Ministry of Transport, Public works and
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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 1999

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Summary

The Netherlands participates in the Joint Assessment and Monitoring Programme (JAMP) of the Oslo and Paris Commissions. This report gives the results of the Dutch contribu-tion to the programme for the year 1999.

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 presents the frequency of sampling and analysis of the various contaminants in the different compartments. Table 2 presents all parameters measured in the different compartments.

Data on supporting parameters, nutrients, metals and organic contaminants in water and biota are presented and discussed.

Tributyltin 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 measuring less than 25 metres.

Recent data on TBT from the monitoring of sediment indicate high concentrations of tributyl and triphenyltin in all Dutch marine waters. TBT concentrations measured range between 10 and 240 µg TBT/kg sediment normalised to 5% organic Carbon. This implies that the Dutch target value MTR (Maximum Tolerable Risk) laid down in the Fourth National Policy Document on Water Management is being exceeded by a factor 80-300. The highest TPT concentration was about 100 µg TPT/kg sediment normalised to 5% organic Carbon, whilst the lowest values were below the detection limit (1 µg TPT/kg).

Fish disease monitoring has been included in the programme since 1991, but no results are presented in this report.

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, the laboratories of the National Institute for Coastal and Marine Management in 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: http://www.waterland.net/rikz/osparwg/trend-y-tector), used to perform trend analyses. We are likewise grateful to the designers of the PRESENTATOR (CD-ROM-part of the Jaarboek Monitoring Rijkswateren 1999 (yearbook on the monitoring of government-managed waters, ref. 15). The PRESENTATOR was used to subtract the data in order to make the tables for this report.

Requests for information of any kind about this programme can be addressed to the Dutch delegations to the OSPAR SIME, ASMO and ADHOC-MON working groups,

or

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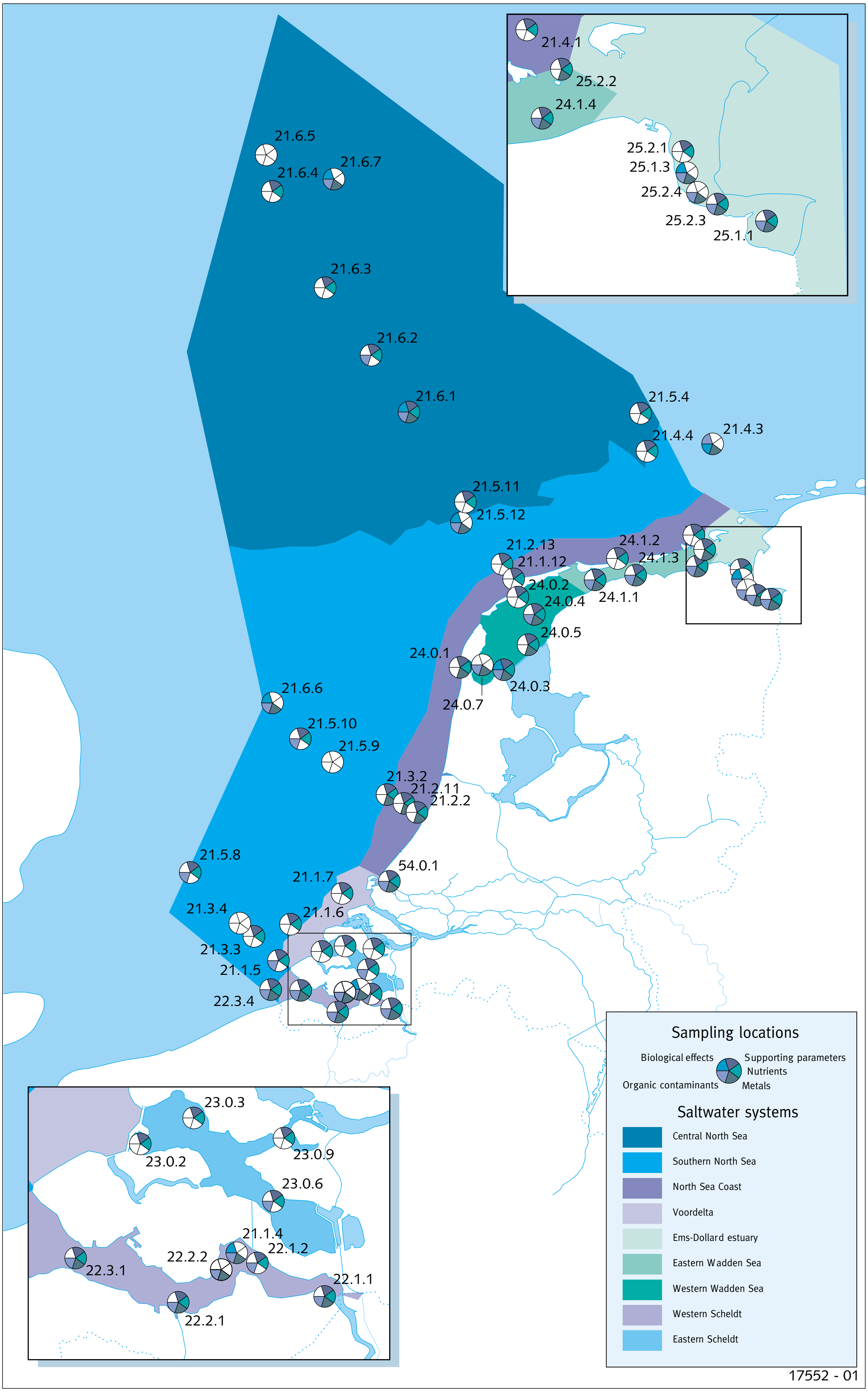
Figure 1.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North Sea Coast
Voordelta
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Eastern Wadden Sea
Western Wadden Sea
Western Scheldt
Eastern Scheldt
17552 - 01

Table 1.

