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 2002

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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 2002.

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

Of all measured metal concentrations in water only copper was occasionally exceeding MTR levels and of all measured metal concentrations in sediment only As, Hg, Cd and Zn was occasionally exceeding the VR (target value).

Most organic contaminants showed no major changes since 2001. TBT concentrations in water are in agreement with earlier reported decreasing trends. Nevertheless, TBT concentrations in sediment still exceed MTR.

A long-term assessment of fish diseases in Flounder presented here showed, when excluding the 2002 data, a general improvement of flounder individuals in 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.

Table of Contents

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. Thanks also to the designers of the Trend-*Y*-tector (Internet website: www.trendytector.nl), used to perform trend analyses.

The data in this report has been retrieved from the database containing all Dutch statistical water monitoring information. This information is available on www.waterstat.nl (Dutch version).

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

or

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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 2002, together with details of the monitoring programme itself and of compliance with the OSPAR guidelines and procedures, and a discussion of the monitoring results.

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

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

Technical details of the national JAMP monitoring programme are given in the chapters following 'Overall conclusions' (chap. 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 18) (ref. 17).

Water

- Dissolved metal concentrations are only measured at the river Rhine outlet at Rotterdam (NIEUWWTWG), the North Sea Coast and the Western Scheldt.
- The number of locations where nutrient concentrations are measured is 4 or 5 per area, with 4 measurements being taken in the winter period from December 1st to March 1st. This produces between 16 and 20 measurements per area, 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 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 2002 sediment in the Wadden Sea and the Ems-Dollard estuary were sampled at 32 locations (table 17).

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
  - EROD in Flounder liver.

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 13. Lake Grevelingen and Veerse Meer are not part of the OSPAR convention area and not presented in this document.

2.3 Sampling and analyses

Sampling is carried out by the sampling departments of the regional divisions of the Directorate-General for Public works and Water Management using standard sampling guidelines (RWSVs). Analyses were carried out by RIKZ, RIZA and RIVO laboratories. There were no major changes in the procedures used. Methods for water, sediment and biota are described in the following documents:
List of analytical methods used for sediment samples contaminants with matching codes, 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 2002 (see table 1 and 17 for location numbers).

