

BALTIC SEA ENVIRONMENT PROCEEDINGS

No. 27 B

GUIDELINES FOR THE BALTIC MONITORING PROGRAMME FOR THE THIRD STAGE

PART B. PHYSICAL AND CHEMICAL DETERMINANDS IN SEA WATER



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PREFACE

The Guidelines for the Third Stage of the Baltic Monitoring Programme (BMP) are based on the Guidelines for the Second Stage of the BMP, published by the Commission as Baltic Sea Environment Proceedings No. 12 (BSEP No.12). They have been revised by an expert group nominated by the Commission. The group was chaired by Dr. Gunni Aertebjerg and experts from all the Baltic Sea States participated in the work, with assistance from the International Council for Exploration of the Sea (ICES) and experts of the Baltic Marine Biologists (BMB).

The ninth meeting of the Helsinki Commission (15-19 February 1988) accepted the Guidelines in general as HELCOM Recommendation 9/7. The Commission recommends that the Governments of the Contracting Parties to the Helsinki Convention should apply the Guidelines for the Third Stage of the BMP, i.e. from 1989 to 1993, and also, whenever possible, to follow the Guidelines in the monitoring of the internal waters as well. The data is to be submitted to the data bases of the Commission, as specified in the Guidelines.

The Guidelines for the Third Stage of the BMP are published in the BSEP series as four separate volumes (27 A, 27 B, 27 C, 27 D) and also as one combined volume of loose sheets.

The contents of the Guidelines for the Third Stage of the BMP is as follows:

- BSEP 27 A; Part A; Introductory Chapters
- 27 B; Part B; Physical and Chemical Determinands in Sea Water
- 27 C; Part C; Harmful Substances in Biota and Sediments
- 27 D; Part D; Biological Determinands

Volumes B, C and D are intended to be used together with Part A which contains general information on e.g. station networks, sampling requirements and data submission.

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Possible comments concerning the formats prepared by the ICES should be addressed to the ICES, accordingly, as indicated in the formats.

GUIDELINES FOR THE BALTIC MONITORING PROGRAMME FOR THE THIRD STAGE

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of the Baltic Sea Environment Proceedings No. 27 A, B, C, D

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B. PHYSICAL AND CHEMICAL DETERMINANDS IN SEA WATER

B. I Basic Hydrographic and Hydrochemical Determinands

Only those methods which have been successfully inter-calibrated have been accepted for the analyses of obligatory determinands.

The determinands to be monitored are as follows:

- temperature
- salinity
- density structure ¹⁾
- oxygen
- hydrogen sulphide
- pH ²⁾
- alkalinity ³⁾
- nutrients: phosphate, total phosphorus, ammonia, nitrate, nitrite, total nitrogen ¹⁾, silicate ⁴⁾

Remarks:

- 1) Tentative determinand
- 2) pH is obligatory only in combination with ¹⁴C-primary production measurements and then in samples from the same depths as the production samples
- 3) Alkalinity is a tentative determinand and should be measured as in 2)
- 4) Silicate is a possible limiting factor for diatoms and should be determined at standard hydrochemical depths in the Kattegat, the Sound and the Belt Sea. For other sea areas, silicate is regarded as a tentative determinand.

1. Temperature

Temperature is to be determined by reversing thermometer. Two reversing thermometers should be attached to each water bottle, and should be calibrated using standard facilities at least once every two years. Mercury thermometer readings should be corrected using the Sverdrup formulae, as given in La Fond (13), or any standard oceanographic text. If digital reversing thermometers are used, they may be reversed as soon as the desired depth is reached; otherwise, the thermometers must be allowed to rest at that depth for at least five minutes and not read until they have reached air temperature (normally about ten minutes). The use of the conductivity-temperature-depth (CTD) sonde is allowed (cf. Paragraph 2. below).

2. Salinity

Samples for the determination of salinity must be collected with care, in order to ensure that no salt crystals are trapped in the cap. Approved sample bottles which ensure negligible evaporation must only be used. Samples should be analyzed using a salinometer that has been carefully standardized using IAPSO Standard Seawater, which can be purchased from the Deacon Laboratory, Wormley, England. It is available at a salinity of about 35 (K-series) or about 30 (L-series). Some countries have established central facilities for preparing ampoules of secondary standard seawaters. It is important that these secondary standards be calibrated against the IAPSO Standard Seawater and not against a KCl standard on which IAPSO Standard Seawater is calibrated. It is also important to follow closely the manufacturer's recommendations on salinometer use.

In order to compute salinity values from salinometer conductivity ratio values, only the International Oceanographic Tables Vol. 3 (UNESCO (9)) or related algorithms (UNESCO (14)) should be used. The values produced by using either of these publications are derived from the Practical Salinity Scale 1978, and are, therefore, in practical salinity units. The algorithms should also be used to compute density values from the Equation of State for Seawater 1980. Density and other derived physical quantities may also be obtained using the Tables published in UNESCO (11). In cases of non-simultaneous determination of salinity and sampling for nutrients, this should be indicated in the Reporting Forms (Section B.I.11).

3. Density structure

Density is to be calculated from temperature and salinity (11).

4. Oxygen

Various modifications of the Winkler method have been intercalibrated.

If oxygen sensors are used (e.g., attached to the CTD), regular checks of the reproducibility of the sensor have to be made by titration of water samples by the Winkler method. At least the surface reading has to be calibrated. Oxygen sensors cannot be properly calibrated against moist air (100% saturation). Oxygen sensors may be poisoned by hydrogen sulphide. If a sensor has been lowered into hydrogen sulphide containing water, it must be checked immediately. In reporting data on oxygen, the method used (Winkler or oxygen sensor) should be stated (Section B.I.11).

5. Hydrogen sulphide

For small amounts, use the colorimetric method according to (1).

For large amounts, use dilution or volumetric titration according to Fonselius (1).

The concept "Negative Oxygen" is a convenient way to express the amount of oxygen utilized for producing hydrogen sulphide by reduction of sulphate ions

$$2(\text{CH}_2\text{O}) + \text{SO}_4^{2-} \longrightarrow 2\text{CO}_2 + 2\text{H}_2\text{O} + \text{S}^{2-}$$

Assuming simple stoichiometry ($\text{S}^{--} + 2\text{O}_2 \longrightarrow \text{SO}_4^{--}$) sulphide may be converted into "negative oxygen" in order to get comparable equivalents by multiplying the hydrogen sulphide result by two (one molecule of H_2S is equivalent with two molecules of oxygen). To convert from $\mu\text{mol}/\text{dm}^3$ of sulphide to cm^3/dm^3 of oxygen, multiply the μmol -result by the factor -0.044. This simplification, however, may meet natural conditions incompletely, because other oxidizable sulphur compounds may possibly be produced in significant amounts by microbial sulphate reduction under anoxic conditions.

6. pH

pH should be measured by the electrometric method with glass electrodes. Measurement should be made according to (2) and (3) using thermostated samples. pH sensors (e.g., attached to a CTD) are also allowed.

Remarks:

- No depth correction should be applied because the pressure coefficient is not precisely known.
- The temperature correction should be made using the temperature coefficient by Gieskes in (3).

7. Alkalinity

Alkalinity should be determined by titration according to Gripenberg on the standard acid addition method (7).

8. Nutrients

- Dissolved inorganic phosphate, total phosphorus, nitrate, nitrite and ammonia

The methods intercalibrated at the Baltic Inter-calibration Workshop (BIW), 1977, Kiel (6), are accepted for the third stage of the BMP (Annex to the report of the BIW). Reference is also given to (5) and (10).

It is recommended that interlaboratory comparisons of nutrient standard solutions be made on a regular basis. Stock standards containing concentrations $> 1 \text{ mmol}/\text{dm}^3$ may be stored for years if kept in DURAN glass ampoules.

Nutrient standard solutions are also recommended to be compared on a regular basis to either "Sagami Industrial Standards" or to primary standards which have been confirmed using Sagami standards or by intercalibration.

- Total nitrogen *)

The peroxo-disulphate oxidation with consecutive determination of the nitrate (4) (Appendix to BIW Report, (6)) should be used. Reference is also given to (10).

- *) Total nitrogen means nitrogen compounds measured after peroxo-disulphate oxidation.

c) Total phosphorus and total nitrogen

As an alternative to the methods listed above for total phosphorus and total nitrogen, use digestion according to (12) and (5).

d) Silicate

Preference should be given to the ascorbic acid method by Koroleff (5) and Appendix to (5). Other methods intercalibrated at the BIW (6) can also be used. Reference is also given to (10).

e) Corrections for turbidity, salinity or hydrogen sulphide

When nutrients are analyzed using various kinds of autoanalyzers, the effect of sample turbidity is often omitted. The cuvettes of autoanalyzers are often too short for registering the small error caused by turbidity. In precise work with cuvettes longer than 2-3 cm, the turbidity of the sample should be measured when analyzing phosphate and nitrite and also nitrate if a cadmium coil is used as reductor instead of cadmium grains.

When large variations in salinity occur, e.g., in brackish water, silicate and ammonia results have to be corrected for salt errors. Koroleff (in Grasshoff, 1976) gives correction factors for silicate and ammonia. In Baltic water the error is very small, but with increasing salinity in the entrance area it becomes important. Some autoanalyzers have cuvettes of low quality, which show considerable errors in the refraction index with varying salinity. The cuvettes have to be checked for this error. The easiest way to compensate for the refraction index error is to measure the sample water reference in the same cuvette as the sample.

If hydrogen sulphide is present in the water, it has to be removed before the analyses. Methods for removing hydrogen sulphide are given in "Methods of Sea Water Analysis", second edition (Editor, Grasshoff et al., reference (3)).

