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DUTCH RESEARCH
ON EUTROPHICATION

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samenvatting:

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A list is given of current and planned research in the Netherlands on eutrophication and eutrophication related aspects in the North Sea, Wadden-sea and estuaries in the Delta region of S.W. Netherlands (Scheldt area) and in the Northern region (the Ems estuary).

The data are compiled from information given by several institutes (in alphabetic order): Delft Hydraulics Laboratory (WL), Delta Institute for Hydrobiological Research (DHO), Department of Marine Biology (MARBIOL), Institute for Nature Management (Estuarine Division) (RIN), Laboratory for Applied Marine Research (MT-TNO), National Institute for Fishery Research (RIVO), Netherlands Institute of Sea Research (NIOZ), North Sea Directorate (DNZ) and Tidal Waters Division (DGW). Most of the above mentioned institutes cooperate with a Programming Bureau (J. Visser) as a secretariat. This bureau is located at the Tidal Waters Division (address see above).

This paper is a follow up of a less detailed information paper (NUT/2/4/7) which was presented at the second meeting of the Working Group on Nutrients, 27-29 October 1987, Stockholm.

A number of national research projects listed here are joint projects in which several institutes participate. If possible joint projects are indicated.

In this paper no attempt is made to comment or to discuss possible overlaps in eutrophication research of the listed institutes.

1. INSTITUTE: DELFT HYDRAULICS (WL), Rotterdamseweg 185, 2600 MH Delft, The Netherlands

Projecttitle: Integrated North Sea Research

Contactperson(s): L. Postma

Timespan: 5 years (1986-1991)

Description: This project contains modelling research on long-term water movement and transport of matter. It includes the influence of vertical inhomogeneities on water quality and ecology, the distribution and pathways of suspended pollutants, and especially the consequences of the input of nutrients on primary production and its relation to higher trophic levels. These studies are strongly dependent on field data collected by other institutes.

Projecttitle: Influence of bioturbation on the sediment-water exchanges

Contactperson(s): M. de Vries in cooperation with IB

Timespan: 3 years (1987-1990)

Description: This project contains experimental and model research on bioturbation. Transport and sediment-water exchange of dissolved and particulate compounds will be measured in sediment columns with the aid of tracers.

Projecttitle: Regulation of matter transport in marine waters

Contactperson(s): L. Postma, in cooperation with and in assignment of the Tidal Waters Division (de Kruik)

Timespan: 3 years (1987-1990)

Description: This project is closely related to the MANS Study (Management Analysis North Sea). Available numerical tools (models) are applied to analyse alternative pathways of discharges into the marine environment. Model calculations will be used for policy analyses for the third note on water management (NW3).

Projecttitle: Eutrophication case study of MANS (Management Analysis North Sea)

Contactperson(s): L. Bosch, in cooperation with the Tidal Waters Division and in assignment of the North Sea Directorate; for eutrophication study P.Glas

Timespan: 1988 - ?

Description: A database management and modelling system for all kinds of management problems in the North Sea will be developed. In a preliminary study 7 cases have been described and elaborated: among them are eutrophication, risk analysis, toxic substances and sand exploitation and exploration.

Projecttitle: Ecological and waterquality modelling of Lake Grevelingen and Lake Veere.

Contactperson(s): I. de Vries /H. Goosens, in cooperation with and in assignment of the Tidal Waters Division.

Timespan: up to 1988 (studies have been nearly completed and models are available for use).

Description: For Lake Grevelingen and Lake Veere an ecological and a water quality model have been constructed respectively. These models are operational and can be used to calculate effects of managerial alternatives (resulting in changes in water level, input of nutrients) on biota or water quality parameters.

Projecttitle: Modelling of phytoplankton and nutrients in the North Sea (SEAWAQ)

Contactperson(s): Verhagen, in cooperation with NIOZ (Fransz)

Timespan: finished and published

Description: A model has been build to simulate phytoplankton growth and composition in relation to availability of nutrients. The model has been documented and published (Fransz, H.G. & J.H.G. Verhagen, Neth. J. Sea Res. 19(3/4): 241-250 (1985)). At present a follow-up is planned to improve the current model and to extend its use into a larger part of the Southern Bight of the North Sea. The model is an extension of the DELWAQ framework and is used in other projects as well e.g. MANS (Management Analysis North Sea), NOMIVE (North Sea Micropollutants).