= water location; = sediment location; = biota location

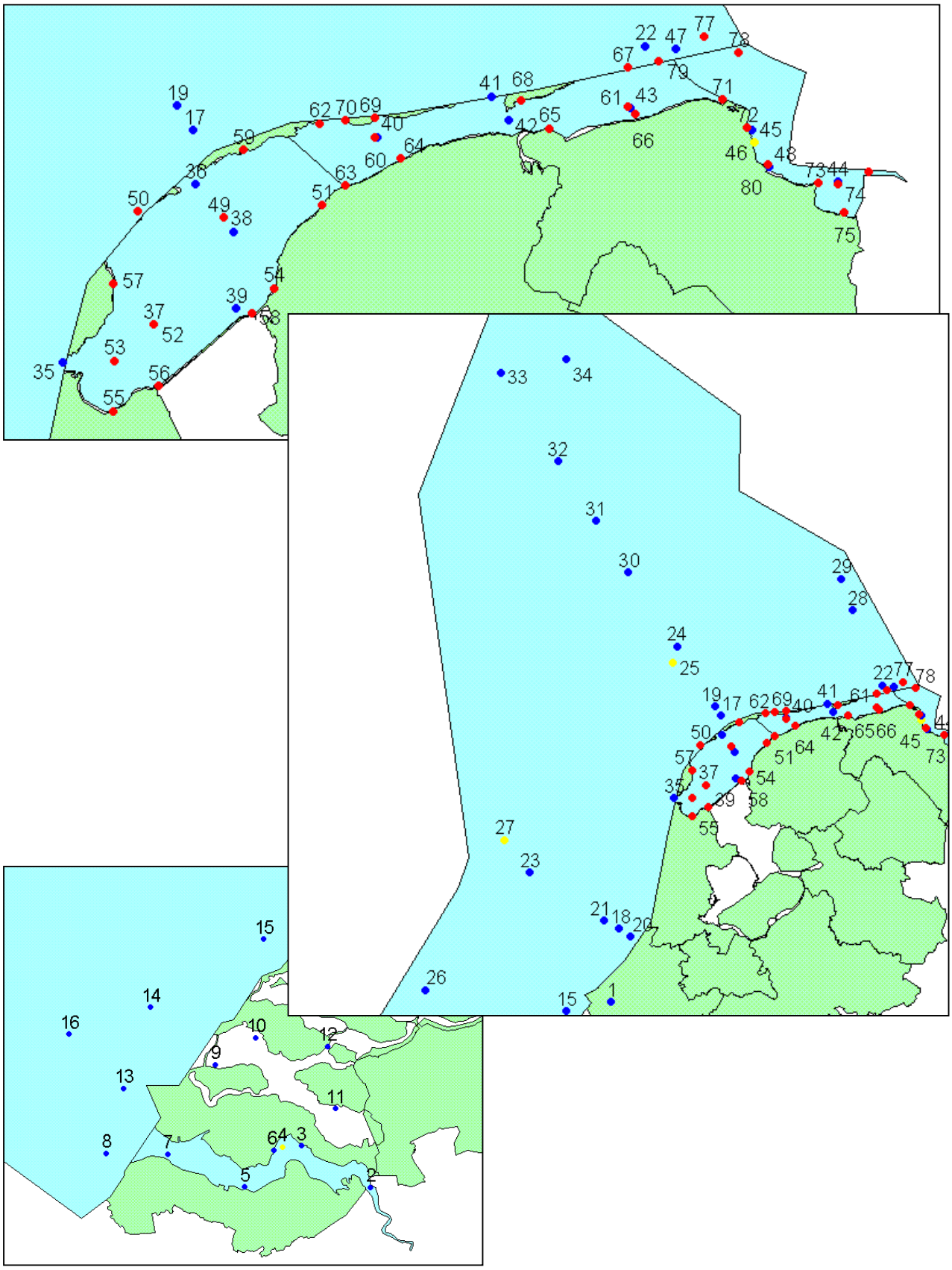


Table 1. Sampling frequencies for the areas covered by the Dutch chemical monitoring programme. The locations are presented in Figure 1.

			water	water	water	sediment	biota	water	sediment	biota	biota
No	ICES CODE	AREA LOCATIONS	Supporting parameters	Nutrients	Metals			Organic contaminants			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	1
5	22.2.1	TERNZBI20	4	4	13	-	-	13	-	-	-
6	22.2.2	HOEDKKKBI4	13	-	-	-	1	-	-	1	-
7	22.3.1	VLISSGBISSVH	19	18	13	-	-	13	-	-	-
8	22.3.4	WIELGN	6	4	-	-	-	4	-	-	-
		Eastern Scheldt									
9	23.0.2	WISSKKE	20	20	-	-	-	4	-	-	1
10	23.0.3	HAMMOT	20	20	-	-	-	-	-	-	-
11	23.0.6	LODSGT	20	20	-	-	-	4	-	-	-
12	23.0.9	ZIJPE	20	20	-	-	-	4	-	-	-
		Voordelta									
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									
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									
23	21.5.10	NOORDWK70	19	19	-	-	-	12	-	-	-
24	21.5.11	TERSLG50	6	4	-	-	-	4	-	-	-
25	21.5.12	TERSLNWT40	-	-	-	-	-	-	-	-	-
26	21.5.8	WALCRN70	12	12	-	-	-	4	-	-	-
27	21.6.6	IJMDWT80	-	-	-	-	-	-	-	-	-
		Central North Sea	1*								
28	21.4.4	ROTTMPT50	7	7	-	-	-	-	-	-	-
29	21.5.4	ROTTMPT70	3	3	-	-	-	-	-	-	-
30	21.6.1	TERSLG100	18	18	-	-	-	-	-	-	1
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	-	-	-	-	-	-	-	-	-
		western Wadden Sea	1*			1*			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*			1*			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*			1*			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 2002 sediment in these areas were sampled on 10-11 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 2002.

group	parameter	description	water	sediment	biota	
					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 5.

4.2 Nutrients in water

4.2.1 The programme

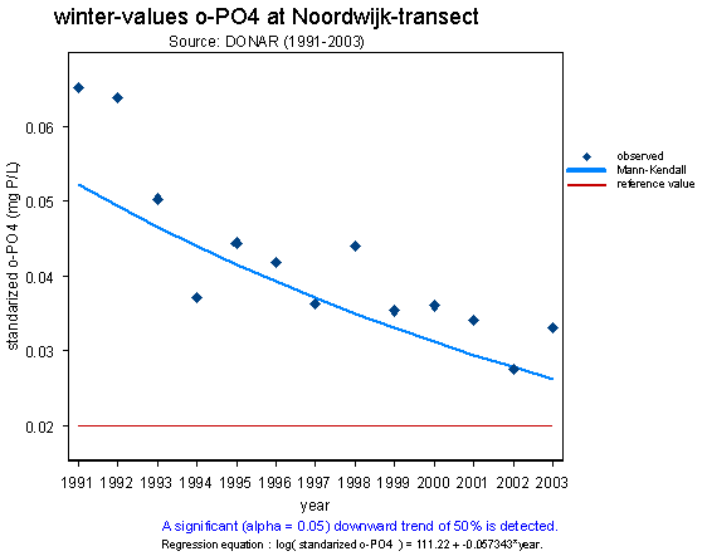
General concentrations of nutrients like Nitrogen, Phosphorus and organic Carbon are measured every time the stations are visited. The median and peak values (shown in table 6) are taken over the whole of 2002. The inorganic nutrient concentrations measured during the winter period (December 1st to March 1st) are used for trend detection.
The nutrient data in the winter period are presented in table 7. The frequency of sampling for phytoplankton is the same for nutrients (see tables 1 and 5: i.e. every month during the winter and every two weeks during the summer).

4.2.2 Trends in winter nutrient concentrations

In Dutch marine waters with salinity gradients, yearly trends in nutrient concentrations are assessed by plotting each year's winter nutrient concentrations versus 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. 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. 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).

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).