Sampling frequenties in the locations covered by the Dutch chemical monitoring programme. The locations are presented in Figure 1.

ICES CODE	CODE	Supporting parameters	Nutrients	Metals			Organic contaminants			Biological effects
		water	water	water	sediment	biota	water	sediment	biota	
	New Waterway									
54.0.1	MAASSS	26	26	26	.	.	13	.	.	.
	Western Scheldt									
22.1.1	SCHAARVODDL	26	26	26	.	.	13	.	.	.
22.1.2	HANSWGL	18	18	.	.	.	4	.	.	.
22.1.2	HANSWBIOHMG	.	.	.	.	.	.	.	.	.
21.1.4	MIDDGBWPMLPT	.	.	.	.	1	.	.	1	1
22.2.2	HOEDKKKBI4	.	.	.	.	1	.	.	1	.
22.2.1	TERNZBI20	6	4	4	.	.	4	.	.	.
22.2.1	TERNZBIWPT2	.	.	.	.	.	.	.	.	.
22.3.1	VLISSGBISSVH	18	18	4	.	.	12	.	.	.
22.3.4	WIELGN	6	4	4	.	.	4	.	.	.
	Eastern Scheldt									
23.0.9	ZIJPE	20	20	.	.	.	.	.	.	.
23.0.6	LODSGT	20	20	.	.	.	1	.	.	.
23.0.3	HAMMOT	20	20	.	.	.	.	.	.	.
23.0.2	WISSKKE	20	20	.	.	.	.	.	.	.
	Voordelta									
21.1.5	WALCRN2	12	12	.	.	.	1	.	.	.
21.3.3	WALCRN20	12	12	.	.	.	.	.	.	.
21.1.6	SCHOUWN10	6	4	.	.	.	.	.	.	.
21.1.7	GOERE6	12	12	.	.	.	.	.	.	.
	North Sea Coast									
21.2.2	NOORDWK2	18	18	4	.	.	.	.	.	.
21.2.11	NOORDWK10	30	30	4	.	.	.	.	.	.
21.3.2	NOORDWK20	18	18	4	.	.	.	.	.	.
21.1.12	TERSLG4	18	18	.	.	.	.	.	.	.
21.2.13	TERSLG10	18	18	.	.	.	.	.	.	.
21.4.1	ROTTMPT3	7	7	.	.	.	.	.	.	.
	Southern North Sea									
21.3.4	WALCRN30	.	.	.	.	.	.	.	.	.
21.5.8	WALCRN70	12	12	.	.	.	4	.	.	.
21.5.9	NOORDWK50	.	.	.	.	.	.	.1	.	.
21.5.10	NOORDWK70	12	12	.	.	.	4	1	.	.
21.6.6	IJMDWT80	.	.	.	.	1	.	.	1	1
21.5.11	TERSLG50	6	4	.	.	.	.	.	.	.
21.5.12	TERSLNWT40	.	.	.	.	1	.	.	1	1
	Central North Sea									
21.4.4	ROTTMPT50	7	7	.	.	.	.	.	.	.
21.5.4	ROTTMPT70	7	7	.	.	.	.	.	.	.
21.4.3	BORKND30	.	.	.	.	1	.	.	1	1
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	.	.	.	.	.	.	.
21.6.5	TERSLG275	.	.	.	.	.	.	.	.	.
21.6.7	DOGGBK	.	.	.	.	1	.	.	1	1
	Western Wadden Sea									
24.0.1	MARSDND	21	21	4	.	.	.	.	.	.
24.0.7	MALZZWL	.	.	.	1	.	.	1	.	.
24.0.3	DOOVBWT	12	4	4	1	.	4	1	.	.
24.0.3	WIERBASDP	.	.	.	.	1	.	.	1	1
24.0.5	DOOVBOT	6	4	4	.	.	.	.	.	.
24.0.4	BLAUWSOT	12	4	.	.	.	.	.	.	.
24.0.4	KOFFBNPT	.	.	.	1	.	.	1	.	.
24.0.2	VLIESM	12	12	.	.	.	.	.	.	.
	Eastern Wadden Sea									
24.1.1	DANTZGT	21	21	4	.	.	.	.	.	.
24.1.1	DANTZGZD	.	.	.	.1	.	.	1	.	.
24.1.2	ZOUTKPLZGT	12	12	.	.	.	.	.	.	.
24.1.3	ZOUTKPLG	12	4	4	.	.	1	.	.	.
24.1.4	ZUIDOLWOT	21	21	4	.	.	.	.	.	.
24.1.4	ZUIDOLWZOT	.	.	.	1	.	.	1	.	.
	Ems-Dollard estuary									
25.2.2	HUIBGOT	21	21	4	.	.	.	.	.	.
25.2.1	BOCHTVWTND	6	4	.	.	.	.	.	.	.
25.2.3	BOCHTVWTM	6	4	4	.	1	.	.	1	.
25.2.4	BOCHTVWTOT	.	.	.	.	.	.	.	.	.
25.1.3	PAAPGTGRDPT	.	.	.	.	1	.	.	1	1
25.1.1	GROOTGND	21	21	4	.	.	4	.	.	.

Table 2.
Parameters measured in the different compartments of marine waters under the Dutch JAMP in 1999.

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		+				
particulated 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	+	+	+	+	+
Cu	copper	+	+		+	+
Zn	zinc	+	+		+	+
Pb	lead	+	+		+	+
Ni	nickel	+	+			+
Cr	chromium	+	+			+
As	arsenic	+	+			+
Al	aluminium		+			
aHCH	alpha HCH	+				+
bHCH	beta HCH	+				+
cHCH	lindane	+				+
TBT	tert. butyl tin	+	+			
HCB			+	+	+	+
PCB cogener			+	+	+	+
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 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 over 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 co-ordinated by ACG (Assessment Co-ordination 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
- compliance with national criteria.

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.

