Ministry of Transport, Public works and Water Management

Directorate-General of Public Works and Water Management

National Institute for Coastal and Marine Management/*RIKZ*

National Evaluation Report of the Joint Assessment and Monitoring Programme of the Netherlands 2001

R.W. Bovelander
A. Akhiat

Report RIKZ/2003.004
January 2003

Summary

The Netherlands participates in the Joint Assessment and Monitoring Programme (JAMP) of the Oslo and Paris Commissions. This report presents the results of the Dutch contribution to the programme 2001 and the sediment results of 2000 which were not yet available at the time of the last evaluation report of the Netherlands in 2000 (ref.19).

Tributyltin (TBT) in water from inland marinas has been monitored ever since 1990. From the resultant data it is clear that there has been a decrease in TBT since the ban on the use of TBT on vessels less than 25 metres in length.
Recent data on TBT from the monitoring of sediment indicate relatively high concentrations of TBT and triphenyltin (TPhT) in all Dutch marine waters. TBT concentrations measured range between 3 and 212 µg TBT/kg sediment normalised to 5% organic Carbon. This implies that the Dutch target value MTR (Maximum Tolerable Risk concentration) of 0.7 µg/kg, laid down in the Fourth National Policy Document on Water Management is being exceeded by a factor 4.5-300. The highest TPhT concentration was about 50 µg TPhT/kg sediment normalised to 5% organic Carbon, the lowest values were below the detection limit (<5 µg TPhT/kg).

Fish disease monitoring has been included in the programme since 1991, the results of 2001 are presented in this report. The results of these assessments showed in the Western Scheldt an increasing trend for Cadmium in Flounder, as against a decreasing trend in Mussels. The water and SPM data for the Western Scheldt cannot explain this increase of Cadmium in Biota. The Cadmium concentration in SPM has been around 1 mg/kg dry weight and is slightly decreasing (27%) while dissolved concentrations show a decrease of 70% over the last decade. Even sediment data from 1988 up to 2001 show no evident change in cadmium concentrations.

The report describes the quality assurance programme of the Dutch laboratories and gives details of detection limits and participation in QUASIMEME exercises.

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Acknowledgement and requests for information

This "National Evaluation Report" has been compiled with the support of various officials at the National Institute for Coastal and Marine Management / RIKZ (part of the Ministry of Transport and Public Works, Directorate-General of Public Works and Water Management). Special thanks are due to H.J.M. Oosterwijk and his team, J. Doekes, the laboratories of the National Institute for Coastal and Marine Management at Middelburg and Haren and the laboratory of the National Institute for Fisheries Research (RIVO) in IJmuiden. The latter performed the analysis of fish diseases and analysis of contaminants in biota.

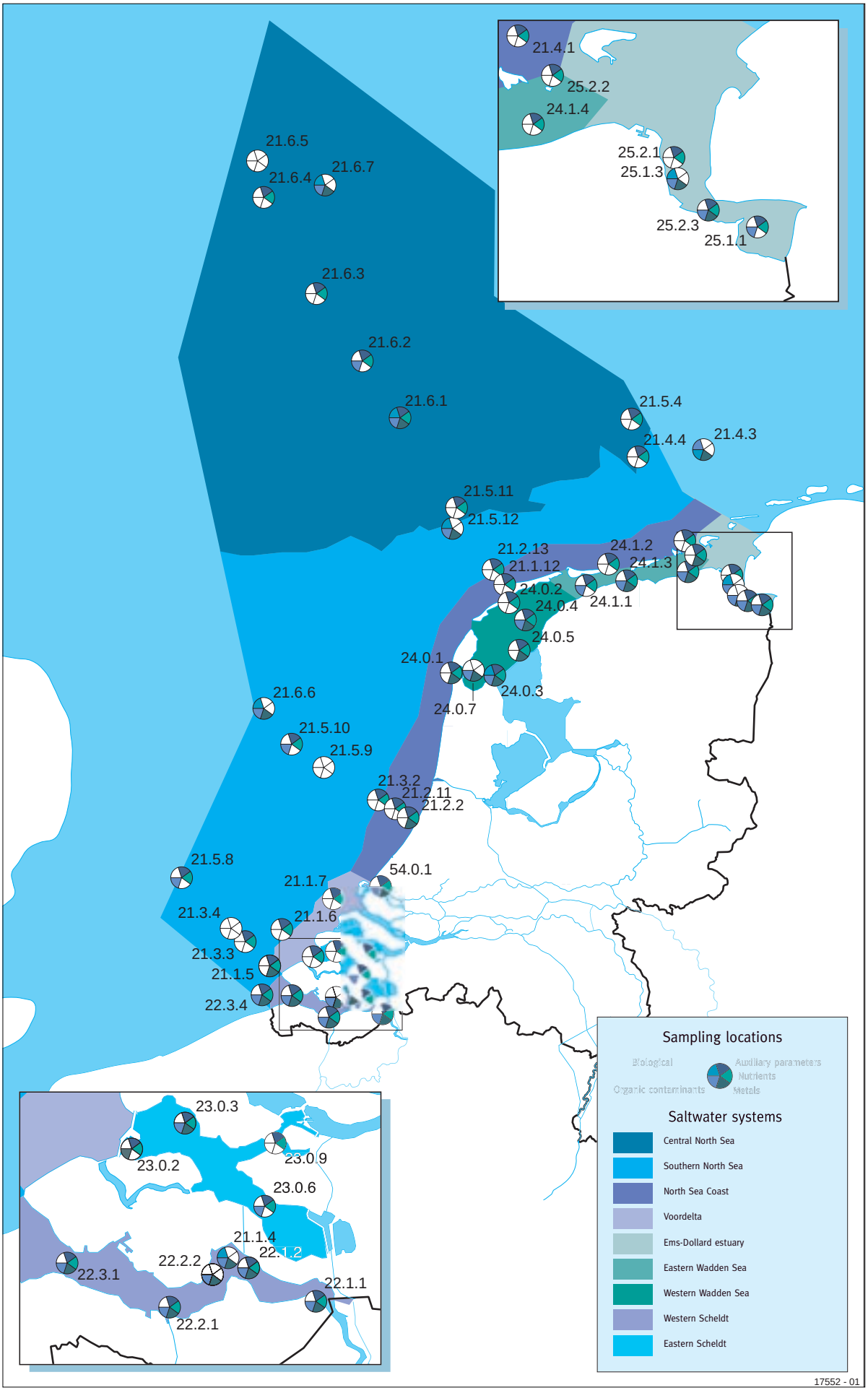
Thanks also to the designers of the Trend-Y-tector (Internet website: www.trendytector.nl), used to perform trend analyses. The data in this report has been retrieved from the database containing all Dutch statistical water monitoring information. This information is available on www.waterstat.nl (Dutch version).

Requests for information of any kind about this programme may be addressed to the Dutch delegations to the OSPAR SIME, ASMO and ADHOCMON working groups,

or

to the Ministry of Transport, Public Works and Water Management
RIJKSWATERSTAAT
RIKZ
BasisInfoDesk
PO Box 20907
NL-2500 EX The Hague
The Netherlands
Phone: +31-703114444
E-mail: basisinfodesk@rikz.rws.minvenw.nl.

Figure 1.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Metals
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Central North Sea
Southern North Sea
North Sea Coast
Voordelta
Ems-Dollard estuary
Eastern Wadden Sea
Western Wadden Sea
Western Scheldt
Eastern Scheldt
17552 - 01

Table 1.

Sampling frequencies for the areas/locations covered by the Dutch chemical monitoring programme. The areas/locations are presented in Figure 1.

ICES CODE	*AREA* LOCATIONS	Auxiliary parameters	Nutrients	Metals water	Metals sediment	Metals biota	Organic contaminants water	Organic contaminants sediment	Organic contaminants biota	Biological effects
	New Waterway									
54.0.1	MAASSS	26	26	26	.	.	13	.	.	.
	Western Scheldt				1*			1*		
22.1.1	SCHAARVODDL	26	26	26	.	.	13	.	.	.
22.1.2	HANSWGL	18	18	13	.	.	13	.	.	.
21.1.4	MIDDGBWPMLPT	.	.	.	.	1	.	.	1	1
22.2.2	HOEDKKKBI4	12	.	.	.	1	.	.	1	.
22.2.1	TERNZBI20	6	4	13	.	.	13	.	.	.
22.3.1	VLISSGBISSVH	18	18	13	.	.	13	.	.	.
22.3.4	WIELGN	6	4	.	.	.	4	.	.	.
	Eastern Scheldt				1*			1*		
23.0.9	ZIJPE	20	20	.	.	.	.	.	.	.
23.0.6	LODSGT	20	20	.	.	.	.	.	.	.
23.0.3	HAMMOT	20	20	.	.	.	.	.	.	.
23.0.2	WISSKKE	20	20	.	.	.	1	.	.	.
	Voordelta									
21.1.5	WALCRN2	12	12	.	.	.	1	.	.	.
21.3.3	WALCRN20	12	12	.	.	.	.	.	.	.
21.1.6	SCHOUWN10	12	4	.	.	.	.	.	.	.
21.1.7	GOERE6	12	12	.	.	.	.	.	.	.
	North Sea Coast									
21.2.2	NOORDWK2	18	18	4	.	.	4	.	.	.
21.2.11	NOORDWK10	30	30	.	.	.	.	.	.	.
21.3.2	NOORDWK20	18	18	.	.	.	.	.	.	.
21.1.12	TERSLG4	18	18	.	.	.	.	.	.	.
21.2.13	TERSLG10	18	18	.	.	.	.	.	.	.
21.4.1	ROTTMPT3	7	7	.	.	.	.	.	.	.
	Southern North Sea				1*			1*		
21.5.8	WALCRN70	12	12	.	.	.	.	.	.	.
21.5.10	NOORDWK70	12	12	.	.	.	4	.	.	.
21.6.6	IJMDWT80	.	.	.	.	1	.	.	.	.
21.5.11	TERSLG50	6	4	.	.	.	.	.	.	.
21.5.12	TERSLNWT40	.	.	.	.	1	.	.	.	.
	Central North Sea				1*			1*		
21.4.4	ROTTMPT50	7	7	.	.	.	.	.	.	.
21.5.4	ROTTMPT70	7	7	.	.	.	.	.	.	.
21.6.1	TERSLG100	18	18	.	.	.	.	.	.	.
21.6.1	TERSLNWT100	.	.	.	.	1	.	.	1	1
21.6.2	TERSLG135	18	18	.	.	.	1	.	.	.
21.6.3	TERSLG175	18	18	.	.	.	.	.	.	.
21.6.4	TERSLG235	18	18	.	.	.	.	.	.	.
21.6.7	DOGGBK	.	.	.	.	1	.	.	.	.
	Western Wadden Sea									.
24.0.1	MARSDND	21	21	.	.	.	.	.	.	.
24.0.3	DOOVBWT	12	12	4	.	.	4	.	.	.
24.0.3	WIERBASDP	.	.	.	.	1	.	.	1	1
24.0.5	DOOVBOT	6	4	.	.	.	.	.	.	.
24.0.4	BLAUWSOT	12	4	.	.	.	.	.	.	.
24.0.2	VLIESM	12	12	.	.	.	.	.	.	.
	Eastern Wadden Sea									.
24.1.1	DANTZGT	21	21	4	.	.	.	.	.	.
24.1.2	ZOUTKPLZGT	12	12	.	.	.	.	.	.	.
24.1.3	ZOUTKPLG	12	4	.	.	.	1	.	.	.
24.1.4	ZUIDOLWOT	21	21	.	.	.	.	.	.	.
	Ems-Dollard estuary									.
25.2.2	HUIBGOT	21	21	.	.	.	.	.	.	.
25.2.1	BOCHTVWTND	6	4	.	.	.	.	.	.	.
25.2.3	BOCHTVWTM	6	4	4	.	1	.	.	1	.
25.1.3	PAAPGTGRDPT	.	.	.	.	1	.	.	1	1
25.1.1	GROOTGND	21	21	.	.	.	4	.	.	.