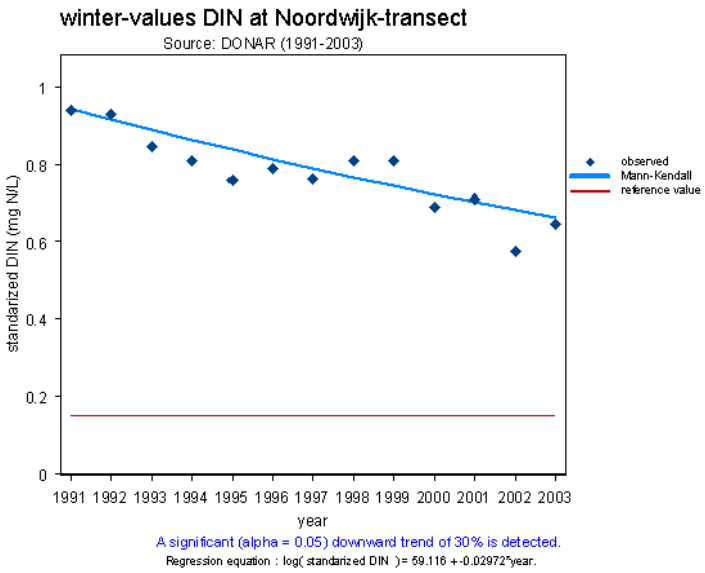


Fig. 3. Winter concentrations of dissolved inorganic Nitrogen on the Noordwijk transect at salinity 30. Winter period is from December 1st year(n-1) to March 1st year(n).

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 2002 only Cadmium, Copper 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 8. At the brakish water location (NIEUWWTWG) only the peak value of Copper (3.2 µg/L) exceeds the Maximum Tolerable Risk (MTR)-value of 1.5 µg/L. For the salt locations only the Copper concentration (2.8 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 which were sampled in the past for JMG and/or JAMP purposes. Sediments taken from the Wadden Sea (East and West) and the Ems Dollard estuary in 2002 were assessed. All peak values of the metal concentrations (table 9) underspend the Maximal

Tolerable Risk-values (table 18). Comparing the results to the Target Value (VR) there are minor exceedings of Cd, Hg and Zn in this 3 areas.

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 a As, Cd, Cr, Cu, Hg, Pb and Zn in Mussels. The results are presented in table 0. Trends in biota were included in the assessment carried out by ADHOC MON (a SIME working group) in February 1998. The results of the actual assessment will be presented in the NER at the next MON.

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

Table 11 presents the concentrations of hexachlorocyclohexane (HCH) and other pesticides 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 a decrease in TBT over the last decade has been detected. Most probably due to the ban on the use of TBT on vessels measuring less than 25 metres.

4.4.2 Organic contaminants in Sediment

Sediments taken from the Wadden Sea (East and West) and the Ems-Dollard in 2002 were assessed.
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 approximately a factor 20.

5% Organic Carbon is equivalent to 10% Organic Matter. The Ecotoxicological Assessment Criterium of OSPAR for TBT is 0,005-0,05 µg Sn/kg.

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

Area	Min.	Med.	Max.	n
Ems Dollard estuary	15	34	46	9
eastern Wadden Sea	<2	28	57	11
western Wadden Sea	9	33	63	11

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 13.

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 2002 Flounder (Platichthys Flesus) was caught at three locations for determination of fish diseases;

- Eastern Scheldt (OOSTSDE)
- Coastal Zone (KUSTZNE)
- western Wadden Sea (WADDZWT)

The overall mean incidence of lymphocystis was 0.4% and of skin ulcer was 10.3%. The results are presented in table 14.

A long term assessment is presented in table 19.

- Skin ulcer occurs the most in the Wadden Sea from year to year between 1.8 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 data this trend is disturbed by an occurrence of lymphocystis in the Wadden sea of 6.6%.
- Except for the Eastern Scheldt at all locations liver tumours hardly occur from the mid nineties up to 2002. 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. This is influenced by all the steps leading to their production: 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 quality assurance systems are being implemented by the various sampling groups. 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)]:

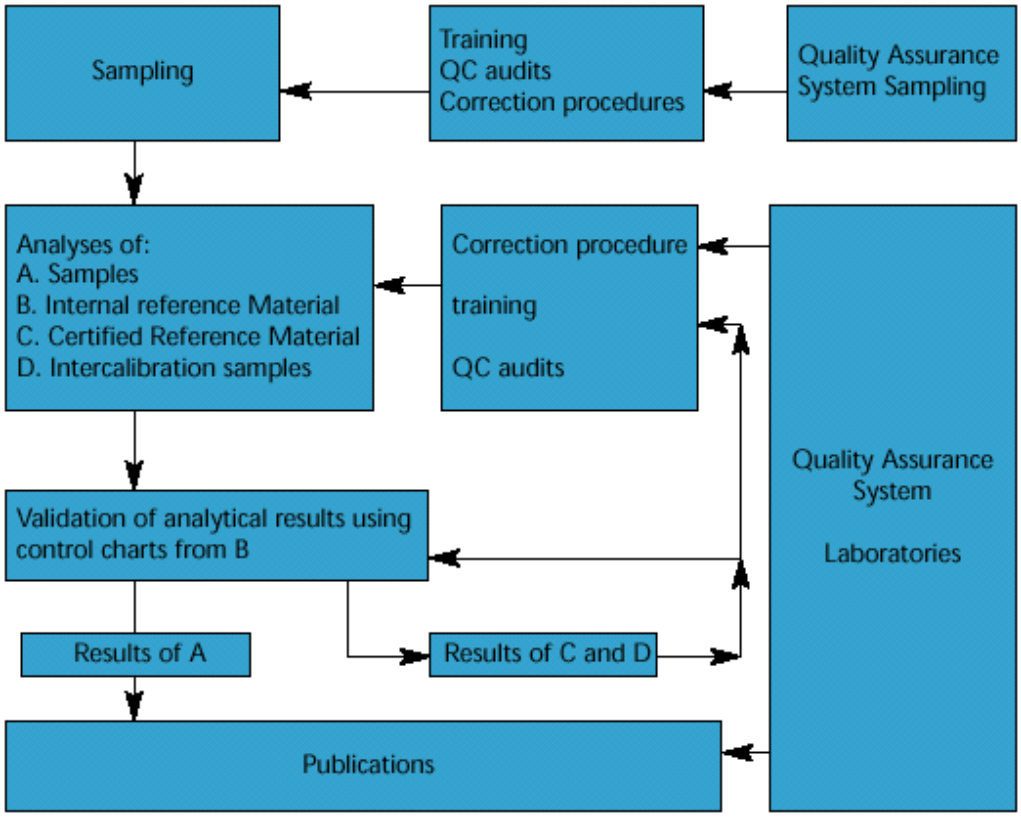
Formula 1: **DL = 3 * S(bl)**

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 15.

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

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

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

5.6 Intercalibration

All Dutch laboratories participating in the Joint Assessment and Monitoring Programme take part in the QUASIMEME programme. QUASIMEME intercalibration exercise rounds in which analysing laboratories participated in 2002 were:

Table 4. QUASIMEME codes for 2002

laboratory	round	excercise	group	parameter	matrix	IC-codes		
RIKZ	27	498	AQ3	trace metals	sea water	HV	HW	HX
RIKZ	27	500	AQ5	OCPs & PCBs	sea water	I1	I2	I3
RIKZ	27	503	AQ8	OPs & triazines	sea water	I8	I9	IA
RIKZ	28	504	AQ1	nutrients	sea water	IB	IC	
RIKZ	28	505	AQ2	nutrients	low salinity water	ID	IE	IF
RIKZ	28	506	MS1	trace metals	sediment	IG	IH	
RIKZ	28	507	MS2	OCPs & PCBs	sediment	II	IJ	
RIKZ	28	508	MS3	PAHs	sediment	IK	IL	
RIKZ	28	509	BT1	trace metals	biota	IM	IN	
RIKZ	28	510	BT2	OCPs & PCBs	biota	IO	OP	
RIKZ	29	513	AQ3	trace metals	sea water	IS	IT	IU
RIKZ	29	515	AQ5	OCPs & PCBs	sea water	IX	IY	IZ
RIKZ	29	518	AQ8	OPs & triazines	sea water	J5	J6	J7
RIVO	27	509	BT1	trace metals	biota	IM	IN	
RIVO	28	510	BT2	OCPs & PCBs	biota	IO	OP	
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	

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., 30 vs. 50% decrease). Consequently, wintertime concentrations of DIN still exceed 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 copper concentrations in water exceeded the Maximum Tolerable Risk concentration (MTR). At brackish water location (NIEUWWTWG) and a salt location (Western Scheldt), copper concentrations peaked at respectively 3.2 and 2.8 µg/L, thus exceeding the MTR of 1.5 µg/L.

The 2002 assessment of the sediments taken from the Wadden Sea (East and West) and the Ems Dollard estuary showed that all peak values of the metal concentrations underspend the Maximal Tolerable Risk-values and that only Cd, Hg and Zn in these 3 areas just exceed the Target Value (VR).

Concerning the organic contaminants in water, HCH and other pesticides showed no major changes as reported earlier in our national evaluation reports. Details on full assessment of organic contaminants will be presented during the next SIME.
The measured TBT concentrations in water are in agreement with earlier reported decreasing trends. Nevertheless, TBT concentrations in sediment still exceed the maximum tolerable risk concentration (set at 0.7 µg Sn/kg) approximately a factor of 20.

A long-term assessment of fish diseases in flounder (Platichthys flesus) showed that skin ulcer occurs the most in the Wadden Sea between 1.8 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 2002. At the Eastern Scheldt liver tumours occur almost every year.

7 Tables

Table 5. Number of measurements (n) and median (M) and peak (P) values of supporting parameters in seawater in 2002.

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	74	23.58	32.80	100	66	191	74	10.70	21.16	73	9.34	11.72	42	7.11	42.40
OOSTSDE	60	30.29	32.51	60	4	64	60	11.16	21.25	60	9.03	11.95	36	4.61	29.00
VOORDTA	45	31.37	33.31	34	14	112	45	11.07	19.99	45	9.06	11.41	12	11.21	52.00
NIEUWWTWG	-	-	-	26	30	106	26	12.80	22.60	24	8.90	13.00	13	8.00	19.00
KUSTZNE	51	30.90	32.86	64	4	68	51	11.59	20.64	52	8.95	11.38	36	7.99	46.40
ZUIDLKNZE	35	34.58	35.19	35	3	9	35	10.56	19.45	36	9.18	11.17	16	2.84	11.80
CENTLNZE	47	34.61	34.88	32	1	3	47	10.62	19.93	47	8.88	10.71	22	0.36	2.54
WADDZWT	50	23.43	29.18	63	32	153	49	10.77	22.08	50	9.53	14.64	13	7.41	23.40
WADDZOT	54	27.95	31.19	63	61	187	54	8.89	23.96	54	9.12	12.29	26	18.30	49.40
EEMSDLD	52	19.20	29.82	65	76	272	52	8.95	24.44	52	9.04	12.72	25	8.89	27.00

Table 6. Number of measurements (n) and median (M) and peak (P) values of Nitrogen, Phosphorus and Organic Carbon in seawater in 2002.