Projecttitle: Seasonal model of wind-driven currents

Contactperson(s): G. Verbaan/ H. Gerritsen

Timespan: runtime 8 months (1988)

Description: Complementary to the tidal model for the continental shelf a model for wind-driven currents is constructed. Geometry and bottom of the Continental Shelf Model (CSM) or CSM-16 is used.

Projecttitle: Development and coupling of a temperature model

Contactperson(s): J.A. van Pagee/ H. Gerritsen

Timespan: starts in 1988

Description: The existing transport models of suspended and dissolved matter e.g. DELWAQ will be extended with a temperature model, including a variable amount of vertically connected layers. The model will be coupled to CSM (see above) and the wind-driven currents model. Calibration and testing with North Sea data sets during stratification is planned.

Projecttitle:Frontal systems

Contactperson(s): H. Gerritsen/ G. Abraham

Timespan: 1987-1991

Description: Modelling of frontal systems due to freshwater-marine and temperature interactions as observed in the North Sea will be started in May 1987. To achieve a better insight into existing frontal systems 3D numerical models will be adapted and/or developed. The project has strong interactions with experimental and analytical/physical research on frontal systems at the NIOZ (project WST-7/Friesian Front) and North Sea Directorate (contactperson J. van Alphen).

2.INSTITUTE: DELTA INSTITUTE FOR HYDROBIOLOGICAL RESEARCH (DIHO), Vierstraat 24, 4401 EA Yerseke, The Netherlands

Projecttitle: Foodwebs in the Western Scheldt in relation to eutrophication and pollution

Contactperson(s): P.H. Nienhuis

Timespan: 1985-1995

Description: The project deals with the combined effects of eutrophication and pollution with heavy metals and organic compounds. A close interaction with the SAWES project of the Tidal Waters Division is planned. The Western Scheldt is under strong environmental stress because of high levels of (micro-)pollutants.

Projecttitle: Structure and function of the Eastern Scheldt Ecosystem in relation to the construction of large civil-technical works

Contactperson(s): P.H. Nienhuis

Timespan: 1982-1992

Description: In this project all trophic levels within the estuarine foodweb are studied such as phytoplankton, zooplankton, phytobenthos, macrozoobenthos, meiozoobenthos and tertiary producers. Also processes such as primary production and mineralisation are studied. Integration of the results is reached within mathematical modelling of (parts of) the ecosystem. With respect to eutrophication this study is important because of the changing underwater light climate after completion of the storm surge barrier which results in a reduced tidal water movement and therefore in a reduced turbidity. The Eastern Scheldt is not under the direct influence of freshwater discharge and therefore less eutrophic when compared with the Dutch coastal zone.

3. INSTITUTE: DEPARTMENT OF MARINE BIOLOGY (MARBIOL), P.O.BOX 14, 9750 AA Haren, The Netherlands

Projecttitle: Studies on Phaeocystis blooms (Joint Program EEC, and NIOZ)
Contactperson(s): W.W.C. Gieskes, M.J.W. Veldhuis (NIOZ), H.Lindeboom (NIOZ) & F. Colijn (DGW).
Timespan: 1988-1991

Description: This project partly financed by the EEC deals with the occurrence of Phaeocystis blooms in the coastal parts of the North Sea. The studies will focus on the spatial and temporal distribution of Phaeocystis blooms and try to reveal the causes of these blooms: are they triggered by the increasing nutrient load of these coastal areas or are other factors such as the reduction of grazers also involved. Several participants in this international study will deliver materials for an ecophysiological model for Phaeocystis blooms.