9. Sampling and preservation of samples

a) Depths for hydrographic and hydrochemical determinands

The depths at which sampling should take place are as follows (in meters): 1, 5, 10, 15, 20, (25)*, 30, 40, 50, 60, 70, 80, 100, 125, 150, 175, 200, 225, 250, 300, and 400 meters, and as close to the bottom as possible, since the oxygen tension near the bottom is of utmost importance to the benthos. (Note that, especially in the case of CTD measurements, the physical measurement of depth is pressure (expressed in decibars (dbars)). In the Baltic, 1 dbar \approx 1 m). In order to calculate the exact distance between the lowest water-bottle and the bottom, the depth to bottom figures should be read when the messengers are released.

Primary sampling depths for pH and alkalinity are those selected for ^{14}C -primary production sampling (cf. Section D.1.b)).

b) Sampling techniques

Data on the determinands listed may be collected using a cast of reversing waters bottles (e.g., Nansen, Knudsen) equipped with reversing thermometers or a CTD recorded with an attached rosette sampler. In the case of rosette sampling, samples should be obtained only on the ascending profile.

*) 25 m obligatory in the Kattegat and the Belt Sea

c) Preservation of samples

Several determinands should be analyzed immediately on board. These determinands are: pH, oxygen, hydrogen sulphide, phosphate, ammonia, nitrite, nitrate and silicate.

Determinands which may be analyzed on shore:

Total phosphorus and total nitrogen samples may be preserved by deep freezing according to Koroleff (5) or by wet digestion according to Valderrama (12) and analyzed on shore. Salinity and alkalinity determinations can also be carried out on shore, provided that the analyses are carried out within a few weeks after sampling. For nutrient samples which cannot be analyzed immediately, sample preservation methods described in Koroleff (5) should be consulted.

d) Use of CTDs

It is important that only CTDs capable of holding a stable calibration, and producing salinity values accurate to the second decimal place should be used. CTDs should at the very least be carefully calibrated using water bottles at the beginning and end of a cruise. However, even the most sophisticated of CTDs can drift in calibration from station to station, and particularly marked changes can occur should the instrument receive a mechanical shock. Thus, calibration samples should be obtained preferably at at least one depth per station.

Well-defined procedures for using CTDs and collecting calibration samples, and processing data that results from such observations, have been proposed by SCOR WG 51 (UNESCO (15)). These proposals, which include the

recommendations on how to compact CTD data, should be followed closely.

10. References in Chapter B I

(Basic Hydrographic and Hydrochemical Determinands)

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2. Carlberg, S.R. (Ed.) 1972. New Baltic Manual, ICES Coop. Res. Rep. No. 29: 1-145.
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11. UNESCO, 1987. UNESCO Technical Papers in Marine Science No. 40, International Oceanographic Tables, Vol. 4.

12. Valderrama, J.R., 1981. The simultaneous analysis of total nitrogen and total phosphorus in natural waters. Marine Chemistry Vol. 10, No. 2: 109-122.
13. La Fond, E.C., 1951. Processing Oceanographic Data. U.S. Navy Hydrographic Office, Washington, D.C. H.O. Publ. No. 614.
14. UNESCO, 1983. UNESCO Technical Papers in Marine Science No. 40, International Oceanographic Tables, Vol. 4.
15. UNESCO, 1988. UNESCO Technical Papers in Marine Science No. 54. The acquisition, calibration, and analysis of CTD data. A report of SCOR Working Group 51. 94 pp.

11. Reporting format for hydrographic and hydrochemical data

Introduction

The recommended format is in general agreement with the ICES Oceanographic Punch Card System. Some extra information can be included by utilizing unused capacity within the original system. The system allows to report the following information and parameters:

- 1) country
- 2) ship
- 3) assigned station number
- 4) latitude, longitude and quadrant
- 5) date and time of the observation (sample collection)
- 6) depth to bottom
- 7) station name
- 8) visibility (Secchi depth)
- 9) maximum observation depth
- 10) mixed layer depth
- 11) wind direction and speed
- 12) air temperature
- 13) weather, cloud amount, state of sea and occurrence of ice
- 14) sampling depth
- 15) temperature
- 16) salinity
- 17) dissolved oxygen content
- 18) dissolved inorganic phosphate
- 19) total phosphorus
- 20) silicate
- 21) nitrate-nitrogen
- 22) nitrite-nitrogen
- 23) ammonia-nitrogen
- 24) total nitrogen
- 25) hydrogen sulphide-sulphur

- 26) pH
- 27) alkalinity
- 28) chlorophyll a
and, furthermore, information on whether biological sampling was carried out or not.

For each hydrographic station a Hydro Master Card, Code 01, is filled in and for each depth where physical and chemical observations are carried out, a Hydro Chemistry Card 2, Code 56 is filled in.

In every case where an element is missing the whole field of the element should be left blank.

Leading zeroes should be filled in for every observation.

For example:

depth of 0 metres is filled in as 0000
temperature of 7.65°C is filled in as 0765
total nitrogen of 22 µmol/dm³ is filled in as 22 blank.

A characteristic feature of the ICES Punch Card System is the many overpunches in zone 11 and 12 that may occur. If data are reported on data sheets (see attached examples) the overpunches 11 and 12 should be indicated by the letters X and R respectively in the columns to which they pertain.

Hydro Master Card, Code 01

Columns:

- 1-2. Country: According to the IOC code, the code numbers for the countries participating in the BMP are as follows:

Denmark	26
Finland	34
German Democratic Republic	96
Federal Republic of Germany	06
Polish People's Republic	67
Sweden	77
USSR	90

- 3-4. Ship: Insert code of the research vessel used when obtaining the sample (see Section A.7.)

- 5-8. Station no: According to the procedure issued by ICES it is recommended to start with station number 1 for each vessel on 1 January of each year and have consecutive numbering for each vessel throughout the year so that one station number for the respective vessel occurs only once per year. This implies that each ship keeps a continuous station log. (It is not necessary that reported data have consecutive station numbers). The system allows for 9999 stations per ship and year.

- 9-12. Latitude: given to the nearest minute. The decimals .1 - .4 should be rounded downwards and .5 - .9 should be rounded upwards.

- 13-17. Longitude: given to the nearest minute. The decimals .1 - .4 should be rounded downwards and .5 - .9 upwards.

- 18. Quadrant: always 0 (zero) for the Baltic

- 19-21. Year: the three last figures of the year

- 22-23. Month

- 24-25. Day

- 26-27. Station time: Starting time (to the nearest hour) of the hydrographic station in GMT

- 28-31. Depth to bottom: in metres, determined while on station

- 32-41. Station name. Left justified. All BMP stations having names of more than ten letters (including blank spaces) have to be written in abbreviated

form:	Fehmarn Belt	FehmarBelt
	Mecklenburger Bucht	MecklBucht
	Halsskov Rev	Halsskov R
	W Landskrona	W Landskro
	Ålborg Bugt	ÅlborgBugt
	Anholt East	AnholtEast
	Bornholm Deep	Bornholm D
	Gotland Deep	Gotland D
	Landsort Deep	Landsort D

42-44. Visibility measured with Secchi disc, in metres, to the first decimal place.

45. Blank

46-47. Maximum observation depth: in hundreds of metres.

The depth is to be filled in as follows:

0 - 50 m	00
51 - 150 m	01
151 - 250 m	02
etc.	

48-50. Mixed layer depth: The thickness, in metres, of the mixed layer determined by means of a BT trace or other equivalent source. The layer is considered mixed (= isothermal, in this case), if the approximate vertical temperature gradient is less than 0.1°C in any 15 metres and less than 0.6°C in any 200 metres with the uppermost 2 metres excluded. If the BT observation shows that the mixed layer extends to the bottom of the trace the depth of the trace should be filled in together with an overpunch 11 in col. 50.

51-52. Wind direction: according to WMO Code 0877, true direction, in tens of degrees, from which the wind is blowing:

00	Calm	19	$185^{\circ} - 194^{\circ}$
01	$5^{\circ} - 14^{\circ}$	20	$195 - 204$
02	$15 - 24$	21	$205 - 214$
03	$25 - 34$	22	$215 - 224$
04	$35 - 44$	23	$225 - 234$
05	$45 - 54$	24	$235 - 244$
06	$55 - 64$	25	$245 - 254$
07	$65 - 74$	26	$255 - 264$
08	$75 - 84$	27	$265 - 274$
09	$85 - 94$	28	$275 - 284$
10	$95 - 104$	29	$285 - 294$
11	$105 - 114$	30	$295 - 304$
12	$115 - 124$	31	$305 - 314$
13	$125 - 134$	32	$315 - 324$
14	$135 - 144$	33	$325 - 334$
15	$145 - 154$	34	$335 - 344$
16	$155 - 164$	35	$345 - 354$
17	$165 - 174$	36	$355 - 4$
18	$175 - 184$	99	Variable

53-54. Wind speed: given in knots

55-57. Temperature, dry bulb, and

58-60. Temperature, wet bulb: Readings, in degrees Celcius to the 1st decimal place, of the dry and wet bulb thermometer, respectively. Negative temperatures will be indicated by means of an overpunch of 11 in the col. 55 and 58, respectively. The case of ice on the wet bulb will not be indicated.