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	68	2.42	5.74	68	0.191	0.307	74	1.6	4.6	68	1.0	1.6
OOSTSDE	60	0.71	1.64	59	0.054	0.110	60	0.4	1.9	60	2.4	3.5
VOORDTA	23	0.71	1.82	23	0.055	0.159	34	0.8	3.3	34	2.2	4.6
NIEUWWTWG	26	3.30	5.00	26	0.180	0.470	-	-	-	25	6.0	10.0
KUSTZNE	50	0.48	1.45	50	0.035	0.130	52	0.4	2.9	52	1.8	4.4
ZUIDLKNZE	27	0.20	0.55	27	0.019	0.042	35	0.2	0.5	35	1.0	1.6
CENTLNZE	31	0.11	0.16	31	0.016	0.033	32	0.1	0.3	32	1.0	1.5
WADDZWT	41	1.12	3.29	41	0.069	0.125	49	1.4	7.4	48	4.0	10.4
WADDZOT	53	0.99	2.83	53	0.138	0.251	53	2.6	6.9	53	5.8	10.0
EEMSDLD	49	2.43	6.55	49	0.199	0.469	49	3.1	11.0	49	10.3	22.0

Table 7. Number of measurements (n) and median (M) and peak (P) values of winter concentrations of nutrients in seawater in 2002. Winter period is from December 1st 2001 to March 1st 2002.

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	17	0.09	0.47	17	0.02	0.07	17	2.0	4.6	17	0.08	0.14	17	2.0	4.3
OOSTSDE	9	0.10	0.15	9	0.04	0.05	9	0.6	1.0	9	0.04	0.05	9	0.7	1.0
VOORDTA	9	0.03	0.07	7	0.01	0.05	9	0.5	0.7	9	0.03	0.04	9	0.5	0.7
NIEUWWTWG	7	0.14	0.26	7	0.04	0.07	-	-	-	7	0.08	0.10	7	3.6	7.1
KUSTZNE	8	0.04	0.08	8	0.02	0.04	8	0.5	0.8	8	0.03	0.04	8	0.5	0.8
ZUIDLKNZE	8	0.00	0.02	7	0.00	0.01	8	0.1	0.2	8	0.02	0.02	8	0.1	0.2
CENTLNZE	3	<0.002	0.01	4	0.01	0.03	4	0.0	0.1	4	0.01	0.02	4	0.1	0.1
WADDZWT	12	0.11	0.18	12	0.01	0.03	12	1.0	2.4	12	0.03	0.04	12	0.8	2.4
WADDZOT	9	0.18	0.31	9	0.02	0.08	9	0.6	0.9	9	0.04	0.08	9	1.2	2.5
EEMSDLD	12	0.13	0.57	12	0.04	0.09	12	2.5	4.4	12	0.06	0.08	12	2.7	5.0

Table 8. Number of measurements (n) and median (M) and peak (P) values of concentrations of dissolved inorganic contaminants in seawater in 2002.

Area	n	Cd in µg /L M	P	n	Cu in µg /L M	P	n	Ni in µg /L M	P	n	Pb in µg /L M	P	n	Zn in µg /L M	P
WESTSDE	39	0.06	0.12	39	1.3	2.8	-	-	-	-	-	-	26	2.2	7.1
NIEUWWTWG	26	<0.05	0.07	26	2.6	3.2	25	0.8	2.6	26	0.1	1.1	26	3.8	8.9
WADDZWT	-	-	-	4	0.8	0.9	-	-	-	-	-	-	-	-	-

Table 9. Number of measurements (n) and median (M) and peak (P) values of concentrations of inorganic metals in sediments in 2002.

Area	n	As mg/kg M	P	n	Cd mg/kg M	P	n	Cr mg/kg M	P	n	Cu mg/kg M	P	n	Hg mg/kg M	P	n	Ni mg/kg M	P	n	Pb mg/kg M	P	n	Zn mg/kg M	P
EEMSDLD	10	17	21	10	0.48	0.58	10	80	95	10	16	19	10	0.25	0.39	10	26	33	10	47	57	10	135	170
WADDZOT	11	16	33	11	0.55	0.69	11	82	97	11	17	23	11	0.26	0.31	11	27	33	11	48	63	11	140	170
WADDZWT	11	17	19	11	0.65	0.81	11	81	92	11	20	25	11	0.29	0.37	11	25	31	11	49	62	11	150	190

Table 10. Number of measurements (n) and median (M) and peak (P) values of concentration of inorganic metals in biota in 2002.