1* In 2001 sediment in these areas were sampled on 10-12 locations. The locations are listed in table 17 including geografical information.

Table 2.

Parameters measured in the different phases of marine waters under the Dutch JAMP in 2001.

parameters	compartment organism	water	sediment	biota Flounder	biota Dab	biota Mussel
SALNTT	salinity	+				
SPM	suspended matter	+				
T	temperature	+				
O2	oxygen	+				
chlorophyll a		+				
total nitrogen		+				
total phosphorus		+				
particulate organic carbon (POC)		+				
total organic carbon (TOC)		+				
OC	organic carbon		+			
lutum	fraction < 2um		+			
NH4	ammonium	+				
NO2	nitrite	+				
NO3	nitrate	+				
o-PO4	ortho-phosphate	+				
SiO2	silicate	+				
Hg	mercury		+	+	+	+
Cd	cadmium	+[1])	+	+	+	+
Cu	copper	+	+		+	+
Zn	zinc	+[1])	+		+	+
Pb	lead	+[1])	+		+	+
Ni	nickel	+[1])	+			+
Cr	chromium		+			+
As	arsenic		+			+
Al	aluminium		+			
aHCH	alpha HCH	+				+
bHCH	beta HCH	+				+
cHCH	lindane	+				+
TBT	tri butyl tin	+	+			
HCB			+	+	+	+
PCB congener			+	+	+	+
Σ7 PCB	sum of 7 PCBs		+	+	+	+
B(a)P	Benzo(a)Pyrene		+			+
PAHs			+			+
Σ6 PAH	sum of 6 PAHs		+			+
4,4'-DDT						+
4,4'-DDD						+
4,4'-DDE						+
dieldrin						+
QCB						+
HEPO						+
PCTA						+
Fish disease				+		

[1]) only brakish water

1 Introduction

Under the authority of the Oslo and Paris Commissions (OSPAR), the condition of sea areas covered by the OSPAR Convention is kept under continuous review. Monitoring is carried out to determine the effectiveness of the measures undertaken by OSPAR to improve this condition. The first meeting of SIME (in 1995) decided on the Joint Assessment and Monitoring Programme (JAMP), a combination of the national monitoring programmes of the contracting parties. The programme was further developed during the years that followed. The JAMP is the successor to the JMP, which had been in operation since 1978.

Since the structure of OSPAR (working) groups changed in 1995, monitoring and assessments have become the task of the Assessment and Monitoring Committee of OSPAR (ASMO). Monitoring is carried out by different Working Groups (SIME, IMPACT, INPUT and RTT II) and coordinated by ACG (Assessment Coordination Group).

The JAMP programme covers environmental issues that will need to be addressed in an assessment. For a number of issues this involves monitoring. In 1996 the guidelines for the JAMP monitoring programme were updated and guidelines were developed for new issues. The first Quality Status Report on the new OSPAR structure, based on the results of both JMP and JAMP, was presented in July 2000.

The Dutch monitoring programme consists of biological and biological effect monitoring, the identification of spatial distribution and temporal trends, and chemical monitoring in water, biota, sediment and suspended matter.

Following further optimisation and modification of the programme in the course of 1995, chemical monitoring has been based since 1996 on two major objectives:
• temporal trend monitoring (median-values are used)
• compliance with national criteria (90-percentile values are used).
The Dutch part of the JAMP monitoring programme is part of this national chemical monitoring programme.

Each year contracting parties of the Oslo and Paris Commissions supply the results of their previous year's national JAMP monitoring programmes to the ICES database. It was agreed that members should provide "National Comments": reports containing the information needed for the correct interpretation of the reported data. Standards for National Comments were discussed and updated at the SIME meeting held in February 1997.

This document contains the National Comments of the Netherlands, together with details of the monitoring programme itself and of compliance with the OSPAR guidelines and procedures, and a discussion of the monitoring results.

An overview of the national JAMP programme is given in figure 1. This figure is a map of the Dutch part of the continental shelf showing the sampling locations. Table 1 lists the sampling frequencies for all combinations of location, substance group and phase. In Table 2 all parameters measured in the various phases are given. Data on auxiliary parameters, nutrients, metals and organic contaminants in water and biota are presented and discussed.

Chapter 2 describes the national JAMP monitoring programme and presents results for all contaminant/phase combinations. Figure 1 presents a map of all locations in the different areas (see also chap. 6.2) where samples were collected. The corresponding locations can be found in table 1 with details of the programmed frequency of sampling. Table 2 presents the parameters measured in the relevant phases and/or organisms. Finally, the locations used to calculate median and peak values for every area are presented in table 16 and 17. The used locations and area codes are the codes used in the national databases in which the results of monitoring are stored.

Technical details of the national JAMP monitoring programme are given in the chapters following 'Overall conclusions' (chap. 3).

2 Description of the monitoring programme

2.1 The monitoring programme

A major evaluation of Dutch chemical monitoring was completed in 1995. As a result, a new national chemical monitoring programme came into operation in 1996 (refs. 14 and 15). The general aims of monitoring are trend detection, assessment of compliance with Dutch criteria combined with measuring of specific contaminants in (preferably) single phases. Locations, frequency and parameters are presented in figure 1 and tables 1 and 2.

Risk limits are used in Dutch environmental policy and are the foundation of environmental quality standards. For surface waters and sediment (incl. suspended matter) two classes can be discriminated: 'streefwaarden' (comparable with Guidance values in EU systems; also considered as "Verwaarloosbaar Risico (VR)" or No Effect Levels; long term policy objectives), and 'MTR '-values (Maximaal Toelaatbaar Risico * Maximal Tolerable Risk concentrations; short term policy objectives) (table 18) (ref. 24).

Water

- Dissolved metal concentrations are only measured at a brackish water location and the Western Scheldt.
- The number of locations where nutrient concentrations are measured is 4 or 5 per area, with 4 measurements being taken in the winter period from December 1st to March 1st. This produces between 16 and 20 measurements per area, which is sufficient to identify trends. At locations used for phytoplankton sampling, the nutrients are sampled with the same frequency as the phytoplankton. At 2 locations in the Wadden Sea, samples for measuring nutrient concentrations are taken every month to gain information on incoming enrichments from the North Sea, an essential factor in the summer period.
- All auxiliary parameters including Oxygen are measured each time a station is visited. Chlorophyll-a is only measured together with samples for phytoplankton species composition.
- For hexachlorocyclohexane concentrations in water, the number of locations is 1 in every area (except for the Western Scheldt) and the frequency of sampling is generally 4 times a year.

SPM

- SPM is sampled as the major phase for trend studies of metals and hydrophobic organic contaminants in five areas: the Western Scheldt, North Sea Coast, Western and Eastern Wadden Sea and Ems-Dollard estuary. Because SPM monitoring is not yet part of the JAMP, these results are not reported to ICES.
- In areas where SPM amounts are too low, hydrophobic organic contaminants are measured by way of active biological monitoring (ABM) using mussels (hanging out mussels for 6 weeks).

Sediment

- In the sediment programme, samples are taken every 3 years from around 11 locations per area. In the case of the North Sea (4 areas), all locations sampled for JMG in the past are combined with locations sampled by The North Sea Directorate and some locations from the macrozoobenthos programme. In 1996 and 1998, all areas were sampled. In 2000 and 2001 all locations in the Central North Sea, the North Sea Coast, the Voordelta, the Southern North Sea, the Eastern Scheldt and the Western Scheldt were sampled.

Biota

- Measurements in biota cover:
  - Fish disease of Dab in spring and Flounder and Mussel in autumn
  - Mercury in Dab/Flounder muscle
  - Cadmium in Flounder liver
  - metals in Dab liver and Mussel soft body
  - PCBs in Dab/Flounder liver and Mussel soft body
  - PAHs and pesticides in Mussels soft body
  - EROD in Dab/Flounder liver.

Dab are sampled in the open sea, Flounder in the coastal zone and estuaries and Mussels in the Western Scheldt, the Voordelta and the Ems-Dollard.