61. Weather: According to the following code:
- 0 - Clear (no clouds at any level)
 - 1 - Partly cloudy (scattered or broken)
 - 2 - Continuous layer(s) of cloud(s)
 - 3 - Sandstorm, duststorm or storm of drifting snow
 - 4 - Fog, thick dust or haze
 - 5 - Drizzle
 - 6 - Rain
 - 7 - Snow, or rain and snow mixed
 - 8 - Shower(s)
 - 9 - Not observed
- Note: Code figure 2 is used when the total amount of clouds is 7/8 or more.
62. Cloud amount: The fraction of the celestial dome covered by cloud, to be given in eights:
- 0 - No clouds
 - 1 - 1/8 or less, but not zero
 - 2 - 2/8
 - 3 - 3/8
 - 4 - 4/8
 - 5 - 5/8
 - 6 - 6/8
 - 7 - 7/8 or more, but not 8/8
 - 8 - 8/8
 - 9 - Not observed
63. State of sea: the average wave height as obtained from the larger well-formed waves of the wave system being observed.
- | | | |
|-----------------------|------------|--------|
| 0 - Calm (glassy) | 0 | metres |
| 1 - Calm (rippled) | 0 - 0.1 | |
| 2 - Smooth (waveless) | 0.1 - 0.5 | |
| 3 - Slight | 0.5 - 1.25 | |
| 4 - Moderate | 1.25 - 2.5 | |
| 5 - Rough | 2.5 - 4 | |
| 6 - Very rough | 4 - 6 | |
| 7 - High | 6 - 9 | |
| 8 - Very high | 9 - 14 | |
| 9 - Not observed | | |

64. Ice codes:

Amount and arrangements of sea ice

- 0 Ice free
- 1 Open water - concentration less than 1/10
- 2 Very open pack ice - concentration 1/10 to less than 4/10
- 3 Open pack ice - concentration 4/10 to 6/10
- 4 Close pack ice - concentration 7/10 to 8/10
- 5 Very close pack ice - concentration 9/10 to 10/10 with small openings
- 6 Compact pack ice, including consolidated pack ice - concentration 10/10
- 7 Fast ice with pack ice outside
- 8 Fast ice
- 9 Lead in very close or compact pack ice or along the fast ice edge
- Blank Unable to report

Stage of ice development

- 0 New ice or dark nilas (less than 5 cm thick)
- 1 Light nilas (5-10 cm thick) or ice rind
- 2 Grey ice (10-15 cm thick)
- 3 Grey-white ice (15-30 cm thick)
- 4 White ice, first stage (30-50 cm thick)
- 5 White ice, second stage (50-70 cm thick)
- 6 Medium first year ice (70-120 cm thick)
- 7 Ice predominantly thinner than 15 cm with some thicker ice
- 8 Ice predominantly 15-30 cm with some ice thicker than 30 cm
- 9 Ice predominantly thicker than 30 cm with some thinner ice
- Blank No information or unable to report

65-78. Blank (see Note)

79-80. Code no: Each Hydro Master Card receives the Code no. 01; in addition col. 80 is overpunched 11.

Note:

col.65 be used for the letters Y or N respectively, depending of whether a Biomaster Record exists for this station or not. If, in the future, a "Heavy Metal Master Record" and/or a "Sediment Master Record" are established, the col. 66 and 67 could be used in the same way. It would mean that the "Hydro Master Card" could be regarded as an overall "Station Master Record".

Hydro Chemistry Card 2, Code 56

1-25. As for the Hydro Master Card.

26-27. Observation time: The nearest hour of the time (in GMT) for the observation. The change of day (and month) during the work at a station is indicated by adding 24 to the time in hours.

28-31. Observation depth: in metres. That a depth is questionable is indicated by an overpunch 11 in col. 29.

32-35. Temperature: in degrees Celsius to the 2nd decimal place. A negative temperature is indicated by an overpunch 11 in col. 32. (How to handle questionable values, see Remark).

36-39. Salinity: in parts per thousand to the 2nd decimal place (salinometer readings should be rounded to the 2nd decimal place).

40-42. Oxygen content: given in $\mu\text{mol}/\text{dm}^3$ (micromole per dm^3) of water at 20°C to the 2nd decimal place. If the value exceeds $9.99 \mu\text{mol}/\text{dm}^3$ the excess of 10.00 is entered and an overpunch 11 is applied in col. 40. If oxygen is found in the presence of H_2S the oxygen value should be reported as questionable.

43-45. Phosphate content: dissolved inorganic, per dm^3 of water at 20°C given as micromoles phosphate-phosphorus to the 2nd decimal place. Values below $0.02 \mu\text{mol}/\text{dm}^3$ should be reported as "traces or non detectable amounts" (henceforth referred to as "traces", see also Remarks).

46-48. Total phosphorus content: given in micromoles per dm^3 of water at 20°C to the 2nd decimal place. If the Tot-P value does not exceed the value of $\text{PO}_4\text{-P}$ in col. 43-45 then the Tot-P value should be reported as questionable. Values below $0.02 \mu\text{mol}/\text{dm}^3$ should be reported as "traces".

49-51. Silicate content: given as micromoles of silicate-silicon per dm^3 of water at 20°C to the 1st decimal place. Values below $0.1 \mu\text{mol}/\text{dm}^3$ should be reported as "traces".

52-54. Nitrate content: given as micromoles nitrate-nitrogen per dm^3 of water at 20°C to the 1st decimal place. Values below $0.1 \mu\text{mol}/\text{dm}^3$ should be reported as "traces".

55-57. Nitrite content: given as micromoles nitrite-nitrogen per dm^3 of water at 20°C to the 2nd decimal place. Values below $0.02 \mu\text{mol}/\text{dm}^3$ should be reported as "traces".

- 58-60. Ammonium content: given as micromoles of ammonium-nitrogen per dm^3 of water at 20°C to the 1st decimal place. Values below $0.1 \mu\text{mol}/\text{dm}^3$ should be reported as "traces".
- 61-63. Total nitrogen content: given in micromoles per dm^3 of water at 20°C to the 1st decimal place. If the sum of nitrate, nitrite and ammonium exceeds the value of Tot-N then the Tot-N value should be reported as questionable. Values below $0.1 \mu\text{mol}/\text{dm}^3$ should be reported as "traces".
- 64-66. Hydrogen sulphide content: given as micromoles sulphide sulphur per dm^3 of water at 20°C to the 1st decimal place. Values below $0.1 \mu\text{mol}/\text{dm}^3$, and with the characteristic smell of H_2S present in the water sample, should be reported as "traces".
- 67-69. Hydrogen ion concentration (pH): in situ, i.e. the measured value corrected for the temperature difference between measuring temperature and in situ temperature but without pressure effect correction, to the 2nd decimal place. If an interpolated in situ temperature has been used to calculate the in situ pH, then the pH value should be reported as questionable.
- 70-73. Alkalinity: given in mmol/dm^3 (millimole per dm^3) of water at 20°C to the 3rd decimal place.
- 74-76. Chlorophyll a: given in micrograms per dm^3 of water at 20°C to the 2nd decimal place.

Note: Chlorophyll a is also included in the format for reporting biological data.

77-78. Blank

79-80. Code no: Each Hydro Chemistry Card 2 receives the Code no 56 if it is based upon original data, and the Code no 66 if it is based upon vertical interpolation (e.g. for standard depths).

Remark to columns 32-76. That a value is questionable is indicated by an overpunch 11 in the 2nd of the columns allotted to the parameter.

Remarks to columns 43-66, 74-76. If only traces or non-detectable amounts of an element have been found this is indicated by reporting 0 (zeroes) in the columns allotted to the element with an overpunch 11 in the last of the columns.

If the only indication of a parameter is that it does not exceed a certain value this figure is entered together with an overpunch 12 in the last of the columns allotted to the parameter.

If the only indication of a parameter is that it exceeds a certain value this figure is entered together with an overpunch 11 in the first of the columns allotted to the parameter. In the same way are handled values greater than 9.99 or 99.9, i.e., 999 is entered together with an overpunch 11 in the first of the columns allotted to the parameter.

Summary of the ICES Hydrographer's report "Some
Consequences of the SUN Report for the ICES Punch
Card System" presented at the ICES WG on Marine
Data Management Meeting, 11-14 May, 1982

The XVIIIth General Assembly of IAPSO (Canberra, Australia, 2-13 December 1979) adopted the Report of the Working Group on Symbols, Units and Nomenclature in Physical Oceanography (the SUN Report). The Report deals with the use in the Physical Sciences of the Ocean of The Systeme International d'Unités (SI) and related standards for symbols, units and terminology. The following parameters in the ICES system are affected by the adoption of the SUN Report:

Wind speed: In the ICES data system wind speed is given in knots. The use of this unit is strongly discouraged by the SUN Report, according to which it should be replaced by metre per second. (1 knot = 0.514 m/s approx.)

Nautical mile: is temporarily tolerated in the Report. Its value in SI units is 1852 metres exactly.

Salinity: From 1st January 1982 the Practical Salinity Scale (1978), as established by the Joint Panel on Oceanographic Tables and Standards (JPOTS), should be used (see paragraph 3.2.2 Salinity). The SUN Report discouraged the use of the o/oo symbol which should be replaced by 10^{-3} . It would then read, e.g. $S = 35.25 \times 10^{-3}$ or $S = 0.03525$ or $S \times 10^3 = 35.25$. JPOTS found this decision inconvenient, and suggested that the practical salinity should be expressed by numbers 1000 times larger than those used in previous definitions.

This solution was adopted by the sponsor organizations of JPOTS. So it will now simply read $S = 35.25$.

Amount of substance: In the ICES Chemistry Card 2 the unit used for the concentration of nutrients in a water sample is microgram atom per dm^3 . The SUN Report declares all units such as gram-atom, gram-molecule, gram-equivalent and gram-ion to be obsolete. So in future the unit used in ICES card system should be called micromole per dm^3 ($\mu\text{mol}/\text{dm}^3$). In the same way the alkalinity unit milli-equivalent (millival) per dm^3 will have to be replaced by millimole (mmol) hydrogen ions per dm^3 .

