BALTIC SEA ENVIRONMENT PROCEEDINGS

**No. 17 A**

# FIRST PERIODIC ASSESSMENT OF THE STATE OF THE MARINE ENVIRONMENT OF THE BALTIC SEA AREA, 1980-1985; GENERAL CONCLUSIONS

BALTIC MARINE ENVIRONMENT PROTECTION COMMISSION
– HELSINKI COMMISSION –

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# Preface

The Baltic Marine Enviroment Protection Commission - Helsinki Commission- on considering the Assessment of the Effects of Pollution on the Natural Resources of the Baltic Sea(published as Baltic Sea Environment Proceedings 5A and 5B,1981), during its second meeting of February 1981, decided to establish an ad hoc Group of Experts on the Assessment of the State of the Marine Environment of the Baltic Sea(GEA). At its third meeting held in February 1982, the Commission approved the action plan of the Group, as proposed by the Scientific-Technological Committee(STC),including the preparation of the First Periodic Assessment of the State of the Marine Environment of the Baltic Sea.

All the Baltic Sea States have participated in the work of the Group. The International Council for the Exploration of the Sea(ICES)has been represented by an observer. Mr.Julius Lassig of Finland has been the Chairman of the Group of Experts, and the Scientific Secretary of the Helsinki Commission has acted as Secretary of the Group:Mr.Evgeny Borisov up till 19 August 1984, and Ms. Terttu Melvasalo from that date onwards.

The General Conclusions are based on a scientific background document, which consists of individual chapters prepared by the Groups of Authors, all of whom are scientists from the various Baltic Sea States. Comments on the draft of the General Conclusions as submitted by the Baltic Sea States,with a view to its approval by the Helsinki Commission, also formed the basis of this report. In contrast, each chapter in the Scientific Background Document has been under the responsibility of individual authors, as indicated in the List of Conveners and Authors *of the Background Document (pp. 7-8 of this document). The Scientific Background Document is being published as No.* 17 *B in the Baltic Sea Environment Proceedings series.*

*The results presented by the Authors* are *based on data emerging from the Baltic Sea Monitoring Programme carried out since 1979 by all the Baltic Sea States, as well* as on *scientific literature and other relevant information. The initial assessment under the auspices of the Helsinki Commission entitled Assessment of the Effects of Pollution on the Natural Resources of the Baltic Sea,1980 (published as* Baltic. Sea *Environment Proceedings* 5A *and 5B),provided* the *source of comparison with the present document.*

*The Helsinki Commission approved the General Conclusions at its seventh meeting in February this year, and the document was finalized for printing by the Secretariat of the Commission. Technical* editorial *assistance has been provided by Ms.Filomenita* Mongaya *Høgsholm.*

*During* its *seventh meeting, the Commission extended its thanks to the Chairman of the Group of Experts(GEA) and it also expressed its gratitude to all scientists and other representatives from the Baltic Sea States who assisted in carrying out the project, and prepared the valuable results for the use of the Commission.*

# Conveners and Authors of the Background Document

The conclusions drawn in this document have been mainly based on the scientific results presented in the Background Document, the First Periodic Assessment of the State of the Marine Environment of the Baltic Sea Area, 1980-1985 (Baltic Sea Environment Proceedings, No. 17 B).

The Conveners and Authors of the various chapters of the Background Document are the following:

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# Summary

One of the observed signs of positive changes in the marine environment of the Baltic Sea during the past five years is, for example, the decrease in the concentrations of DDT in fish and birds, owing to effective measures carried out by the Baltic Sea States. Another is the general decrease of PCBs detected in certain areas. The metal concentrations in the open Baltic waters are comparatively low, taking into account the high fresh water content of these waters. This indicates that the effects of anthropogenic contribution to trace metal concentrations in the open Baltic Sea is not alarmingly high. Generally, the values of mercury in fish in the open Baltic Sea are comparable to "natural" levels in the central North Sea and the North Atlantic. No widespread negative effects of oil on biota was documented during the study period, although chronic accidental oil pollution has caused local damage to the ecosystem.

The main negative changes in the marine environment of the Baltic Sea observed in the present assessment are those concerning the trend towards increasing nutrient concentrations, contributing to more frequent oxygen depletion, and the occurence of hydrogen sulphide in deep parts of the Baltic Proper. In addition, exceptionally strong blooms of algae have occurred in the Kattegat and the Belt Sea. The blooms have caused depletion of oxygen in near-bottom waters, as well as mortality of bottom fauna in larger areas. Studies in the Northern and Central Baltic Proper, as well as in the Gulf of Finland and the Gulf of Bothnia, have not

revealed any clear changes in the open areas in spite of the clear nutrient accumulation in the Gulf of Finland. However, it is stated in the conclusions that the material available is still too scanty to give a reliable picture of changes in the pelagic community of the Baltic Sea.

In some areas,there is a close relationship between nutrient concentrations and salinity. In these areas the increase of nutrients is partially due to transport of deep water,rich in nutrients,to the surface. However, in the Gulf of Bothnia, Gulf of Finland, Kattegat and Belt Sea,no correlations between salinity and nutrients have been observed, and anthropogenic sources are suggested to be responsible for the increasing nutrient concentrations in the surface layers of these areas.

Since 1980, new information has been obtained in the Baltic Sea Area on the presence of "newly detected" contaminants in trace amounts, which are highly toxic, persistent and bioaccumulative compounds.