Area	Species	Organ	As mg/kg dw M	P	Cd mg/kg dw M	P	Cr mg/kg dw M	P	Cu mg/kg dw M	P	Hg mg/kg dw M	P	Pb mg/kg dw M	P	Zn mg/kg dw M	P
WESTSDE	Mussel	soft body	5 10.8	12.4	5 7.94	8.59	5 4.8	5.8	5 10.9	12.5	5 0.27	0.30	5 6.9	7.1	5 258	282
EEMSDLD	Mussel	soft body	5 8.1	8.9	5 1.02	1.38	5 5.8	7.3	5 7.9	9.0	5 0.21	0.24	5 4.0	5.8	5 118	142
WESTSDE	Flounder	liver			23 0.13	0.23										
EEMSDLD	Flounder	liver			16 0.60	1.52										
WADDZWT	Flounder	liver			22 0.06	0.21										
WESTSDE	Flounder	muscle									23 0.28	1.04				
EEMSDLD	Flounder	muscle									16 0.26	0.57				
WADDZWT	Flounder	muscle									22 0.07	0.15				

Table 11. Number of measurements (n) and median (M) and peak (P) values of concentrations of hexachlorocyclohexane in seawater in 2002.

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	40	0.0001	0.0001	30	0.0002	0.0002	40	0.0013	0.0052
OOSTSDE	1	<0.0001	<0.0001	1	<0.0002	<0.0002	1	0.0009	0.0009
VOORDTA	1	<0.0001	<0.0001	1	<0.0002	<0.0002	1	0.0012	0.0012
NIEUWWTWG	13	<0.001	<0.001	12	<0.001	<0.002	13	<0.001	0.002
KUSTZNE	4	<0.0001	0.0001	3	<0.0002	<0.0002	4	0.0004	0.0012
ZUIDLKNZE	-	-	-	-	-	-	-	-	-
CENTLNZE	1	<0.0001	<0.0001	1	<0.0002	<0.0002	1	0.0003	0.0003
WADDZWT	3	0.0001	0.0002	2	0.0002	0.0003	3	0.0007	0.0009
WADDZOT	1	<0.0001	<0.0001	1	<0.0002	<0.0002	1	0.0011	0.0011
EEMSDLD	3	0.0001	0.0002	2	<0.0002	<0.0002	3	0.0015	0.0016

Area	Atrazine ug/l			Diuron ug/l			Simazine ug/l		
	n	M	P	n	M	P	n	M	P
WESTSDE	42	0.035	0.2	42	0.11	0.5	42	0.016	0.06
OOSTSDE	8	0.012	0.014	8	0.037	0.054	8	<0.005	0.007
VOORDTA	12	0.01	0.013	12	0.014	0.03	12	<0.005	0.007
NIEUWWTWG	13	0.02	0.15	13	<0.05	0.07	13	<0.01	0.03
KUSTZNE	20	0.008	0.018	20	0.009	0.026	20	<0.005	0.005
ZUIDLKNZE	8	<0.005	<0.005	8	0.002	0.002	8	<0.005	<0.005
CENTLNZE	8	<0.005	<0.005	8	<0.001	<0.001	8	<0.005	<0.005
WADDZWT	24	0.011	0.017	21	0.013	0.017	24	<0.005	<0.015
WADDZOT	12	<0.007	0.008	11	0.011	0.016	12	<0.005	<0.005
EEMSDLD	24	<0.005	0.01	20	0.033	0.06	24	<0.005	0.013

Table 12. Number of measurements (n) and median (M) and peak (P) values of concentrations of organic contaminants and Organic Carbon (OC) in sediments in 2002.

Area	n	PCB 153 µg/kg M	PCB 153 µg/kg P	n	Σ7PCB µg/kg M	Σ7PCB µg/kg P	n	BaP µg/kg M	BaP µg/kg P	n	Σ6PAH µg/kg M	Σ6PAH µg/kg P	n	TBT µg Sn/kg M	TBT µg Sn/kg P	n	HCB µg/kg M	HCB µg/kg P	n	OC % ww M	OC % ww P
EEMSDLD	10	1.5	2.3	10	6.0	9.4	10	58	100	10	474	739	10	16	28	10	0.7	1.5	11	2.5	3.8
WADDZOT	11	1.6	2.0	11	7.6	8.5	11	60	76	11	481	2000	11	14	34	11	0.5	2.0	11	2.3	3.4
WADDZWT	11	2.1	2.8	11	8.3	12.0	11	66	81	11	510	601	11	15	33	11	0.7	0.8	11	2.8	3.5

Table 13. Number of measurements (n) and median (M) and peak (P) values of concentrations of organic contaminants in biota in 2002, expressed as µg/kg wet weight, µg/kg dry weight and µg/kg fat.

Area	Species	Organ	n	Σ7PCB in ug/kg ww M	Σ7PCB in ug/kg ww P	Σ7PCB in ug/kg dw M	Σ7PCB in ug/kg dw P	Σ7PCB in ug/kg fat M	Σ7PCB in ug/kg fat P	Σ6PAH in ug/kg ww M	Σ6PAH in ug/kg ww P	Σ6PAH in ug/kg dw M	Σ6PAH in ug/kg dw P	Σ6PAH in ug/kg fat M	Σ6PAH in ug/kg fat P
WADDZWT	Flounder - male	liver	21	79	325	274	918	1295	2440	-	-	-	-	-	-
WESTSDE	Flounder - male	liver	14	293	1239	1177	5005	5244	12906	-	-	-	-	-	-
EEMSDLD	Flounder - male	liver		89	177	244	408	702	1147	-	-	-	-	-	-
WESTSDE	Mussel	soft body	5	49	64	388	446	4381	4592	44	66	354	459	4390	4721
EEMSDLD	Mussel	soft body	5	10	13	79	87	871	1010	23	27	180	180	1943	2280