[illegible][illegible]

Remarks:

International Council for the Exploration of the Sea

B. PHYSICAL AND CHEMICAL DETERMINANDS IN SEA WATER

B. II Heavy Metals, Petroleum Hydrocarbons and Chlorinated Hydrocarbons in Sea Water

The determinands to be monitored in sea water are as follows:

- heavy metals ¹⁾ (Hg, Cd, Zn, Cu and Pb)
- total tin and organic tin ¹⁾
- petroleum hydrocarbons (PHCs) ¹⁾
- chlorinated hydrocarbons (e.g. DDTs, PCBs, lindane) ¹⁾

Remarks: 1) Tentative determinand

1. Heavy metals

These substances are included in the Monitoring Programme for the Third Stage as tentative determinands because of the methodological problems concerned (5, 7).

a) Noxious metals

Noxious heavy metals of high priority are mercury (Hg), cadmium (Cd), zinc (Zn), lead (Pb) and copper (Cu). The determination of Hg, Cd, Zn, Pb and Cu in water cannot be obligatory unless the laboratories are equipped with suitable (metal-free) sampling gear, clean benches and dust-free premises. Experience has shown that contamination of the sea water samples during the sampling procedure, storage and working up, is the most serious interference.

b) Methods

The most successful methods for the measurement of individual trace metals in sea water, as determined by the ICES Sixth Round Intercalibration on Trace Metals in Sea Water (5), are listed below:

Copper, zinc, cadmium, lead: chelation/solvent extraction/atomic absorption spectrometry (either graphite furnace or flame);

Mercury: collection on gold followed by cold vapor atomic absorption spectrometry.

Analysis of all the metals except mercury can be achieved using anodic stripping voltammetry, provided the methods are carefully checked and all organic matter is destroyed before the determination stage.

It is recommended that measurements of total organic tin be made in water from harbour areas and in coastal areas with ship and pleasure boat traffic. This proposal is made because it has been shown that the organo-tin compounds used in antifouling paints have serious effects on the larvae and other life stages of molluscs and other marine organisms.

Detailed procedures for the measurement of organic tin and total tin in sea water are described in (8).

2. Petroleum hydrocarbons (PHCs)

The IOC Manual No. 13 (2) is recommended for the determination of petroleum hydrocarbons in sea water with the change that, instead of carbon tetrachloride, hexane shall be used for the extraction, as recommended by the Workshop for Intercalibration of Methods for Analysis of Petroleum Hydrocarbons in Sea Water (3).

However, the following remarks should be taken into account:

- the UV-spectrofluorometric method should be considered as a screening technique and if unusually high concentrations of PHCs are recorded, other relevant techniques (e.g., GC-MS) should be applied to study the case;
- it is recommended that improved techniques for determination of PHCs be developed;
- topped Ekofisk crude oil could be used as the reference standard for oil contamination monitoring purposes (available from the Deutsches Hydrographisches Institut, Hamburg).

3. Chlorinated hydrocarbons (CHCs)

These are included in the Monitoring Programme for the Third Stage on a tentative basis because of the serious methodological difficulties encountered (7).

4. Sampling and preservation of samples

a) Depths for harmful substances

Water samples for the measurement of the harmful substances should be taken from the following layers (depth specifications are not given, as these will vary in the different areas of the Baltic Sea):

- surface microlayer (not obligatory)
- middle of mixed surface layer
- middle of winter surface layer
- middle of deep water.

Petroleum hydrocarbons are sampled at 1 m depth only.

b) Sampling techniques

For heavy metal determinations (tentative), completely metal-free samplers should be used, together with plastic-coated hydrowires, stainless steel guide wheels and plastic-coated messengers.

Methods for the sampling of sea water and storage of samples prior to measurement of trace metals are given in (4).

The sampling technique for petroleum hydrocarbons is described in (3).

The sampling technique for chlorinated hydrocarbons is described in (6).

c) Preservation of samples

Heavy metals need not be analyzed on board. Any filtration must be carried out immediately after sampling, preferably using a "clean bench". Acidification (at pH 1-2) of samples (preferably in polyethylene, teflon or quartz bottles) is the recommended method of preservation (1) and (4).

PHCs and CHCs

A description of agreed and intercalibrated methods for PHCs in sea water is given in (3).

No agreed methods can be recommended for CHCs.

5. References in Chapter B II

(Heavy Metals, Petroleum Hydrocarbons and Chlorinated Hydrocarbons in Sea Water)

1. Kremling, K., Olafsson, G., Andreae, M., Koroleff, F. 1983. Determination of trace metals. In: Grasshoff, K. et al. (Eds.) "Methods of sea-water analysis", 189-246, Weinheim.
2. UNESCO, 1984. Manual for Monitoring Oil and Dissolved/Dispersed Petroleum Hydrocarbons in Marine Waters and on Beaches. IOC Manual No. 13.
3. Helsinki Commission, 1981. Workshop on the Analysis of Hydrocarbons in Seawater, Kiel, 23 March - 3 April 1981, Baltic Sea Environment Proceedings No. 6: 1-52.
4. Yeats, P.A., 1987. Trace metals in sea water: Sampling and storage methods. ICES Techniques in Marine Environmental Sciences No. 2.
5. Berman, S.S. and Boyko, V.J., 1988. Report on the Results of the ICES Sixth Round Inter-calibration on Trace Metals in Estuarine Water. ICES Coop. Res. Rep. No. 152.
6. Gaul, H. and Ziebarth, U. 1983. Method for the Analysis of Lipophilic Compounds in Water and Results about the Distribution of Different Organochlorine Compounds in the North Sea. Dt. hydrogr. Z. 36, 191-212.
7. Alzieu, C., Bewers, J.M., Duinker, J.C., Berman, S.S. et al., 1986. Report on the ICES Fifth Round Intercalibration on Trace Metals in Sea Water and the Fifth Intercomparative Exercise on the Determination of Organochlorine Residues in Fish Oil. ICES Coop. Res. Rep. No. 136.
8. Jensen, A. and Cheng, J. (in prep.). Determination of organic and total tin in sea water by extraction and graphite furnace atomic absorption spectroscopy. ICES Techniques in Marine Environmental Sciences No. 8.

6. Reporting format for contaminants in sea water

International Council for
the Exploration of the Sea *

INTERIM REPORTING FORMAT FOR
CONTAMINANTS IN SEA WATER

HELCOM-VERSION

REVISED MAY 1986

*) All questions or inquiries concerning this format and its use should be directed to the ICES Environmental Officer, I C E S, Palægade 2, DK-1261 Copenhagen K, Denmark.

INTERIM REPORTING FORMAT FOR CONTAMINANTS IN SEA WATER
VERSION 2

1. INTRODUCTION

This Interim Reporting Format for Contaminants in Sea Water has been drafted on the basis of the present requirements of monitoring programmes for contaminants, primarily trace metals, in sea water.

2. OVERVIEW OF THE SYSTEM

Three types of forms have been included in the system: a Sea Water Sampling and Analytical Methods Form, a Sea Water Contaminant Master Form, and a Sea Water Contaminant Data Form.

***** FORMAT MODIFICATION - NEW FORM *****

The Sea Water Sampling and Analytical Methods Form records information on the methods of sampling, pretreatment, preservation and analysis used for a particular contaminant by the analytical laboratory involved for the year concerned.

A series of these forms should be filled out and should precede the first Master form; they should describe the methods associated with any contaminant subsequently reported.

Generally, only one form will need to be filled out for each contaminant; however, if more than one series of methods have been used for any contaminant, a separate form must be filled out for each new combination of methods.

Each contaminant analysis reported later on the Sea Water Contaminant Data Forms is unambiguously associated with a specific Sea Water Sampling and Analytical Methods Form by means of a Method Identifier item.

The Sea Water Contaminant Master Form serves as the master record for the series of data obtained at one sampling station on one sampling occasion. This form provides general information on when and where the sample was obtained

The Sea Water Contaminant Data Form provides the record for the data on the sea water samples obtained, according to sampling depth. This form is used to report data on the salinity, amount of suspended solids and the concentrations of contaminants in the sample. Previously it was necessary to fill in separate forms for each contaminant; now several contaminants can be reported on one form with the Method Identifier item used to link each analysis with the Sampling and Analytical Methods Form which contains the relevant method details. Furthermore, data relating to samples from different depths can be reported on a single form as each time a new depth value (ie. a new depth parameter line) is recorded, this signifies that the data lines which follow belong to the sample at that depth.

Positions have been provided on all forms for comments and additional information. These positions should be used for information which will assist in the interpretation of the data, thus making the data more valuable for future use. One example is the inclusion of information on methods which have been changed from previous years.

It is intended that all types of relevant data be reported on these forms. If codes for any items are missing, they can be developed on request to the ICES Environment Officer.

3. DETAILED DESCRIPTION

3.1 General

The following description applies to all forms. The page number should be inserted in the upper left-hand corner of each page. On the first page of the series, i.e., on the first Sea Water Sampling and Analytical Methods Form, the total number of pages of forms associated with the series should be included.

3.2 Sea Water Sampling and Analytical Methods Form

***** FORMAT MODIFICATION - NEW FORM *****

Sea Water Sampling and Analytical Methods forms are required for 'contaminants' ie. for those parameters where this type of information is appropriate. Annex 5 indicates whether Sampling and Analytical Methods Forms are mandatory, optional or not required for a particular parameter.

