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 on the Joint Assessment and Monitoring Programme of the Netherlands 2003

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Summary

The Netherlands participates in the Joint Assessment and Monitoring Programme (JAMP) of the Oslo and Paris Commissions. In this framework it was agreed that all members or contracting parties should report on the national comments that accompany the data submissions to ICES database. This report presents the results and comments of the Dutch contribution to the JAMP programme 2003.

Wintertime concentrations of DIN (Dissolved Inorganic Nitrogen) and Ortho-phosphate were in agreement with earlier reported downward trends. Though both nutrients still exceed their respective MTR (Maximum Tolerable Risk concentration), the downward trend seems more progressive for Ortho-phosphate than for DIN.

Of all measured dissolved metal concentrations only copper was recurrently exceeding MTR levels and of all measured metal concentrations in sediment only the yearly means of Hg, Zn, Cr and Ni were occasionally exceeding the VR.

A long term assessment of γ-HCH presented here showed a strong decreasing trend in concentrations up to levels below VR.
Dissolved TBT concentrations are in agreement with earlier reported trends (ref.15). Nevertheless TBT concentrations in sediment still exceed the MTR.

A general improvement in flounder health, in terms of ulcers and tumours, was noted for the Wadden sea, Eastern Scheldt and coastal zone since the early nineties.

The quality assurance Programme of the Dutch Laboratories and details on detection limits, and participation in QUASIMEME exercises are given.

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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 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 analysed the fish diseases and contaminants in biota.

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 MON, SIME, HSC and ASMO working groups,

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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 (e.g. SIME, MON and INPUT) under ASMO.

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 for 2003, 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/matrix combinations. Figure 1 presents a map of all locations in the different areas (see also chap. 6.2) where samples were collected in the Dutch part of the continental shelf. 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 matrices and/or organisms. Finally, the locations used to calculate median and peak values for every area are presented in table 15 and 16. 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. 6).

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. 12 and 13). The general aims of monitoring are trend detection, assessment of compliance with Dutch criteria combined with measuring of specific contaminants in (preferably) single matrices. 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 17) (ref. 17).

Water

- Dissolved metal concentrations are only frequently measured at the river Rhine outlet at Rotterdam (NIEUWWTWG) 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 12 and 15 measurements per area, and allows the identification of trends. At locations used for phytoplankton sampling, the nutrients are as frequently sampled as the phytoplankton. At 2 locations in the Wadden Sea, samples for measuring nutrient concentrations are taken every month to gather 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-a is only measured together with samples for phytoplankton species composition.
- For pesticide concentrations in water, the number of locations is 1 in every area (except for the Western Scheldt and the New Waterway) and the frequency of sampling is generally 4 times a year.

SPM

- SPM is sampled as the major matrix for trend studies of metals and hydrophobic organic contaminants in five areas: the Western Scheldt, North Sea Coast, Western and Eastern Wadden Sea and the Ems-Dollard estuary. Because SPM monitoring is not yet part of the JAMP, these results are not reported to ICES and not presented in this document.

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 2003 sediments in the Dutch Northe Sea were sampled at 43 locations (table 16).

Biota

- Measurements in biota cover:
  - Mussel and fish disease of Flounder in autumn
  - Mercury in Flounder muscle
  - Cadmium in Flounder liver
  - Metals in Mussel soft body
  - PCBs in Flounder liver and Mussel soft body
  - PAHs and pesticides in Mussels soft body

Flounder is sampled 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 (M) and peak (P) values for each area are presented in table 12. Lake Grevelingen and Veerse Meer are not part of the OSPAR convention area and not presented in this document.

2.3 Sampling and analyses

The sampling departments of the regional divisions of the Directorate-General for Public works and Water Management carry out sampling by using standard sampling guidelines (RWSVs). RIKZ, RIZA and RIVO laboratories carried out analyses. 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, 6th edition (April 2003), RIKZ-MI/2003.007X (ref.10).
List of analytical methods used for seawater contaminants with matching codes, 11th edition (July 2003), RIKZ-MI/2003.013X (ref 9).
List of analytical methods used for biota samples contaminants with matching codes, 3rd edition (April 2002), RIKZ-IT/2002.116X (ref 11).

Figure 1. Sampling locations 2003 (see table 1 and 16 for location numbers).

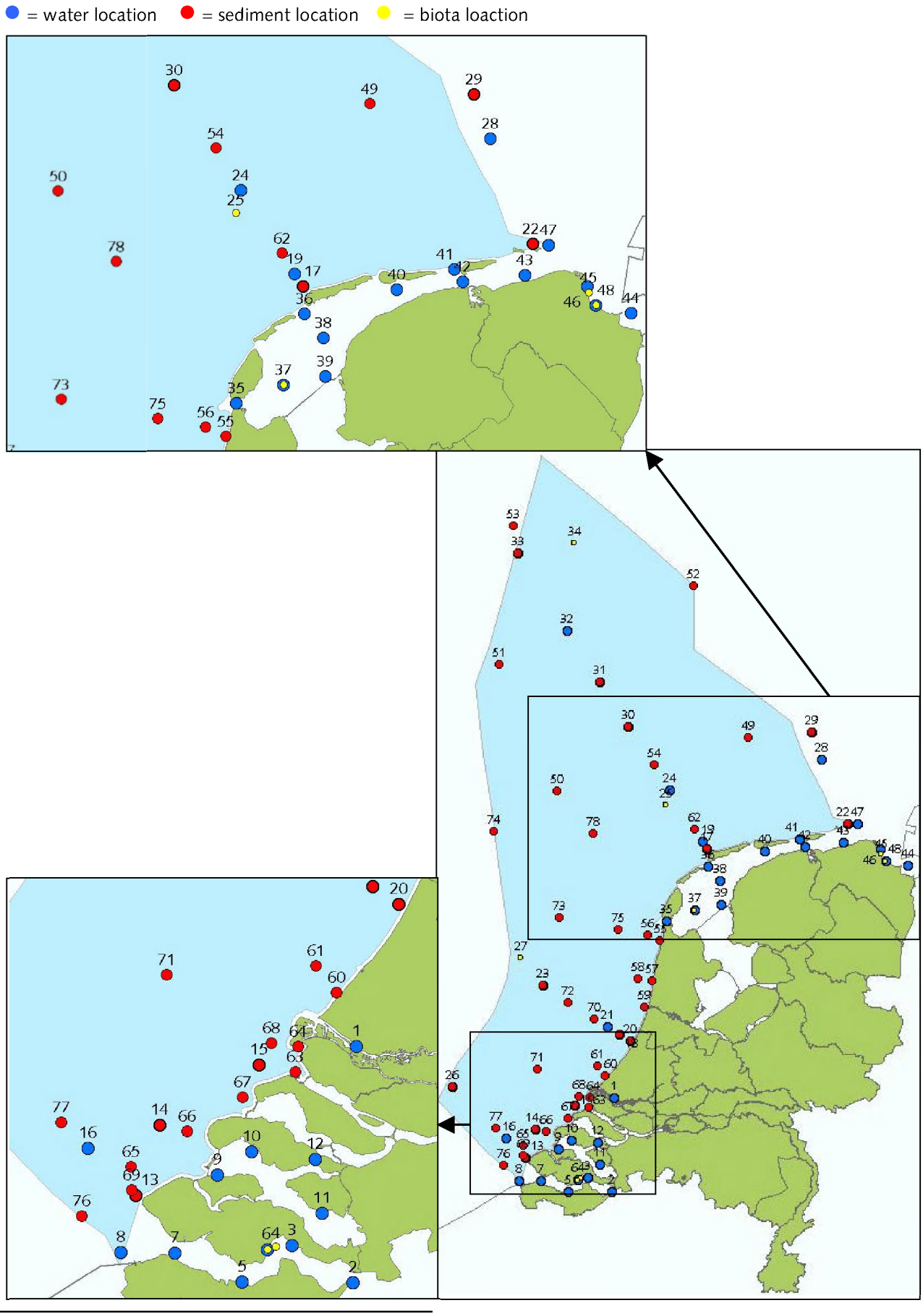


Table 1. Sampling frequencies for the areas covered by the Dutch chemical monitoring programme. The locations are presented in Figure 1.

