made to articles published in a journal during the two previous years. This figure is then divided by the number of articles published in the journal during the same two previous years.

*JIF – Category*

The JCR journals all belong to one or more of four different subject categories. In order to assess whether the JIF value of a journal is higher than or lower than the values of the other journals in the same categories it was necessary to employ a method of normalisation. An average value for the categories utilised was used for this purpose (see Appendix D).

*JIF – Relative*

This is the actual JIF divided by the average value of the JIF for each category. If the relative JIF value is greater than 1.0 then the journal is used more frequently than the other journals in the same categories. If it is less than 1.0 then it is used less often.

The three JIF variables of the JCR journals used are given according to ranking in terms of

relative JIF in Appendix B. This also shows how many articles were published in each journal during the period 1998-2002. The same list has been compiled alphabetically in Appendix C.

The data gathered in the analysis was processed using Microsoft Excel and Microsoft Access, as well as other programs.

## Results of analysis

Table 1 shows how all of the publications evaluated for the years 1989-2002 fall into three types of documents. The groupings are given in terms of both number and percentage. Figure 1 is a diagrammatic version of Table 1. Appendix A contains an evaluation of the period 1998-2002, shown according to department. Appendix F contains the corresponding information for the oxygen-depletion related publications.

Table 2 shows the extent of JCR coverage. This illustrates, for the period 1998-2002 for example, the number of articles published in journals that were found in the Journal Citation Reports 2000 – Science Edition/Social Sciences Edition, or for the period 1989-1997, the number of articles that the data in the original analysis indicate are JCR journals. The journals from the first period mentioned that were not found in the JCR 2000 are shown in Appendix E. The JCR journals for this period are shown in Appendices B and C.

Table 3 shows developments in the relative JIF for the period 1989-2002, the standard deviation of JIF values, and the Standard Error of Mean (SEM, i.e. the standard deviation normalised using the number of articles). A diagrammatic form of the development, including the standard deviation expressed as SEM, is shown in Figure 2. Excluded from the evaluations were six articles from *Nature* and two articles from *Science* because their JIF values are significantly greater than the other journals. Articles published in journals with a JIF=0 were also excluded.

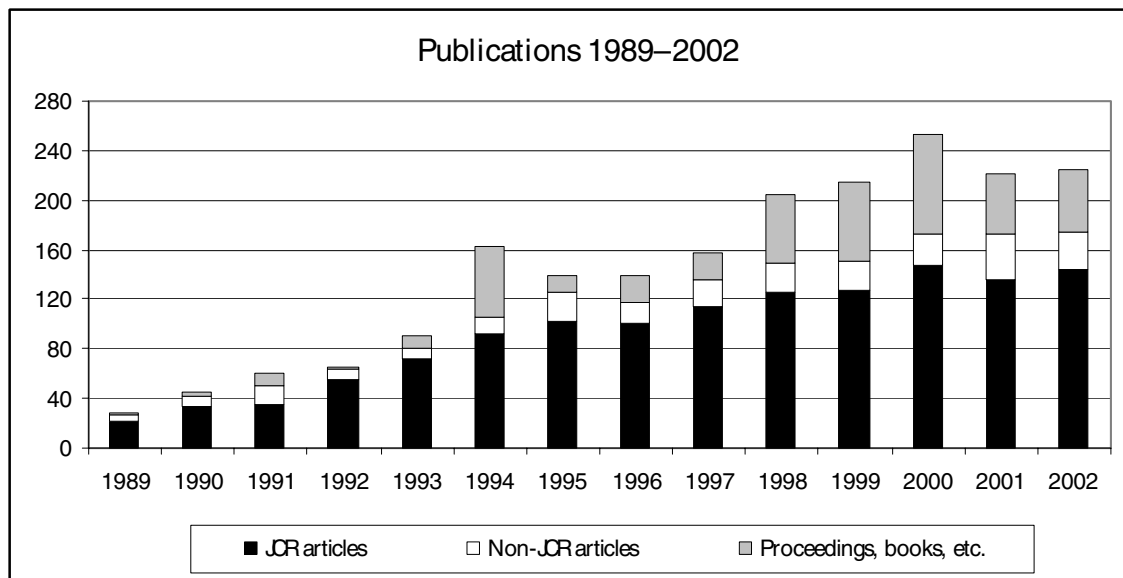
Table 4 shows the developments in the relative JIF for the period 1998-2002 for all NERI departments. Three articles from *Nature* and two from *Science* were omitted in the evaluation because these have JIF values that are significantly higher than the other journals. Articles published in journals with a JIF=0 were also omitted. Appendix F contains the corresponding information for the oxygen-depletion related publications.

**Table 1.** NERI publications 1989–2002 in the category international scientific publications grouped after document type and shown by number and percentage. Source: JCR-Web, publication lists for the period 1998–2002 and data from the original analysis of the period 1989–1998.

Year	JCR articles	Non-JCR articles	Proceedings, books, etc.	Total	JCR articles	Non-JCR articles	Proceedings, books, etc.
2002	145	30	49	224	64.7%	13.4%	21.9%
2001	135	37	50	222	60.8%	16.7%	22.5%

2000	147	25	82	254	57.9%	9.8%	32.3%
1999	127	24	63	214	59.3%	11.2%	29.4%
1998	126	24	54	204	61.8%	11.8%	26.5%
1997	114	22	21	157	72.6%	14.0%	13.4%
1996	100	18	22	140	71.4%	12.9%	15.7%
1995	103	22	15	140	73.6%	15.7%	10.7%
1994	92	14	57	163	56.4%	8.6%	35.0%
1993	72	9	9	90	80.0%	10.0%	10.0%
1992	55	9	1	65	84.6%	13.8%	1.5%
1991	36	14	11	61	59.0%	23.0%	18.0%
1990	33	9	4	46	71.7%	19.6%	8.7%
1989	21	6	1	28	75.0%	21.4%	3.6%

**Figure 1.** NERI publications 1989–2002 in the category international scientific publications grouped by document type. Source: JCR-Web, publication lists for the period 1998–2002 and data from the original analysis of the period 1989–1998.