The Sea Water Sampling and Analytical Methods Form is designed to provide a means of recording all details of the methods used in the sampling and analysis of a particular contaminant in one initial stage, and to remove the need to duplicate this information repeatedly on other forms where data for the same contaminant is included. Thus, a series of these forms is filled out, preceding the first Sea Water Contaminant Master, to cover all combinations of methods used by a particular laboratory in that year. The methods forms can therefore be referred to repeatedly from the Sea Water Contaminant Data Forms.

Often it will only be necessary to fill out one Sampling and Analytical Methods Form for each contaminant reported; if more than one method description applies to any one contaminant, then additional methods forms should be filled out for that contaminant, each with a different Method Identifier (see description of Method Identifiers on pages 9 and 10). If analysis of a contaminant is carried out by more than one analytical laboratory, the appropriate number of methods forms should be filled out for each laboratory.

It should be noted that the methods are described on this form by means of codes which should be linked to a full description of the details, including types of equipment, that is retained in the laboratory; if the laboratory is participating in the Joint Monitoring Programme these details should also be sent to the Secretariat of the Oslo and Paris Commissions.

The Sea Water Sampling and Analytical Methods Form should be filled in according to the following description.

<u>Item</u>	<u>Code Description</u>
1. Form identifier code	The code "A" identifies the Sea Water Sampling and Analytical Methods Form.
2. Country	Insert the IOC Country code (see Annex 2), the same information appears on the Sea Water Master Form.
3. Year	Insert the last two digits of the sampling year.
4. Reporting Laboratory	Insert the four-letter mnemonic code (see Annex 1) for the laboratory reporting the data, the same information appears on the Sea Water Master Form.
5. Analytical Laboratory	Insert the four-letter mnemonic code (see Annex 1) for the analytical laboratory concerned.
6. Parameter/Contaminant code	Insert the code for the parameter/contaminant for which the methods data apply, according to the codes given in Annex 5.

7. Method identifier

Insert a method identifier code for the combination of methods described on this form. It is suggested that a code "1" is given for the first Methods Form for each contaminant, then "2", "3" etc. for additional forms, if more than one combination of methods has been used for that contaminant. This item links the method information which follows with any analysis (of the contaminant identified in item 6 by the laboratory identified in item 5) for which this Identifier is reported on a Sea Water Contaminant Data Form (item 11 or 14).

8. Method of sampling: bottle type deployment

Insert code for sampling bottle type in the left column and code for means of sampler deployment in the right column. Each laboratory should maintain detailed records of the methods used and should assign a code number for each of these methods.

9. Method of pre-treatment

Insert code for method of separation of suspended solids in the left column and code for any other pre-treatment used in the right column. Each laboratory should maintain detailed records of the methods used and should assign a code number for each of these methods.

10. Method of preservation

Insert code. Each laboratory should maintain detailed records of the methods used and should assign a code number for each of these methods.

11. Method of analysis

Insert a 3-digit code for the method used to analyse the contaminant. Each laboratory submitting data should maintain detailed records of the methods used to analyse the contaminants and should assign a 3-digit code number for each of these methods. The appropriate code should be inserted here.

12. Limit of detection Right justified, zero filled. Insert the detection limit for the method of analysis used to determine the contaminant reported in the units appropriate to that contaminant (see Annex 5). The limit of detection is defined here as that concentration of analyte which yields an analytical response equal to three times the standard deviation of the complete procedural blank.
13. I/C (intercalibration) Insert a 2-digit code for the relevant intercalibration exercise in which the laboratory has most recently participated, according to the list in Annex 3.
14. Comments Plain language comments can be inserted as needed. Such comments can include information of relevance to the interpretation of the methods used, description of an intercalibration exercise etc.

3.3 Sea Water Contaminant Master Form

One Sea Water Contaminant Master is filled in for each sampling station or area on each sampling occasion. The Master Form should be filled in according to the following description.

<u>Item</u>	<u>Code Description</u>
PART I	
1. Form identifier code	The code "M" identifies the Sea Water Contaminant Master Form.
2. Sampling country	Insert the IOC Country Code (see Annex 2).
3. Ship code	Insert code of the search vessel used when obtaining the samples. (see list of ICES Ship Codes.)

***** FORMAT MODIFICATION - NEW DEFINITION *****

4. EITHER - Sequence no. Insert the number of the Master Form being filled in beginning with 0001 for the first Master form in a year, 0002 for the second etc.
- OR - Station no. If the sample data reported coincide with other measurements which are reported elsewhere using the ICES Hydrographic Data Format a comment should be included to this effect. The station number which is associated with the ICES Hydrographic Data Format should be inserted instead of the Sequence number, to allow future cross-referencing of the data.

5. Sampling date Indicate the year (last two digits only), month, and date of sampling. (The day may be omitted, if desired, and the applicable columns filled with zeroes).

***** FORMAT MODIFICATION - NEW ITEM *****

6. Sampling time Time at which sampling commenced (optional parameter to permit correspondence with the Hydrographic Data Format).

7. Sampling area co-ordinates Insert coordinates of the sampling area, as follows:

Note that decimal fractions of minutes are recorded and not seconds -

(1) A sample taken at the coordinates 59° 20.15' N 18° 55.3' E would be designated according to the coordinates system as:

5 9 2 0 1 5 1 8 5 5 3 0 E

(2) A sample taken at the coordinates 50° 10.5' N 4° 30.25' W would be designated according to the coordinates system as:

5 0 1 0 5 0 0 4 3 0 2 5 W

PART II

8. Reporting Laboratory Insert the four-letter mnemonic code for the laboratory reporting the data (see Annex 1).

***** FORMAT MODIFICATION - NEW OPTIONS *****

9. Organization code Indicate the organization(s) for which data are submitted, as follows:

I - International Council for the Exploration of the Sea

J - Joint Monitoring Programme of the Oslo and Paris Commissions

B - Baltic Monitoring Programme of the Helsinki Commission

10. Sampling area designation (eg. JMP Area (sub-area)) If the Organization code J has been included in item 9 (above) then insert, left-justified, the code number of the JMP area sampled. If appropriate, insert a sub-area or station number, leaving one blank after the area number.

11. Purpose of monitoring Indicate purpose of monitoring according to the following code:

0 - No specific purpose
2 - Geographical distribution
3 - Trend determination

12. Number of Sea Water Contaminant Data Forms following this Master Right justified, zero filled. Insert number of Contaminant Data Forms following this Master.

13. Comments Insert plain language comments, as needed.

3.4 Sea Water Contaminant Data Form

***** FORMAT MODIFICATION - NEW DEFINITION *****

The Contaminant Data Form records data on the various 'parameters' which are associated with each sample. Parameters can be physical measurements such as depth, salinity, temperature, etc., or chemical measurements such as contaminant concentrations, nutrients, etc.; a list of parameters with associated codes and units, etc., is given in Annex 5. The nature of a particular parameter determines (i) whether it is appropriate to fill out an associated Sampling and Analytical Methods form, and (ii) whether it should be reported as a single value under item 7, or, as in the case of contaminants which can be determined in a sample before or after filtration, a value should be recorded under items 7 and/or 10 as appropriate.

Each line on the Contaminant Data Form, (items 4-11), records data for one 'parameter'. One form can include data for several parameters associated with samples taken at a particular station. Depth is a 'key' parameter; all parameters which follow a particular depth record are assumed to be parameters associated with a sample taken at that depth. Thus, the first record line on a Contaminant Data Form should contain data on the sampling depth, other parameters associated with that sample are reported on the following lines. A new depth record (at the same depth or another depth) indicates that subsequent parameter records are associated with a sample taken at this 'new' depth.

The Sea Water Contaminant Data Form should be filled in according to the following description:

Item	Code Description
1. Year	Insert the last two digits of the sampling year, the same as on the Sea Water Sampling and Analytical Methods Form.
2. Sequence/Station no.	Insert the Sequence/Station number, the same information as on the Sea Water Contaminant Master.
3. Form identifier code	The code "C" identifies the Sea Water Contaminant Data Form.

***** FORMAT MODIFICATION - NEW DESCRIPTION *****

4. Parameter/contaminant code Insert the code for the parameter/contaminant according to the codes given in Annex 5.

***** FORMAT MODIFICATION - NEW ITEM *****

5. Method Identifier (before filtration) If relevant, insert the appropriate Method Identifier corresponding to that inserted on the associated Sampling and Analytical Methods Form for the methods of sampling and analysis for the contaminant before filtration.

6. Qualifier In the first column, indicate whether the value reported under item 7 should be qualified by:

> - greater than, or
< - less than.

If not, leave blank. When not detected, use < the detection limit in numerical terms.

In the second column, insert a Validation Flag as follows:

Blank - unspecified or quality control check has not been made

A - Acceptable: data found acceptable during quality control checks.

S - Suspect Value: data considered suspect (but not replaced) by the data originator on the basis of either quality control checks or recorder/instrument/platform performance.

Q - Questionable Value: data considered suspect (but not replaced) during quality control checks by persons other than those responsible for its original collection, e.g., a data centre.

R - Replaced Value: erroneous or missing data has been replaced by estimated or interpolated value - method by which replacement values have been derived should be described in plain language records.

M - Missing Value: original data erroneous or missing.

***** FORMAT MODIFICATION - NEW DEFINITION *****

7. Parameter value Right justified, zero filled. Insert the parameter value or the concentration of the contaminant as obtained from the analysis of the sea water before filtration, centrifugation, or other means of separation of suspended solids, in the appropriate units (see Annex 5).
OR
Contaminant concentration before filtration

***** FORMAT MODIFICATION - NEW ITEM *****

8. Method Identifier (after filtration) Insert the appropriate Method Identifier corresponding to that inserted on the relevant Sampling and Analytical Methods Form for the methods of sample analysis for the contaminant after filtration.