Chapter 2 describes the national JAMP monitoring programme and presents results for all contaminant/compartment combinations. Figure 1 presents a map of all locations in the different areas (see also chap. 6.2) where samples have been taken. 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 compartments and/or organisms. Finally, the locations used to calculate median and peak values for every area are presented in table 13. The used locations and areacodes are the codes used in the national databases in which the results of monitoring are being stored.

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

2 Information on measurements

2.1 Supporting parameters

Many of the OSPAR guidelines describe requirements for supporting 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 supporting parameters.
The locations are divided into geographical areas and the results (median and peak values) for each of these are presented in table 3.

2.2 Nutrients in water

2.2.1 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 4) are taken over the whole of 1999.
The inorganic nutrient concentrations measured during the winter period (December 1st to March 1st) are used for temporal trend purposes.
The nutrient data in the winter period are presented in table 5.
The frequency of sampling for phytoplankton is the same as that for nutrients (see tables 1 and 3: i.e. every month during the winter and every two weeks during the summer).

2.2.2 Trends in winter nutrient concentrations

In Dutch marine waters with salinity gradients, yearly trends in nutrient concentrations are assessed by plotting each year's winter nutrient concentrations 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 indication 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 riverine outflow), nutrient concentrations are "normalised" for salinity. This is done by calculating the winter nutrient concentrations 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).

Figure 2.
Wintertime concentrations of ortho-Phosphate on the Noordwijk track at salinity 30. Winter period is from December 1st to March 1st.

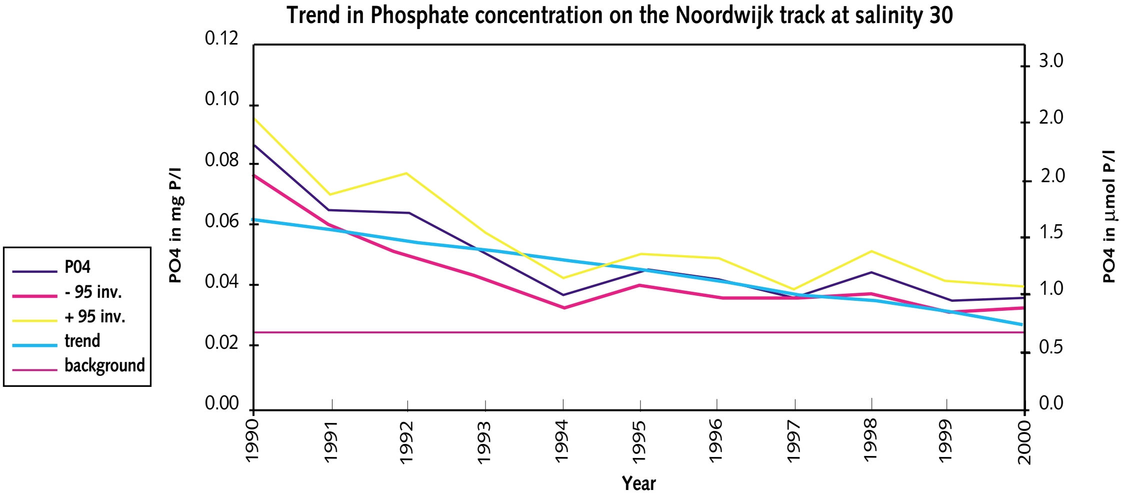


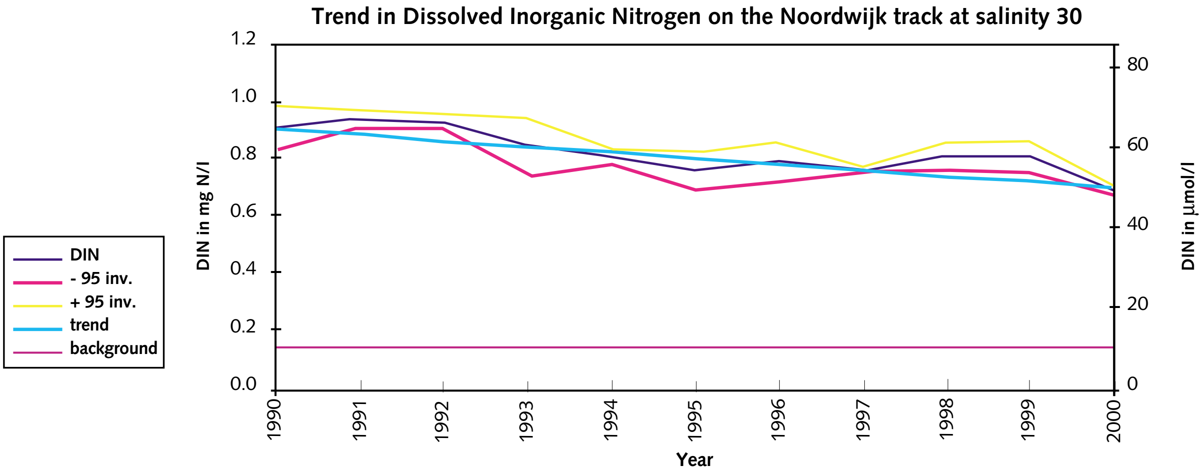
Fig. 2 shows the reduction in P-inputs, as a decline in the ortho-P- concentration on the Noordwijk track.

> 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.waterland.net/rikz/osparwg). The software is also available on CD-ROM. <

Until 2000 there was a downward trend (1-sided, 5% significance) of 57%. This trend was more evident in a narrow strip (1-4 km) along the Dutch coast. However, when compared with the reference (= background) values of 0.013 - 0.029 mg/l, and the levels of 1961 (refs. 5 and 6), the ortho-P-concentrations were still higher (by a factor of 2).

In the case of total dissolved inorganic Nitrogen, a downward trend in the elevated concentrations has been observed over the last 10 years (Fig. 3). This trend is amounting to a 24% decrease (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).