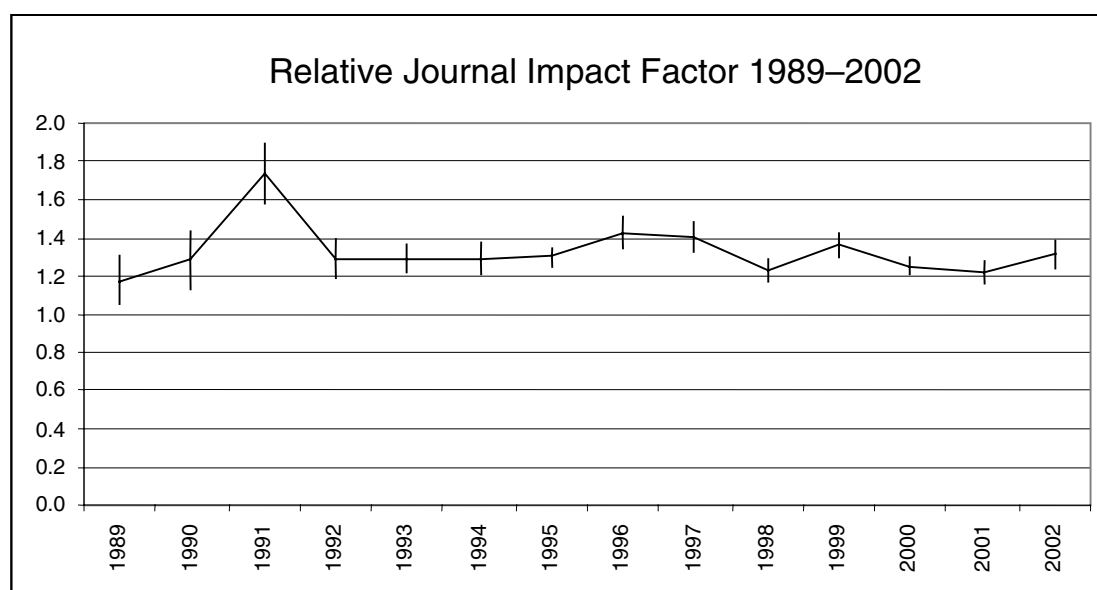


**Table 2.** Extent of JCR coverage, i.e. the number of articles published in journals that were found in the Journal Citation Reports 2000 – Science Edition/Social Sciences Edition. Source: JCR-Web, publication lists for the period 1998–2002 and data from the original analysis of the period 1989–1998.

Year	JCR articles	Non-JCR articles	Total	JCR articles	Non-JCR articles
2002	145	30	175	82.9%	17.1%
2001	135	37	172	78.5%	21.5%
2000	147	25	172	85.5%	14.5%
1999	127	24	151	84.1%	15.9%
1998	126	24	150	84.0%	16.0%
1997	114	22	136	83.8%	16.2%
1996	100	18	118	84.7%	15.3%
1995	103	22	125	82.4%	17.6%
1994	92	14	106	86.8%	13.2%
1993	72	9	81	88.9%	11.1%
1992	55	9	64	85.9%	14.1%
1991	36	14	50	72.0%	28.0%
1990	33	9	42	78.6%	21.4%
1989	21	6	27	77.8%	22.2%

**Table 3.** Relative JIF for JCR journals. Articles published in *Nature*, *Science* and those with JIF=0 are omitted. Source: JCR-Web, publication lists for the period 1998–2002 and data from the original analysis of the period 1989–1998.

Year	JCR Articles	Relative JIF	Std. Deviation	Std. Error of Mean
2002	143	1.32	0.85	0.07
2001	132	1.22	0.65	0.06
2000	146	1.25	0.58	0.05
1999	124	1.36	0.78	0.07
1998	126	1.24	0.62	0.05
1997	113	1.41	0.84	0.08
1996	100	1.43	0.82	0.08
1995	103	1.30	0.56	0.05
1994	89	1.29	0.79	0.08
1993	69	1.29	0.61	0.07
1992	54	1.29	0.75	0.10
1991	36	1.73	0.92	0.15
1990	31	1.29	0.87	0.16
1989	21	1.18	0.58	0.13



**Figure 2.** Developments in the relative Journal Impact Factor 1989-2002  $\pm$  the standard deviation expressed as Standard Error of Mean (SEM). Articles published in *Nature*, *Science* and those with JIF=0 are omitted. Source: JCR-Web, publication lists for the period 1998–2002 and data from the original analysis of the period 1989–1998.

**Table 4.** Relative JIF for JCR journals grouped by department. Source: JCR-Web, publication lists for the period 1998–2002 and data from the original analysis of the period 1989–1998. Articles published in *Nature*, *Science* and those with JIF=0 are omitted

	Relative JIF 1998	Relative JIF 1999	Relative JIF 2000	Relative JIF 2001	Relative JIF 2002	Relative JIF 1998–2002
AM	0,67	0,84	1,14	1,03	0,85	0,96
ATMI	1,21	1,37	1,02	1,17	1,36	1,22
FEVØ	1,04	1,36	1,01	1,52	1,26	1,21
KALØ	1,17	1,34	1,27	0,98	1,02	1,17
MAR	1,65	1,67	1,52	1,48	1,50	1,55
MIMI	1,12	1,45	1,26	1,22	1,06	1,21
SYS	1,04	1,02	0,82	1,03	1,41	1,17
TERI	1,21	1,20	1,37	1,24	1,71	1,31
DMU Total	1,24	1,36	1,25	1,22	1,32	1,28



## Appendix A

*NERI publications from the period 1998–2002 in the category international scientific publications grouped by department and according to document type, expressed in number and percentage. Source: JCR-Web and publication lists for the period 1998–2002.*

1998	JCR articles	Non-JCR articles	Proceedings, books, etc.	Total	JCR articles	Non-JCR articles	Proceedings, books, etc.
AM	6	1	4	11	54.5%	9.1%	36.4%
ATMI	25	4	18	47	53.2%	8.5%	38.3%
FEVØ	16	0	15	31	51.6%	0.0%	48.4%
KALØ	19	14	3	36	52.8%	38.9%	8.3%
MAR	27	0	0	27	100.0%	0.0%	0.0%
MIMI	11	1	4	16	68.8%	6.3%	25.0%
SYS	6	1	1	8	75.0%	12.5%	12.5%
TERI	16	3	9	28	57.1%	10.7%	32.1%
Total	126	24	54	204	61.8%	11.8%	26.5%

1999	JCR articles	Non-JCR articles	Proceedings, books, etc.	Total	JCR articles	Non-JCR articles	Proceedings, books, etc.
AM	5	1	4	10	50.0%	10.0%	40.0%
ATMI	25	3	20	48	52.1%	6.3%	41.7%
FEVØ	15	2	1	18	83.3%	11.1%	5.6%
KALØ	25	13	20	58	43.1%	22.4%	34.5%
MAR	20	2	1	23	87.0%	8.7%	4.3%
MIMI	12	0	1	13	92.3%	0.0%	7.7%
SYS	2	2	8	12	16.7%	16.7%	66.7%
TERI	23	1	8	32	71.9%	3.1%	25.0%
Total	127	24	63	214	59.3%	11.2%	29.4%