If the method of analysis used is the same as that used before filtration and the details of sample collection/preservation etc. are also the same, then insert the same Method Identifier as that used in Item 5 (above).

9. Qualifier Indicate whether the value recorded under item 10 should be qualified; fill in as described in Item 6, above.

10. Parameter/Contaminant concentration after filtration Right justified, zero filled. Insert the concentration of the contaminant in µg/l, as obtained from the analysis of the sea water after filtration, centrifugation, or other means of separation of suspended solids.

11. Analytical Laboratory Insert the four-letter mnemonic code (see Annex 1) for the analytical laboratory. This is a mandatory item and should correspond to the code reported on the Sampling and Analytical Methods Form which contains details of the methods applied.

12. Comments Plain language comments can be inserted as needed. Such comments can include information relevant to the interpretation of the contaminant values or sample data.

Reporting format for contaminants in sea water

ANNEX 1

LABORATORY CODES FOR THE REPORTING AND ANALYTICAL
LABORATORIES OF THE MONITORING PROGRAMMES - BY COUNTRY

DENMARK	HFLD	Miljøstyrelsens Havforureningslaboratorium Jægersborg Allé 1B DK-2920 Charlottenlund DENMARK
	SCSS	State Chemical Supervision Service Mørkhøj Bygade 26-H DK-2860 Søborg DENMARK
	ICDK	Danish Isotope Center Skelbækgade 2 DK-1717 Copenhagen V DENMARK
FINLAND	IMRF	Institute of Marine Research P.O. Box 33 00931 Helsinki 93 FINLAND
G.D.R	AHZL	Arbeitshygienisches Zentrum der chemischen Industrie GERMAN DEMOCRATIC REPUBLIC
	FREI	Forschungsinstitut für NE-Metalle Freiberg 9200 GERMAN DEMOCRATIC REPUBLIC
	BHIR	Bezirkshygiene-Institut Rostock GERMAN DEMOCRATIC REPUBLIC
	IGDR	Institut für Meereskunde Akademie der Wissenschaften de DDR Seestrasse 15 DDR-2530 Rostock-Warnemünde GERMAN DEMOCRATIC REPUBLIC

F.R.G	AHHG	FEDERAL REPUBLIC OF GERMANY
	BFRG	Bundesforschungsanstalt für Fischerei Laboratory für Radioökologie der Gewässer Wüstland 2, 2000 Hamburg 55 FEDERAL REPUBLIC OF GERMANY
	BFKG	Bundesforschungsanstalt für Fischerei Institut für Küsten- und Binnenfischerei Palmaille 9 2000 Hamburg 50 FEDERAL REPUBLIC OF GERMANY
	BFGG	BUNDESANSTALT FÜR GEWAESSERKUNDE Kaiserin-Augusta-Anlagen 15-17 D-5400 Koblenz FEDERAL REPUBLIC OF GERMANY
	DHIG	Deutsches Hydrographisches Institut Bernhard-Nocht-Strasse 78 D-2000 Hamburg 50 FEDERAL REPUBLIC OF GERMANY
	NLWG	Niedersaechsisches Landesamt für Wasserwirtschaft An der Scharlake 39 D - 3200 Hildesheim FEDERAL REPUBLIC OF GERMANY
	WGEg	Wassergütestelle Elbe Focksweg 32 a D - 2103 Hamburg 95 FEDERAL REPUBLIC OF GERMANY
	FITG	Fresenius Institut Chemische und Biologische Laboratorien GmbH D-6204 Taunusstein-Neuhof FEDERAL REPUBLIC OF GERMANY
	ISHG	Institute Schumacher Laboratorium für Wasser-, Abwasser- und Ölanalytik Dr. Harald Schumacher (Dipl. Chem.) Sophie-Dethleffs-Str. 4 D-2240 Heide FEDERAL REPUBLIC OF GERMANY

LWKG	Landesamt für <u>W</u> asserhaushalt und <u>K</u> üsten Saarbrückenstraße 38 D-2300 <u>K</u> iel 1 FEDERAL REPUBLIC OF <u>G</u> ERMANY
VUCG	Veterinär <u>u</u> ntersuchungsamt Cuxhaven Schleusenstraße D-2190 <u>C</u> uxhaven FEDERAL REPUBLIC OF <u>G</u> ERMANY
POLAND	IMWP Institute of Meteorology and Water Management Wazingtona 42 81-342 Gdynia <u>P</u> OLAND
VHRP	Veterinary <u>H</u> ygien <u>e</u> <u>R</u> esearch Station Gdansk <u>P</u> OLAND
SFIP	Sea Fisheries Institute Aleja Zjednoczenia 1 81-345 Gdynia <u>P</u> OLAND
IIAP	Institute of Ichthyology Agriculture Academy Szczecin <u>P</u> OLAND
SWEDEN	HRFS Institute of Hydrographic Research National Board of Fisheries Box 2566 403 17 Göteborg <u>S</u> WEDEN
UCKS	University College of Kalmar Inst. Natural Sciences and Technology Box 905 S-391 29 Kalmar <u>S</u> WEDEN
MNHS	Miljögiftsö <u>o</u> vervakning PMK Naturhistoriska riksmuseet Box 50007 S-104 05 Stockholm <u>S</u> WEDEN

NSIS	National Swedish Environment Protection Board Naturvårdsverkets <u>S</u> pecial Analytical Laboratory Box 1302 S-171 25 Solna <u>S</u> WEDEN
NWLS	National Swedish Environment Protection Board Naturvårdsverkets <u>W</u> ater Quality Laboratory S-75008 Uppsala <u>S</u> WEDEN
LCRS	Swedish Environment Protection Board Laboratory for Coastal Research S-170 11 Drottningholm <u>S</u> WEDEN
SERI	<u>S</u> wedish <u>E</u> nvironmental <u>R</u> esearch Institute Sten Sturegatan 42 Box 5207 S-402 24 Gothenburg <u>S</u> WEDEN
IAMK	Institutionen för <u>a</u> lytisk och <u>m</u> arin <u>k</u> emi Chalmers tekniska högskola S-412 96 Gothenburg <u>S</u> WEDEN
SLKS	AB <u>S</u> vensk <u>L</u> aboratoriet (SWELAB) Box 903 S-391 29 Kalmar <u>S</u> WEDEN
USSR	DBST Department of the Baltic Sea Academy of Sciences Paldiski Street 1 200031 Tallinn USSR
ASLR	Academy of Sciences of Latvian SSR Institute of Biology Riga 229021 USSR

Reporting format for contaminants in sea water

ANNEX 2

IOC COUNTRY CODES FOR BMP MEMBER COUNTRIES

<u>COUNTRY</u>	<u>CODE</u>
Denmark	26
Finland	34
German Democratic Republic	96
Germany, Federal Republic of	06
Poland	67
Sweden	77
Union of Soviet Socialist Republics	90

Reporting format for contaminants in sea water

ANNEX 3

CODE LIST FOR INTERCALIBRATION EXERCISES ON CONTAMINANTS
IN SEA WATER

<u>CODE</u>	<u>INTERCALIBRATION EXERCISE</u>
4A	1/TM/SW - ICES First Round Intercalibration for Trace Metal Standard Solutions - 1976
4B	2/TM/SW - ICES Second Round Intercalibration for Mercury in Sea Water - 1976
4C	3/TM/SW - ICES Third Round Intercalibration for Trace Metals in Sea Water - 1977
4D	4/TM/SW - ICES Fourth Round Intercalibration for Trace Metals in Sea Water - 1978
4E	ICES/JMG/1/HG/SW - ICES/JMG Intercalibration Exercise for Mercury in Sea Water - 1979
4F	ICES/JMG/1/CD/SW - ICES/JMG Intercalibration Exercise for cadmium in Sea Water - 1979
4G	5/TM/SW(3) - ICES Fifth Round Intercalibration for Trace Metals in Sea Water - Section 3 - Analyses for Cd, Cu, Ni, Zn, Pb, Fe and Mn - 1982/83
4H	5/TM/SW(4) - ICES Fifth Round Intercalibration for Trace Metals in Sea Water - Section 4 - Analysis of mercury - 1983
4I	JMG Intercalibration on Trace Metals in Estuarine Waters - 1986
4Z	Other Intercomparison/Intercalibration Exercise on Trace Metals in Sea Water - Describe in comments.
	-O-O-O-O-
5A	JMG Intercalibration on Analyses of PCBs in Sea Water - 1981
5Z	Other Intercomparison/Intercalibration Exercise on Organochlorines in Sea Water - Describe in comments.
	-O-O-O-O-
6A	Kiel Intercalibration Workshop on Petroleum Hydrocarbons in Sea Water - 1981

Reporting format for contaminants in sea water

ANNEX 4

PARAMETER CODES FOR SALINITY/CHLOROSITY

Previously salinity/chlorosity data have been reported in association with a method code which implied whether the value was a chlorosity or salinity determination.