4. INSTITUTE: INSTITUTE FOR NATURE MANAGEMENT (ESTUARINE DIVISION) (RIN),
P.O.BOX 59, 1790 AB Den Burg, Texel, The Netherlands

Projecttitle: The function of the Blue mussel culture in the Wadden Sea

Contactperson(s): N. Dankers

Timespan: 1984 till 1990

Description: The project deals with the culture of mussels in the Wadden Sea which has been expanded strongly over the last three decennia. The consequences of this expansion and the possibility and desirability of an even further intensification are studied. Also new culture plots are evaluated.

Projecttitle: SEDEX (sediment experiment- The effects of dredged material in model tidal flat ecosystems

Contactperson(s): Dr. N. Dankers

Timespan: 1987-1990

Description: The dumping of large amounts of dredged material mostly contaminated with micropollutants and heavy metals is a serious problem. This project tries to test the effects of different types of contaminated sediments with adsorbed nutrients in tidal flat ecosystems. Both effects of contaminants and their pathways are studied in combination with possible eutrophication effects in the same tidal flat model systems. The project is a cooperation between four institutes: NIOZ, Institute for Nature Management and MT-TNO and in assignment of the Tidal Waters Division.

Projecttitle: The significance of eutrophication as a possible cause of the decline of seagrasses in the Wadden Sea

Contactperson(s): K.S. Dijkema

Timespan: 1987-1991

Description: Seagrasses have vanished almost completely from the Dutch and German Wadden Sea since the wasting disease in the thirties. Remarkably no recovery has taken place since then. Probably changes in turbidity, or in eutrophication level, related to the former, play a role in the impossibility to recover in the Wadden Sea. The study tries to find out which factor is decisive for the present situation. The project is a cooperation with the Tidal Waters Division (project INDICAT, contactperson: V.N. de Jonge).

5. INSTITUTE: LABORATORY FOR APPLIED MARINE RESEARCH (MT-TNO), Ambachtsweg
8A, P.O.Box 57, 1780 AB Den Helder, The Netherlands

Projecttitle: Studies with Model Ecosystems

Contactperson(s): M. Scholten

Timespan: longterm

Description: Studies direct attention to pathways and effects of contaminants in model systems of plankton communities, to mathematical modelling of mechanisms and processes in disturbed plankton and tidal flat ecosystems. The institute cooperates within the SEDEX project (ecotoxicological studies).

6. INSTITUTE: NATIONAL INSTITUTE FOR FISHERY RESEARCH (RIVO), Haringkade 1,
1976 CP, IJmuiden, The Netherlands

Projecttitle: Baseline studies on phytoplankton in Dutch coastal waters
with emphasis on the occurrence of toxic dinoflagellates

Contactperson(s): M. Kat

Timespan: project stops in 1989

Description: During monitoring studies of the waterquality of the Dutch
coastal waters a large amount of work has been done on the description of
the plankton communities occurring along the Dutch coast for a 10 year
long period.

7. INSTITUTE: NETHERLANDS INSTITUTE FOR SEA RESEARCH (NIOZ), P.O.BOX 59, 1790 AB Den Burg, Texel, The Netherlands

Projecttitle: Nutrients, oxygen and carbon in Wadden Sea and North Sea

Contactperson(s): W. Helder

Timespan: 1987-1989

Description: The project is part of the long-term studies of the institute on chemical and physical oceanography in Wadden Sea and North Sea. At present research concentrates within the Friesian Front project on the relations between nutrient levels, primary production, both in terms of carbon and oxygen production.

Projecttitle: Role of nitrogen compounds in marine sediments

Contactperson(s): W. Helder/ P. Keskamp

Timespan: 1987-1991

Description: The project deals with the early diagenesis of nitrogen containing organic compounds in relation to other diagenetic processes and to the sedimentary oxygen profiles. Also the exchange of the diagenetic products between the sediment and the overlying water will be studied. Besides the study of these processes in nature also experiments will be conducted under conditioned circumstances, with use of labeled ^{15}N .

Projecttitle: Marine optics and remote sensing

Contactperson(s): R.M.J. Dirks

Timespan: 1988-1992

Description: The primary goal of this project is to test the possibilities of determining the spatial distribution of silt, primary producers and yellow substances in coastal waters by means of existing or still to develop algorithms. Also optical remote sensing will be tested for the determination of bottom depth and composition.