Figure 3.
Wintertime concentrations of dissolved inorganic Nitrogen on the Noordwijk track at salinity 30. Winter period is from December 1st to March 1st.



2.3 Metals

Metals were measured in three compartments: 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 water have no longer been measured and measurement of dissolved Mercury on marine locations ended in 1998.
The Dutch national programme does include concentrations of metals in SPM but the data are not reported here since this is not yet part of the JAMP monitoring programme.

2.3.1 Metals in Water

Concentrations of dissolved metals are presented in table 6.
Cadmium, Lead, Chromium and Zinc are likewise around the detection limit, except at the brackish locations Maassluis (MAASSS) and Schaar van Ouden Doel (SCHAARVODDL). Concentrations of metals are highest in the Western Scheldt and Ems-Dollard estuaries and in the New Waterway, and next highest in the Coastal Zone and the Wadden Sea (for locations and codes see fig. 1 + table 2 and 13). In general, concentrations of inorganic contaminants are gradually declining over the years to an environmentally acceptable level. The 1999 data show no change in this situation.

2.3.2 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. In 1998 large numbers of sediment samples were taken from the Wadden Sea and Ems-Dollard estuary, but none from the remaining areas (i.e. the North Sea, Western and Eastern Scheldt estuary). Sediments taken from Wadden Sea and Ems-Dollard estuary in 1999 were assessed (using the 90-percentile) on the basis of Dutch environmental criteria. All metal concentrations still exceeded the criteria in these areas, except for Copper and Lead.

In the Ems-Dollard estuary also the criteria for Arsenic and Cadmium were not exceeded. The ranges of the OSPAR Ecotoxicological Assessment Criteria are in the same range as the Dutch national criteria.

2.3.3 Metals in Biota

Dab (Limanda limanda) and Flounder (Platichthys flesus) were caught at five offshore locations and in the Western Scheldt, the Wadden Sea and the Ems-Dollard estuary. Mussels (Mytilus edulis) were collected in the middle part of the Western Scheldt 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 8. 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, amounting to an 420% increase over the 1989-1999 period. In the same period, an increase of 62% 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 (20%) while dissolved concentrations show a decrease of 78% over the last decade. Even sediment data from 1988, 1990 and 1996 show no evident 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 effect 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)

2.4 Organic contaminants

Organic contaminants are measured in three compartments 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.

2.4.1 Organic contaminants in Water

Table 9 presents the concentrations of hexachloro-cyclohexane (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.

2.4.2 Organic contaminants in Sediment

In 1999 sampling of sediments took place in the Wadden Sea and Ems-Dollard estuary. The sediments were assessed (using the 90-percentile) on the basis of Dutch environmental criteria. In all areas, concentrations of PAHs exceeded the criteria and concentrations of PCBs were about equal to them. The ranges of the OSPAR Ecotoxicological Assessment Criteria are in the same range as the Dutch national criteria.

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 1999. In the Wadden Sea and Ems-Dollard estuary the criteria were exceeded by a factor of 55. Sampling, analyses and quality assurance were in accordance with OSPAR guidelines. At 5% organic Carbon, standardised results are presented in the table below. 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
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
Western Wadden Sea	13	25	56	11
Eastern Wadden Sea	10	20	88	11
Ems-Dollard	15	36	46	10

> Highest Tri-PhenylTin (TPhT) concentration was about 20 µg TPhT/kg sediment standardised at 5% organic Carbon, lowest values were below detection limit (1 µg TPhT/kg) <.

2.4.3 Organic contaminants in Biota

Organic contaminants were measured in female Dab liver, male Flounder liver and Mussels. The results are presented in table 11. The ADHOCMON working group assessed these 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.

2.5 Biological effects

2.5.1 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 occurrence 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.

3 Overall conclusions

The data in this report reveal a decreasing trend in Phosphate and dissolved inorganic Nitrogen in the Coastal zone. Increasing Cadmium concentrations in biota in the Western Scheldt in the 1989-1999 period could not be explained using information from other compartments. For a better understanding of the underlying mechanisms, further research will be necessary.

In general, concentrations of Phosphate and inorganic contaminants 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, concentration of PCBs were about equal to them.

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

The 1999 data show a further significant continuation in the increase in Cadmium in Flounder from the Western Scheldt. The concentrations are the highest measured in the last decade. 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.

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 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 10 and 240 µg TBT/kg sediment normalised to 5% organic Carbon. The Dutch target value (MTR) laid down in the Fourth National Policy Document on Water Management is exceeded by a factor of 80-300. In the 1999 sampled areas , Wadden Sea and Ems-Dollard estuary, showed exceedingfactors of 55 times the national criteria.

4 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 track 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 are 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.

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 properly assessed. It is supposed to contain information on quality assurance measures in relation to all data reported, as well as on intercalibration 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 can also be supplied on request.

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

In order usefully 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 interpretation. A minimum prerequisite to ensure the overall quality of data is a Quality Assurance System complying with European Norm EN45001.
The policy of the Dutch government is that QA-procedures for sampling and analysis (in its own and vendor laboratories) must be accredited by the Dutch Accreditation Board (complying to the international standaard). The RIKZ laboratory (which supplied most of the results discussed in this report) received accreditation in 1999. The RIZA and RIVO laboratories are accreditated 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 sampling is not subject to the Quality Assurance System of the laboratory. However, there is close 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 different 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 national 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 achieving 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 2001.