No	ICES CODE	AREA LOCATIONS	water Supporting parameters	water Nutrients	water Metals	sediment Metals	biota Metals	water Organic contaminants	sediment Organic contaminants	biota Organic contaminants	biota Biological effects
		New Waterway									
1	54.0.1	MAASSS	26	26	26	-	-	13	-	-	-
		Western Scheldt									
2	21.1.1	SCHAARVODDL	26	26	26	-	-	13	-	-	-
3	21.1.2	HANSWGL	19	19	13	-	-	13	-	-	-
4	21.1.4	MIDDGBWPMLPT	-	-	-	-	1	-	-	1	-
5	22.2.1	TERNZBI20	4	4	13	-	-	13	-	-	-
6	22.2.2	HOEDKKKBI4	13	-	-	-	-	-	-	-	-
7	22.3.1	VLISSGBISSVH	19	19	13	-	-	13	-	-	-
8	22.3.4	WIELGN	6	4	-	-	-	4	-	-	-
		Eastern Scheldt									
9	23.0.2	WISSKKE	20	20	-	-	-	4	-	-	
10	23.0.3	HAMMOT	20	20	-	-	-	-	-	-	-
11	23.0.6	LODSGT	20	20	-	-	-	4	-	-	-
12	23.0.9	ZIJPE	20	20	-	-	-	4	-	-	-
		Voordelta				1*)			1*)		
13	21.1.5	WALCRN2	12	12	-	-	-	4	-	-	-
14	21.1.6	SCHOUWN10	12	4	-	-	-	4	-	-	-
15	21.1.7	GOERE6	12	12	-	-	-	4	-	-	-
16	21.3.3	WALCRN20	12	12	-	-	-	-	-	-	-
		North Sea Coast				1*)			1*)		
17	21.1.12	TERSLG4	19	19	-	-	-	4	-	-	-
18	21.2.11	NOORDWK10	31	31	-	-	-	-	-	-	-
19	21.2.13	TERSLG10	18	18	-	-	-	-	-	-	-
20	21.2.2	NOORDWK2	19	19	4	-	-	12	-	-	-
21	21.3.2	NOORDWK20	19	19	-	-	-	4	-	-	-
22	21.4.1	ROTTMPT3	7	7	-	-	-	-	-	-	-
		Southern North Sea				1*)			1*)		
23	21.5.10	NOORDWK70	19	19	-	-	-	12	-	-	-
24	21.5.11	TERSLG50	6	4	-	-	-	4	-	-	-
25	21.5.12	TERSLNWT40	-	-	-	-	1	-	-	1	1
26	21.5.8	WALCRN70	12	12	-	-	-	4	-	-	-
27	21.6.6	IJMDWT80	-	-	-	-	1	-	-	1	1
		Central North Sea	1*			1*)			1*)		
28	21.4.4	ROTTMPT50	7	7	-	-	-	-	-	-	-
29	21.5.4	ROTTMPT70	3	3	-	-	-	-	-	-	-
30	21.6.1	TERSLG100	18	18	-	-	-	-	-	-	-
31	21.6.2	TERSLG135	18	18	-	-	-	4	-	-	-
32	21.6.3	TERSLG175	18	18	-	-	-	-	-	-	-
33	21.6.4	TERSLG235	18	18	-	-	-	-	-	-	-
34	21.6.7	DOGGBK	-	-	-	-	1	-	-	1	1
		western Wadden Sea	1*								
35	24.0.1	MARSDND	21	21	-	-	-	4	-	-	-
36	24.0.2	VLIESM	12	12	-	-	-	-	-	-	-
37	24.0.3	DOOVBWT/WIERBASDP	12	12	-	-	1	12	-	1	1
38	24.0.4	BLAUWSOT	12	4	-	-	-	4	-	-	-
39	24.0.5	DOOVBOT	6	4	-	-	-	4	-	-	-
		eastern Wadden Sea	1*								
40	24.1.1	DANTZGT	21	21	-	-	-	4	-	-	-
41	24.1.2	ZOUTKPLZGT	12	12	-	-	-	-	-	-	-
42	24.1.3	ZOUTKPLG	12	12	-	-	-	4	-	-	-
43	24.1.4	ZUIDOLWOT	21	21	-	-	-	4	-	-	-
		Ems-Dollard estuary	1*								
44	25.1.1	GROOTGND	21	21	-	-	-	12	-	-	-
45	25.1.3	PAAPGTGRDPT	-	-	-	-	1	-	-	1	-
46	25.2.1	BOCHTVWTND	6	4	-	-	-	4	-	-	-
47	25.2.2	HUIBGOT	21	21	-	-	-	4	-	-	-
48	25.2.3	BOCHTVWTM	6	4	-	-	1	4	-	1	-

1* In 2003 sediment in these areas were sampled on 43 locations. The locations are listed in table 17 including geographical information.

Table 2. Parameters measured in the different matrices of marine waters under the Dutch JAMP in 2003.

group	parameter	description	water	sediment	biota		
					dab	flounder	mussel
Supporting parameters	SALNTT	salinity	+				
	SPM	suspended matter	+				
	T	temperature	+				
	O2	oxygen	+				
	ChlFa	chlorophyll-a	+				
	OC	organic carbon		+			
	lutum	fraction <2 µm		+			
	POC	purgeable organic carbon	+				
	TOC	total organic carbon	+				
Nutrients	N	total Nitrogen	+				
	P	total Phosphorous	+				
	NH4	ammonium	+				
	NO2	nitrite	+				
	NO3	nitrate	+				
	o-PO4	ortho-phophate	+				
	SiO2	silicate	+				
Metals	Al	aluminium		+			
	As	arsenic		+			+
	Cd	cadmium	+ [1])	+	+	+	+
	Cr	chromium		+			+
	Cu	copper	+	+	+		+
	Hg	mercury		+	+	+	+
	Ni	nickel	+ [1])	+			+
	Pb	lead	+ [1])	+	+		+
	Zn	zinc	+ [1])	+	+		+
Organic contaminants	a-HCH	alpha-HCH	+				+
	b-HCH	beta-HCH	+				+
	c-HCH	lindane	+				+
	4.4'-DDD	p.p'-DDD					+
	4.4'-DDE	p.p'-DDE					+
	4.4'-DDT	p.p'-DDT					+
	Atr	atrazine	+				
	Sim	simazine	+				
	DIURN	diuron	+				
	TBySn	tributyltin-compounds	+	+			
	HCB	hexachlorobenzene		+	+	+	+
	PCB...	PCB-congener		+	+	+	+
	s_PCB7	sum 7 Ballschmiter PCBs		+	+	+	+
	DIELDRN	dieldrin					+
	QCB	pentachlorobenzene					+
	Hepo	b-heptachloro-epoxide					+
	PCTA	pentachlorothioanisole					+
	PAH	polycyclic aromatic hydrocarbon (16EPA)		+		+	+
	s_PAH6	sum 6 Borneff PAHs		+		+	+
Biological effects	-	fish deseases			+	+	

+ [1]) only brakish water

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 (2002/ref.11).