Projecttitle: Sedimentation in the Wadden Sea

Contactpersons(s): D. Eisma, G.W. Berger

Timespan: 1986-1990

Description: Sedimentation and erosion are studied in areas of different sediment stability. Pb^{210} in silt is used as a tracer for finescale estimates of reworking, resuspension and mixing with 'old' silt. The course of sedimentation is important in relation to changes in biological activity due to eutrophication.

Projecttitle: Experimental system for ecological studies

Contactpersons(s): P.A.W.J. de Wilde

Timespan: 1987-1992

Description: By means of benthic ecosystems in mesocosm model systems studies will focus on problems related to dumping of dredged material and effects of eutrophication. An experimental benthic North Sea mesocosm has been constructed. Other experimental studies refer to the measurement of the activity of microorganisms (mineralisation processes), bioturbation and use and production of energy by dominant benthic organisms and community respiration.

Projecttitle: Role of benthic fauna in the marine system of the Southern North Sea

Contactpersons(s): F. Creutzberg, G.C.A. Duineveld

Timespan: up to 1990

Description: Since 1976 structure and function of the frontal system south of the Oyster Grounds have been studied with increasing interest. In this area an almost permanent chlorophyll front is observed concurrent with a benthic front. Causes for this benthic front are studied.

Projecttitle: Tertiary producers in the pelagic system

Contactpersons(s): F. Creutzberg, B.R. Kuipers

Timespan: up to 1990

Description: A pelagic unbalance between primary productivity and herbivorous zooplankton has been observed in the eutrophic coastal zone. An explanation for this observation is the low water temperature limiting the development of copepods. Also pelagic carnivores could suppress the herbivorous zooplankton. The project tries to find clues for the possible role of pelagic carnivores within the foodweb of the Southern Bight.

Projecttitle: Production and import of organic material in the Wadden Sea

Contactpersons(s): J.J. Beukema, G.C. Cadée

Timespan: 1986-1991

Description: Within this project longterm series of primary production measurements and biomass estimates of phytoplankton and microphytobenthos are collected since 1968. An increasing trend is observed in production and biomass of phytoplankton and microphytobenthos in the Marsdiep inlet to the Wadden Sea, probably due to eutrophication. The measurements including identification of the phytoplankton species are continued.

Projecttitle: Secondary production and population dynamics of bivalves and other benthos in the Wadden Sea

Contactpersons(s): J.J. Beukema

Timespan: longterm

Description: Population dynamics of bivalves and dominant macrobenthic species are studied with respect to numbers, distribution patterns, age distribution, recruitment, mortality, growth etc.. Long term changes in population dynamical parameters are studied and causal relations are inspected between population parameters and abiotic and biotic parameters. This study is done in cooperation with the DGW (K. Essink).

Projecttitle: Pelagic system of a non-stratified coastal sea

Contactpersons(s): H.G. Fransz, M.J.W. Veldhuis, M.A. Baars

Timespan: up to 1990

Description: The project studies several aspects of ecodynamics in the eutrophic coastal zone of the North Sea: growth of phytoplankton, limiting factors and grazing by herbivores. Also primary production measurements are anticipated.

Projecttitle: Pelagic system of a semipermanent stratified sea

Contactperson(s): H.G. Fransz, M.J.W. Veldhuis, M.A. Baars

Timespan: up to 1991

Description: The project differs from the preceding that it is situated in an other area of the North Sea: an area characterized by the Friesian front. The consequences of the front for the biological processes is the issue of the project.

Projecttitle: Ecological Study of the North Sea (BEON)

Contactperson(s): H. Lindeboom

Timespan: 1988-1992

Description: Within this project eutrophication studies will be conducted. At present the contents of the project are formulated but emphasis will be laid upon the study of the small food web (bacteria, phytoplankton, micro-zooplankton and their grazers). Also processes connecting these trophic levels will be studied in the field and in (laboratory) mesocosms. The group will also cover other aspects of the ecology of the North Sea, including micropollutant studies and modelling of (parts of) the marine ecosystem. These studies should inform decision makers on measures to be taken to control the eutrophication in the coastal zone of the North Sea.