2000	JCR articles	Non-JCR articles	Proceedings, books, etc.	Total	JCR articles	Non-JCR articles	Proceedings, books, etc.
AM	17	0	9	26	65.4%	0.0%	34.6%
ATMI	17	4	17	38	44.7%	10.5%	44.7%
FEVØ	17	1	16	34	50.0%	2.9%	47.1%
KALØ	30	15	10	55	54.5%	27.3%	18.2%
MAR	30	1	12	43	69.8%	2.3%	27.9%
MIMI	12	0	6	18	66.7%	0.0%	33.3%
SYS	3	1	1	5	60.0%	20.0%	20.0%
TERI	21	3	11	35	60.0%	8.6%	31.4%
Total	147	25	82	254	57.9%	9.8%	32.3%

2001	JCR articles	Non-JCR articles	Proceedings, books, etc.	Total	JCR articles	Non-JCR articles	Proceedings, books, etc.
AM	7	2	5	14	50.0%	14.3%	35.7%
ATMI	35	10	16	61	57.4%	16.4%	26.2%
FEVØ	12	3	8	23	52.2%	13.0%	34.8%
KALØ	22	9	1	32	68.8%	28.1%	3.1%
MAR	21	0	4	25	84.0%	0.0%	16.0%
MIMI	10	4	3	17	58.8%	23.5%	17.6%
SYS	6	2	8	16	37.5%	12.5%	50.0%
TERI	22	7	5	34	64.7%	20.6%	14.7%
Total	135	37	50	222	60.8%	16.7%	22.5%

2002	JCR articles	Non-JCR articles	Proceedings, books, etc.	Total	JCR articles	Non-JCR articles	Proceedings, books, etc.
AM	11	3	1	15	73.3%	20.0%	6.7%
ATMI	16	8	16	40	40.0%	20.0%	40.0%
FEVØ	9	3	14	26	34.6%	11.5%	53.8%
KALØ	18	10	1	29	62.1%	34.5%	3.4%
MAR	50	0	0	50	100.0%	0.0%	0.0%
MIMI	18	1	5	24	75.0%	4.2%	20.8%
SYS	12	1	6	19	63.2%	5.3%	31.6%
TERI	11	4	6	21	52.4%	19.0%	28.6%
Total	145	30	49	224	64.7%	13.4%	21.9%

## Appendix B

*Journals that were found in the JCR 2000 (210 in total), ranked by relative JIF. Source: JCR-Web and publication lists for the period 1998-2002.*

Journal Name	Articles	JIF Journal	JIF Category	JIF Relative
Nature	3	25.814	1.740	14.836
Science	2	23.872	1.740	13.720
Proceedings of the National Academy of Sciences of the United States of America	2	10.789	1.740	6.201
Trends in Ecology & Evolution	2	8.765	2.214	3.959
Environmental Science & Technology	4	3.035	0.812	3.738
Paleoceanography	1	3.740	1.001	3.735
Limnology and Oceanography	15	2.990	0.930	3.215
Annals of the Missouri Botanical Garden	1	4.327	1.370	3.158
Journal of Chemical Information and Computer Sciences	2	2.929	0.991	2.955
Global Change Biology	1	3.775	1.306	2.890
Current Opinion in Biotechnology	1	4.711	1.645	2.865
American Journal of Epidemiology	1	3.870	1.396	2.772
Geophysical Research Letters	2	2.719	0.997	2.727
Zoologica Scripta	1	2.375	0.875	2.714
American Naturalist	1	3.944	1.466	2.690
Journal of Geophysical Research	2	2.680	0.997	2.688
Global Biogeochemical Cycles	1	3.084	1.154	2.672
Journal of Animal Ecology	4	2.862	1.210	2.366
Ecology	2	3.650	1.544	2.364
Journal of Aerosol Science	3	2.071	0.880	2.354
Geology	2	2.154	0.953	2.260
Ecological Applications	3	3.488	1.544	2.259
Journal of Agricultural and Food Chemistry	1	1.560	0.701	2.224
Soil Biology & Biochemistry	4	1.747	0.793	2.203
Tellus Series B-Chemical and Physical Meteorology	3	3.256	1.478	2.203
Conservation Biology	2	2.814	1.306	2.154
Plant Cell and Environment	1	2.799	1.370	2.043
Journal of Avian Biology	1	1.511	0.756	1.999
Geomicrobiology Journal	1	1.936	0.992	1.952
Journal of Hydrology	1	1.272	0.659	1.929
Geochimica et Cosmochimica Acta	2	2.534	1.321	1.918
Ecosystems	2	2.753	1.544	1.783
Journal of Computational Physics	1	1.550	0.873	1.777
British Journal of Dermatology	1	2.214	1.247	1.775
Soil Science Society of America Journal	1	1.401	0.793	1.767
Canadian Journal of Fisheries and Aquatic Sciences	2	1.685	0.965	1.747
Journal of Atmospheric Chemistry	2	2.135	1.233	1.732
Applied and Environmental Microbiology	13	3.389	1.971	1.720
Proceedings of the Royal Society of London Series B-Biological Sciences	4	3.037	1.778	1.708
Aquatic Microbial Ecology	22	2.190	1.286	1.704
Water Research	2	1.285	0.756	1.700
Radiocarbon	1	2.234	1.321	1.691
Sociologia Ruralis	1	1.132	0.672	1.685
Pesticide Science	3	1.236	0.741	1.669
Microbial Ecology	3	2.703	1.636	1.652