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 Bovelander (RIKZ-MI/-2003.013X, 2003 / ref. 9).

The measurement of biological effects was part of the NSTF (North Sea Task Force) programme, which was incorporated into the JAMP monitoring programme. The analytical methods were described by Van Zeijl (RIKZ-IT/2002.116X, 2002 / ref. 11).

4 Information on measurements

4.1 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 grouped into geographical areas and the results (median and peak values) for each of these are presented in table 4.

4.2 Nutrients in water

4.2.1 The programme

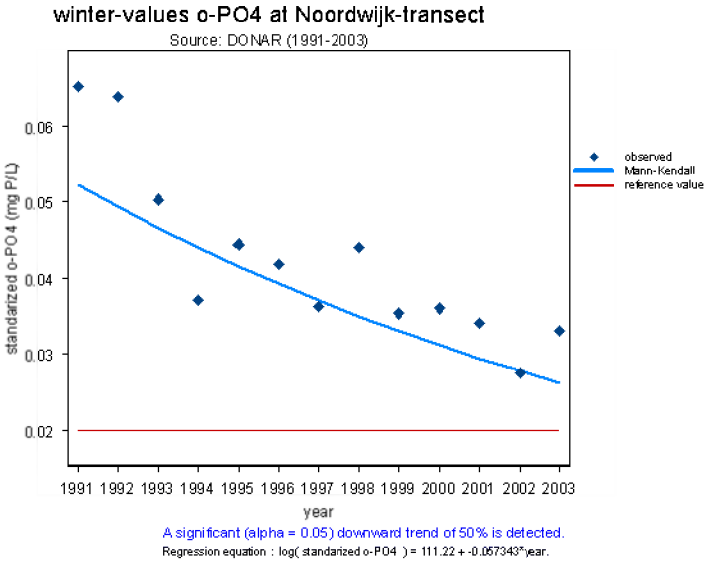
General concentrations of nutrients like Nitrogen, Phosphorus and Organic Carbon are measured every time the stations are visited. The median and peak values (shown in table 5) are taken over the whole of 2003. The inorganic nutrient concentrations measured during the winter period (December 1st to March 1st) are used for trend detection.
The nutrient data in the winter period are presented in table 6. The frequency of sampling for phytoplankton is the same for nutrients (see tables 1 and 4: 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, plotting each year's winter nutrient concentrations versus the measured salinity values to produce nutrient- salinity plots assesses yearly trends in nutrient concentrations. 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. 1 to 3). 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 river discharges), nutrient concentrations are "normalised" for salinity 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).

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).

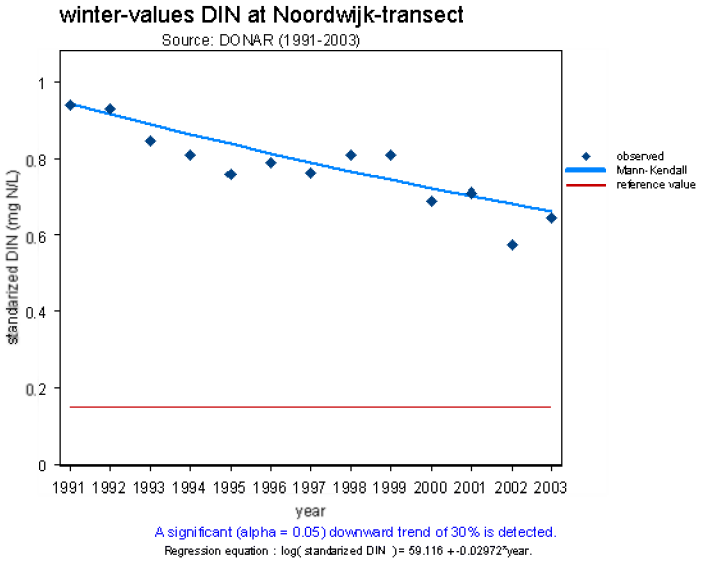


> For fig.2. and fig 3.: The trend was estimated by a suite of trend detection methods called Trend-Y-tector. This suite of methods for detecting and estimating trends was developed in co-operation with members of the statistical working group of the International Council for the Exploration of the Sea (ICES) and is available on the Internet (www.trendytector.nl). The software is also available on CD-ROM. <

Until 2003 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. 4 and 5). 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 elevated concentrations has been observed over the last 13 years (Fig. 3). This trend is amounting to a 30% 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 additional N-inputs over the last two decades (refs. 6 and 14).

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).



4.3 Metals

Metals were measured in three matrices:

- 1) Water (dissolved)
- 2) Sediments (<63 µm)
- 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 2003 only Cadmium, Copper, Nickel, Lead and Zinc were 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 7.
At the brackish water location (NIEUWWTWG) only the peak value of Copper (6.5 µg/L) exceeds the Maximum Tolerable Risk (MTR)-value of 1.5 µg/L. For the salt locations only the Copper concentration (1.7 µg/L) at the Western Scheldt exceeds the MTR.

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 that were sampled in the past for JMG and/or JAMP purposes. Sediments taken from the Dutch North Sea in 2003 were assessed. All but one of the peak values of the metal concentrations (table 8) underspend the Maximal Tolerable Risk (MTR)-values (table 17); only the nickel concentration of 44 mg/kg in the central North Sea equals the MTR.
Exceedings of the "verwaarloosbaar risico-concentration" (VR) occur at: the Voordelta for Hg; the Coastal Zone for Hg; the central North Sea for Cr and Cu. No exceeding of the metal VR's occurs at the southern North Sea.

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 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 As, Cd, Cr, Cu, Hg, Pb and Zn in Mussels. The results are presented in table 9.

4.4 Organic contaminants

Organic contaminants are measured in three matrices 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

In table 10 the concentrations of hexachlorocyclohexane (HCH) and other pesticides in water are presented. A qualitative comparison of the results of γ-HCH in the period 1997 up to 2003 shows a significant decrease in the Western Scheldt of 81% (from 0.016 µg/l to 0.0028 µg/l); see figure 5 page 34.

4.4.2 Organic contaminants in Sediment

Sediments taken from 4 areas in the North Sea (central North Sea, Coastal Zone, "Voordelta" and the southern North Sea) in 2003 were assessed.
The peak value of PCB153 (5.5 µg/kg) exceeds the MTR (4 µg/kg) in the "Voordelta".
All the Mean and peak values of BaP do not exceed the MTR of 3 mg/kg. However they all do exceed the VR of 3 µg/kg.
Despite the decreasing trend of TBT in the water matrix, the Median Value of TBT in de sediment matrix still exceeds the Maximal Tolerable Risk concentration (0.7 µg Sn/kg dry weight) by a factor 4 to 50.

4.4.3 Organic contaminants in Biota

Organic contaminants were measured in male Flounder liver and Mussels (ref. 16). The results are presented in table 12.

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. 7). Long-term exposure to chemically contaminated sediment can induce liver tumours in Flounder (ref. 8).

Monitoring of the incidence of skin and liver diseases is performed at all locations where Flounder are caught for monitoring of contaminants in biota. Details of these can be found in figure 1.