8. INSTITUTE: NORTH SEA DIRECTORATE, P.O. Box 5807, 2280 HV Rijswijk, The Netherlands

Projecttitle: Algal blooms

Contactperson(s): W. Zevenboom

Timespan: longterm

Description: In 1986 the monitoring by airsurveillance and ship of surface algal blooms was intensified in order to assess the frequency and coverage of algal blooms and to identify the dominant phytoplankton species of these blooms. The project also deals with data gathered for 1979 to 1986, in cooperation with RIVO.

Projecttitle: Monitoring trends in chlorophyll-a and nutrients in the Dutch part of the North Sea.

Contactperson(s): W. Zevenboom, J.C.H. Peeters, R.W.P.M. Laane & F. Colijn

Timespan: long term, and in 1987-1991 in combination with EUZOUT (see 9.)

Description: During monitoring studies of the waterquality of the Dutch part of the North sea spatial and temporal trends in chlorophyll-a and nutrient concentrations are followed in 3 area's along the Dutch coast, and offshore. Assessing of corresponding phytoplankton species is in cooperation with RIVO (see 6) and DGW (see 9).

9. INSTITUTE: TIDAL WATERS DIVISION (DGW), van Alkemadeaan 400, P.O.BOX 20904, 2500 EX The Hague

Projecttitle: BAGHWAD

Contactperson(s): L. Kohsieck, K. Essink, V.N. de Jonge, J.H. de Reus

Timespan: 1987-1990

Description: Study of the effects of dredging on biota of the Waddensea, including the sensitivity analysis of the BOEDE ecosystem model on behalf of changing nutrient conditions in the Ems estuary

Projecttitle: ECOLMOD

Contactperson(s): O. Klepper, J. van der Meer, J.C.H. Peeters, J. Dijkzeul & R.W.P.M. Laane

Timespan: 1988-1990

Description: The project covers the development of mathematical models of (parts of) ecosystems to support the management analysis in the field of eutrophication, micropollutants, suspended matter and the evaluation of the Delta Works.

Projecttitle: EUZOUT

Contactperson(s): C.J.H. Peeters, R.W.P.M. Laane, F. Colijn & W. Zevenboom (North Sea Directorate)

Timespan: 1987-1991

Description: The project includes field measurements on the distribution of nutrients in the North Sea with emphasis on the coastal zone, on the primary production rates at selected stations in both eutrophic and less eutrophic areas, in combination with short-term nutrient uptake experiments (to assess the in situ limiting factor at time of sampling) and long term-term bioassay experiments (to assess the potential limiting factor). These processtudies will generate data needed to construct ecosystem models of eutrophication. Also the oxygen balance will be studied especially in stratified areas in summer.

Projecttitle: INDICAT

Contactperson(s): R. Leewis, W. Zevenboom (North Sea Directorate)

Timespan: long term, at least up to 1992

Description: The project deals with the establishment of indicator species in marine and estuarine management and monitoring studies. Aspects which are relevant for eutrophication studies are the distribution of phytoplankton species and possible changes in their distributional patterns due to altered nutrient ratio's in the coastal zone or the river Rhine discharge. Also planned is the study of possible toxic dinoflagellates in the North sea and the Wadden Sea in relation to shellfish cultures (in cooperation with National Institute for Fishery Research, M. Kat).

Projecttitle: POLWAD

Contactperson(s): G.M. Janssen

Timespan: 1987 - 1990

Description: The project deals with several aspects of pollution in the Wadden Sea; the amount and transport of micropollutants and nutrients into the Wadden sea ecosystem is quantified together with the effects of these compounds.

Projecttitle: REMOSENS

Contactperson(s): D. Spitzer

Timespan:1987-1990

Description: Examination of satellite pictures for rough estimates on surface abundance of chlorophyll-a in the Dutch part of the North Sea. In cooperation with North Sea Directorate (Peters, van Alphen, Zevenboom).