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)]:

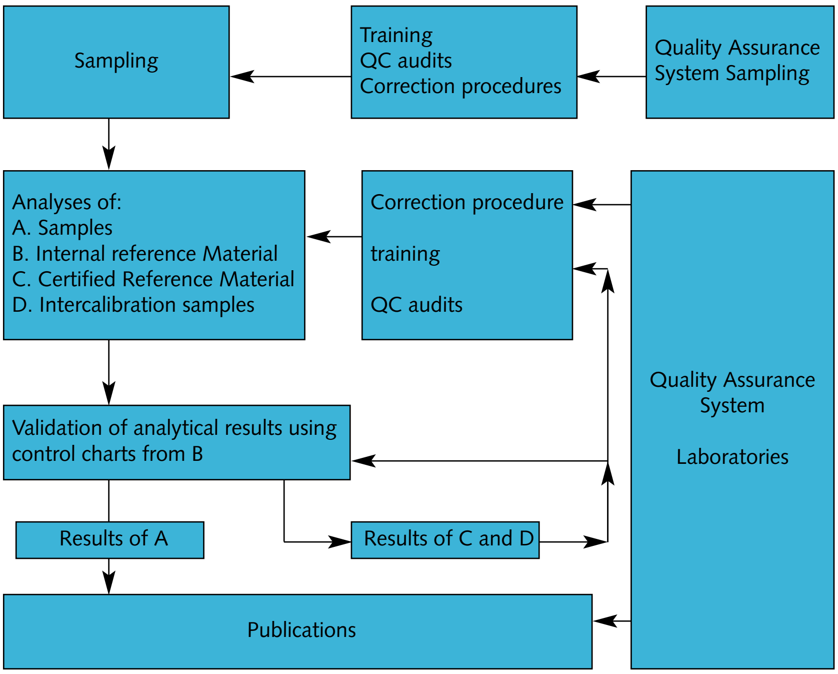
Formula 1: **DL = 3 * S(bl)**

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

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

Numerical values for seawater are listed in table 12.

Figure 4.
Analytical Quality Control Scheme.



5.5.2 Biota

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

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

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

This formula for the detection limit is used for the metals Mercury and Cadmium. The detection limit depends on the amount of sample that is taken for the analysis. The detection limit 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 12.

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 1999 were:

Lab.	Round / Code	Parameter / Compartment		ICES code
RIKZ	15 / QCO09SW	382AQ5	HCH's/Seawater	BT
RIKZ	15 / QCO10SW	382AQ5	HCH's/Seawater	BU
RIKZ	16 / QNU061SW	387AQ1	Nutrients/Seawater	C3
RIKZ	16 / QNU062SW	387AQ1	Nutrients/Seawater	C4
RIKZ	16 / QTM045MS	389MS1	Metals/Sediment	C8
RIKZ	16 / QTM046MS	389MS1	Metals/Sediment	C9
RIKZ	16 / QOR056MS	390MS2	PCB's & OCP's/Sediment	CA
RIKZ	16 / QOR057MS	390MS2	PCB's & OCP's/Sediment	CB
RIKZ	16 / QPH020MS	391MS3	PAH's/Sediment	CC
RIKZ	16 / QPH021MS	391MS3	PAH's/Sediment	CD
RIKZ	17 / QCH001SW	427	Chlorophyll/Seawater	A7
RIKZ	17 / QCH002SW	427	Chlorophyll/Seawater	
RIKZ	17 / QCH003SW	427	Chlorophyll/Seawater	
RIKZ	17 / QTM028SW	397AQ3	Metals/Seawater	CT
RIKZ	17 / QTM029SW	397AQ3	Metals/Seawater	CU
RIKZ	17 / QTM030SW	398AQ4	Mercury/Seawater	CV
RIKZ	17 / QTM031SW	398AQ4	Mercury/Seawater	CW
RIKZ	18 / QNU066SW	410AQ1	Nutrients/Seawater	D6
RIKZ	18 / QNU067SW	410AQ1	Nutrients/Seawater	D7
RIKZ	18 / QTM047MS	412MS1	Metals/Sediment	DB
RIKZ	18 / QTM048MS	412MS1	Metals/Sediment	DC
RIKZ	18 / QOR058MS	413MS2	PCB's & OCP's/Sediment	DD
RIKZ	18 / QOR059MS	413MS2	PCB's & OCP's/Sediment	DE
RIKZ	18 / QPH022MS	414MS3	PAH's/Sediment	
RIKZ	18 / QPH023MS	414MS3	PAH's/Sediment	
RIVO	16 / QPH010BT	394BT4	PAH's/Biota	CI
RIVO	16 / QPH011BT	394BT4	PAH's/Biota	CJ
RIVO	16 / QTM041BT	392BT1	Metals/Biota	CE
RIVO	16 / QTM042BT	392BT1	Metals/Biota	CF
RIVO	16 / QOR058BT	393BT2	PCB'& OCP's/Biota	CG
RIVO	16 / QOR059BT	393BT2	PCB'& OCP's/Biota	CH
RIVO	18 / QTM043BT	415BT1	Metals/Biota	DF
RIVO	18 / QTM044BT	415BT1	Metals/Biota	DG
RIVO	18 / QOR060BT	416BT2	PCB'& OCP's/Biota	DH
RIVO	18 / QOR061BT	416BT2	PCB'& OCP's/Biota	DI

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 Description of the monitoring programme

6.1 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, compliance with national criteria combined with measuring of specific contaminants in (preferably) single compartments, plus the highest possible trend detection at the lowest possible cost. Locations, frequency and parameters are presented in figure 1 and tables 1 and 2.

Water

- Dissolved metal concentrations are measured at stations where SPM is sampled plus some extra stations to produce at least 12 measurement points in each of the areas except the Voordelta and the Southern and Central North Sea. After 3 years (in 1999) the results are to be evaluated with the intention that the measurement of dissolved metal concentrations should be abandoned if calculation from SPM data proves feasible. By the time of the production of this report, this evaluation has not been performed yet.
- 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 supporting parameters including Oxygen are measured each time a station is visited. Chlorophyll α is only measured together with samples for phytoplankton species composition.
- For hexachloro-cyclohexane 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 compartment 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.

ABM

- 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 macro-zoobenthos programme. In 1996 and 1998, all areas were sampled.
In 1999 all locations in the Wadden Sea and Ems-Dollard estuary were sampled. In 2000 the North Sea is programmed again.