2.2 National areas

Dutch marine and brackish waters are divided into 11 areas (abbreviation used in tables is given in brackets):

1. Western Scheldt: from the Belgium border to the North Sea (WESTSDE).
2. Eastern Scheldt: behind the storm surge barrier (OOSTSDE).
3. Lake Grevelingen
4. Veerse Meer (a salt lake)
5. Voordelta: defined as the area 0 - 20 km off the coast at the mouth of the Scheldt/Rhine/Meuse delta (VOORDTA).
6. North Sea Coast: the area 0 - 20 km off the North Sea and Wadden Sea Coast (KUSTZNE).
7. Southern North Sea: Dutch part of the North Sea continental shelf south of the Frisian Front (ZUIDLKNZE).
8. Central North Sea: Dutch part of the North Sea continental shelf from the Frisian Front to the Dogger Bank (CENTLNZE).
9. Western Wadden Sea: from Marsdiep to half way up Terschelling and the Frisian Coast (WADDZWT).
10. Eastern Wadden Sea: between Western Wadden Sea and Ems-Dollard estuary (WADDZOT).
11. Ems-Dollard estuary: Dutch part of the Ems-Dollard down to the North Sea (EEMSDLD).

The locations used to calculate median and peak values for each area are presented in table 13. Lake Grevelingen and Veerse Meer are not part of the OSPAR convention area.

2.3 Sampling and analyses

Sampling is carried out by the sampling units of the regional divisions of the Directorate-General for Public works and Water Management using standard sampling guidelines (RWSVs). Analyses were carried out by RIKZ, RIZA and RIVO laboratories. There were no major changes in the procedures used. Methods for water, sediment and biota are described in the following documents:
List of analytical methods used for sediment samples contaminants with matching codes, 5th edition (April 1997), RIKZ/IT-97.110X.
List of analytical methods used for seawater contaminants with matching codes, 8th edition (April 1997), RIKZ/IT-98.106X.
List of analytical methods used for biota samples contaminants with matching codes, 3rd edition (May 1995), RIKZ/IT-95.140X.

3 Compliance with the guidelines

The guidelines were revised and guidelines for new monitoring issues were produced at ADHOC meetings in 1995 and 1996. A proportion of these guidelines were then adopted by ASMO in 1997. This work is now finished and a new Manual was completed by the OSPAR secretariat in 1998.

Biota sampling in the Netherlands is performed in accordance with the guidelines (A11/94-E of the Manual, Oslo and Paris Commissions, 1990), except that Mussels are directly preserved and not allowed to discharge pseudo-faeces. This process is not considered to have a significant influence on the concentrations. Length stratified sampling is used for Flounder. Dab samples are pooled over a transect and Mussels are pooled for each length class. The analytical methods are described by Van Zeijl (1995/ref.12).

Monitoring of seawater is done in accordance with the guidelines (A12/90-E of the Manual, Oslo and Paris Commissions, 1990). The analytical methods were described by Pijnenburg (RIKZ/IT-98.106X, 1997 / ref. 10).

The measurement of biological effects was part of the NSTF (North Sea Task Force) programme, which was incorporated into the JAMP monitoring programme.

4 Information on measurements

4.1 Auxiliary parameters

Many of the OSPAR guidelines describe requirements for auxiliary parameters. For two of these (Oxygen and Chlorophyll -a), a specific guideline is available.

These parameters are measured each time a station in the Dutch national programme is visited, except for Chlorophyll-a which is measured only when phytoplankton samples are taken.

Table 1 lists the frequency of measurement of auxiliary parameters. The locations are grouped into geographical areas and the results (median and peak values) for each of these are presented in table 5.

4.2 Nutrients in water

4.2.1 The programme

General concentrations of nutrients like Nitrogen, Phosphorus and organic Carbon are measured every time the stations are visited. The median and peak values (shown in table 6) are taken over the whole of 2001. The inorganic nutrient concentrations measured during the winter period (December 1st to March 1st) are used for trend computation. The nutrient data in the winter period are presented in table 7. The frequency of sampling for phytoplankton is the same as that for nutrients (see tables 1 and 5: i.e. every month during the winter and every two weeks during the summer).

4.2.2 Trends in winter nutrient concentrations

In Dutch marine waters with salinity gradients, yearly trends in nutrient concen-trations are assessed by plotting each year's winter nutrient concen-trations against the measured salinity values to produce nutrient - salinity plots. This procedure, often called mixing diagrams, was adopted by NUT in 1989. In winter, when algae activity is lowest, nutrients show more or less conservative behaviour and a clear linear relationship with salinity: i.e. increase in concentration with decreasing distance from the coast (refs. 2 to 4). The slope of the regression line in the mixing diagram is an indica-tion of the level of nutrient inputs from land/coast during a particular year or years. For instance, a steep slope is an indication of high levels of nutrient inputs when compared with (salinity specific) reference (= background) concentrations.

In order to "compensate" for differences in salinity at the various locations from one year to another (due to differences in yearly river discharges), nutrient concentrations are "normalised" for salinity. This is done by calculating the winter nutrient concentra-tions at a given salinity (30) from the mixing diagram for a particular year. Trends in the yearly winter nutrient concentrations at a given salinity can be assessed accordingly (Figs. 2 and 3).

Fig. 2.

Winter concentrations of ortho-phosphate on the Noordwijk transect at salinity 30. Winter period is from December 1st year(n-1) to March 1st year(n).

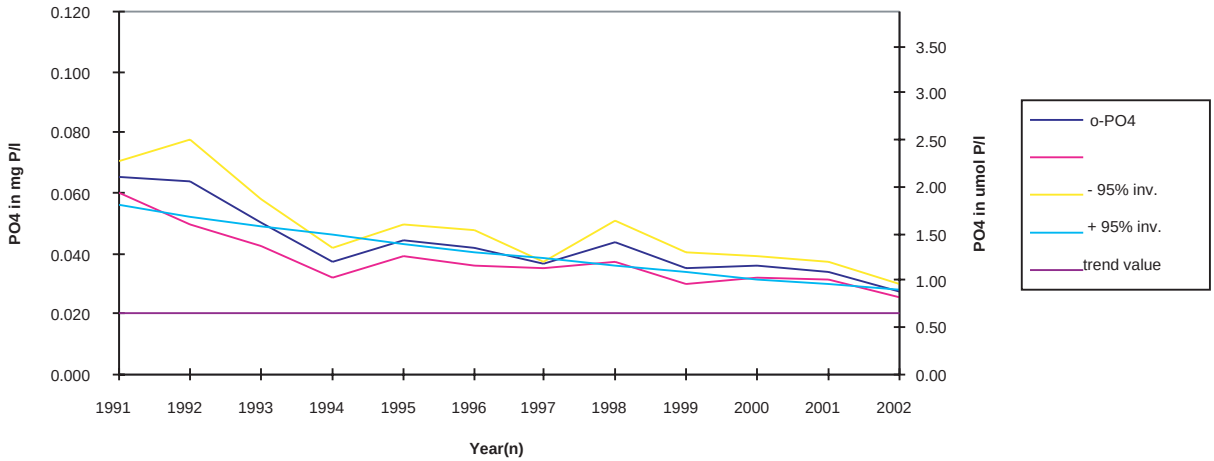

Fig. 2 shows the reduction in P-inputs, as a decline in the ortho-P- concentration on the Noordwijk transect.

> The trend was estimated by a suite of trend detection methods called Trend-Y-tector. This suite of methods for detecting and estimating trends was developed in co-operation with members of the statistical working group of the International Council for the Exploration of the Sea (ICES) and is available on the Internet (www.trendytector.nl). The software is also available on CD-ROM. <

Until 2002 there was a downward trend (Mann-Kendall, 1-sided, 5% significance) of 50%. This trend was more evident in a narrow strip (1-4 km) along the Dutch coast. (refs. 5 and 6). The wintertime background value of the ortho-phosphate concentration is 0.02 mg P/L. The wintertime concentration of ortho-phosphate on the Noordwijk transect is slightly declining towards this objective.

In the case of total dissolved inorganic Nitrogen, a downward trend in the eleva-ted con-centrations has been observed over the last 12 years (Fig. 3). This trend is amounting to a 29% decrease (Mann-Kendall, 1-sided, 5% significance). Despite the decrease, concentrations still exceed the reference (= background) values by a factor of 3-4. This is due to the constant high N-inputs over the last two decades (refs. 7 and 17).

Fig. 3.

Winter concentrations of dissolved inorganic Nitrogen on the Noordwijk transect at salinity 30. Winter period is from December 1st year(n-1) to March 1st year(n).

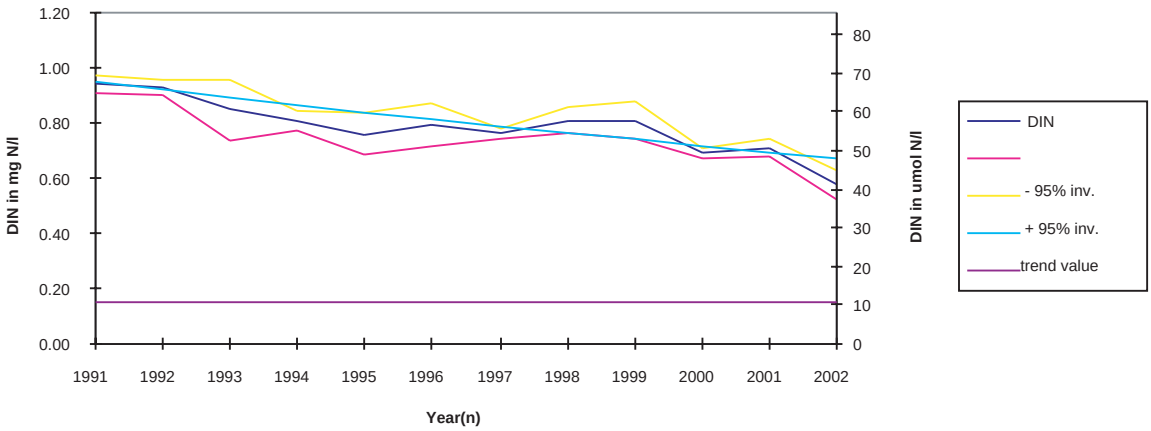

Fig. 3 shows the reduction in N-inputs, as a decline in the Dissolved Inorganic Nitrogen concentration on the Noordwijk transect.