As a consequence of the use of parameters for reporting data a new system has been instituted for the coding of the parameter associated with salinity/chlorosity measurements. In this new system the first four characters of the parameter code define whether the data reported is a salinity value (PSAL) or a chlorosity value (CHLR): The method code information is incorporated in the parameter code as its last character according to the following list:

Method

(a) Measurement from water sample (temperature measurement by thermometer assumed)

- | | |
|--|-------|
| 1 Titration by routine Mohr-Knudsen method | CHLRA |
| 2 Titration by special precision method | CHLRB |
| 3 Conductivity measurement by Laboratory salinometer | PSALA |
| 4 Refractive Index/direct density measurement | PSALB |

(b) Measurement in situ (temperature measurement by thermistor assumed)

- | | |
|---|-------|
| 5 Conductivity/salinity measurement from CTD/STD yielding precision in salinity $<0.01 \times 10^{-3}$. | PSALC |
| 6 Conductivity/salinity measurement from CTD/STD with precision in salinity $>0.01 \times 10^{-3}$. | PSALD |
| 7 Conductivity/salinity measurement from CTD/STD calibrated with at least one <u>in situ</u> sample yielding precision in salinity $<0.01 \times 10^{-3}$. | PSALE |
| 8 Conductivity/salinity measurement from CTD/STD calibrated with at least one <u>in situ</u> sample yielding precision in salinity $>0.01 \times 10^{-3}$. | PSALF |
| 9 Conductivity/salinity measurement using instrument yielding precision in salinity $>0.5 \times 10^{-3}$ (e.g., Switchgear Bridge). | PSALG |

Reporting format for contaminants in sea water

ANNEX 5

CODE LIST FOR PARAMETERS/CONTAMINANTS

PARAMETER/CONTAMINANT			METHODS FORM REQUIRED	CONTAMINANT DATA FORM FIELD ¹
NAME	CODE	UNITS		
Depth	DEPH	m	no	7
Temperature ²	TEMP	°C	no	7
Salinity/ Chlorosity (see Annex 4 for codes)	PSALA	practical salinity unit	no	7
	PSALB		no	7
	PSALC		no	7
	PSALD		no	7
	PSALE		no	7
	PSALF		no	7
	PSALG		no	7
Suspended Solids	CHLRA	g/kg	no	7
	CHLRB		no	7
Suspended Solids	SUSP	mg/l	optional	7
Mercury	HG	µg/l	yes	7 and/or 10
Cadmium	CD	µg/l	yes	7 and/or 10
Copper	CU	µg/l	yes	7 and/or 10
Zinc	ZN	µg/l	yes	7 and/or 10
Lead	PB	µg/l	yes	7 and/or 10
Nickel	NI	µg/l	yes	7 and/or 10
Chromium	CR	µg/l	yes	7 and/or 10
Iron	FE	µg/l	yes	7 and/or 10
Manganese	MN	µg/l	yes	7 and/or 10
Cobalt	CO	µg/l	yes	7 and/or 10
Arsenic	AS	µg/l	yes	7 and/or 10
Antimony	SB	µg/l	yes	7 and/or 10
Tin	SN	µg/l	yes	7 and/or 10
Lindane (γ-HCH)	HCHG	ng/l	yes	7 and/or 10
Polychlorinated biphenyls	PCB	ng/l	yes	7 and/or 10
Petroleum hydrocarbons (total)	sPHC	µg/l	yes	7 and/or 10

¹ - Report the parameter value on the Contaminant Data Form in the field indicated

² - In the case of a negative temperature, insert a '-' sign in the far left column of the field (item 7).

Page ___ of ___ pages

INTERIM REPORTING FORMAT FOR CONTAMINANTS IN SEA WATER
VERSION 2 (DRAFT 2)

SEA WATER SAMPLING AND ANALYTICAL METHODS FORM

1. Form identifier code
2. Country
3. Year
4. Reporting Laboratory
5. Analytical Laboratory
6. Parameter/Contaminant code
7. Method identifier
8. Method of sampling - bottle type/deployment
9. Method of pretreatment - separation of suspended solids/other
10. Method of preservation
11. Method of analysis of parameter/contaminant
12. Limit of detection of parameter/contaminant
13. Intercalibration exercise
14. Comments _____

Page ___ of ___ pages

INTERIM REPORTING FORMAT FOR CONTAMINANTS IN SEA WATER
VERSION 2 (DRAFT 2)

SEA WATER CONTAMINANT MASTER

PART I

1. Form identifier code
2. Country
3. Ship code
4. Sequence number (Station)
5. Sampling date
Y Y M M D D
6. Sampling time
7. Sampling area coordinates
o ' o ' E/W

PART II

8. Reporting Laboratory
9. Organization
10. Sampling area designation (eg. JMP area)
11. Purpose of monitoring
12. Number of sample data forms following this master
13. Comments _____

SEA WATER CONTAMINANT DATA FORM

- [illegible]

4	5	6	7	8	9	10	11

4. Parameter/contaminant code
5. Method identifier (before filtration)
6. Qualifier
7. Parameter/contaminant value (if appropriate report value before filtration)
8. Method identifier (after filtration)
9. Qualifier
10. Parameter/contaminant value after filtration
11. Analytical Laboratory
12. Comments _____

(ICES, revised version May 1986)

This document should be read in parallel with "INTERIM REPORTING FORMAT FOR CONTAMINANTS IN SEA WATER", published by ICES (May 1986 revised version). This Format is described in three versions: the full ICES version, the JMP version and the HELCOM version, the latter two are essentially subsets of the first with reference to the particular requirements of the JMP and HELCOM. The magnetic tape format (described below) can be used in conjunction with either of the three versions, where reference is made to specific sections of the full ICES version an equivalent section appears in the JMP and HELCOM subsets.

Magnetic tapes sent to ICES should be:

```

9 tracks, odd parity
800, 1600 or 6250 bpi (1600 bpi is strongly preferred)
EBCDIC OR ASCII
no label
fixed blocked records
logical record length 80 characters
blocksize, a suitable multiple of 80

```

The exchange-format consists of the following record types:

- 04 - Sea Water Sampling and Analytical Methods Record
- 01 - Sea Water Master Record
- 10 - Sea Water Parameter/Contaminant Data Record
- 13 - Plain Language Record

An entire series of data obtained on one from one station/area on one sampling occasion should be organized as follows:

- 04-Sampling and Analytical Methods Record
13-Plain Language Records (optional, max 5)

- 04-Sampling and Analytical Methods Record
13-Plain Language Records (optional,max 5)
01-Master Record
13-Plain Language Records (optional,max 5)
10-Parameter/Contaminant Record

- 10-Parameter/Contaminant Record
01-Master Record (next series)

Record layout for the different record types:

Sea Water Sampling and Analytical Methods Record:

Field name	Columns	Valid values	Comments
Record id	1-2	04	Mandatory.
Country	3-4	See Annex 2	Mandatory. All Annexes refer to "Interim Reporting Format...".
Year	5-6		Mandatory. Insert the last two digits of the year in which samples were taken.
Reporting Laboratory	7-10	See Annex 1	Mandatory. Insert the code for the laboratory responsible for reporting the data.
Analytical Laboratory	11-14	See Annex 1	Mandatory. Insert the code for the laboratory responsible for carrying out the analyses the details of which are located in columns.
Parameter/Contaminant code	15-19	See Annex 5	Mandatory, left justified, space filled. Insert the code for the parameter for which the methods details in columns to apply.
Method Identifier	20-20		Insert the identifier for the series of methods described (see page 6 of the "Interim Reporting Format..."). The identifier must be unique for each of the Sampling and Analytical Methods records supplied within the series for a single parameter by a particular Analytical Laboratory in any one year.
Method of sampling			
-bottle type	21-21	0-9, A-Z	Mandatory.
-deployment	22-22		Mandatory. Each laboratory should maintain detailed records of the methods used and should assign a code for each of these methods.

Method of pre-treatment			
-separation of suspended solids	23-23	0-9, A-Z or space	Space filled if solids not separated, otherwise same comment as above.
-other	24-24	0-9, A-Z or space	Space filled if no other pre-treatment used otherwise same comment as above.
Method of preservation	25-25	0-9, A-Z or space	Space filled if sample not preserved otherwise same comment as above.
Method of analysis	26-28		Mandatory, left justified, space filled (code is alphanumeric). See page 6 of "Interim Reporting Format...".
Limit of detection	29-34		Mandatory, right justified, zero filled. Insert the limit of detection as defined on page 7 of "Interim Reporting Format" in the appropriate units (see Annex 5) to 4 implied decimals. NOTE: Both this record and the Contaminant Data Record contain numeric data fields with implied decimals. For these fields "zero filled" means both leading and trailing zeroes.
I/C (Inter-calibration)	35-36	See Annex 3	Mandatory.
Filler	37-80	Spaces	For future use.