Biology and Fertility of Soils	1	1.307	0.793	1.648
Journal of Ecology	3	2.535	1.544	1.642
Condor	1	1.207	0.756	1.597
Oikos	4	2.461	1.544	1.594
Journal of Chromatography A	5	2.551	1.605	1.590
Atmospheric Environment	22	1.942	1.233	1.576
Environmental Toxicology and Chemistry	18	2.091	1.331	1.572
Climatic Change	2	1.916	1.233	1.555
Environmental Research	1	1.845	1.192	1.548
Journal of the Atmospheric Sciences	1	2.287	1.478	1.547
Antarctic Science	1	1.433	0.936	1.530
Freshwater Biology	11	1.571	1.027	1.530
Toxicology and Applied Pharmacology	1	2.730	1.801	1.516
Journal of Environmental Quality	3	1.485	0.987	1.505
Marine Ecology-Progress Series	34	1.928	1.286	1.500
Journal of Marine Research	1	1.438	0.967	1.487
Annals of Applied Biology	1	0.597	0.403	1.481
Journal of Phycology	4	1.773	1.199	1.479
Genetics	1	4.687	3.194	1.467
Journal of Contaminant Hydrology	2	1.284	0.876	1.466
Animal Behaviour	1	2.138	1.460	1.465
European Journal of Agronomy	1	0.959	0.662	1.449
Oecologia	2	2.232	1.544	1.446
Marine Chemistry	1	1.798	1.256	1.432
Ibis	5	1.077	0.756	1.425
Palaeogeography Palaeoclimatology Palaeoecology	1	1.467	1.040	1.411
Ambio	4	1.142	0.812	1.406
Journal of Physical Chemistry A	5	2.754	1.963	1.403
Journal of Applied Ecology	5	2.091	1.544	1.354
Applied Soil Ecology	4	1.067	0.793	1.346
Hydrological Sciences Journal-Journal Des Sciences Hydrologiques	1	0.861	0.644	1.337
Journal of Invertebrate Pathology	2	1.142	0.875	1.305
Biological Journal of the Linnean Society	2	2.316	1.778	1.303
Journal of Vegetation Science	8	1.589	1.229	1.293
Plant and Soil	2	1.218	0.942	1.293
Forest Ecology and Management	8	0.982	0.772	1.272
Science of the Total Environment	28	1.252	0.987	1.268
Marine Biology	9	1.297	1.027	1.263
Landscape Ecology	1	1.408	1.122	1.255
Ecology Letters	1	1.880	1.544	1.218
Journal of Paleolimnology	1	1.145	0.940	1.218
Functional Ecology	4	1.869	1.544	1.210
Biological Conservation	4	1.578	1.306	1.208
Journal of Hydraulic Engineering-Asce	1	0.579	0.482	1.201
Journal of Wildlife Management	3	1.436	1.210	1.187
Molecular Ecology	3	2.769	2.353	1.177
Journal of Zoology	1	1.024	0.875	1.170
Sar and Qsar in Environmental Research	3	1.796	1.542	1.165
International Journal of Systematic Bacteriology	1	2.675	2.337	1.145
Environmental Pollution	8	1.121	0.987	1.136
Archiv Fur Hydrobiologie	3	1.072	0.960	1.117
Journal of the North American Benthological Society	1	1.436	1.286	1.117
Journal of Experimental Marine Biology and Ecology	2	1.419	1.286	1.104
Journal of Exposure Analysis and Environmental Epidemiology	1	1.489	1.352	1.101
Estuarine Coastal and Shelf Science	3	1.096	0.997	1.099
Biometrics	1	1.170	1.069	1.094
Marine Pollution Bulletin	5	1.101	1.007	1.093
Ecography	3	1.683	1.544	1.090

Bird Study	6	0.821	0.756	1.086
Journal of Environmental Monitoring	2	1.068	0.987	1.082
Archives of Environmental Contamination and Toxicology	3	1.437	1.331	1.080
Nordic Hydrology	1	0.690	0.644	1.071
Entomologia Experimentalis et Applicata	3	0.876	0.819	1.070
International Journal of Remote Sensing	1	0.827	0.779	1.062
Journal of Plankton Research	9	1.084	1.027	1.056
Chemosphere	16	1.033	0.987	1.047
Continental Shelf Research	2	1.011	0.967	1.046
Fems Microbiology Ecology	5	2.439	2.337	1.044
Reviews of Environmental Contamination and Toxicology	2	1.385	1.331	1.041
Estuaries	5	1.031	1.007	1.024
Chromatographia	1	1.619	1.605	1.009
Ecological Economics	1	1.258	1.266	0.994
Environmental Toxicology	1	1.088	1.102	0.988
Journal of Marine Systems	3	0.984	0.997	0.987
Journal of the Air & Waste Management Association	1	1.007	1.034	0.974
Arctic	10	0.880	0.906	0.971
New Phytologist	1	2.149	2.266	0.948
Applied Microbiology and Biotechnology	2	1.505	1.604	0.938
Journal of Aoac International	2	1.066	1.137	0.938
Aquatic Sciences	1	0.894	0.960	0.931
Fresenius Journal of Analytical Chemistry	2	1.418	1.524	0.930
Photogrammetric Engineering and Remote Sensing	1	0.783	0.845	0.927
Agriculture Ecosystems & Environment	3	0.903	0.978	0.923
Journal of Insect Physiology	4	1.468	1.599	0.918
American Journal of Industrial Medicine	1	1.277	1.396	0.915
International Journal of Vehicle Design	1	0.309	0.338	0.914
Canadian Journal of Zoology-Revue Canadienne De Zoologie	4	0.779	0.875	0.890
Plant Pathology	1	0.903	1.016	0.889
Marine Mammal Science	1	0.833	0.951	0.876
Accreditation and Quality Assurance	2	0.894	1.037	0.862
Environmental Monitoring and Assessment	3	0.839	0.987	0.850
Ardea	7	0.640	0.756	0.847
Journal of Theoretical Biology	2	1.550	1.841	0.842
Nuclear Instruments & Methods in Physics Research Section B-Beam Interactions With Materials and Atoms	1	0.955	1.172	0.815
Journal of Comparative Physiology B-Biochemical Systemic and Environmental Physiology	3	1.324	1.627	0.814
Pure and Applied Chemistry	3	1.257	1.544	0.814
Marine Biotechnology	1	1.068	1.316	0.812
Environmental Modelling & Software	1	0.545	0.673	0.809
Ecotoxicology and Environmental Safety	4	1.060	1.331	0.797
Evolutionary Ecology	2	1.762	2.214	0.796
Phycologia	1	0.950	1.199	0.793
Ecotoxicology	2	1.108	1.402	0.790
Transportation Research Part D-Transport and Environment	1	0.443	0.563	0.788
Energy Economics	1	0.561	0.713	0.787
Deep-Sea Research Part II-Topical Studies in Oceanography	2	0.755	0.967	0.781
Journal of Environmental Radioactivity	1	0.764	0.987	0.774
American Behavioral Scientist	1	0.619	0.804	0.770
Aquatic Conservation-Marine and Freshwater Ecosystems	8	0.990	1.286	0.770
Environmental and Resource Economics	1	0.554	0.722	0.768
Journal of Applied Microbiology	2	1.511	1.971	0.767
Helgoland Marine Research	2	0.750	0.997	0.752
Journal of Microbiological Methods	2	1.512	2.011	0.752
Aquatic Botany	2	0.885	1.199	0.738
Polar Biology	10	1.067	1.466	0.728