In 2003 Flounder (Platichthys Flesus) was caught at one location for determination of fish diseases;

- Western Wadden Sea (WADDZWT)

The overall mean incidence of lymphocystis was 0.0% and of skin ulcer was 1.0%. The results are presented in table 13.

A long-term assessment is presented in table 18.

- Skin ulcer occurs the most in the Wadden Sea from year to year between 1.0 and 12.7 % of the species caught. At the other locations there is a small decrease during the last 13 years.
- For Lymphocystis in the Wadden Sea a downward trend of 99% is detected in the period 1991-2001 (www.trendytector.nl; Mann-Kendall; two sided α=0.05). Adding the 2002 and 2003 data this trend is disturbed by an occurrence of lymphocystis in the Wadden sea of 6.6%; while in 2003 lymphocystis doesn't occur.
- Except for the Eastern Scheldt at all locations liver tumours hardly occur from the mid nineties up to 2003. At the Eastern Scheldt liver tumours occur almost every year.

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 contains 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 ref. 9 to 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 to compare results from different laboratories, it is essential to know the quality of the data. All the steps leading to their production influence this: sampling, transport, storage, analysis, calculation and interpretation. A minimum requirement to ensure the overall quality of data is a Quality Assurance System complying with the European Standard EN45001.
The policy of the Dutch government is that QA-procedures for sampling and analysis (in (non) governmental 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, several 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. As a result, sampling procedures are well documented and the various sampling groups are implementing quality assurance systems. An external auditor will regularly audit the Quality Assurance Systems of the different Divisions.

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 2004.

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)]:

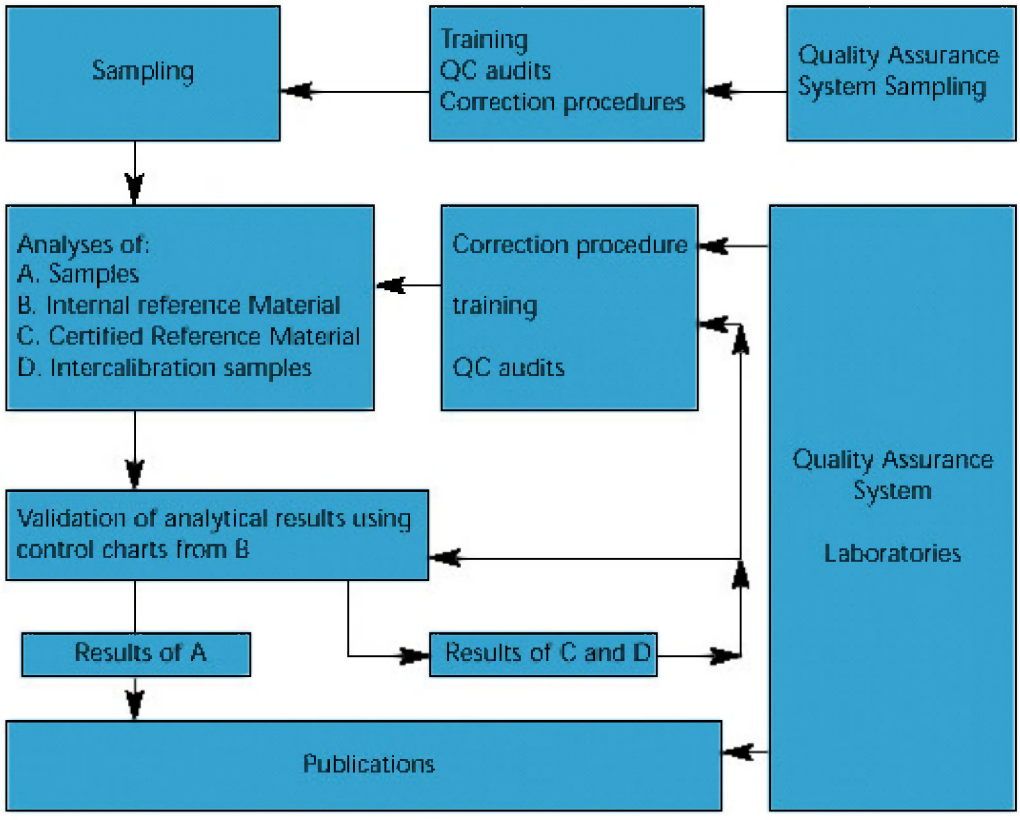
Formula 1: **DL = 3 * S(bl)**

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 14.

Figure 4. Analytical Quality Assurance 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 micro pollutants:
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 14.

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 2003 were:

Table 3. **QUASIMEME codes for 2003**

laboratory	round	excercise	group	parameter	matrix	IC-codes
RIKZ	31	538	AQ3	trace metals	sea water	KP KQ KR
RIKZ	31	540	AQ5	OCPs & PCBs	sea water	KU KV KW
RIKZ	31	543	AQ8	OPs & triazines	sea water	L2 L3 L4
RIKZ	32	544	AQ1	nutrients	sea water	L5 L6
RIKZ	32	545	AQ2	nutrients	low salinity water	L7 L8
RIKZ	32	546	MS1	trace metals	sediment	LB LC
RIKZ	32	547	MS2	OCPs & PCBs	sediment	LD LE
RIKZ	32	548	MS3	PAHs	sediment	LF LG
RIKZ	32	549	BT1	trace metals	biota	LH LI
RIKZ	32	550	BT2	OCPs & PCBs	biota	LJ LK
RIKZ	33	554	AQ3	trace metals	sea water	LS LT LU
RIKZ	33	556	AQ4	OCPs & PCBs	sea water	LV LW LX
RIKZ	33	559	AQ5	OPs & triazines	sea water	LY LZ M1
RIVO	30	535	BT1	trace metals	biota	KJ KK
RIVO	30	536	BT2	OCPs & PCBs	biota	KL KM
RIVO	30	537	BT4	PAHs	biota	KN KO
RIVO	32	547	MS2	OCPs & PCBs	sediment	LD LE
RIVO	32	549	BT1	trace metals	biota	LH LI
RIVO	32	550	BT2	OCPs & PCBs	biota	LJ LK

Reported data (with all the detailed information of the results of the desired intercalibration) of the Netherlands can by supplied on request by ICES.

6 Overall conclusions

In the last 13 years, Ortho-phosphate wintertime concentrations decreased by approx. 50%. This trend was more evident in a narrow strip (1-4 km) along the Dutch coast.
Overall, the wintertime concentration of Ortho-phosphate on the Noordwijk transect is declining towards the objective background value of 0.02 mg P/L.

A similar trend was observed for total dissolved inorganic Nitrogen (DIN) although the decrease was smaller in percentage than for Ortho-phosphate (i.e., ca. 30 vs. 50% decrease). Consequently, wintertime concentrations of DIN still exceeded reference or background concentration by a factor of 3-4. This is most probably due to the additional N-inputs over the last two decades.

Concentrations of dissolved metals were in general low. Only at two locations Cu concentrations in water exceeded the Maximum Tolerable Risk concentration (MTR). At brackish water location (NIEUWWTWG) and a salt-water location (WESTSDE), Cu concentrations peaked at respectively 6.5 and 1.7 µg/L.

The 2003 assessment of the sediments taken in 4 areas in the North Sea showed that all but one peak-value of the metal concentrations were lower than the MTR. Only Ni at the central North Sea equalled the MTR. Mean dissolved metal concentrations in 2003 exceeding the VR (negligible risk-concentration" (VR) occurred at: the Voordelta for Hg and Zn; the Coastal Zone for Hg; the central North Sea for Cr and Ni. In the Southern North Sea dissolved metal concentrations did not exceed their VR's.