Sea Water Contaminant Master Record:

Field name	Columns	Valid values	Comments
Record id	1-2	01	Mandatory.
Sampling country	3-4	See Annex 2	Mandatory.
Ship code	5-6		Space filled if ship code missing. Code according to ICES Ship Code List.
Sequence number (Station)	7-10	0001-9999	Mandatory, right justified, zero filled. Consecutive numbers for one year, starting with 0001 for the first Master Form in a year, 0002 for the second, etc. or Station number as described in "Interim Reporting Format..."
Sampling date	11-16		Mandatory. In the form YYMMDD, if day not reported then DD=00.
Sampling time	17-18	00-24	Space filled if not given otherwise, right justified zero filled insert time at which sampling commenced to the nearest hour.
Sampling area coordinates	19-31		Space filled if not given otherwise (see Interim Reporting Format... page 8):
	19-20	36-73	Latitude degrees (a)
	21-22	00-59	Latitude minutes (a)
	23-24		Latitude decimal fraction of minutes (b)
	25-26	42-00 and 00-13	Longitude degrees (a)
	27-28	00-59	Longitude minutes (a)
	29-30		Longitude decimal fraction of minutes (b)
			a) mandatory, right justified, zero filled. b) optional, left justified, space filled. NB. decimal fraction <u>not</u> seconds.
	31-31	E or W	Quadrant, mandatory

Reporting laboratory code	32-35	See Annex 1	Mandatory.
Organization code	36-36	0 or 1	Mandatory. If data submitted for ICES insert 1, otherwise 0.
	37-37	0 or 1	Mandatory. If data submitted for JMP insert 1, otherwise 0.
	38-38	0 or 1	Mandatory. If data submitted for BMP insert 1, otherwise 0.
			NOTE: At least one of the columns 36-38 must contain a '1'. Data can be submitted for more than one organization.
Sampling area indicator	39-39	I, J, B or space	If data submitted for JMP (ie. 1 in column 37) then mandatory, insert J. Otherwise optional, insert I, J or B according to the sampling area designation in columns 40-48. Space filled if no sampling area designation given.
Sampling area designation	40-48		If data submitted for JMP (ie. 1 in column 37) then mandatory: Left justified, space filled, insert number of JMP area sampled. If appropriate, insert a sub-area or station number, leaving one blank after the area number.
			If data not submitted for JMP then optional - allowed sampling area systems are ICES statistical rectangles, JMP areas and station numbers and BMP stations.
Purpose	49-49	0-4	Mandatory.
Number of Contaminant Data records following this Master record	50-51	01-99	Mandatory, right justified, zero filled.
Filler	52-80,	Spaces	For future use.

Sea Water Parameter/Contaminant Data Record:

Field name	Columns	Valid values	Comments
Record id	1-2	10	Mandatory.
Information from master record	3-31		Mandatory, copy the information in columns 3-31 of the preceding Master Record.
Parameter/Contaminant code	32-36	see Annex 5	Mandatory, left justified, space-filled.
Method identifier	37-37		Space filled if not required, otherwise, insert the method identifier to link the data reported in columns 38-47 to one of the Sampling and Analytical Methods records for the parameter concerned.
Qualifier	38-38 39-39	space, > or < space, A, S, Q, R or M	Insert the Qualifiers appropriate to the data reported in columns 40-47. See page 11 of the "Interim Reporting Format.."
Parameter/Contaminant value	40-47		Insert the parameter value in the units specified in Annex 5 to four implied decimals. Where appropriate (see Annex 5) this value should be for the contaminant concentration in the sample before filtration. Space filled if not given, otherwise right justified zero filled.
Method identifier	48-48		Space filled if not required, otherwise, insert the method identifier to link the data reported in columns 49-58 to one of the Sampling and Analytical Methods records for the parameter concerned.
Qualifier	49-49 50-50	space, > or < space, A, S, Q, R or M	Insert the Qualifiers appropriate to the data reported in columns 51-58. See page 11 of the "Interim Reporting Format.."

Parameter/Contaminant value 51-58

Analytical laboratory code	59-62	see Annex 1
Filler	63-80	Spaces

Insert the parameter value in the units specified in Annex 5 to four implied decimals. Where appropriate (see Annex 5) this value should be for the contaminant concentration in the sample after filtration. Space filled if not given, otherwise right justified zero filled.

Mandatory.
For future use.

Plain Language Record:

Field name	Columns	Valid values	Comments
Record id	1-2	13	Mandatory.
Comments	3-62		Left justified, space filled.
Filler	63-80	Spaces	

BALTIC SEA ENVIRONMENT PROCEEDINGS

- No. 1 JOINT ACTIVITIES OF THE BALTIC SEA STATES WITHIN THE FRAMEWORK OF THE CONVENTION ON THE PROTECTION OF THE MARINE ENVIRONMENT OF THE BALTIC SEA AREA 1974-1978 (1979)*
- No. 2 REPORT OF THE INTERIM COMMISSION (IC) TO THE BALTIC MARINE ENVIRONMENT PROTECTION COMMISSION (1981)
- No. 3 ACTIVITIES OF THE COMMISSION 1980
- Report on the activities of the Baltic Marine Environment Protection Commission during 1980
- HELCOM Recommendations passed during 1980 (1981)
- No. 4 BALTIC MARINE ENVIRONMENT BIBLIOGRAPHY 1970-1979 (1981)
- No. 5A ASSESSMENT OF THE EFFECTS OF POLLUTION ON THE NATURAL RESOURCES OF THE BALTIC SEA, 1980
PART A-1: OVERALL CONCLUSIONS (1981)*
- No. 5B ASSESSMENT OF THE EFFECTS OF POLLUTION ON THE NATURAL RESOURCES OF THE BALTIC SEA, 1980
PART A-1: OVERALL CONCLUSIONS
PART A-2: SUMMARY OF RESULTS
PART B: SCIENTIFIC MATERIAL (1981)
- No. 6 WORKSHOP ON THE ANALYSIS OF HYDROCARBONS IN SEAWATER
Institut für Meereskunde an der Universität Kiel,
Department of Marine Chemistry, March 23 - April 3, 1981
(1982)
- No. 7 ACTIVITIES OF THE COMMISSION 1981
- Report of the activities of the Baltic Marine Environment Protection Commission during 1981 including the Third Meeting of the Commission held in Helsinki 16-19 February 1982
- HELCOM Recommendations passed during 1981 and 1982 (1982)
- No. 8 ACTIVITIES OF THE COMMISSION 1982
- Report of the activities of the Baltic Marine Environment Protection Commission during 1982 including the Fourth Meeting of the Commission held in Helsinki 1-3 February 1983
- HELCOM Recommendations passed during 1982 and 1983 (1983)

* out of print

- No. 9 SECOND BIOLOGICAL INTERCALIBRATION WORKSHOP
Marine Pollution Laboratory and Marine Division of the
National Agency of Environmental Protection, Denmark,
August 17-20, 1982, Rønne, Denmark
(1983)
- No. 10 TEN YEARS AFTER THE SIGNING OF THE HELSINKI CONVENTION
National Statements by the Contracting Parties on the
Achievements in Implementing the Goals of the
Convention on the Protection of the Marine Environment
of the Baltic Sea Area
(1984)
- No. 11 STUDIES ON SHIP CASUALTIES IN THE BALTIC SEA 1979-1981
Helsinki University of Technology, Ship Hydrodynamics
Laboratory, Otaniemi, Finland
P. Tuovinen, V. Kostilainen and A. Hämäläinen
(1984)
- No. 12 GUIDELINES FOR THE BALTIC MONITORING PROGRAMME FOR THE
SECOND STAGE
(1984)
- No. 13 ACTIVITIES OF THE COMMISSION 1983
- Report of the activities of the Baltic Marine Envi-
ronment Protection Commission during 1983 including
the Fifth Meeting of the Commission held in Helsinki
13-16 March 1984
- HELCOM Recommendations passed during 1983 and 1984
(1984)
- No. 14 SEMINAR ON REVIEW OF PROGRESS MADE IN WATER PROTECTION
MEASURES
17-21 October 1983, Espoo, Finland
(1985)
- No. 15 ACTIVITIES OF THE COMMISSION 1984
- Report on the activities of the Baltic Marine Envi-
ronment Protection Commission during 1984 including
the Sixth Meeting of the Commission held in Helsinki
12-15 March 1985
- HELCOM Recommendations passed during 1984 and 1985
(1985)
- No. 16 WATER BALANCE OF THE BALTIC SEA
A Regional Cooperation Project of the Baltic Sea
States; International Summary Report
(1986)
- No. 17A FIRST PERIODIC ASSESSMENT OF THE STATE OF THE MARINE
ENVIRONMENT OF THE BALTIC SEA AREA, 1980-1985; GENERAL
CONCLUSIONS
(1986)
- No. 17B FIRST PERIODIC ASSESSMENT OF THE STATE OF THE MARINE
ENVIRONMENT OF THE BALTIC SEA AREA, 1980-1985;
BACKGROUND DOCUMENT
(1987)

- No. 18 ACTIVITIES OF THE COMMISSION 1985
- Report on the activities of the Baltic Marine Envi-
ronment Protection Commission during 1985 including
the Seventh Meeting of the Commission held in
Helsinki 11-14 February 1986
- HELCOM Recommendations passed during 1986
(1986)*
- No. 19 BALTIC SEA MONITORING SYMPOSIUM
Tallinn, USSR, 10-15 March 1986
(1986)
- No. 20 FIRST BALTIC SEA POLLUTION LOAD COMPILATION
(1987)*
- No. 21 SEMINAR ON REGULATIONS CONTAINED IN ANNEX II OF MARPOL
73/78 AND REGULATION 5 OF ANNEX IV OF THE HELSINKI
CONVENTION
National Swedish Administration of Shipping
and Navigation; 17-18 November 1986, Norrköping,
Sweden
(1987)
- No. 22 SEMINAR ON OIL POLLUTION QUESTIONS
19-20 November 1986, Norrköping, Sweden
(1987)
- No. 23 ACTIVITIES OF THE COMMISSION 1986
- Report on the activities of the Baltic Marine Envi-
ronment Protection Commission during 1986 including
the Eighth Meeting of the Commission held in
Helsinki 24-27 February 1987
- HELCOM Recommendations passed during 1987
(1987)*
- No. 24 PROGRESS REPORTS ON CADMIUM, MERCURY, COPPER AND ZINC
(1987)
- No. 25 SEMINAR ON WASTEWATER TREATMENT IN URBAN AREAS
7-9 September 1986, Visby, Sweden
(1987)
- No. 26 ACTIVITIES OF THE COMMISSION 1987
- Report on the activities of the Baltic Marine Envi-
ronment Protection Commission during 1987 including
the Ninth Meeting of the Commission held in Helsinki
15-19 February 1988
- HELCOM Recommendations passed during 1988
(1988)

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