Journal of Arachnology	3	0.585	0.819	0.714
Annales Zoologici Fennici	1	0.620	0.875	0.709
Biodegradation	1	1.109	1.604	0.691
Fems Microbiology Letters	1	1.615	2.337	0.691
Plant Ecology	5	0.822	1.229	0.669
Parallel Computing	2	0.470	0.708	0.664
Water Science and Technology	5	0.495	0.756	0.655
Journal of Hazardous Materials	1	0.424	0.654	0.649
Behaviour	1	0.942	1.460	0.645
Ophelia	6	0.649	1.027	0.632
Taxon	1	0.863	1.370	0.630
Journal of Environmental Management	2	0.610	0.987	0.618
Waterbirds	3	0.467	0.756	0.618
Water Air and Soil Pollution	4	0.632	1.036	0.610
Pesticide Biochemistry and Physiology	1	1.233	2.120	0.582
Hydrobiologia	14	0.582	1.027	0.567
Clinical Chemistry and Laboratory Medicine	1	1.744	3.162	0.552
Lecture Notes in Computer Science	8	0.390	0.708	0.551
Computers & Geosciences	1	0.468	0.851	0.550
Ecological Modelling	5	0.849	1.544	0.550
Biomass & Bioenergy	1	0.466	0.872	0.534
Zeitschrift Fur Säugetierkunde-International Journal of Mammalian Biology	2	0.467	0.875	0.534
Contact Dermatitis	14	0.675	1.306	0.517
Evolutionary Ecology Research	1	1.127	2.214	0.509
Comparative Biochemistry and Physiology B-Biochemistry & Molecular Biology	1	1.015	2.019	0.503
Computers & Mathematics With Applications	1	0.339	0.687	0.494
Cryo-Letters	2	1.053	2.141	0.492
Environmental and Ecological Statistics	1	0.478	0.987	0.484
Acta Theriologica	1	0.422	0.875	0.482
Folia Geobotanica	1	0.649	1.370	0.474
Clinica Chimica Acta	2	1.041	2.293	0.454
Current Microbiology	3	1.029	2.337	0.440
Marine Ecology-Pubblicazioni Della Stazione Zoologica di Napoli I	1	0.452	1.027	0.440
Acta Oecologica-International Journal of Ecology	1	0.672	1.544	0.435
Canadian Journal of Microbiology	2	1.105	2.553	0.433
Mammalia	1	0.360	0.875	0.411
Economic Botany	1	0.557	1.370	0.407
Bulletin of Environmental Contamination and Toxicology	1	0.513	1.331	0.386
Pedobiologia	6	0.520	1.544	0.337
Polar Research	4	0.246	0.944	0.261
Acta Biotheoretica	1	0.446	1.778	0.251
Hereditas	2	0.753	3.194	0.236
South African Journal of Botany	1	0.317	1.370	0.231
Entomologia Generalis	1	0.179	0.819	0.219
Nordic Journal of Botany	4	0.271	1.370	0.198
International Journal of Environment and Pollution	4	0.176	0.987	0.178
Microbiological Research	1	0.382	2.337	0.163
Polycyclic Aromatic Compounds	2	0.305	1.961	0.156
International Journal of Systematic and Evolutionary Microbiology	2	0.000	2.337	0.000
Pest Management Science	1	0.000	0.741	0.000
Population Ecology	1	0.000	1.544	0.000

## Appendix C

*Journals that were found in the JCR 2000 (210 in total), ranked alphabetically. Source: JCR-Web and publication lists for the period 1998-2002.*

Journal Name	Articles	JIF Journal	JIF Category	JIF Relative
Accreditation and Quality Assurance	2	0.894	1.037	0.862
Acta Biotheoretica	1	0.446	1.778	0.251
Acta Oecologica-International Journal of Ecology	1	0.672	1.544	0.435
Acta Theriologica	1	0.422	0.875	0.482
Agriculture Ecosystems & Environment	3	0.903	0.978	0.923
Ambio	4	1.142	0.812	1.406
American Behavioral Scientist	1	0.619	0.804	0.770
American Journal of Epidemiology	1	3.870	1.396	2.772
American Journal of Industrial Medicine	1	1.277	1.396	0.915
American Naturalist	1	3.944	1.466	2.690
Animal Behaviour	1	2.138	1.460	1.465
Annales Zoologici Fennici	1	0.620	0.875	0.709
Annals of Applied Biology	1	0.597	0.403	1.481
Annals of the Missouri Botanical Garden	1	4.327	1.370	3.158
Antarctic Science	1	1.433	0.936	1.530
Applied and Environmental Microbiology	13	3.389	1.971	1.720
Applied Microbiology and Biotechnology	2	1.505	1.604	0.938
Applied Soil Ecology	4	1.067	0.793	1.346
Aquatic Botany	2	0.885	1.199	0.738
Aquatic Conservation-Marine and Freshwater Ecosystems	8	0.990	1.286	0.770
Aquatic Microbial Ecology	22	2.190	1.286	1.704
Aquatic Sciences	1	0.894	0.960	0.931
Archiv Fur Hydrobiologie	3	1.072	0.960	1.117
Archives of Environmental Contamination and Toxicology	3	1.437	1.331	1.080
Arctic	10	0.880	0.906	0.971
Ardea	7	0.640	0.756	0.847
Atmospheric Environment	22	1.942	1.233	1.576
Behaviour	1	0.942	1.460	0.645
Biodegradation	1	1.109	1.604	0.691
Biological Conservation	4	1.578	1.306	1.208
Biological Journal of the Linnean Society	2	2.316	1.778	1.303
Biology and Fertility of Soils	1	1.307	0.793	1.648
Biomass & Bioenergy	1	0.466	0.872	0.534
Biometrics	1	1.170	1.069	1.094
Bird Study	6	0.821	0.756	1.086
British Journal of Dermatology	1	2.214	1.247	1.775
Bulletin of Environmental Contamination and Toxicology	1	0.513	1.331	0.386
Canadian Journal of Fisheries and Aquatic Sciences	2	1.685	0.965	1.747
Canadian Journal of Microbiology	2	1.105	2.553	0.433
Canadian Journal of Zoology-Revue Canadienne De Zoologie	4	0.779	0.875	0.890
Chemosphere	16	1.033	0.987	1.047
Chromatographia	1	1.619	1.605	1.009
Climatic Change	2	1.916	1.233	1.555
Clinica Chimica Acta	2	1.041	2.293	0.454
Clinical Chemistry and Laboratory Medicine	1	1.744	3.162	0.552
Comparative Biochemistry and Physiology B-Biochemistry & Molecular Biol-	1	1.015	2.019	0.503