Concerning the organic contaminants in water, during the last 7 years γ-HCH showed a decreasing trend in concentration and the peak value of γ-HCH in 2003 was lower than the VR.
The measured TBT concentrations in water show in agreement with earlier reported decreasing trends. Nevertheless, TBT concentrations in sediment still exceeded the maximum tolerable risk concentration (set at 0.7 µg Sn/kg); occasionally up to a factor of 50.

A long-term assessment of fish diseases in flounder (Platichthys flesus) showed that skin ulcers were found the most in the Wadden Sea. (Over the last 12 years ranging between 1.0 and 12.7 % of the species caught). At the other locations ulcers were in general less common or tended to decrease as of the second half of the nineties.
The occurrence of Lymphocystis and liver tumours in all areas sampled seemed generally lower than the period of a decade ago. The somewhat lowered occurrences of Lymphocystis in flounder and the detected downward trend in the Wadden Sea in recent years was disturbed by one of the highest occurrences of Lymphocystis measured (6.6% of the analysed flounders were affected) in 2002. Except for the Eastern Scheldt at all locations liver tumours hardly occur from the mid nineties up to 2003. At the Eastern Scheldt liver tumours occur almost every year.

7 Tables

Table 4. Number of measurements (n) and median (M) and peak (P) values of supporting parameters in seawater in 2003.

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	O_2 in mg/l M	O_2 in mg/l P	n	Chlorophyll-a in ug/l in summer M	Chlorophyll-a in ug/l in summer P
WESTSDE	77	26.1	33.6	104	30	153	77	9.1	23.8	73	9.4	11.1	40	7.9	38.0
OOSTSDE	60	31.1	34.5	60	3	25	60	11.0	22.4	56	9.1	13.4	39	5.4	41.4
VOORDTA	42	31.8	33.6	36	14	51	42	9.3	22.2	41	9.5	15.1	12	9.8	40.8
NIEUWWTWG	-	-	-	27	10	69	27	12.8	24.8	27	9.3	15.1	13	12.0	30.0
KUSTZNE	41	31.7	34.0	58	5	49	41	9.9	21.8	41	9.4	13.2	28	4.9	30.4
ZUIDLKNZE	34	34.8	35.2	40	2	11	33	9.7	20.8	33	8.8	12.1	15	1.5	12.4
CENTLNZE	31	34.5	34.8	28	1	2	31	10.8	20.4	30	8.8	12.3	16	0.7	3.5
WADDZWT	51	27.9	36.0	61	24	144	50	9.7	24.7	50	8.8	12.5	14	8.1	35.4
WADDZOT	54	30.5	33.4	66	52	226	54	10.3	25.3	54	9.3	12.3	24	26.5	64.4
EEMSDLD	55	23.1	32.0	62	84	278	55	8.8	22.3	55	9.4	12.9	24	9.7	15.8

Table 5. Number of measurements (n) and median (M) and peak (P) values of Nitrogen, Phosphorus and Organic Carbon in seawater in 2003.

Area	n	Total Nitrogen in mg N/l M	Total Nitrogen in mg N/l P	n	Total Phosphorus in mg P/l M	Total Phosphorus 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	71	1.88	5.66	69	0.16	0.69	75	1.0	3.9	73	3.6	10.2
OOSTSDE	60	0.60	1.52	54	0.06	0.10	60	0.4	2.4	60	2.2	4.7
VOORDTA	36	0.61	1.16	34	0.05	0.12	36	0.7	4.4	36	2.1	7.5
NIEUWWTWG	27	2.11	3.40	27	0.14	0.26	-	-	-	26	4.0	6.0
KUSTZNE	49	0.48	1.35	46	0.04	0.09	49	0.4	2.1	49	1.8	4.0
ZUIDLKNZE	39	0.16	0.43	38	0.02	0.10	39	0.2	1.2	39	1.1	2.8
CENTLNZE	28	0.11	0.20	28	0.02	0.04	28	0.1	0.2	28	1.0	1.3
WADDZWT	39	0.71	2.82	39	0.06	0.19	49	1.1	5.7	47	3.9	8.7
WADDZOT	53	0.95	2.40	53	0.15	0.26	54	2.5	6.6	53	5.2	8.6
EEMSDLD	49	2.02	6.54	47	0.19	0.48	53	3.5	13.0	49	9.8	24.0

Table 6. Number of measurements (n) and median (M) and peak (P) values of winter concentrations of nutrients in seawater in 2003. Winter period is from December 1st 2002 to March 1st 2003.

Area	n	NH4 in mg N/l M	NH4 in mg N/l P	n	NO2 in mg N/l M	NO2 in mg N/l P	n	NO3 in mg N/l M	NO3 in mg N/l P	n	o-PO4 in mg P/l M	o-PO4 in mg P/l P	n	SiO2 in mg Si/l M	SiO2 in mg Si/l P
WESTSDE	18	0.12	0.65	18	0.016	0.045	18	1.9	4.2	18	0.11	1.22	18	2.0	4.4
OOSTSDE	9	0.11	0.14	9	0.023	0.032	9	0.5	1.1	9	0.04	0.05	9	0.7	1.0
VOORDTA	9	0.03	0.06	9	0.013	0.017	9	0.6	0.8	9	0.03	0.04	9	0.6	0.8
NIEUWWTWG	7	0.15	0.21	7	0.040	0.050	-	-	-	6	0.07	0.10	7	3.3	3.5
KUSTZNE	12	0.04	0.13	11	0.013	0.023	12	0.5	1.1	12	0.03	0.04	12	0.6	1.0
ZUIDLKNZE	10	<0.002	0.01	10	0.002	0.022	10	0.1	0.1	10	0.01	0.02	10	0.1	0.2
CENTLNZE	6	<0.002	0.02	6	0.002	0.006	6	0.1	0.1	6	0.02	0.02	6	0.1	0.2
WADDZWT	12	0.10	0.16	12	0.016	0.029	12	1.0	2.2	12	0.03	0.04	12	0.8	1.7
WADDZOT	11	0.27	0.41	11	0.032	0.062	11	0.7	1.3	11	0.05	0.06	11	1.3	1.9
EEMSDLD	14	0.30	0.61	14	0.041	0.055	14	2.7	3.9	13	0.05	0.07	14	2.9	4.7

Table 7. Number of measurements (n) and median (M) and peak (P) values of concentrations of dissolved inorganic contaminants in seawater in 2003.

Area	Cd in µg /L			Cu in µg /L			Ni in µg /L			Pb in µg /L			Zn in µg /L		
	n	M	P	n	M	P	n	M	P	n	M	P	n	M	P
WESTSDE	39	0.04	0.14	39	1.1	1.7	30	1.6	2.8	30	<0.3	0.3	39	1.1	5.6
NIEUWWTWG	27	<0.05	0.1	26	3.3	6.5	27	1.8	2.8	27	0.2	0.5	27	2.9	8.2
KUSTZNE	3	0.02	0.02	4	0.4	0.5	1	0.4	0.4	1	<0.3	<0.3	3	<1	<1
WADDZWT	2	<0.01	<0.01	4	0.5	0.6	1	0.4	0.4	1	<0.3	<0.3	2	<1	1.2
WADDZOT	2	<0.01	0.02	4	0.6	0.9	1	0.5	0.5	1	<0.3	<0.3	2	<1	<1
EEMSDLD	3	0.02	0.02	4	1	1.1	2	0.9	1	2	<0.3	<0.3	3	<1	<1

Table 8. Number of measurements (n) and median (M) and peak (P) values of concentrations of inorganic metals in sediments in 2003.