Area	Species	Organ	n	PCB153 µg/kg dw M	PCB153 µg/kg dw P	Dieldrin µg/kg dw M	Dieldrin µg/kg dw P	BaP µg/kg dw M	BaP µg/kg dw P	4.4'-DDT µg/kg dw M	4.4'-DDT µg/kg dw P
WESTSDE	Mussel	soft body	5	20	25	0.8	1.1	3.2	4.6	<0.1	<0.1
EEMSDLD	Mussel	soft body	5	4	5.3	0.5	1	2.2	2.2	<0.1	0.2

Table 14. Incidence of fish diseases in biota in 2002 in various size classes.

location **WADDZWT**	FLOUNDER (Platichthys Flesus) male					FLOUNDER (Platichthys Flesus) female					overall total	
	20-24cm	25-29cm	>29cm	total		15-19cm	20-24cm	>25cm	total			
	n	n	n	n	Perc.(%)	n	n	n	n	Perc.(%)	n	Perc.(%)
number of specimen	39	9	3	51	100.0	63	20	17	100	100.0	151	100.0
affected with:												
lymphocystis	7	0	0	7	13.7	3	0	0	3	3.0	10	6.6
skin ulcer	0	1	1	2	3.9	0	0	4	4	4.0	6	4.0
liver nodule/tumour	-	1	1	2	3.9	-	0	0	0	0.0	2	4.1

location **OOSTSDE**	FLOUNDER (Platichthys Flesus) male					FLOUNDER (Platichthys Flesus) female					overall total	
	20-24cm	25-29cm	>29cm	total		15-19cm	20-24cm	>25cm	total			
	n	n	n	n	Perc.(%)	n	n	n	n	Perc.(%)	n	Perc.(%)
number of specimen	52	59	27	138	100.0	49	49	25	123	100.0	261	100.0
affected with:												
lymphocystis	0	0	0	0	0.0	0	0	0	0	0.0	0	0.0
skin ulcer	0	0	1	1	0.7	0	0	0	0	0.0	1	0.4
liver nodule/tumour	-	1	1	2	1.4	-	1	0	1	0.8	3	1.9

location **KUSTZNE**	FLOUNDER (Platichthys Flesus) male					FLOUNDER (Platichthys Flesus) female					overall total	
	20-24cm	25-29cm	>29cm	total		15-19cm	20-24cm	>25cm	total			
	n	n	n	n	Perc.(%)	n	n	n	n	Perc.(%)	n	Perc.(%)
number of specimen	57	56	26	139	100.0	52	49	27	128	100.0	267	100.0
affected with:												
lymphocystis	0	1	1	2	1.4	0	1	0	1	0.8	3	1.1
skin ulcer	0	0	0	0	0.0	0	0	0	0	0.0	0	0.0
liver nodule/tumour	-	0	0	0	0.0	-	0	0	0	0.0	0	0.0

Table 15. Detection limits of all analyses used for JAMP monitoring by the laboratories involved.

Compartment	Seawater		Biota		Sediment
	RIKZ	RIZA	Fish (RIVO)	Mussel (RIKZ)	
Parameter					
	mg/m^3		mg/kg ww		mg/kg ww
Mercury	-	-	0.01	0.01	0.05
Cadmium	0.01	0.02	0.003	0.003	0.01
Copper	0.1	0.01	0.1	0.03	0.2
Zinc	1	0.3	0.6	0.5	2
Lead	0.3	0.1	0.02	0.1	0.2
Nickel	0.3	0.08	0.04	0.03	0.2
Chromium	-	-	0.05	0.1	0.5
Arsenic	-	-	0.5	0.05	1
Nitrite-N	1	2	-	-	-
Nitrate-N	3	20	-	-	-
Ammonium-N	1	50	-	-	-
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			
	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 16. 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 17. 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			°	'	''	°	'	''
WADDZWT	49	GRIENDKDR	52	53	33.36	4	54	30.17
	50	POSTHWD	53	7	20.55	5	24	14.66
	51	VLAKTVOTBRM	52	56	21.21	5	2	48.54
	52	DOOVBWT	53	3	14.39	5	1	57.51
	53	MALZZWL	53	15	9.36	5	14	51.13
	54	BOONTOOVR	53	4	35.51	5	20	4.78
	55	BALGZWWZD	52	59	10.21	4	54	39.87
	56	DENOVSSBTN	53	15	47.59	4	58	45.17
	57	VLAKTVKKSRND	53	22	43.93	5	18	36.88
	58	KORNWDZBTSKM	53	7	49.40	4	54	18.03
	59	TERSLKDVSP	53	16	30.11	5	33	18.90
Wadden Sea East								
WADDZOT	60	DANTZGZD	53	26	14.43	5	43	7.37
	61	ZUIDOLWZOT	53	25	59.04	5	37	36.81
	62	KOFFBNPT	53	21	40.16	5	48	2.70
	63	NIEUWBT	53	24	1.41	5	43	7.10
	64	DANTZGKDBTN	53	26	19.24	6	31	44.96
	65	LAUWOODVT	53	25	39.43	5	32	52.02
	66	GRONGWWFMLZD	53	24	54.11	6	15	44.22
	67	ROTTMPKDZD	53	18	40.38	5	37	34.91
	68	SIEGWL	53	31	33.54	6	30	36.18
	69	BALLMBT	53	28	4.47	6	10	24.59
	70	BORNDZWT	53	27	9.46	6	30	28.57
Ems Dollard estuary								
EEMSDLD	71	UITHZWEHVWT	53	33	1.60	6	51	20.95
	72	BOCHTVWTDVVA	53	24	39.81	6	52	38.56
	73	REIDPND	53	20	26.20	6	56	24.95
	74	HERPNOT	53	34	51.56	6	44	57.65
	75	OOSTFSPZWT	53	19	21.40	7	15	16.96
	76	EEMSPGM	53	18	3.67	7	9	28.97
	77	BORKKDZD	53	14	57.38	7	10	28.23
	78	BLINDRZGZOT	53	18	13.96	7	5	50.07
	79	ROTTMOZOT	53	32	18.86	6	36	23.36
	80	BOCHTVWTOT	53	27	48.34	6	48	18.36