ogy				
Computers & Geosciences	1	0.468	0.851	0.550
Computers & Mathematics With Applications	1	0.339	0.687	0.494
Condor	1	1.207	0.756	1.597
Conservation Biology	2	2.814	1.306	2.154
Contact Dermatitis	14	0.675	1.306	0.517
Continental Shelf Research	2	1.011	0.967	1.046
Cryo-Letters	2	1.053	2.141	0.492
Current Microbiology	3	1.029	2.337	0.440
Current Opinion in Biotechnology	1	4.711	1.645	2.865
Deep-Sea Research Part II-Topical Studies in Oceanography	2	0.755	0.967	0.781
Ecography	3	1.683	1.544	1.090
Ecological Applications	3	3.488	1.544	2.259
Ecological Economics	1	1.258	1.266	0.994
Ecological Modelling	5	0.849	1.544	0.550
Ecology	2	3.650	1.544	2.364
Ecology Letters	1	1.880	1.544	1.218
Economic Botany	1	0.557	1.370	0.407
Ecosystems	2	2.753	1.544	1.783
Ecotoxicology	2	1.108	1.402	0.790
Ecotoxicology and Environmental Safety	4	1.060	1.331	0.797
Energy Economics	1	0.561	0.713	0.787
Entomologia Experimentalis et Applicata	3	0.876	0.819	1.070
Entomologia Generalis	1	0.179	0.819	0.219
Environmental and Ecological Statistics	1	0.478	0.987	0.484
Environmental and Resource Economics	1	0.554	0.722	0.768
Environmental Modelling & Software	1	0.545	0.673	0.809
Environmental Monitoring and Assessment	3	0.839	0.987	0.850
Environmental Pollution	8	1.121	0.987	1.136
Environmental Research	1	1.845	1.192	1.548
Environmental Science & Technology	4	3.035	0.812	3.738
Environmental Toxicology	1	1.088	1.102	0.988
Environmental Toxicology and Chemistry	18	2.091	1.331	1.572
Estuaries	5	1.031	1.007	1.024
Estuarine Coastal and Shelf Science	3	1.096	0.997	1.099
European Journal of Agronomy	1	0.959	0.662	1.449
Evolutionary Ecology	2	1.762	2.214	0.796
Evolutionary Ecology Research	1	1.127	2.214	0.509
Fems Microbiology Ecology	5	2.439	2.337	1.044
Fems Microbiology Letters	1	1.615	2.337	0.691
Folia Geobotanica	1	0.649	1.370	0.474
Forest Ecology and Management	8	0.982	0.772	1.272
Fresenius Journal of Analytical Chemistry	2	1.418	1.524	0.930
Freshwater Biology	11	1.571	1.027	1.530
Functional Ecology	4	1.869	1.544	1.210
Genetics	1	4.687	3.194	1.467
Geochimica et Cosmochimica Acta	2	2.534	1.321	1.918
Geology	2	2.154	0.953	2.260
Geomicrobiology Journal	1	1.936	0.992	1.952
Geophysical Research Letters	2	2.719	0.997	2.727
Global Biogeochemical Cycles	1	3.084	1.154	2.672
Global Change Biology	1	3.775	1.306	2.890
Helgoland Marine Research	2	0.750	0.997	0.752
Hereditas	2	0.753	3.194	0.236
Hydrobiologia	14	0.582	1.027	0.567
Hydrological Sciences Journal-Journal Des Sciences Hydrologiques	1	0.861	0.644	1.337
Ibis	5	1.077	0.756	1.425
International Journal of Environment and Pollution	4	0.176	0.987	0.178



International Journal of Remote Sensing	1	0.827	0.779	1.062
International Journal of Systematic and Evolutionary Microbiology	2	0.000	2.337	0.000
International Journal of Systematic Bacteriology	1	2.675	2.337	1.145
International Journal of Vehicle Design	1	0.309	0.338	0.914
Journal of Aerosol Science	3	2.071	0.880	2.354
Journal of Agricultural and Food Chemistry	1	1.560	0.701	2.224
Journal of Animal Ecology	4	2.862	1.210	2.366
Journal of Aoac International	2	1.066	1.137	0.938
Journal of Applied Ecology	5	2.091	1.544	1.354
Journal of Applied Microbiology	2	1.511	1.971	0.767
Journal of Arachnology	3	0.585	0.819	0.714
Journal of Atmospheric Chemistry	2	2.135	1.233	1.732
Journal of Avian Biology	1	1.511	0.756	1.999
Journal of Chemical Information and Computer Sciences	2	2.929	0.991	2.955
Journal of Chromatography A	5	2.551	1.605	1.590
Journal of Comparative Physiology B-Biochemical Systemic and Environmental Physiology	3	1.324	1.627	0.814
Journal of Computational Physics	1	1.550	0.873	1.777
Journal of Contaminant Hydrology	2	1.284	0.876	1.466
Journal of Ecology	3	2.535	1.544	1.642
Journal of Environmental Management	2	0.610	0.987	0.618
Journal of Environmental Monitoring	2	1.068	0.987	1.082
Journal of Environmental Quality	3	1.485	0.987	1.505
Journal of Environmental Radioactivity	1	0.764	0.987	0.774
Journal of Experimental Marine Biology and Ecology	2	1.419	1.286	1.104
Journal of Exposure Analysis and Environmental Epidemiology	1	1.489	1.352	1.101
Journal of Geophysical Research	2	2.680	0.997	2.688
Journal of Hazardous Materials	1	0.424	0.654	0.649
Journal of Hydraulic Engineering-Asce	1	0.579	0.482	1.201
Journal of Hydrology	1	1.272	0.659	1.929
Journal of Insect Physiology	4	1.468	1.599	0.918
Journal of Invertebrate Pathology	2	1.142	0.875	1.305
Journal of Marine Research	1	1.438	0.967	1.487
Journal of Marine Systems	3	0.984	0.997	0.987
Journal of Microbiological Methods	2	1.512	2.011	0.752
Journal of Paleolimnology	1	1.145	0.940	1.218
Journal of Phycology	4	1.773	1.199	1.479
Journal of Physical Chemistry A	5	2.754	1.963	1.403
Journal of Plankton Research	9	1.084	1.027	1.056
Journal of the Air & Waste Management Association	1	1.007	1.034	0.974
Journal of the Atmospheric Sciences	1	2.287	1.478	1.547
Journal of the North American Benthological Society	1	1.436	1.286	1.117
Journal of Theoretical Biology	2	1.550	1.841	0.842
Journal of Vegetation Science	8	1.589	1.229	1.293
Journal of Wildlife Management	3	1.436	1.210	1.187
Journal of Zoology	1	1.024	0.875	1.170
Landscape Ecology	1	1.408	1.122	1.255
Lecture Notes in Computer Science	8	0.390	0.708	0.551
Limnology and Oceanography	15	2.990	0.930	3.215
Mammalia	1	0.360	0.875	0.411
Marine Biology	9	1.297	1.027	1.263
Marine Biotechnology	1	1.068	1.316	0.812
Marine Chemistry	1	1.798	1.256	1.432
Marine Ecology-Progress Series	34	1.928	1.286	1.500
Marine Ecology-Pubblicazioni Della Stazione Zoologica di Napoli I	1	0.452	1.027	0.440
Marine Mammal Science	1	0.833	0.951	0.876
Marine Pollution Bulletin	5	1.101	1.007	1.093
Microbial Ecology	3	2.703	1.636	1.652