> The trend was estimated by a suite of trend detection methods called Trend-Y-tector. This suite of methods for detecting and estimating trends was developed in co-operation with members of the statistical working group of the International Council for the Exploration of the Sea (ICES) and is available on the Internet (www.trendytector.nl). The software is also available on CD-ROM. <

4.3 Metals

Metals were measured in three phases: 1) Water (only dissolved), 2) Sediments (<63 mm) and 3) Biota (fish and mussel).
Since the optimisation of the national programme in 1996, total metal concentrations in seawater have no longer been measured. Measurement of dissolved Mercury at marine locations ended in 1998 and of dissolved Chromium and Arsenic in 2000. In 2001 only Copper was monitored at marine locations.
The Dutch national programme also includes concentrations of metals in SPM but the data are not reported here since this is not yet part of the JAMP monitoring programme.

4.3.1 **Metals in Water**

Concentrations of dissolved metals are presented in table 8.
The median values of Cadmium, Nickel, Lead and Zinc in the brackish water location MAASSS do not exceed a value of ten times the detection limit. Except for Copper the 90 percentile of all metals are below the target value of Maximal Tolerable Risk concentration (MTR). Copper concentrations are highest in the New Waterway and the Ems-Dollard.

In general, concentrations of inorganic metals are gradually declining over the years to an environmentally acceptable level. The concentrations of heavy metals in the brackish water location in 2001 do not show this phenomenon (yet).

4.3.2 **Metals in Sediment**

Sampling of the whole Dutch marine area is spread over 3 years. The measurement of concentrations in sediments has been part of the national programme since 1996, with each location being sampled once every 3 years. This national sediment monitoring programme includes all the locations which were sampled in the past for JMG and/or JAMP purposes. Sediments taken from the Central North Sea, the North Sea Coast, the Voordelta and the Southern North Sea in 2000; and sediments taken from the Eastern and Western Scheldt in 2001 were assessed (using the 90-percentile) on the basis of Dutch environmental criteria. In all areas (in which sediment was sampled in the year 2000) there was at least one metal concentration which exceeded the national target value. Major problem area in 2000 is the North Sea Coast; 5 of the 8 metals exceeded. Minor problem area in 2000 was the Central North Sea; only Arsenic exceeded the target value.
In the Western Scheldt all the metal concentrations in 2001 exceeded the national minimal risk values (VR). In the Eastern Scheldt only Arsenic and Zinc exceeded the target values. The ranges of the OSPAR Ecotoxicological Assessment Criteria are in the same range as the Dutch national criteria.

4.3.3 **Metals in Biota**

Dab (Limanda limanda) and Flounder (Platichthys flesus) were caught at three offshore locations and in the Western Wadden Sea. Mussels (Mytilus edulis) were collected in the middle part of the Western Scheldt, the Voordelta and in the Ems-Dollard estuary. Mercury concentrations were measured in female Dab muscle, male Flounder muscle and Mussels. Cadmium, Lead, Copper and Zinc were measured in female Dab liver, Cadmium in male Flounder liver and a range of metals in Mussels. The results are presented in table 10. Trends in biota were included in the assessment carried out by ADHOC MON (a SIME working group) in February 1998. The results of these assessments showed in the Western Scheldt an increasing trend for Cadmium in Flounder, as against a decreasing trend in Mussels. In the case of Flounder, the 1999 data show a continuation of this trend. Adding the 1999 data, resulted in a significant increasing trend in Cadmium concentrations in Mussels from the Western Scheldt, where no significant trend could be found in former years.

If these trends are quantified using a smoother, the results show a significant trend for Cadmium in Flounder liver tissue in the Western Scheldt, amounting to appr. 300% increase over the 1992-2001 period. In the same period, an increase of more then one order of magnitude is observed in the soft body of Mussels. The water and SPM data for the Western Scheldt cannot explain this increase of Cadmium in Biota. The Cadmium concentration in SPM has been around 1 mg/kg dry weight and is slightly decreasing (27%) while dissolved concentrations show a decrease of 70% over the last decade. Even sediment data from 1988 up to 2001 show no significant change in cadmium concentrations.

Given that the Cadmium levels in SPM and sediment have been more or less stable (at 1mg/kg) over the last decade, we cannot explain the increasing levels found in biota. However a possible explanation could be dredging activity near Antwerp or the increase in oxygen concentration in the

Scheldt, which might affect Flounder more due to their migratory behaviour. Since information on dredging activity is not currently available, it is not possible to investigate these patterns further. In a joint assessment workshop of INPUT and SIME in november 2000 this was one of the assessed cases (ref. 20)

4.4 Organic contaminants

Organic contaminants are measured in three phases in the Dutch marine area: 1) Water, 2) Sediment and 3) Biota. They are also measured in SPM but these measurements are not reported here since SPM is not part of JAMP.

4.4.1 **Organic contaminants in Water**

Table 11 presents the concentrations of hexachlorocyclohexane (HCH) in water. A qualitative comparison of the results with results from former years reveals no major changes.

Since 1990, water from inland marinas has also been tested for Tributyltin. From the resultant data it is very clear that there has been a decrease in TBT over the last decade, since the ban on the use of TBT on vessels measuring less than 25 metres.

4.4.2 **Organic contaminants in Sediment**

Sediments taken from the Central North Sea, the North Sea Coast, the Voordelta and the Southern North Sea in 2000; and sediments taken from the Eastern and Western Scheldt in 2001 were assessed (using the 90-percentile) on the basis of Dutch environmental criteria. In the sampled areas, concentrations of PAHs exceeded the criteria and concentrations of PCBs were about equal to them or lower (Central and Southern North Sea). An exception is the Western Scheldt; e.g. PCB153 was exceeded by a factor 4.5.

In 1998 a special report was issued on Butyltin concentrations in the Dutch coastal marine environment (ref. 18). The highest values were observed in the sediment of the Western Scheldt (an estuary) and the Veerse Meer (a salt lake). The Dutch target value for short-term MTR (laid down in the Fourth National Policy Document on Water Management) was exceeded by a factor of 80-300. The target for the long term is a factor of 100 lower. Data levels are of the same order as those given in the literature. However, differences in sampling techniques, analysis and presentation make comparison difficult.

This report presents Dutch monitoring data for TriButylTin (TBT) compounds in sediment from 2000 and 2001. In the Western Scheldt the criteria were exceeded by a factor of approximately 270! Sampling, analyses and quality assurance were in accordance with OSPAR guidelines. At 5% Organic Carbon, standardized results are presented in table 3.
5% Organic Carbon is equivalent to 10% Organic Matter. The Ecotoxicological Assessment Criterium of OSPAR for TBT is 0,005-0,05 mg/kg.

Table 3.
Lowest, median and highest TBT levels in µg/kg sediment standardised at 5% organic Carbon and the number of measurements.

Area	Min.	Med.	Max.	N
Central North Sea	3	6.6	12	10
North Sea Coast	36	65	113	12
Voordelta	46	58	89	10
Southern North Sea	10	22	76	11
Eastern Scheldt	25	34	47	9
Western Scheldt	22	150	212	9

> Highest Tri-PhenylTin (TPhT) concentration was about 20 µg TPhT/kg sediment standardised at 5% organic Carbon, lowest values were below detection limit (<5 µg TPhT/kg) <.

4.4.3 **Organic contaminants in Biota**

Organic contaminants were measured in female Dab liver, male Flounder liver and Mussels. The results are presented in table 13. The ADHOCMON working group assessed older data at its February 1998 meeting. The following trends were found:

- decreasing trends of PAHs and HCH in Mussels in the Western Scheldt and Ems-Dollard estuary.
- decreasing trends of organochlorine pesticides (OCPs) in Mussels.

A large number of data were excluded from this assessment for QA reasons. They related mainly to PCBs in Flounder.
The data presented in table 13 confirm the above-mentioned trends.

4.5 Biological effects

4.5.1 **Fish disease**

It is generally recognised that certain fish diseases are suitable indicators for monitoring anthropogenic environmental stress, including pollution (ref. 8). Long-term exposure to chemically contaminated sediment can induce liver tumours in Flounder (ref. 9).

Monitoring of the incidence of skin and liver diseases is performed at all locations where Dab and Flounder are caught for monitoring of contaminants in biota. Details of these can be found in figure 1. A discussion of the monitoring of fish disease is included in the 1995 National Evaluation Report.

In 2001 dab (Limanda limanda) was caught at three offshore locations. For dab, the overall mean incidence of the three epidermal diseases (Lymphocystis, epidermal papilloma and skin ulcer) varied from 0.2% up to 6.2%, depending on the kind of disease and the location. The results are presented in table 14. Incidence of epidermal diseases in dab was highest at the location DOGGBK located in the Central North Sea (lymphocystis 6.2% and skin ulcer 5.9%).
The spatial variation of the occurrence of liver diseases was much smaller. The overall mean incidence of the liver diseases varied from 0% up to 0.2% (table 14).
Prevalence of Glugea cysts were highest at the location IJMDWT80 located in the Southern North Sea (Glugea cysts 7.9%) (table 14).

In 2001 flounder (Platichthys Flesus) was caught at only one location, namely WIERBASDP located in the Western Wadden Sea. The overall mean incidence of lymphocystis was 0.4% and of skin ulcer was 10.3%. The results are presented in table 14.

A long term assessment of fish diseases is planned for 2003 and will be included in the next National Evaluation Report of the Netherlands.

5 Information on Quality Assurance

5.1 Introduction

This chapter contains what were originally called the National Comments. This is intended to be a document explaining the JAMP data reported to ICES so that they can be assessed properly. It is supposed to contain information on quality assurance measures in relation to all data reported, as well as on inter-calibration exercises and participation in QUASIMEME activities.
Methods of sampling and analysis are described in separate documents: Van Zeijl (1995 / ref. 12) and Pijnenburg (1997a, b / refs. 10 and 11). These documents have been submitted to the OSPAR secretariat and ICES, but will also be supplied on request.