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

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 19. Incidence of fish disease in flounder in the period 1991 - 2002 (in percentages).

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

	Coastal Zone		
Year	Skin ulcer	Lymphocystis	Liver tumour
1991	1.9	5.3	1.1
1992	2.9	1.5	0
1993	2.3	2.7	1.1
1994	1.8	4.5	0.6
1995	3.9	1.5	0
1996	1.3	0.3	0
1997	0.3	4	0
1998	2	2.6	0
1999	0.7	1.7	0
2000	1.6	1	0.5
2001	-	-	-
2002	0	1.1	0

	Western Scheldt			Ems Dollard estuary		
Year	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	-	-	-	-	-	-

Table 20. 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
EROD	Ethoxyresorufin-O-deethylase
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
X(r)	Average of the noise
ww	Wet weight
Zn	Zinc

8 References

1. Klein, A.W.O., van Buuren, J.T. 1992. Eutrophication of the North Sea in the Dutch coastal zone 1976-1990. Tidal Waters Division report, WS 92.003.
2. Laane, R.W.P.M., van der Meer, J., de Vries, A., van der Giesen, A. 1989. Monitoring the progress of attempts to reduce nutrient load and inputs of certain compounds in the North Sea by 50%. Tidal Waters Division report GWAO-89.008.
3. Zevenboom, W., Vransen, R.G., Orth, R.C., van Zeijl, W.J.M., de Vries, I. 1996. Trends in winter nutrient concentrations in the Dutch North Sea waters. Report NZ-96.08, EUT (2) 96/3/2.
4. Van Bennekom, A.J., Wetsteyn, L.F.M.J. 1990. The winter distribution of nutrients in de southern Bight of the North Sea and in the estuaries of the Scheldt and the Rhine/Meuse. Netherlands Journal Sea Research, 25: 75-87.
5. Zevenboom, W., Orth, R.C., Peperzak, L., Rademaker, M., Vransen, R.G., de Vries, I. 1995. Assessment criteria for eutrophication and its effects (DPEUT 95/4/1), Report NZ-95.12.
6. Anonymous, 1994. An update on nutrients, eutrophication symptoms and problem areas in the Dutch part of the North Sea, 1976-1992. EUT 1/2/1; ASMO 95/7/INFO1
7. Vethaak, A.D., ap Rheinallt, T., 1992. Fish disease as a monitor of marine pollution: case of the North Sea. Rev. in Fish Biology and Fisheries 2: 1-32.
8. Vethaak, A.D. et al. 1996. Skin and liver disease induced in Flounder (*Platichthys Flesus*) after long-term exposure to contaminated sediments in large-scale mesocosmos, Envir. Health Persp. 104:1218-1229.
9. Bovelander,R., 2003. List of analytical methods used for seawater contaminants with matching codes, Working document RIKZ-MI/2003.013X.
10. Bovelander,R., 2003. List of analytical methods used for sediment samples contaminants with matching codes, Working document RIKZ-MI/2003.007X.
11. Van Zeijl, W.J.M., 2002. List of analytical methods used for biota samples contaminants with matching codes, Working document RIKZ-IT/2002.116X.
12. Swertz, O.C., Laane, R.W.P.M., Kramer, K.J.M., 1996. Assessment of Water Quality Monitoring in the Dutch Coastal Zone: Needs, Aims and Optimisation, Proceedings of Monitoring Tailor-made II 287-296.
13. RIKZ and RIZA, 2000, Jaarboek Monitoring Rijkswateren 1999.
14. OSPARCOM, 1998, Integrated assessment of inputs to the OSPAR Convention area 1990-1996. Outcome of INPUT Special Assessment Workshop, The Hague 26-27 March 1998. Environmental Assessment and Monitoring Committee (ASMO), 122 pp.
15. Akiat, A., Bovelander, R.W., 2003, National Evaluation Report of the Joint Assessment and Monitoring Programme of the Netherlands 2001, RIKZ report RIKZ-2003.004.
16. Kotterman, M.J.J., 2003, Results of the RWS-RIKZ JAMP 2002 monitoring programme of flounder (Platichthys flesus L.): biological data of flounder and hazardous environmental compound in flounder and mussels., RIVO report C0028/03.

17. C.van Guchte, M.Beek, J.Tuinstra and M.van Rossenberg; Commissie Integraal Waterbeheer; Normen voor waterbeheer; mei 2000.