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 and 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 and Ems-Dollard.

6.2 National area's

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
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.

6.3 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). Analysis is 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.

7 Tables

Table 3.
Number of measurements and median and highest values of supporting parameters in seawater in 1999.

Location		SALNTT		SPM in mg/l		T in °C		O2 in mg/l		Chlorophyll α in µg/l in summer		
	n	M	P	M	P	M	P	M	P	M	P	n
WESTSDE										8.0	34.2	30
OOSTSDE										7.1	23.8	39
VOORDTA	35	31.61	33.24	21	129	14.5	20.3	8.91	10.41	8.8	29.6	12
NIEUWWTWG	26			29	220	12.7	25.8	10.0	14.2	3	22	26
KUSTZNE	44	31.13	33.22	6	76	13.0	19.9	9.30	12.04	7.5	54.8	44
ZUIDLKNZE	31	35.01	35.31	3	28	11.6	18.6	9.05	11.11	1.62	13.2	16
CENTLNZE	26	34.81	34.93	1	8	13.4	17.8	8.49	10.24	0.52	1.74	18
WADDZWT	51	25.17	31.60	25	135	9.5	20.5	9.30	10.65	7.5	28	13
WADDZOT	54	29.10	32.13	75	278	11.1	22.2	8.71	10.46	19.2	37.8	26
EEMSDLD	54	21.11	31.84	94	353	8.6	21.9	9.72	12.12	8.8	24	25

Table 4.
Concentrations Nitrogen, Phosphorus and Organic Carbon in seawater in 1999.

Location	n	Total Nitrogen in mg N/l		Total Phosphores in mg P/l		Part. Org. Carbon in mg C/l		Part. Org. Carbon in mg C/l	
		M	P	M	P	M	P	M	P
WESTSDE	40	2.31	6.32	0.174	0.263	1.2	6.6	4.6	8.1
OOSTSDE	60	0.744	1.97	0.065	0.111	0.48	6.6	2.53	8.0
VOORDTA	22	0.771	1.34	0.061	0.194	0.79	4.21	2.47	5.51
NIEUWWTWG	26	3.0	5.1	0.21	0.31			4	7
KUSTZNE	46	0.535	1.62	0.046	0.085	0.57	3.4	2.12	5.8
ZUIDLKNZE	27	0.170	0.341	0.017	0.037	0.16	0.67	1.09	2.19
CENTLNZE	25	0.111	0.177	0.014	0.022	0.11	0.33	1.06	1.37
WADDZWT	43	0.939	3.59	0.067	0.148	1.6	6.7	4.3	10.8
WADDZOT	54	1.26	2.87	0.152	0.349	3.0	10.9	6.5	15.7
EEMSDLD	54	2.04	6.63	0.236	0.663	3.8	15.4	9.7	25.5

Table 5.
Winterconcentrations of nutrients in seawater in 1999. Winter period is from December 1st to March 1st.

Location	n	NH4 in mg N/l M	NH4 in mg N/l P	NO2 in mg N/l M	NO2 in mg N/l P	NO3 in mg N/l M	NO3 in mg N/l P	o-PO4 in mg P/l M	o-PO4 in mg P/l P	SiO2 in mg Si/l M	SiO2 in mg Si/l P
WESTSDE	12	0.062	0.121	0.031	0.079	1.26	4.19	0.086	0.161	1.13	2.66
OOSTSDE	12	0.115	0.187	0.031	0.040	0.570	1.31	0.043	0.053	0.496	0.873
VOORDTA	9	0.038	0.069	0.008	0.017	0.449	0.686	0.031	0.043	0.409	0.499
NIEUWWTWG	6	0.18	0.20	0.040	0.050			0.131	0.180	3.35	3.58
KUSTZNE	9	0.037	0.069	0.0100	0.036	0.526	0.954	0.034	0.057	0.389	0.742
ZUIDLKNZE	9	0.003	0.017	0.003	0.012	0.092	0.117	0.014	0.018	0.108	0.135
CENTLNZE	6	0.004	0.025	0.002	0.019	0.067	0.081	0.017	0.018	0.096	0.126
WADDZWT	12	0.099	0.183	0.021	0.045	0.698	1.34	0.028	0.045	0.558	0.787
WADDZOT	9	0.160	0.377	0.030	0.128	0.576	1.07	0.034	0.052	0.701	1.23
EEMSDLD	12	0.130	0.240	0.056	0.102	1.88	5.43	0.059	0.092	2.04	3.93

Table 6.
Concentrations of dissolved inorganic contaminants in seawater in 1999.

Location	n	Hg in µg/l M	Hg in µg/l P	Cd in µg/l M	Cd in µg/l P	Cu in µg/l M	Cu in µg/l P	Zn in µg/l M	Zn in µg/l P
WESTSDE	12			0.04	0.09	0.9	1.5	2	4.6
NIEUWWTWG	26	< 0.001	0.011	< 0.05	0.05	1.9	3.4	1.4	12
KUSTZNE	11			0.02	0.03	0.5	0.7	0.8	1.3
WADDZWT	12			0.01	0.03	0.7	1.3	0.5	2.9
WADDZOT	12			0.01	0.03	0.6	1	0.5	1.1
EEMSDLD	12			0.03	0.05	1	1.8	0.5	2.5

Location	n	Pb in µg/l M	Pb in µg/l P	Ni in µg/l M	Ni in µg/l P	Cr in µg/l M	Cr in µg/l P	As in µg/l M	As in µg/l P
WESTSDE	12	0.1	0.2	1.2	2.2	0.3	0.3	1.6	2.9
NIEUWWTWG	26	< 0.05	0.4	0.9	2.5	0.45	2.6		
KUSTZNE	11	0.1	0.1	0.5	0.8	0.3	0.3	0.9	1.4
WADDZWT	12	0.1	0.8	0.6	1.3	0.3	0.3	0.9	1
WADDZOT	12	0.1	0.1	0.6	0.9	0.3	0.3	0.9	2.3
EEMSDLD	12	0.1	0.1	1.1	1.8	0.3	0.4	1.2	1.8

Table 7.
Concentrations of inorganic contaminants in sediments in 1999.