5.2 Quality assurance at the National Institute for Coastal and Marine Management/RIKZ

In order to compare results from different laboratories, it is essential to know the quality of the data. This is influenced by all the steps leading to their production: sampling, transport, storage, analysis, calculation and interpre-tation. A minimum prerequisite to ensure the overall quality of data is a Quality Assurance System complying with the European Norm EN45001.
The policy of the Dutch government is that QA-procedures for sampling and analysis (in governmental and commercial laboratories) must be accredited by the Dutch Accreditation Board (complying to the international standard). The RIKZ laboratory (which supplied most of the results discussed in this report) received accreditation in 1999. The RIZA and RIVO laboratories are accredited for the analyses they perform.

5.3 Sampling

Within the Ministry's Public Works and Water Management Department, different divisions are responsible for sampling (and preservation) on the one hand and chemical analysis on the other. This means that sampl-ing is not subject to the Quality Assurance System of the laboratory. However, there is clo-se and evident co-operation between the laboratory and the sampling groups. A project is currently under way to help the sampling groups to set up their own Quality Assurance Systems. As a result, sampling procedures are now well-documented and quality assurance systems are being implemented by the various sampling groups. An external auditor already has audited the Quality Assurance Systems of the different Divisions just to see what still has to be done.

5.4 Analysis

A quality control scheme has been established in order to provide information on the precision, accuracy and comparability of analysis (see figure 4). Control charts of Internal Reference Material (IRM) or Certified Reference Material are used for internal validation.

Intercalibration of the laboratories has been achieved through participation in appropriate natio-nal and international intercalibration tests. All the Dutch laboratories that participate in the Joint Monitoring Programme are taking part in the QUASIMEME programme.
A international Quality Assurance Control Scheme can be a powerful tool for achie-ving better comparability between different laboratories. Unfortunately, the number of laboratories available to carry out marine analyses in the Netherlands is too small to permit the development of a useful National Analytical Quality Control Scheme.

Results of analyses of Internal Reference Material or Certified Reference Material will be reported together with the monitoring data to ICES in 2003.

5.5 Detection limits

5.5.1 **Seawater and sediment**

Definition: The detection limit (DL) equals three times the standard deviation of the blank [S(bl)]:

Formula 1: **DL = 3 * S(bl)**

This calculation of the detection limit is used for metals, nutrients and organic micro pollutants.

The detection limit depends on the amount of sample taken for the analysis. It is computed by taking the minimum amount of sample prescribed by the method. The blank is analysed ten times.

Numerical values for seawater and sediment are listed in table 15.

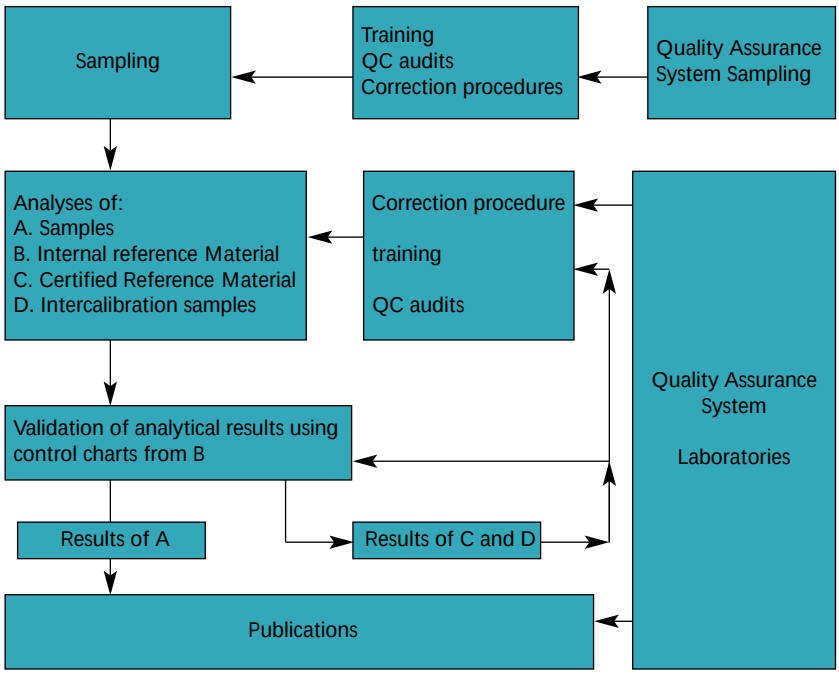

Figure 4.
Analytical Quality Control Scheme.

5.5.2 **Biota**

The analyses of biological materials in biota are performed in the context of the JAMP monitoring programme by RIVO.

Definition of detection limit for trace metals:
The detection limit (DL) equals twice the standard deviation of the blank [S(bl)]:

Formula 2: **DL = 2 * S(bl)**

This formula for the detection limit is used for Mercury and Cadmium. The detection limit depends on the amount of sample taken for the analysis. It is computed by taking the minimum amount of sample prescribed by the method.

Definition for organic micropollutants:
The detection limit equals three times the average of the noise [(X(r)]:

Formula 3: **DL = 3 * X(r)**

This formula for the detection limit is used for PCBs. The detection limit depends on the amount of sample taken for the analysis. It is computed by taking the minimum amount of sample prescribed by the method.
Numerical values for biota are listed in table 15.

5.6 Intercalibration

All Dutch laboratories participating in the Joint Assessment and Monitoring Programme take part in the QUASIMEME programme. QUASIMEME intercalibration exercise rounds in which analysing laboratories participated in 2001 were:

Table 4.
QUASIMEME codes for 2001

Lab.	Round / Code	Parameter / Compartment		ICES code
RIKZ	23 / QTM042SW	459AQ3	Metals/Seawater	FZ
RIKZ	23 / QTM043SW	459AQ3	Metals/Seawater	G1
RIKZ	23 / QTM045SW	460AQ4	Mercury/Seawater	G3
RIKZ	23 / QTM046SW	460AQ4	Mercury/Seawater	G4
RIKZ	23 / QOC021SW	461AQ5	PCB's & OCP's/Seawater	G6
RIKZ	23 / QTP026SW	464AQ8	Ops and Herbs/Seawater	GC
RIKZ	23 / QTP028SW	464AQ8	Ops and Herbs/Seawater	GE
RIKZ	24 / QNU086SW	467AQ1	Nutrients/Seawater	GI
RIKZ	24 / QNU087SW	468AQ1	Nutrients/Seawater	GJ
RIKZ	24 / QTM054MS	469MS1	Metals/Sediment	GO
RIKZ	24 / QTM055MS	469MS1	Metals/Sediment	GP
RIKZ	24 / QOR064MS	470MS2	PCB's & OCP's/Sediment	J7
RIKZ	24 / QOR065MS	470MS2	PCB's & OCP's/Sediment	J8
RIKZ	24 / QPH028MS	471MS3	PAH's/Sediment	GQ
RIKZ	24 / QPH029MS	471MS3	PAH's/Sediment	GR
RIKZ	25 / QTP029SW	464AQ8	Ops and Herbs/Seawater	HB
RIKZ	25 / QTP030SW	464AQ8	Ops and Herbs/Seawater	HC
RIKZ	25 / QTP031SW	464AQ8	Ops and Herbs/Seawater	HD
RIKZ	25 / QOC022SW	477AQ5	PCB's & OCP's/Seawater	H4
RIKZ	25 / QOC023SW	477AQ5	PCB's & OCP's/Seawater	H5
RIKZ	25 / QOC024SW	477AQ5	PCB's & OCP's/Seawater	H6
RIKZ	25 / QCH001SW	484DE	Chlorophyll/Seawater	
RIKZ	26 / QNU091SW	490AQ1	Nutrients/Seawater	HE
RIKZ	26 / QNU092SW	491AQ1	Nutrients/Seawater	HF
RIKZ	26 / QTM056MS	492MS1	Metals/Sediment	HJ
RIKZ	26 / QTM057MS	492MS1	Metals/Sediment	HK
RIKZ	26 / QOR066MS	493MS2	PCB's & OCP's/Sediment	HL
RIKZ	26 / QOR067MS	493MS2	PCB's & OCP's/Sediment	HM
RIKZ	26 / QPH030MS	494MS3	PAH's/Sediment	HN
RIKZ	26 / QPH031MS	494MS3	PAH's/Sediment	HO
RIVO	24 / QOR066BT	473BT2	PCB'& OCP's/Biota	GU
RIVO	24 / QOR067BT	473BT2	PCB'& OCP's/Biota	GV
RIVO	24 / QTM049BT	472BT1	Metals/Biota	GS
RIVO	24 / QTM050BT	472BT1	Metals/Biota	GT
RIVO	26 / QOR068BT	496BT2	PCB'& OCP's/Biota	HR
RIVO	26 / QOR069BT	496BT2	PCB'& OCP's/Biota	HS
RIVO	26 / QTH027BT	497BT4	PAH's/Biota	HT
RIVO	26 / QTH028BT	497BT4	PAH's/Biota	HU
RIVO	26 / QTM051BT	495BT1	Metals/Biota	HP
RIVO	26 / QTM052BT	495BT1	Metals/Biota	HQ

Experts who wish to evaluate the reported data of the Netherlands will be supplied by ICES on request with all the detailed information of the results of the desired intercalibration.

6 Overall conclusions

The data in this report reveal a decreasing trend in dissolved inorganic phosphate and dissolved inorganic nitrogen in the Coastal zone. Increasing Cadmium concentrations in biota in the Western Scheldt in the 1991-2001 period could not be explained using information from other phases. For a better understanding of the underlying mechanisms, further research will be necessary.

Compared to 2000 the 2001 data showed halving of the Cadmium concentration in Flounder muscle from the Western Scheldt. The concentrations are the highest measured in the last decade. Adding the 2001 data, resulted in a significant increasing trend in Cadmium concentrations in Mussels from the Western Scheldt, where no significant trend could be found up to 1995.

In general, concentrations of dissolved inorganic phosphate and metals are slowly declining over the years towards an environmentally acceptable level.

Trends in sediments have not been assessed, but a comparison of concentrations in sediment with national criteria was performed in 1999. Concentrations of PAHs exceed these criteria, concentrations of PCBs were about equal to them, except for the Western Scheldt.