Area	Al mg/kg			As mg/kg			Cd mg/kg			Cr mg/kg			Cu mg/kg		
	n	M	P	n	M	P	n	M	P	n	M	P	n	M	P
VOORDTA	10	37475	47100	10	18	28	10	0.5	1.2	10	84	100	10	18	31
KUSTZNE	11	38100	67500	11	18	42	11	0.4	1.0	11	87	120	11	20	31
ZUIDLKNZE	11	43100	62500	11	24	54	11	0.3	0.6	11	77	110	11	16	21
CENTLNZE	10	57400	64750	10	23	42	10	0.1	0.4	10	102	120	10	18	21

Area	Hg mg/kg			Li mg/kg			Ni mg/kg			Pb mg/kg			Zn mg/kg		
	n	M	P	n	M	P	n	M	P	n	M	P	n	M	P
VOORDTA	10	0.4	0.5	10	40	52	10	24	33	10	64	92	10	165	410
KUSTZNE	11	0.3	0.6	11	43	75	11	28	42	11	72	140	11	72	140
ZUIDLKNZE	11	0.2	0.3	11	47	70	11	29	41	11	55	93	11	55	93
CENTLNZE	10	0.1	0.2	10	60	71	10	39	44	10	82	110	10	82	110

Table 9. Number of measurements (n) and median (M) and peak (P) values of concentration of inorganic metals in biota in 2003.

Area	Species	Organ	n	As mg/kg dw M	As mg/kg dw P	n	Cd mg/kg dw M	Cd mg/kg dw P	n	Cr mg/kg dw M	Cr mg/kg dw P	n	Cu mg/kg dw M	Cu mg/kg dw P
WESTSDE	Mussel	soft body	5	5.9	7.6	5	7.30	7.40	5	4.2	5.4	5	10.2	11.2
EEMSDLD	Mussel	soft body	4	8.3	10.0	4	1.42	1.76	4	6.6	16.0	4	10.1	12.9
WESTSDE	Flounder	liver	-	-	-	21	0.44	1.12	-	-	-	-	-	-
EEMSDLD	Flounder	liver	-	-	-	22	0.33	0.94	-	-	-	-	-	-
WADDZWT	Flounder	liver	-	-	-	25	0.08	0.30	-	-	-	-	-	-

Area	Species	Organ	n	Hg mg/kg dw M	Hg mg/kg dw P	n	Ni mg/kg dw M	Ni mg/kg dw P	n	Pb mg/kg dw M	Pb mg/kg dw P	n	Zn mg/kg dw M	Zn mg/kg dw P
WESTSDE	Mussel	soft body	5	0.23	0.24	5	4.9	5.2	5	6.5	6.9	5	250	310
EEMSDLD	Mussel	soft body	4	0.28	0.31	4	6.3	9.6	4	6.5	12.0	4	132	192
WESTSDE	Flounder	muscle	21	0.21	0.53	-	-	-	-	-	-	-	-	-
EEMSDLD	Flounder	muscle	22	0.34	0.56	-	-	-	-	-	-	-	-	-
WADDZWT	Flounder	muscle	25	0.36	0.97	-	-	-	-	-	-	-	-	-

Table 10. Number of measurements (n) and median (M) and peak (P) values of concentrations of hexachlorocyclohexane in seawater in 2003.

Area	α-HCH in ug/l			β-HCH in ug/l			γ-HCH in ug/l		
	n	M	P	n	M	P	n	M	P
WESTSDE	43	<0.0001	<0.0001	43	<0.0003	0.0004	43	0.0011	0.0028
OOSTSDE	1	<0.0001	<0.0001	1	<0.0003	<0.0003	1	0.0005	0.0005
VOORDTA	1	<0.0001	<0.0001	1	<0.0003	<0.0003	1	0.0003	0.0003
NIEUWWTWG	13	<0.001	0.001	12	<0.001	<0.002	13	<0.001	0.003
KUSTZNE	4	<0.0001	0.0003	4	<0.0003	<0.0003	4	0.0005	0.0009
ZUIDLKNZE	-	-	-	-	-	-	-	-	-
CENTLNZE	1	0.0001	0.0001	1	<0.0003	<0.0003	1	0.0002	0.0002
WADDZWT	4	<0.0001	0.0002	4	<0.0003	<0.0003	4	0.0005	0.0009
WADDZOT	1	<0.0001	<0.0001	1	<0.0003	<0.0003	1	0.0024	0.0024
EEMSDLD	4	<0.0001	0.0001	4	<0.0003	<0.0003	4	0.002	0.0048

Area	Atrazine ug/l			Diuron ug/l			Simazine ug/l		
	n	M	P	n	M	P	n	M	P
WESTSDE	41	0.029	0.13	41	0.091	0.37	41	0.0086	0.043
OOSTSDE	8	0.0062	0.0085	8	0.037	0.055	8	<0.003	0.0032
VOORDTA	12	0.0056	0.0083	12	0.015	0.024	12	<0.003	0.0021
NIEUWWTWG	13	<0.01	0.15	24	0.05	0.11	13	<0.01	<0.01
KUSTZNE	20	0.0048	0.011	20	0.012	0.023	20	0.0015	0.0035
ZUIDLKNZE	8	0.0016	0.003	8	<0.003	0.0062	8	0.0015	<0.003
CENTLNZE	8	0.001	0.0011	8	0.001	0.0074	8	0.0015	<0.003
WADDZWT	24	0.0055	0.0083	24	0.014	0.029	24	0.0015	<0.005
WADDZOT	12	0.0038	0.0046	12	0.012	0.016	12	0.0015	<0.005
EEMSDLD	24	0.004	0.0054	24	0.024	0.056	24	0.0015	0.0043

Figure 5.
Trend of γ-HCH in filtered surface water in the Western Scheldt from 1997 to 2003.

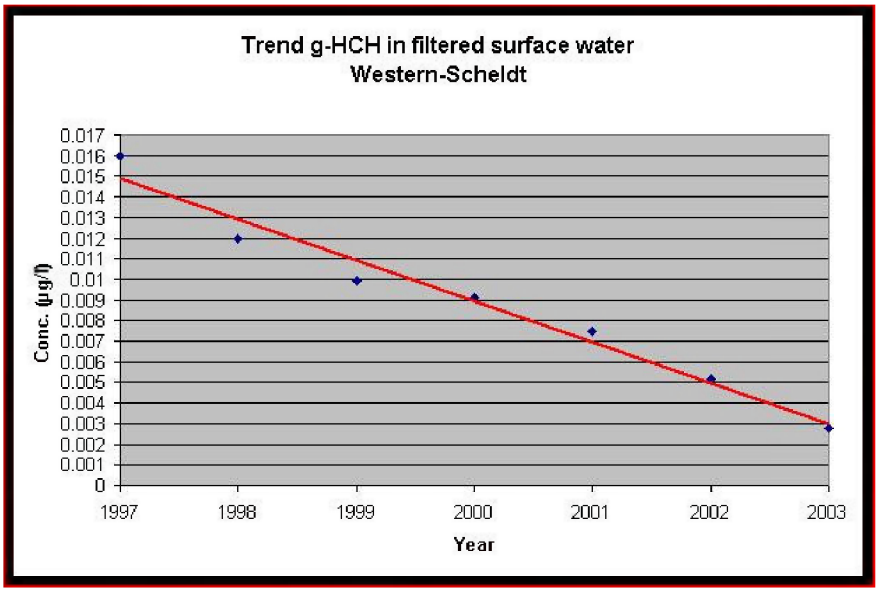


Table 11. Number of measurements (n) and median (M) and peak (P) values of concentrations of organic contaminants and Organic Carbon (OC) in sediments in 2003.