Microbiological Research	1	0.382	2.337	0.163
Molecular Ecology	3	2.769	2.353	1.177
Nature	3	25.814	1.740	14.836
New Phytologist	1	2.149	2.266	0.948
Nordic Hydrology	1	0.690	0.644	1.071
Nordic Journal of Botany	4	0.271	1.370	0.198
Nuclear Instruments & Methods in Physics Research Section B-Beam Interactions With Materials and Atoms	1	0.955	1.172	0.815
Oecologia	2	2.232	1.544	1.446
Oikos	4	2.461	1.544	1.594
Ophelia	6	0.649	1.027	0.632
Palaeogeography Palaeoclimatology Palaeoecology	1	1.467	1.040	1.411
Paleoceanography	1	3.740	1.001	3.735
Parallel Computing	2	0.470	0.708	0.664
Pedobiologia	6	0.520	1.544	0.337
Pest Management Science	1	0.000	0.741	0.000
Pesticide Biochemistry and Physiology	1	1.233	2.120	0.582
Pesticide Science	3	1.236	0.741	1.669
Photogrammetric Engineering and Remote Sensing	1	0.783	0.845	0.927
Phycologia	1	0.950	1.199	0.793
Plant and Soil	2	1.218	0.942	1.293
Plant Cell and Environment	1	2.799	1.370	2.043
Plant Ecology	5	0.822	1.229	0.669
Plant Pathology	1	0.903	1.016	0.889
Polar Biology	10	1.067	1.466	0.728
Polar Research	4	0.246	0.944	0.261
Polycyclic Aromatic Compounds	2	0.305	1.961	0.156
Population Ecology	1	0.000	1.544	0.000
Proceedings of the National Academy of Sciences of the United States of America	2	10.789	1.740	6.201
Proceedings of the Royal Society of London Series B-Biological Sciences	4	3.037	1.778	1.708
Pure and Applied Chemistry	3	1.257	1.544	0.814
Radiocarbon	1	2.234	1.321	1.691
Reviews of Environmental Contamination and Toxicology	2	1.385	1.331	1.041
Sar and Qsar in Environmental Research	3	1.796	1.542	1.165
Science	2	23.872	1.740	13.720
Science of the Total Environment	28	1.252	0.987	1.268
Sociologia Ruralis	1	1.132	0.672	1.685
Soil Biology & Biochemistry	4	1.747	0.793	2.203
Soil Science Society of America Journal	1	1.401	0.793	1.767
South African Journal of Botany	1	0.317	1.370	0.231
Taxon	1	0.863	1.370	0.630
Tellus Series B-Chemical and Physical Meteorology	3	3.256	1.478	2.203
Toxicology and Applied Pharmacology	1	2.730	1.801	1.516
Transportation Research Part D-Transport and Environment	1	0.443	0.563	0.788
Trends in Ecology & Evolution	2	8.765	2.214	3.959
Water Air and Soil Pollution	4	0.632	1.036	0.610
Water Research	2	1.285	0.756	1.700
Water Science and Technology	5	0.495	0.756	0.655
Waterbirds	3	0.467	0.756	0.618
Zeitschrift Fur Säugetierkunde-International Journal of Mammalian Biology	2	0.467	0.875	0.534
Zoologica Scripta	1	2.375	0.875	2.714

## Appendix D

*This appendix contains the subject categories of the JCR journals. The Journal Impact Factors shown are average JIF values for the journals in each subject category that have JIF values greater than 0. Source: JCR-Web and publication lists for the period 1998-2002.*

Subject Category	Category JIF
Agricultural Engineering	0.533
Agriculture, Multidisciplinary	0.403
Agriculture, Soil Science	0.793
Agronomy	0.662
Allergy	1.364
Behavioral Sciences	2.044
Biochemical Research Methods	1.685
Biochemistry & Molecular Biology	3.162
Biodiversity Conservation	1.388
Biology	1.778
Biology, Miscellaneous	1.904
Biotechnology & Applied Microbiology	1.604
Chemistry, Analytical	1.524
Chemistry, Applied	0.951
Chemistry, Multidisciplinary	1.544
Chemistry, Organic	1.961
Chemistry, Physical	1.963
Computer Science, Information Systems	0.726
Computer Science, Interdisciplinary Applications	0.704
Computer Science, Software, Graphics, Programming	0.679
Computer Science, Theory & Methods	0.708
Dermatology & Venereal Diseases	1.247
Ecology	1.544
Economics	0.713
Energy & Fuels	0.479
Engineering, Chemical	0.589
Engineering, Civil	0.337
Engineering, Environmental	0.637
Engineering, Mechanical	0.465
Entomology	0.819
Environmental Sciences	0.987
Environmental Studies	0.730
Fisheries	0.902
Food Science & Technology	0.750
Forestry	0.772
Genetics & Heredity	3.194
Geochemistry & Geophysics	1.321
Geography	0.825
Geology	0.953
Geosciences, Interdisciplinary	0.997
Imaging Science & Photographic Technology	0.713
Immunology	3.108
Instruments & Instrumentation	0.550
Limnology	0.893
Marine & Freshwater Biology	1.027
Mathematics, Applied	0.669