Trends in biota were examined at the ADHOCMON meeting in February 1998. Almost all detected trends were downward. The results have been used for the QRS2000.

Levels of TBT in inland marinas relatively close to the coast have declined rapidly since the implementation of a ban on its use on small vessels more then ten years ago.

Recent monitoring data on TBT in sediment indicate high concentrations of Tributyl and Triphenyltin in all Dutch marine waters. TBT concentrations measured range between 3 and 212 µg TBT/kg sediment normalised to 5% organic Carbon. The Dutch target value (MTR), of 0.7 µg/kg, laid down in the Fourth National Policy Document on Water Management is exceeded by a factor of 4.5-300. In the 2001 sampled areas, Western and Eastern Scheldt, showed exceeding factors of 272 times the national objectives.

7 Tables

Table 5.

Number of measurements (n) and median (M) and peak (P) values of auxiliary parameters in seawater in 2001.

Area	n	SALNTT M	SALNTT P	n	SPM in mg/l M	SPM in mg/l P	n	T in °C M	T in °C P	n	O2 in mg/l M	O2 in mg/l P	n	Chlorophyll a in ug/l in summer M	Chlorophyll a in ug/l in summer P
WESTSDE	79	21.38	32.05	116	42	316	79	10.75	21.72	76	9.41	11.21	44	8.36	75.2
OOSTSDE	60	29.82	33.75	60	4	40	60	10.81	22.28	60	9.24	11.81	52	7.88	26.4
VOORDTA	36	31.08	32.73	36	15	85	36	10.70	20.16	36	9.194	11.06	18	7.85	55.8
NIEUWWTWG				26	29	211	26	14.0	24.7	25	10.2	13.7	13	8	27
KUSTZNE	52	30.61	32.93	63	7	53	52	11.55	19.90	52	9.099	13.31	69	7.25	37.4
ZUIDLKNZE	37	34.40	35.23	38	3	7	37	11.84	18.64	38	8.460	12.04	21	2	10.8
CENTLNZE	25	34.67	34.83	25	2	6	25	12.56	17.04	25	8.591	11.05	40	0.71	6.14
WADDZWT	50	24.51	30.15	62	19	70	51	9.25	21.40	51	9.80	14.37	21	9.18	26
WADDZOT	54	27.85	31.76	64	66	217	54	11.26	22.13	54	8.62	10.89	34	22.8	56.2

Table 6.

Number of measurements (n) and median (M) and peak (P) values of Nitrogen, Phosphorus and Organic Carbon in seawater in 2001.

Area	n	Total Nitrogen in mg N/l M	Total Nitrogen in mg N/l P	n	Total Phospores in mg P/l M	Total Phospores in mg P/l P	n	Part. Org. Carbon in mg C/l M	Part. Org. Carbon in mg C/l P	n	Total Org. Carbon in mg C/l M	Total Org. Carbon in mg C/l P
WESTSDE	65	2.84	6.1	66	0.198	0.301	74	1.5	4.5	71	4.6	12.1
OOSTSDE	60	0.795	1.31	60	0.056	0.101	60	0.43	1.6	60	2.26	4.44
VOORDTA	23	0.766	1.32	23	0.067	0.103	36	0.79	3.7	36	2.3	5.7
NIEUWWTWG	26	3.49	5.1	26	0.11	0.20				26	4.5	13
KUSTZNE	52	0.51	1.31	52	0.034	0.085	52	0.55	4.0	52	1.99	6.4
ZUIDLKNZE	31	0.204	0.444	31	0.018	0.034	38	0.18	1.2	38	1.08	2.7
CENTLNZE	25	0.113	0.18	25	0.013	0.03	25	0.11	0.59	25	0.98	1.43
WADDZWT	42	1.06	2.76	41	0.058	0.127	51	1.3	3.3	50	4.2	7.6
WADDZOT	52	1.29	2.71	53	0.162	0.298	51	3.0	7.7	51	6.3	11
EEMSDLD	51	2.55	7.14	50	0.223	0.458	52	3.3	9.2	52	9.2	22.3

Table 7.

Number of measurements (n) and median (M) and peak (P) values of winter concentrations of nutrients in seawater in 2001. Winter period is from December 1st 2000 to March 1st 2001.

Area		NH4 in mg N/l		NO2 in mg N/l		NO3 in mg N/l		o-PO4 in mg P/l		SiO2 in mg Si/l	
	n	M	P	M	P	M	P	M	P	M	P
WESTSDE	16	0.07	0.47	0.026	0.049	2.05	4.82	0.089	0.166	2.14	4.71
OOSTSDE	9	0.12	0.197	0.027	0.042	0.554	0.878	0.041	0.061	0.824	1.16
VOORDTA	8	0.028	0.049	0.008	0.01	0.619	0.85	0.034	0.045	0.669	0.715
NIEUWWTWG	7	0.2	0.4	0.03	0.05			0.08	0.111	6.5	7.2
KUSTZNE	11	0.034	0.074	0.009	0.014	0.606	0.985	0.03	0.044	0.51	0.838
ZUIDLKNZE	8	0.002	0.02	0.003	0.005	0.116	0.156	0.016	0.02	0.109	0.173
CENTLNZE	2	0.004	0.005	0.002	0.002	0.089	0.093	0.019	0.02	0.119	0.14
WADDZWT	12	0.093	0.126	0.014	0.022	0.94	1.88	0.028	0.033	1	1.63
WADDZOT	9	0.162	0.249	0.027	0.037	0.775	0.971	0.04	0.07	1.09	1.98
EEMSDLD	12	0.161	0.439	0.038	0.064	2.14	5	0.055	0.077	2.53	3.67

Table 8.

Number of measurements (n) and median (M) and peak (P) values of concentrations of dissolved inorganic contaminants in seawater in 2001.

Parameter	Area	n	in µg/L M	P
Cd	WESTSDE	39	0.04	0.07
	NIEUWWTWG	26	0.05	0.08
Cu	WESTSDE	37	1.2	3.4
	NIEUWWTWG	26	1.95	8.5
	KUSTZNE	4	0.6	0.6
	WADDZWT	4	0.7	0.8
	WADDZOT	4	0.6	0.8
	EEMSDLD	4	1.1	1.5
Ni	NIEUWWTWG	25	0.8	2.6
Pb	NIEUWWTWG	26	0.1	0.5
Zn	WESTSDE	39	3.5	10
	NIEUWWTWG	26	2.4	8.3

Table 9.

Number of measurements (n) and median (M) and peak (P) values of concentrations of inorganic metals in sediments in 2000 and 2001.

	Concentrations of inorganic metals in sediments in 2000.				Concentrations of inorganic metals in sediments in 2001.			
Parameter	Area	n	in mg/kg M	P	Area	n	in mg/kg M	P
As	CENTLNZE	10	24	51	OOSTSDE	9	20	57
	KUSTZNE	11	28	47	WESTSDE	9	27	58
	VOORDTA	10	20	26				
	ZUIDLKNZE	11	29	48				
Cd	CENTLNZE	10	0.13	0.48	OOSTSDE	9	0.57	0.77
	KUSTZNE	11	0.53	0.89	WESTSDE	9	1.00	3.70
	VOORDTA	10	0.47	0.73				
	ZUIDLKNZE	11	0.35	1.0				
Cr	CENTLNZE	10	98	110	OOSTSDE	9	84	100
	KUSTZNE	11	92	120	WESTSDE	9	98	140
	VOORDTA	10	88	100				
	ZUIDLKNZE	11	81	110				
Cu	CENTLNZE	10	18	22	OOSTSDE	9	16	25
	KUSTZNE	11	22	28	WESTSDE	9	24	58
	VOORDTA	10	16	24				
	ZUIDLKNZE	11	18	24				
Hg	CENTLNZE	10	0.11	0.14	OOSTSDE	9	0.25	0.28
	KUSTZNE	11	0.32	0.52	WESTSDE	9	0.41	0.62
	VOORDTA	10	0.24	0.38				
	ZUIDLKNZE	11	0.15	0.29				
Ni	CENTLNZE	10	38	41	OOSTSDE	9	26	35
	KUSTZNE	11	29	34	WESTSDE	9	26	38
	VOORDTA	10	24	27				
	ZUIDLKNZE	11	33	40				
Pb	CENTLNZE	10	68	110	OOSTSDE	9	53	81
	KUSTZNE	11	74	120	WESTSDE	9	70	98
	VOORDTA	10	62	86				
	ZUIDLKNZE	11	66	78				
Zn	CENTLNZE	10	110	160	OOSTSDE	9	150	230
	KUSTZNE	11	200	280	WESTSDE	9	230	440
	VOORDTA	10	165	210				
	ZUIDLKNZE	11	130	180				

Table 10.

Number of measurements (n) and median (M) and peak (P) values of concentration of inorganic metals in biota in 2001.

Area	Parameter	Species	Organ	n	in mg/kg dw M	P
WESTSDE	As	Mussel	soft body	5	7.8	9.5
EEMSDLD	As	Mussel	soft body	5	7.5	9
WESTSDE	Cd	Mussel	soft body	5	6.4	9.7
EEMSDLD	Cd	Mussel	soft body	5	0.74	1.41
WESTSDE	Cd	Flounder	liver	25	0.38	0.99
WADDZWT	Cd	Flounder	liver	25	0.058	0.22
EEMSDLD	Cd	Flounder	liver	22	0.23	0.32
ZUIDLKNZE	Cd	Dab	liver	6	0.18	0.22
CENTLNZE	Cd	Dab	liver	3	0.26	0.29
WESTSDE	Cr	Mussel	soft body	5	3.8	4.1
EEMSDLD	Cr	Mussel	soft body	5	3.3	5.6
WESTSDE	Cu	Mussel	soft body	5	10	11
EEMSDLD	Cu	Mussel	soft body	5	8.1	8.6
ZUIDLKNZE	Cu	Dab	liver	6	6.6	8
CENTLNZE	Cu	Dab	liver	3	4.4	4.9
WESTSDE	Hg	Mussel	soft body	5	0.27	0.35
EEMSDLD	Hg	Mussel	soft body	5	0.191	0.24
WESTSDE	Hg	Flounder	muscle	25	0.29	0.58
WADDZWT	Hg	Flounder	muscle	25	0.23	0.61
EEMSDLD	Hg	Flounder	muscle	22	0.29	0.68
WESTSDE	Pb	Mussel	soft body	5	5.1	6
EEMSDLD	Pb	Mussel	soft body	5	3.5	4.9
WESTSDE	Zn	Mussel	soft body	5	260	290
EEMSDLD	Zn	Mussel	soft body	5	108	112
ZUIDLKNZE	Zn	Dab	liver	6	34	59
CENTLNZE	Zn	Dab	liver	3	40	58

Table 11.