Area	n	PCB 153 µg/kg M	P	n	Σ7PCB µg/kg M	P	n	BaP µg/kg M	P	n	Σ6PAH µg/kg M	P	n	TBT µg Sn/kg M	P	n	HCB µg/kg M	P	n	OC % ww M	P
CENTLNZE	10	0.2	0.4	10	1.1	1.7	10	53	89	10	546	758	10	3	6	10	0.2	0.2	10	2.1	4.9
KUSTZNE	11	2.0	3.5	11	7.1	14.1	11	36	100	11	392	728	11	32	55	11	0.8	2.1	11	3.3	5.0
VOORDTA	10	2.8	5.5	10	11.5	23.0	10	95	135	10	699	942	10	20	33	10	0.8	1.9	10	2.2	3.0
ZUIDLKNZE	11	0.5	1.4	11	1.9	5.4	11	22	64	11	250	538	11	13	33	11	0.2	0.8	11	2.3	4.1

Table 12. Number of measurements (n) and median (M) and peak (P) values of concentrations of organic contaminants in biota in 2003, expressed as µg/kg wet weight, µg/kg dry weight and µg/kg fat.

Area	Species	Organ	n	Σ7PCB in ug/kg ww M	P	n	Σ7PCB in ug/kg dw M	P	n	Σ7PCB in ug/kg fat M	P	n	Σ6PAH in ug/kg ww M	P	n	Σ6PAH in ug/kg dw M	P	n	Σ6PAH in ug/kg fat M	P
WADDZWT	Flounder - male	liver	25	57	299	25	230	870	25	1000	1150		-	-		-	-		-	-
WESTSDE	Flounder - male	liver	20	460	1090	20	1440	2600	20	3200	5700		-	-		-	-		-	-
EEMSDLD	Flounder - male	liver	20	100	211	20	310	530	20	660	1080		-	-		-	-		-	-
WESTSDE	Mussel	soft body	5	56	85	5	410	500	5	5100	5700	5	44	79	5	320	460	5	3700	5300
EEMSDLD	Mussel	soft body	5	8.3	9.4	5	62	69	5	940	1010	4	42	49	4	310	390	4	4800	6100

Area	Species	Organ	n	PCB153 µg/kg dw M	P	n	Dieldrin µg/kg dw M	P	n	BaP µg/kg dw M	P	n	4.4'-DDT µg/kg dw M	P
WESTSDE	Mussel	soft body	5	175	210	5	11.7	12.9	5	31	49	5	0.6	0.73
EEMSDLD	Mussel	soft body	4	28	31	4	5.6	6.6	4	28	40	4	0.54	0.58

Table 13. Incidence of fish diseases in biota in 2003 in various size classes.

location WADDZWT	FLOUNDER (Platichthys Flesus) male 20-24cm	25-29cm	>29cm	total		FLOUNDER (Platichthys Flesus) female 15-19cm	20-24cm	>25cm	total		overall total	
	n	n	n	n	Perc.(%)	n	n	n	n	Perc.(%)	n	Perc.(%)
number of specimen	93	67	37	197	100.0	29	33	28	90	100.0	287	100.0
affected with:												
lymphocystis	0	0	0	0	0.0	0	0	0	0	0.0	0	0.0
skin ulcer	0	1	0	1	0.5	0	2	0	2	2.2	3	1.0
liver nodule/tumour	-	0	1	1	0.5	-	0	0	0	0.0	1	2.0

Table 14. Detection limits of all analyses used for JAMP monitoring by the laboratories involved.

Compartment	Seawater		Biota		Sediment
Parameter	RIKZ	RIZA	Fish (RIVO)	Mussel (RIKZ)	
	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	-	-	-
Total-N	22		-	-	-
Ortho-P	1	5	-	-	-
Total-P	5	10	-	-	-
Silicon-SiO2	3	10	-	-	-
Chlorophyll	0.02	0.02	-	-	-
	mg/L				
SPM	1	1			
Parameter	ng/kg	pg/L	µg/kg ww		µg/kg ww
HCB	-	-	1	0.3	0.3
PCB28	-	-	1	0.5	0.5
PCB52	-	-	1	0.5	0.5
PCB101	-	-	1	0.3	0.3
PCB118	-	-	1	0.3	0.3
PCB138	-	-	1	0.3	0.3
PCB153	-	-	1	0.5	0.5
PCB180	-	-	1	0.3	0.3
PCB187	-	-	1	0.5	0.5
Phenanthrene	-	-	0.1	5	5
other PAHs	-	-	0.1	3	3
γ-HCH	0.1	0.1	-	0.1	-
Dieldrin	-	-	-	0.1	-
DDT	-	-	-	0.1	-
TBT (Sn)	3	-	-	1.0 (dw)	1.0 (dw)
Atrazine	1	-	-	-	-
Simazine	3	-	-	-	-
Diuron	1	-	-	-	-

Table 15. Locations used for calculating median and peak values for different areas of Dutch marine waters.

Compartment => Organism => Area	Water	Flounders	Mussel
Western Scheldt	Locations	Locations	Locations
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		
Central North Sea			
CENTLNZE	TERSLG135 TERSLG235		
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 16. Locations used for calculating median and peak values in sediment for different areas of Dutch marine waters.

Area Area code	No	Location codes	Longitude N.			Latitude E.		
Wadden Sea West			°	'	"	°	'	"
CENTLNZE	29	ROTTMPT70	6	12	51.00	54	07	5.00
	30	TERSLG100	4	20	31.00	54	08	58.00
	31	TERSLG135	4	02	28.00	54	24	56.00
	33	TERSLG235	3	09	27.00	55	10	20.00
	49	AMLD70	5	33	45.00	54	05	10.00
	50	FRIESFT04	3	37	50.00	53	45	20.00
	51	OESTGDN19	3	00	0.00	54	30	0.00
	52	OESTGDN21	5	00	0.00	55	00	0.00
	53	TERSLG275	3	05	58.78	55	20	14.60
	54	TERSLG70	4	36	33.67	53	55	18.34
North Sea Coast								
KUSTZNE	17	TERSLG4	5	09	2.00	53	24	55.00
	18	NOORDWK10	4	18	9.00	52	18	8.00
	20	NOORDWK2	4	24	22.00	52	15	41.00
	22	ROTTMPT3	6	33	51.00	53	33	58.00
	55	CALLOG1	4	41	15.51	52	37	15.01
	56	CALLOG10	4	28	27.58	52	38	11.04
	57	EGMAZE1	4	36	30.49	52	37	15.01
	58	EGMAZE10	4	28	27.58	52	38	11.04
	59	IJMDBTN1	4	32	25.00	52	28	0.00
	60	TERHDE1	4	10	11.70	52	02	47.36
	61	TERHDE10	4	05	18.75	52	06	35.31
	62	TERSLG20	5	01	18.33	53	32	13.53
Voordelta								
VOORDTA	13	WALCRN2	3	24	39.00	51	32	56.00
	14	SCHOUWN10	3	29	43.00	51	43	12.00
	15	GOERE6	3	52	25.00	51	52	11.00
	63	HARVT1	4	00	54.00	51	51	18.00
	64	HARVT4	4	01	24.00	51	54	57.00
	65	VOORDTA2	3	23	15.00	51	37	4.00
	66	VOORDTA3	3	36	2.00	51	42	23.00
	67	VOORDTA4	3	48	48.00	51	47	26.00
	68	VOORDTA5	3	55	9.00	51	55	20.00
	69	WALCRN4	3	23	35.14	51	33	41.64
Southern North Sea								
ZUIDLKNZE	23	NOORDWK70	3	31	53.00	52	35	10.00
	26	WALCRN70	2	40	45.00	51	57	25.00
	70	NOORDWK30	4	02	53.00	52	23	15.00
	71	GOERE40	3	30	27.00	52	04	52.00
	72	NOORDWK50	3	47	12.00	52	28	51.00
	73	CALLOG70	3	40	54.13	52	59	28.87
	74	BREEVTN26	3	00	0.00	53	30	0.00
	75	CALLOG30	4	16	18.78	52	55	34.89
	76	APPZK20	3	12	18.32	51	29	44.68
	77	WALCRN30	3	06	49.00	51	43	6.00
	78	TEXL70	4	00	0.00	53	30	3.00