Medical Laboratory Technology	1.423
Meteorology & Atmospheric Sciences	1.478
Microbiology	2.337
Multidisciplinary Sciences	1.740
Nuclear Science & Technology	0.710
Oceanography	0.967
Ornithology	0.756
Paleontology	1.040
Pharmacology & Pharmacy	1.928
Physics, Atomic, Molecular & Chemical	1.702
Physics, Mathematical	1.041
Physics, Nuclear	1.724
Physiology	2.378
Plant Sciences	1.370
Psychology, Clinical	1.062
Public, Environmental & Occupational Health	1.396
Remote Sensing	0.844
Social Sciences, Interdisciplinary	0.545
Sociology	0.672
Statistics & Probability	0.635
Toxicology	1.674
Transportation	0.395
Transportation Science & Technology	0.211
Water Resources	0.644
Zoology	0.875

## Appendix E

*Journals that were not found in the JCR 2000 (72 in total), ranked by number of articles.*

*Source: JCR-Web and publication lists for the period 1998-2002.*

Journal Name	Articles
Wildlife Biology	11
Wildfowl	8
Norsk Polarinstitutt. Skrifter	7
CLER Review	6
Physics and Chemistry of the Earth Part B	6
Physics and Chemistry of the Earth	5
Water, Air, and Soil Pollution: Focus	5
Acta Jutlandica	4
Aquatic Ecology	3
BioSafety Journal (Online Journal)	3
Danish Review of Game Biology	3
Dansk Ornitologisk Forenings Tidsskrift	3
Entomologiske Meddelelser	3
IUCN Otter Specialist Group Bulletin	3
Annali di Botanica	2
Applied Vegetation Science	2
Aquatic Ecosystem Health & Management	2
BWP Update	2
Environmental Management and Health	2
Environmental Modeling and Assessment	2
Geografisk Tidsskrift-Danish Journal of Geography	2
Journal of Soils and Sediments	2
Lindbergia	2
Organohalogen Compounds	2
Rangifer	2
Systems Analysis Modelling Simulation	2
Acta Botanica Venezuelica	1
Aerosols	1
Agricultural Economics and Management	1
Annales Universitatis Scientiarum Budapestinensis	1
Aquatic Mammals	1
Atmospheric Chemistry and Physics Discussions	1
Austrian Journal of Statistics	1
Avocetta	1
Bahamas Journal of Science	1
Boreal Environment Research	1
British Birds	1
Canadian Journal of Remote Sensing	1
Chemistry International	1
Conservation Genetics	1
Cybernetics & Human Knowing	1
Deutsche Hydrographische Zeitschrift-German Journal of Hydrography	1
Economic Geography	1
Economic Systems Research	1
European Environment	1
Fróðskaparrit	1
Gene Families and Isozymes Bulletin	1

Hystrix	1
Idojaras	1
Journal of Environmental Planning and Management	1
Journal of Material Cycles and Waste Management	1
Journal of Separation Science	1
Lake and Reservoir Management	1
Lakes & Reservoirs. Research and Management	1
Limnologica	1
Lutra	1
Mammalian Biology	1
Mathematical Modeling	1
NAFO Scientific Council Studies	1
Newsletter - WHO Collaborating Centre for Air Quality Management and Air Pollution Control	1
NSN Newsletter	1
Ornis Svecica	1
Parallel and Distributed Computing Practices	1
Pesticide Management Science	1
Scientific World (Online)	1
Soil and Sediment Contamination	1
Toxicological and Environmental Chemistry	1
Transport Policy	1
Vogelwelt	1
World Futures	1
World Resource Review	1
Zeitschrift für Umweltchemie und Ökotoxikologie	1

## Appendix F

*Oxygen-depletion related publications 1998-2002, and publications provisionally compiled for 2003. Source: JCR-Web and publication lists for the period 1998-2003 (Enclosure 1).*

*Articles published in Nature, Science and those with JIF=0 are omitted.*

Oxygen	JCR articles	Non-JCR articles	Proceedings, books, etc.	Total	JCR articles	Non-JCR articles	Proceedings, books, etc.
2003	17	1	1	19	89.5%	5.3%	5.3%
2002	31	0	0	31	100.0%	0.0%	0.0%
2001	17	0	1	18	94.4%	0.0%	5.6%
2000	24	0	0	24	100.0%	0.0%	0.0%
1999	10	2	0	12	83.3%	16.7%	0.0%
1998	18	0	0	18	100.0%	0.0%	0.0%
Total	117	3	2	122	95.9%	2.5%	1.6%

*Relative JIF values for oxygen-depletion related publications 1998–2002, and publications provisionally compiled for 2003. Source: JCR-Web and publication lists for the period 1998-2003. Articles published in Nature, Science and those with JIF=0 are omitted.*

	Relative JIF 1998	Relative JIF 1999	Relative JIF 2000	Relative JIF 2001	Relative JIF 2002	Relative JIF 2003	Relative JIF 1998–2003
ILT	1,76	1,78	1,54	1,42	1,47	1,55	1,56
DMU Total	1,24	1,36	1,25	1,22	1,32	n/a	n/a

## Enclosure 8

### Examples of oxygen reports for 2002

Available on NERI's homepage (in Danish with an English summary):

August 2002

[http://www.dmu.dk/1\\_viden/2\\_Miljoe-tilstand/3\\_vand/4\\_iltsvind/rapporter/082002.asp](http://www.dmu.dk/1_viden/2_Miljoe-tilstand/3_vand/4_iltsvind/rapporter/082002.asp)

September 2002

[http://www.dmu.dk/1\\_viden/2\\_Miljoe-tilstand/3\\_vand/4\\_iltsvind/rapporter/092002.asp](http://www.dmu.dk/1_viden/2_Miljoe-tilstand/3_vand/4_iltsvind/rapporter/092002.asp)

October 2002

[http://www.dmu.dk/1\\_viden/2\\_Miljoe-tilstand/3\\_vand/4\\_iltsvind/rapporter/102002.asp](http://www.dmu.dk/1_viden/2_Miljoe-tilstand/3_vand/4_iltsvind/rapporter/102002.asp)

November 2002

[http://www.dmu.dk/1\\_viden/2\\_Miljoe-tilstand/3\\_vand/4\\_iltsvind/rapporter/rapport.asp](http://www.dmu.dk/1_viden/2_Miljoe-tilstand/3_vand/4_iltsvind/rapporter/rapport.asp)