Location	n	Parameter	in mg/kg M	P
WADDZWT	11	Hg	0.28	0.36
WADDZOT	11	Hg	0.28	0.37
EEMSDLD	10	Hg	0.24	0.55
WADDZWT	11	Cd	0.6	0.7
WADDZOT	11	Cd	0.6	0.7
EEMSDLD	10	Cd	0.5	0.5
WADDZWT	11	Cr	91	120
WADDZOT	11	Cr	90	110
EEMSDLD	10	Cr	96	140
WADDZWT	11	Cu	18	25
WADDZOT	11	Cu	18	24
EEMSDLD	10	Cu	18	20
WADDZWT	11	Ni	26	30
WADDZOT	11	Ni	28	31
EEMSDLD	10	Ni	28	140
WADDZWT	11	Pb	51	65
WADDZOT	11	Pb	53	66
EEMSDLD	10	Pb	48	68
WADDZWT	11	Zn	150	180
WADDZOT	11	Zn	150	180
EEMSDLD	10	Zn	145	190
WADDZWT	11	As	17	37
WADDZOT	11	As	17	36
EEMSDLD	10	As	18	31

Table 8.
Concentration of inorganic contaminants in biota in 1999.

Location	Parameter	Species	Organ	n	in mg/kg dw M	P
WESTSDE	As	Mussel	soft body	5	7.6	8.9
EEMSDLD	As	Mussel	soft body	5	7.7	9.3
WESTSDE	Cd	Mussel	soft body	5	6.9	8.4
EEMSDLD	Cd	Mussel	soft body	5	0.83	1.22
WESTSDE	Cd	Flounder	liver	25	0.71	2.45
WADDZWT	Cd	Flounder	liver	25	0.07	0.17
EEMSDLD	Cd	Flounder	liver	25	0.39	1.00
ZUIDLKNZE	Cd	Dab	liver	6	0.42	0.65
CENTLNZE	Cd	Dab	liver	9	0.51	0.61
WESTSDE	Cr	Mussel	soft body	5	3.82	4.56
EEMSDLD	Cr	Mussel	soft body	5	4.36	10.0
WESTSDE	Cu	Mussel	soft body	5	10.2	10.9
EEMSDLD	Cu	Mussel	soft body	5	7.6	8.2
ZUIDLKNZE	Cu	Dab	liver	6	24.7	33.9
CENTLNZE	Cu	Dab	liver	9	23.4	29.3
WESTSDE	Hg	Mussel	soft body	5	0.28	0.32
EEMSDLD	Hg	Mussel	soft body	5	0.17	0.24
WESTSDE	Hg	Flounder	muscle	25	0.40	1.39
WADDZWT	Hg	Flounder	muscle	25	0.39	0.63
EEMSDLD	Hg	Flounder	muscle	25	0.39	1.17
ZUIDLKNZE	Hg	Dab	muscle	6	0.55	0.62
CENTLNZE	Hg	Dab	muscle	9	0.49	0.63
WESTSDE	Pb	Mussel	soft body	5	5.25	5.93
EEMSDLD	Pb	Mussel	soft body	5	4.46	5.21
ZUIDLKNZE	Pb	Dab	liver	6	0.22	0.27
CENTLNZE	Pb	Dab	liver	9	0.19	0.48
WESTSDE	Zn	Mussel	soft body	5	288	327
EEMSDLD	Zn	Mussel	soft body	5	104	113
ZUIDLKNZE	Zn	Dab	liver	6	122	126
CENTLNZE	Zn	Dab	liver	9	134	133

Table 9.
Concentrations of hexachloro-cyclohexane in seawater in 1999.

Location		αHCH in μg/l		βHCH in μg/l		γHCH in μg/l	
	n	M	P	M	P	M	P
WESTSDE	24	0.0001	0.0003	0.0001	0.0002	0.0020	0.0099
OOSTSDE	1	0.0001	0.0001	0.0001	0.0001	0.0019	0.0019
VOORDTA	1	0.0001	0.0001	0.0001	0.0001	0.0012	0.0012
NIEUWWTWG	26	< 0.001	0.004	< 0.001	< 0.008	0.002	0.005
KUSTZNE	4	0.0003	0.001	0.0004	0.0006	0.0013	0.0029
ZUIDLKNZE	4	0.0001	0.0001	0.0001	0.0003	0.0007	0.0010
CENTLNZE	1	0.0001	0.0001	0.0003	0.0003	0.0007	0.0007
WADDZWT	4	0.0003	0.0002	0.0001	0.0001	0.0012	0.0023
WADDZOT	1	0.0001	0.0001	0.0001	0.0001	0.0026	0.0026
EEMSDLD	4	0.0001	0.0002	0.0001	0.0001	0.0037	0.0066

Table 10.
Concentrations of organic contaminants in sediments in 1999.

Location	n	Parameter	in µg/kg M	H
WADDZWT	11	PCB153	1.6	3.0
WADDZOT	11	PCB153	2.0	2.6
EEMSDLD	10	PCB153	1.6	3.4
WADDZWT	11	Σ7PCB	8.9	15.2
WADDZOT	11	Σ7PCB	9.3	11.5
EEMSDLD	10	Σ7PCB	7.5	14.0
WADDZWT	11	B(a)P	65	110
WADDZOT	11	B(a)P	69	100
EEMSDLD	10	B(a)P	64	97
WADDZWT	11	Σ6PAH	490	858
WADDZOT	11	Σ6PAH	534	852
EEMSDLD	10	Σ6PAH	526	728
WADDZWT	11	TBySn	15	37
WADDZOT	11	TBySn	11	56
EEMSDLD	10	TBySn	14	25
			in % M	P
WADDZWT	11	OC	2.8	4.5
WADDZOT	11	OC	3.1	4.2
EEMSDLD	10	OC	2.5	4.0

Table 11.
Concentrations of organic contaminants in biota in 1999.