Number of measurements (n) and median (M) and peak (P) values of concentrations of hexachlorocyclohexane in seawater in 2001.

Area	n	α–HCH in ug/l M	α–HCH in ug/l P	β–HCH in ug/l M	β–HCH in ug/l P	ϒ–HCH M	ϒ–HCH P
WESTSDE	52	< 0.00010	0.0002	< 0.00010	0.0005	0.0018	0.0072
OOSTSDE	1	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0006	0.0006
VOORDTA	1	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0007	0.0007
NIEUWWTWG	13	< 0.001	< 0.001	< 0.001	< 0.005	0.001	0.002
KUSTZNE	4	< 0.00010	0.00010	0.00010	0.0002	0.0006	0.0011
ZUIDLKNZE	4	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0003	0.0003
CENTLNZE	1	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0001	0.0001
WADDZWT	4	0.00010	0.0002	0.0003	0.0002	0.0007	0.001
WADDZOT	1	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0006	0.0006
EEMSDLD	4	< 0.00010	0.0002	< 0.00010	0.00010	0.0012	0.0038

Table 12.

Number of measurements (n) and median (M) and peak (P) values of concentrations of organic contaminants in sediments in 2001. VR = "Verwaarloosbaar Risico" or No Effect Level; MTR = Maximal Tolerable Risk concentration.

	Concentrations of organic contaminants in sediments in 2000				Concentrations of organic contaminants in sediments in 2001				VR	MTR
Parameter	Area	n	in µg/kg M	P	Area	n	in µg/kg M	P		
PCB153	CENTLNZE	10	0.3	0.5	OOSTSDE	9	2.0	3.2	4 µg/kg	4 µg/kg
	KUSTZNE	12	3.3	4.0	WESTSDE	9	5.0	18.0		
	VOORDTA	10	2.1	4.7						
	ZUIDLKNZE	11	0.7	1.6						
∑7PCB	CENTLNZE	10	0.8	2.1	OOSTSDE	9	7.3	12.5		
	KUSTZNE	12	13.6	16.7	WESTSDE	9	19.5	67.5		
	VOORDTA	10	7.6	19.9						
	ZUIDLKNZE	11	2.8	6.1						
BaP	CENTLNZE	10	59	100	OOSTSDE	9	65	130	3 µg/kg	3000 µg/kg
	KUSTZNE	12	73	100	WESTSDE	9	120	250		
	VOORDTA	10	54	100						
	ZUIDLKNZE	11	24	73						
∑6PAH	CENTLNZE	10	0.58	0.83	OOSTSDE	9	0.5	0.9		
	KUSTZNE	12	0.56	0.77	WESTSDE	9	0.8	1.5		
	VOORDTA	10	0.42	0.75						
	ZUIDLKNZE	11	0.24	0.59						
TBT	CENTLNZE	10	3.2	8.2	OOSTSDE	9	20	32	0.007 µg/kg	0.7 µg/kg
	KUSTZNE	12	40	59	WESTSDE	9	72	140		
	VOORDTA	10	30	40						
	ZUIDLKNZE	11	15	28						
TPhT	CENTLNZE	7	<3	10.0	OOSTSDE	9	6.2	16.0		
	KUSTZNE	7	5.3	11.0	WESTSDE	9	8.4	33.0	0.01 µg/kg	1 µg/kg
	VOORDTA	5	3.6	5.2						
	ZUIDLKNZE	9	3.3	8.7						

Parameter	Area	n	in % M	P	Area	n	in % M	P
OC	CENTLNZE	10	2.2	5.3	OOSTSDE	9	3.1	5.0
	KUSTZNE	12	3.0	4.6	WESTSDE	9	2.3	3.3
	VOORDTA	10	2.6	3.2				
	ZUIDLKNZE	11	3.3	4.4				

Table 13.

Number of measurements (n) and median (M) and peak (P) values of concentrations of organic contaminants in biota in 2001, expressed as µg/kg wet weight, µg/kg dry weight and µg/kg fat.

Area	Species	Organ	n	∑7PCB in ug/kg ww		∑7PCB in ug/kg dw		∑7PCB in ug/kg fat	
				M	P	M	P	M	P
ZUIDLKNZE	Dab	liver	6	34	62	45	85	533	655
CENTLNZE	Dab	liver	3	7.9	9.9	11	13	117	141
WESTSDE	Flounder	liver	25	601	1058	1760	4200	2800	3900
EEMSDLD	Flounder	liver	21	102	133	220	390	450	800
WADDZWT	Flounder	liver	25	76	369	270	700	690	1250
WESTSDE	Mussel	soft body	5	51	65	370	400	3500	4300
EEMSDLD	Mussel	soft body	5	13.5	16.7	84	106	890	1190

Area	Species	Organ	n	∑6PAH in ug/kg ww		∑6PAH in ug/kg dw		∑6PAH in ug/kg fat	
				M	P	M	P	M	P
WESTSDE	Mussel	soft body	5	29.8	35	200	230	2000	2300
EEMSDLD	Mussel	soft body	5	25.4	30.6	157	195	1590	2200

Area	Species	Organ	n	Parameter	in ug/kg ww	
					M	P
WESTSDE	Mussel	soft body	5	PCB153	20	25
EEMSDLD	Mussel	soft body	5	PCB153	5.3	6.6
WESTSDE	Mussel	soft body	5	Dld	1.3	1.6
EEMSDLD	Mussel	soft body	5	Dld	0.8	0.9
WESTSDE	Mussel	soft body	5	BaP	1.3	2.5
EEMSDLD	Mussel	soft body	5	BaP	0.7	2.2
WESTSDE	Mussel	soft body	5	44DDT	< 0.1	< 0.1
EEMSDLD	Mussel	soft body	5	44DDT	< 0.1	< 0.1

Table 14.

Incidence of fish diseases in biota in 2001 in various size classes.

location IJMDWT80	DAB (limanda limanda) male					DAB (limanda limanda) female					overall total	
	15-19cm	20-24cm	>24cm	total		15-19cm	20-24cm	>24cm	total			
	n	n	n	n		n	n	n	n		n	
	171	19	0	190	Perc.(%)	156	94	29	279	Perc.(%)	469	Perc.(%)
affected with:												
lymphocystis	4	0	0	4	2.1	0	1	1	2	0.7	6	1.3
epidermal papilloma	3	0	0	3	1.6	0	1	3	4	1.4	7	1.5
skin ulcer	0	0	0	0	0.0	0	1	0	1	0.4	1	0.2
liver nodule/tumour		0	0	0	0.0	0	0	1	1	0.4	1	0.2
glugea		7	0	7	3.7	0	24	6	30	10.8	37	7.9

location TERSLNWT40	DAB (limanda limanda) male					DAB (limanda limanda) female					overall total	
	15-19cm	20-24cm	>24cm	total		15-19cm	20-24cm	>24cm	total			
	n	n	n	n		n	n	n	n			
	126	30	0	156	Perc.(%)	79	74	18	171	Perc.(%)	327	Perc.(%)
affected with:												
lymphocystis	1	1	0	2	1.3	0	2	1	3	1.8	5	1.5
epidermal papilloma	1	2	0	3	1.9	0	10	0	10	5.8	13	4.0
skin ulcer	0	1	0	1	0.6	0	0	0	0	0.0	1	0.3
liver nodule/tumour		0	0	0	0.0	0	0	0	0	0.0	0	0.0
glugea		1	0	1	0.6	0	2	2	4	2.3	5	1.5

location DOGGBK	DAB (limanda limanda) male					DAB (limanda limanda) female					overall total	
	15-19cm	20-24cm	>24cm	total		15-19cm	20-24cm	>24cm	total			
	n	n	n	n		n	n	n	n			
	151	46	2	199	Perc.(%)	146	52	40	238	Perc.(%)	437	Perc.(%)
affected with:												
lymphocystis	10	5	0	15	7.5	4	8	0	12	5.0	27	6.2
epidermal papilloma	1	0	0	1	0.5	1	2	0	3	1.3	4	0.9
skin ulcer	6	4	0	10	5.0	6	8	2	16	6.7		
liver nodule/tumour		1	0	1	0.5		0	0	0	0.0	1	0.2
glugea		0	0	0	0.0		1	1	2	0.8	2	0.5

location WIERBASDP	FLOUNDER (Platichthys Flesus) male					FLOUNDER (Platichthys Flesus) female					overall total	
	20-24cm	25-29cm	>29cm	total		15-19cm	20-24cm	>25cm	total			
	n	n	n	n		n	n	n	n			
	57	59	19	135	Perc.(%)	48	45	24	117	Perc.(%)	252	Perc.(%)
affected with:												
lymphocystis	0	0	1	1	0.5	0	0	0	0	0.0	1	0.4
skin ulcer	7	5	5	17	8.5	3	3	3	9	3.8	26	10.3

Table 15.

Detection limits of all analyses used for JAMP monitoring by the laboratories involved.