Table 17. Dutch environmental quality standards 2000 (ref.17).

Parameter		Surface water (dissolved)		
		Background concentration North Sea	Target value (VR)	Maximal Tolerable Risk concentration (MTR)
As	µg/L	-	1	25
Cd	µg/L	0.03 (n)	0.08	0.4
Cr	µg/L	-	0.3	8.7
Cu	µg/L	0.3 (n)	0.5	1.5
Hg	µg/L	0.003 (n)	0.01	0.2
Ni	µg/L	-	3.3	5.1
Pb	µg/L	0.02 (n)	0.3	11
Zn	µg/L	0.4 (n)	2.9	9.4
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
HCB	ng/L	-	0.09	9
PCB153	-	-	-	-
a-HCH	ng/L	-	33	3300
b-HCH	ng/L	-	9	800
g-HCH	ng/L	-	9	910
Atrazine	ng/L	-	29	2900
Diuron	ng/L	-	4	430
Simazine	ng/L	-	1!	140!
TBT	ng/L	-	0.01	1

Parameter		Sediment (d.w.)	
		Target value (VR)	Maximal Tolerable Risk concentration (MTR)
As	mg/kg	29	55 #
Cd	mg/kg	0.8	12 #
Cr	mg/kg	100	380 #
Cu	mg/kg	36	73
Hg	mg/kg	0.3	10 #
Ni	mg/kg	35	44
Pb	mg/kg	85	530 #
Zn	mg/kg	140	620
Chlorophyll-a	-	-	-
DIN	-	-	-
total-N	-	-	-
o-PO4	-	-	-
total-P	-	-	-
BaP	mg/kg	0.003 *	3 *
HCB	µg/kg	0.05	5
PCB153	µg/kg	4	4
a-HCH	µg/kg	3	290
b-HCH	µg/kg	9	920
g-HCH	µg/kg	0.05	230
Atrazine	µg/kg	0.2!	26
Diuron	µg/kg	0.08!	9
Simazine	µg/kg	0.009!	0.9!
TBT	µg/kg	0.007	0.7

n	90-percentile value
#	single value
!	uncertainty factor at deduction of 10, due to the lack of sufficient data
*	if OS<10%, no standardization
w	winter time value (1December to 1 March)
z	summer time value (1 April to 1 October)
d.w.	dry weight
DIN	Dissolved Inorganic Nitrogen

Table 18. Incidence of fish disease in flounder in the period 1991 - 2003 (in percentages).

Incidence of fish disease in flounder in the period 1991 - 2003 (in percentages)

Year	Wadden Sea			Eastern Scheldt			Coastal Zone		
	Skin ulcer	Lymphocystis	Liver tumour	Skin ulcer	Lymphocystis	Liver tumour	Skin ulcer	Lymphocystis	Liver tumour
1991	12.7	5.2	0	2.3	4.3	0.3	1.9	5.3	1.1
1992	8.4	3.2	0	0.9	2	1	2.9	1.5	0
1993	9	8.1	1.8	0	0.7	1.2	2.3	2.7	1.1
1994	1.8	4.5	1	0.3	1.3	0	1.8	4.5	0.6
1995	4.7	1.6	0.8	0.4	0.4	2.5	3.9	1.5	0
1996	10.8	0.9	0	0	0.3	1.9	1.3	0.3	0
1997	5.5	0.3	0	0	0.6	0	0.3	4	0
1998	7.1	1.6	0	0	0.4	0.6	2	2.6	0
1999	6.1	0	0	0	0.5	0.8	0.7	1.7	0
2000	7.1	0	0	0	1.4	0	1.6	1	0.5
2001	10.3	0.4	0	-	-	-	-	-	-
2002	3.8	6.6	4.1	0.4	0	1.9	0	1.1	0
2003	1.0	0	2.0	-	-	-	-	-	-

Year	Western Scheldt			Ems Dollard estuary		
	Skin ulcer	Lymphocystis	Liver tumour	Skin ulcer	Lymphocystis	Liver tumour
1991	1	2.3	0.5	2	3.2	0
1992	0.7	0.7	2.2	3.5	2.4	0
1993	1.5	1.5	1.2	1.3	3.6	0.8
1994	0.8	0.4	0	0.8	0.5	0
1995	0	0	0	0	0	0
1996	0.7	0	0	0.5	1	0
1997	0.6	0.6	0	1	0	0
1998	0.4	0.8	0	0	1.7	0
1999	0.5	1.9	0	0	0.4	0
2000	-	-	-	-	-	-
2001	-	-	-	-	-	-
2002	-	-	-	-	-	-
2003	-	-	-	-	-	-

Table 19. 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
ABM	Active Biological Monitoring
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
Chr	Chrysene
Cl	Chloride
Cr	Chromium
Cu	Copper
Dab	*Limanda limanda*
DbahAnt	Dibenz(ah)anthracene
DL	Detection limit
DONAR	Data Opslag Natte Rijkswaterstaat (water data bank of the Netherlands)
dw	Dry weight
Flounder	*Platichthys flesus*
Flu	Fluoranthene
HCB	Hexachlorobenzene
HCH (α, β, γ)	Hexachlorocyclohexane (γHCH = Lindane)
Hg	Mercury
ICES	International Council for the Exploration of the Sea
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
NH_4	Ammonium
Ni	Nickel
NO_2	Nitrite
NO_3	Nitrate
NUT	OSPAR working group on Eutrophication
O2	Oxygen
OCPs	Organo Chlorine Pesticides
Ops	Organo Phosphorous Pesticides
o-PO_4	Ortho-phosphate (=dissolved phosphate)
P	Peak value
PAHs	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCB (n)	Polychlorobiphenyls (IUPAC- Number of the congener)
Pyr	Pyrene
QSR2000	Quality Status Report 2000
QA	Quality Assurance
QUASIMEME	Quality Assurance Laboratory Performance Studies for Environmental Measurements in Marine Samples.
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
VR	Verwaarloosbaar risico concentratie (negligible risk concentration)
X(r)	Average of the noise
ww	Wet weight
Zn	Zinc

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