Location	species	organ	n	Σ7PCB in µg/kg ww M	Σ7PCB in µg/kg ww P	Σ7PCB in µg/kg dw M	Σ7PCB in µg/kg dw P	Σ7PCB in µg/kg fat M	Σ7PCB in µg/kg fat P
ZUIDLKNZE	Dab	liver	6	33.5	44.5	142	172	604	728
CENTLNZE	Dab	liver	9	17.4	50.9	74	207	318	878
WESTSDE	Flounder	liver	25	536	2535	1322	5140	3300	12200
EEMSDLD	Flounder	liver	25	95	247	307	556	650	990
WADDZWT	Flounder	liver	25	124	411	338	822	614	1070
WESTSDE	Mussel	soft body	5	22.1	39	245	312	3979	4333
EEMSDLD	Mussel	soft body	5	12.9	14.9	102	107	1280	1300

	species	organ	n	Σ6PAH in µg/kg dw M	Σ6PAH in µg/kg dw P	Σ6PAH in µg/kg dw M	Σ6PAH in µg/kg dw P	Σ6PAH in µg/kg fat M	Σ6PAH in µg/kg fat P
WESTSDE	Mussel	soft body	5	16.4	39.0	201	312	3303	4333
EEMSDLD	Mussel	soft body	5	21.8	35.0	177	237	2180	3646

	species	organ	n	parameter	in µg/kg ww M	in µg/kg ww P
WESTSDE	Mussel	soft body	5	PCB153	9.2	16
EEMSDLD	Mussel	soft body	5	PCB153	5.5	6.3
WESTSDE	Mussel	soft body	5	dieldrin	1.1	1.2
EEMSDLD	Mussel	soft body	5	dieldrin	0.6	0.7
WESTSDE	Mussel	soft body	5	γHCH	0.2	0.3
EEMSDLD	Mussel	soft body	5	γHCH	0.2	0.3
WESTSDE	Mussel	soft body	5	B(a)P	2.0	5.0
EEMSDLD	Mussel	soft body	5	B(a)P	2.0	4.2
WESTSDE	Mussel	soft body	5	4,4'-DDT	0.2	0.2
EEMSDLD	Mussel	soft body	5	4,4'-DDT	0.2	0.2

Table 12.
Detection limits of all analyses used for JAMP monitoring by the laboratories involved.

Compartment	Seawater		Biota		Sediment
	RIKZ	RIZA	Fish	Mussel	
Parameter	mg/m³		mg/kg ww		mg/kg ww
Mercury	0.03	0.004	0.01	0.01	0.01
Cadmium	0.01	0.02	0.003	0.003	0.1
Copper	0.1	0.01	0.1	0.1	1
Zinc	1	0.3	0.6	0.6	3
Lead	0.3	0.1	0.02	0.02	5
Nickel	0.3	0.08	0.04	0.04	3
Chromium	0.3	0.6	0.05	0.05	3
Arsenic	0.3	0.7	0.5	0.5	1
Nitrite	1	2			
Nitrate	3	20			
Ammonium	1	50			
Ortho-P	1	5			
Total P	5	10			
Total N	22				
Silicon	3	10			
Chlorophyll α	0.02	0.02			
SPM	1 mg/l	1 mg/l			
			ug/kg ww		ug/kg dw
HCB			1	1	0.5
PCB101,153,187					0.5
PCBs			1	1	0.25
Phen, Ant					5
PAHs			0.1	0.1	3
γHCH	0.1 ng/kg	0.1 pg/l		0.1	
Dieldrin				0.1	
DDT				0.1	

Table 13.
Locations used for calculating median and peak values for different areas of Dutch marine waters.

	Locations				
Compartment Organism Area	Water	Biota Flounder	 Dab	 Mussel	Sediment
WESTSDE	WIELGN VLISSGBISSVH TERNZBI20 HANSWGL LAMSWDBI59	MIDDGBWPMLPT		HOEDKKKBI4	
OOSTSDE	ZIJPE LODSGT WISSKKE				
VOORDTA	WALCNR2 SCHOUWN10 GOERE6				
NIEUWWTWG	MAASSS				
KUSTZNE	NOORDWK2 NOORDWK20 TERSLG4				
ZUIDLKNZE	WALCRN70 NOORDWK70 TERSLG50		IJMDWT80 TERSLGNWT40		
CENTLNZE	TERSLG135 TERSLG235		BORKND30 TERSLNWT100 DOGGBK		
WADDZWT	MARSDND DOOVBWT DOOVBOT BLAUWSOT	WIERBASDP			GRIENDKRD POSTHWD VLAKTVOTBRM DOOVBWT MALZZWL BOONTOOVR BALGZWWZD DENOVSSBTN VLAKTVKKSRND KORNWDZBTSKM TERSLKDVSP
WADDZOT	DANTZGT ZOUTKPLG ZUIDOLWOT				DANTZGZD ZUIDOLWZOT KOFFBNPT NIEUWBT DANTZGKDBTN LAUWOODVT GRONGWWFMLZD ROTTMPKDZD SIEGWL BALLMBT BORNDZWT
EEMSDLD	HUIBGOT BOCHTVWTND BOCHTVWTM GROOTGND	PAAPGTGRDPT		BOCHTVWTM	UITHZWEHVWT BOCHTVWTDVVA REIDPND HERPNOT OOSTFSPZWT EEMSPGM BORKKDZD BLINDRZGZOT ROTTMOZOT BOCHTVWTOT

Table 14.
List of abbreviations and technical terms.

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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