Compartment	Seawater		Biota		Sediment
	RIKZ	RIZA	Fish (RIVO)	Mussel (RIKZ)	
Parameter	mg/m^3		mg/kg ww		mg/kg ww
Mercury			0.01	0.01	0.05
Cadmium	0.01	0.02	0.003	0.003	0.01
Copper	0.1	0.01	0.1	0.03	0.2
Zinc	1	0.3	0.6	0.5	2
Lead	0.3	0.1	0.02	0.1	0.2
Nickel	0.3	0.08	0.04	0.03	0.2
Chromium			0.05	0.1	0.5
Arsenic			0.5	0.05	1
Nitrite-N	1	2			
Nitrate-N	3	20			
Ammonium-N	1	50			
Ortho-P	1	5			
Total-P	5	10			
Total-N	22				
Silicon-SiO_2	3	10			
a-Chlorophyll	0.02	0.02			
SPM	1 mg/L	1 mg/L			
			µg/kg ww		µg/kg ww
HCB			1	0.3	0.3
PCB101,153,187				0.3/0.5/0.3	0.3/0.5/0.3
PCBs			1	1	0.3-0.5
Phen,Ant				5/3	5/3
PAHs			0.1		3-5
g-HCH	0.3 ng/kg	0.1 pg/L		0.1	
Dieldrin				0.1	
DDT				0.1	
TBT	3.0 ng/kg			1.0 µg/kg dw	1.0 µg/kg dw

Table 16.

Locations used for calculating median and peak values for different areas of Dutch marine waters.

	Locations			
Compartment Organism Area	Water	Biota Flounders	Dab	Mussel
Western Scheldt WESTSDE	WIELGN VLISSGBISSVH TERNZBI20 HANSWGL LAMSWDBI59	MIDDGBWPMLPT		HOEDKKKBI4
Eastern Scheldt OOSTSDE	ZIJPE LODSGT WISSKKE			
Voordelta VOORDTA	WALCNR2 SCHOUWN10 GOERE6			
New Waterway NIEUWWTWG	MAASSS			
North Sea Coast KUSTZNE	NOORDWK2 NOORDWK20 TERSLG4			
Southern North Sea ZUIDLKNZE	WALCRN70 NOORDWK70 TERSLG50		IJMDWT80 TERSLGNWT40	
Central North Sea CENTLNZE	TERSLG135 TERSLG235		BORKND30 TERSLNWT100 DOGGBK	
Western Wadden Sea WADDZWT	MARSDND DOOVBWT DOOVBOT BLAUWSOT	WIERBASDP		
Eastern Wadden Sea WADDZOT	DANTZGT ZOUTKPLG ZUIDOLWOT			
Ems-Dollard estuary EEMSDLD	HUIBGOT BOCHTVWTND BOCHTVWTM GROOTGND	PAAPGTGRDPT		BOCHTVWTM

Table 17.

Locations used for calculating median and peak values in sediment for different areas of Dutch marine waters.

Area Area code	Location codes	Longitude	Latitude
Eastern Scheldt			
OOSTSDE	HAMMOT	4883000 E	40905000 N
	KRAMMR	6563000 E	40940000 N
	MARLGOT	7250000 E	38800000 N
	PIETMKK	6780000 E	39050000 N
	ROGGPND	4470000 E	41190000 N
	SCHAARVCLPOT	4885000 E	40348000 N
	SCHAARVCLPWT	4550000 E	40360000 N
	STAVNSKTN	5995000 E	40217000 N
	WILHMNDGGPT	5360000 E	39667000 N
Western Scheldt			
WESTSDE	BAARLDPL	5150000 E	37700000 N
	BATHBI68	7285000 E	37857500 N
	BATHBI71	6995000 E	37788000 N
	BORSLDPL	3800000 E	38000000 N
	HANSWBIOHMG	5790600 E	38436700 N
	HOEDKKKBI4	5300000 E	38280000 N
	SCHAARVODDL	4550000 E	40360000 N
	SPEELMGT	6600000 E	37520000 N
	TERNZBIWPT2	4619900 E	37455000 N
	VLISSGBISSVH	2828000 E	38190000 N
Central North Sea			
CENTLNZE	AMLD70	5334500 E	54051000 N
	FRIESFT04	3375000 E	53452000 N
	OESTGDN19	3000000 E	54300000 N
	OESTGDN21	5000000 E	55000000 N
	ROTTMPT70	6125100 E	54070500 N
	TERSLG100	4203100 E	54085800 N
	TERSLG135	4022800 E	54245600 N
	TERSLG235	3092700 E	55102000 N
	TERSLG275	3055878 E	55201460 N
	TERSLG70	4363367 E	53551834 N
North Sea Coast			
KUSTZNE	CALLOG1	4411551 E	52371501 N
	CALLOG10	4282758 E	52381104 N
	EGMAZE1	4363049 E	52371501 N
	EGMAZE10	4282758 E	52381104 N
	IJMDBTN1	4322500 E	52280000 N
	NOORDWK10	4180900 E	52180800 N
	NOORDWK2	4242200 E	52154100 N
	ROTTMPT3	6335100 E	53335800 N
	TERHDE1	4101170 E	52024736 N
	TERHDE10	4051875 E	52063531 N
	TERSLG20	5011833 E	53321353 N
	TERSLG4	5090200 E	53245500 N
Voordelta			
VOORDTA	GOERE6	3522500 E	51521100 N
	HARVT1	4005400 E	51511800 N
	HARVT4	4012400 E	51545700 N
	SCHOUWN10	3294300 E	51431200 N
	VOORDTA2	3231500 E	51370400 N
	VOORDTA3	3360200 E	51422300 N
	VOORDTA4	3484800 E	51472600 N
	VOORDTA5	3550900 E	51552000 N
	WALCRN2	3243900 E	51325600 N
	WALCRN4	3233514 E	51334164 N
Southern North Sea			
ZUIDLKNZE	NOORDWK30	4025300 E	52231500 N
	GOERE40	3302700 E	52045200 N
	WALCRN70	2404500 E	51572500 N
	NOORDWK70	3315300 E	52351000 N
	NOORDWK50	3471200 E	52285100 N
	CALLOG70	3405413 E	52592887 N
	BREEVTN26	3000000 E	53300000 N
	CALLOG30	4161878 E	52553489 N
	APPZK20	3121832 E	51294468 N
	WALCRN30	3064900 E	51430600 N
	TEXL70	4000000 E	53300300 N

Table 18.

Dutch environmental quality standards 2000 (ref.24).

Parameter	Surface water (dissolved)				Sediment (d.w.)		
		Background concentration North Sea	Target value (VR)	Maximal Tolerable Risk concentration (MTR)		Target value (VR)	Maximal Tolerable Risk concentration (MTR)
As	µg/L	-	1	25	mg/kg	29	55 #
Cd	µg/L	0.03 (n)	0.08	0.4	mg/kg	0.8	12 #
Cr	µg/L	-	0.3	8.7	mg/kg	100	380 #
Cu	µg/L	0.3 (n)	0.5	1.5	mg/kg	36	73
Hg	µg/L	0.003 (n)	0.01	0.2	mg/kg	0.3	10 #
Ni	µg/L	-	3.3	5.1	mg/kg	35	44
Pb	µg/L	0.02 (n)	0.3	11	mg/kg	85	530 #
Zn	µg/L	0.4 (n)	2.9	9.4	mg/kg	140	620
Chlorophyll-a	µg/L	-	-	100 (z)	-	-	-
DIN	mg N/L	0.15 (w)	-	-			
total-N	mg N/L	-	1 (z)	2.2 (z)			
o-PO4	mg P/L	0.02 (w)	-	-	-	-	-
total-P	mg P/L	-	0.05 (z)	0.15 (z)	-	-	-
BaP	µg/L	-	0.002	0.05	mg/kg	0.003 *	3 *
PCB153	-	-	-	-	µg/kg	4	4
a-HCH	ng/L	-	33	3300	µg/kg	3	290
b-HCH	ng/L	-	9	800	µg/kg	9	920
g-HCH	ng/L	-	9	910	µg/kg	0.05	230
TBT	ng/L	-	0.01	1	µg/kg	0.007	0.7
TPhT	ng/L	-	0.009	0.8	µg/kg	0.01	1

n	90-percentile value
#	single value
*	if OS<10%, no standardization
w	winter time value
z	summer time value
d.w.	dry weight
DIN	Dissolved Inorganic Nitrogen

Table 18.
Dutch environmental quality standards 2000 (ref.24).

Σ7PCB	Sum of PCB congeners: 28, 52, 101, 118, 138, 153 and 180
Σ6PAH	Sum of 6 PAHs: Flu, B(b)F, B(k)F, B(a)P, B(ghi)P, InP
ASMO	OSPAR working group on Assessment and Monitoring
ADHOCMON	SIME AD HOC working group on Monitoring
As	Arsenic
B(b)F	Benzo[b]Fluoranthene
B(k)F	Benzo[k]Fluoranthene
B(a)P	Benzo[a]Pyrene
B(ghi)P	Benzo[ghi]Perylene
Cd	Cadmium
Cl	Chloride
Cr	Chromium
Cu	Copper
Dab	Limanda limanda
DL	Detection limit
dw	Dry weight
EROD	Ethoxyresorufin-O-deethylase
Flounder	*Platichthys flesus*
Flu	Fluoranthene
HCB	Hexachlorobenzene
HCH (α, β, γ)	Hexachlorocyclohexane (γHCH = Lindane)
Hg	Mercury
InP	Indeno[1,2,3]Pyrene
INPUT	ASMO working group on Input
JAMP	Joint Assessment and Monitoring Programme
JMG	Joint Monitoring Group
JMP	Joint Monitoring Programme
Mussel	Mytilus edulis
M	Median value
MTR	Maximum Tolerable Risk
n	Number of analysis
NH4	Ammonium
Ni	Nickel
NO2	Nitrite
NO3	Nitrate
NUT	OSPAR working group on Eutrophication
O2	Oxygen
o-PO4	Ortho-phosphate (=dissolved phosphate)
P	Peak value
Pb	Lead
PCB (n)	Polychlorobiphenyls (IUPAC No congener)
QSR2000	Quality Status Report 2000
QA	Quality Assurance
RIKZ	National Institute for Coastal and Marine Management
RIVO	National Institute for Fisheries Research
RTT II	ASMO Regional Task Team II (North Sea)
SALNTT	Salinity
S(bl)	Standard deviation of the blank
SIME	ASMO working group on Substances in the Marine Environment
SiO2	Silicate
SPM	Suspended matter
T	Temperature
X(r)	Average of the noise
ww	Wet weight
Zn	Zinc

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