# Introduction

Due to concern over the pollution of the Baltic Sea, the Baltic Sea States signed the Convention on the Protection of the Marine Environment of the Baltic Sea Area in 1974. Among the duties of the Commission, as stated in the Convention are for example, to receive, process, summarize and disseminate relevant scientific, technological and statistical information in order to promote measures to protect the marine environment of the Baltic Sea Area. The Contracting Parties, thus undertake to support or contribute to programmes aimed at developing ways and means for the assessment of the nature and extent of pollution, pathways,exposures, risks and remedies in the Baltic Sea Area.

The present assessment of the state of the Baltic Sea is the third one in the history of the Commission. In 1977, a pre-study was prepared by the International Council for the Exploration of the Sea(ICES) as a background document for the joint monitoring programme(BMP). In 1978, the Interim Commission initiated a project to prepare an assessment in cooperation with ICES. The Commission approved the "Overall Conclusions" of the project at its meeting in 1981, and it later adopted HELCOM Recommendation 2/8 concerning the implications of the conclusions.The results were published in the Baltic Sea Environment Proceedings (5A,5B).

The present third assessment of the state of the Baltic Sea was prepared on the basis of the decision by the Commission at its third meeting in 1982. The Commission stated that periodic assessments would give a general view of the state of the marine environment of the Baltic Sea, and it would reflect the Commission's opinion in this regard. Periodic assessments should be made at suitable intervals on the basis of data obtained from the joint monitoring programme and other relevant sources.

In this document the general scientific results on the state of the Baltic Sea is presented in the following chapters: "General Conclusions" prepared on the basis of the Background Document, and "Changes observed in comparison with the Assessment 1980." Need for further research is considered in the chapter on "Action required."

In addition to the chapters bearing conclusions on the scientific results of the present assessment project, the problem identification as expressed in the earlier Assessment(l980) is compared with activities that the Commission has carried out during the just-concluded 5-year period(Annex 1).

# Changes observed in comparison with the Assessment in 1980

The findings from research and monitoring during the period 1980-1985 show apparent signs of eutrophication in the Baltic Sea. This calls for further action to reduce the input of nutrients from the Baltic Sea States. The findings, compared with the Assessment in 1980, are summarized as follows:

## Temperature, Salinity, Oxygen

Since the beginning of this century, overall trends of increasing salinity and temperature, and of decreasing oxygen concentration, have existed in the deep waters of the Baltic Proper. During 1979-1985, the hydrography of the Baltic Sea was characterized by a serious stagnation. During this period, the salinity and temperature of deep water, as well as the surface salinity, were decreasing and the decrease of oxygen concentration was particularly strong. At this stage, it is impossible to foresee whether the abovementioned overall trend still continues or not.

# Nutrients

The recent estimates of the total annual input of phosphorus (P) and nitrogen (N) into the Baltic Sea amount to 62 000 - 77 000 tons and 800 000 - 1 200 000 tons, respectively.

The increasing trend of both P and N, is demonstrated in all sub-regions of the Baltic Sea. The strongest increase has been found in the Gulf of Finland, the average annual increase being 0.03 µmol/l for phosphate and 0.07 µmol/l for nitrate. The lowest increase has been found in the Gulf of Bothnia.

The effects of certain chemical and biological processes, for example, denitrification and variations in the redox conditions near to the bottom, may render difficult the statistical evaluation of the detected variations in the deep water layer. Also, in certain areas, changes in the oxygen concentrations and water movements may cause remobilization of nutrients from sediments,thus increasing the deep-water concentrations. In spite of these uncertainties, statistically significant trends have been found in many areas.

The relative concentrations of phosphate and nitrate in different sub-areas show large variations.

# Trace Metals

Due to considerable improvement in analytical techniques, resulting in more consistent and accurate trace metal data for most marine media, reliable comparisons with data on concentration from the Assessment 1980 seems impossible. The more recent data indicate much lower concentration levels of trace metals,including some typical"anthropogenic metals", than previously believed to occur in open Baltic waters.

Comparing the more recent results with those obtained for surface waters of the North Atlantic Ocean and the central North Sea, and also taking into account the low salinity of the Baltic surface waters(i.e.the high freshwater fraction), it must be concluded that Baltic offshore waters show comparatively low trace metal concentrations, indicating that the anthropogenic impact on the water quality, with respect to trace metals, is not alarmingly high.

As regards sediments, the concentration ranges reported in the 1980 Assessment were confirmed for most of the elements. However, the data of the recent findings is much more consistent with respect to different sediment types. Results on the spatial distribution pattern of metals in sediments reveal distinct concentration maxima in special coastal areas, which must be attributed to discharges of industrial or municipal sewage. Trace metal enrichment in offshore regions, however,is no longer attributed exclusively to anthropogenic activities. Biogeochemical controls resulting -to a varying extent- in trace metal enrichment have to be considered. These control mechanisms are not yet fully understood.

Trace metal data for organisms is still not suitable to provide an analysis of regional or temporal trends.

# Organic Contaminants

As to the organic contaminants, there has been a significant decrease in the concentration of DDT and its metabolites in fish and birds from the Baltic Sea during the 1970s and 1980s. The reason for this is probably the ban on the use of DDT introduced by all the Baltic Sea States in the 1970s. There is, however, a slight increase observed in some areas after 1983, which has not yet been explained.

Heavy restrictions have been laid upon the use of PCBs by all Baltic Sea States. These actions have resulted in a general decrease in all areas from the mid-seventies onwards, except in the Bothnian Sea, where a steady-state situation exists. The latest information available indicate, however, a slight increase during the last year (1984/1985) probably due to airborne fallout.

Since 1980, more information on "newly detected contaminants" in the Baltic Sea has been obtained. This information shows the presence of such contaminants as polychlorinated camphenes (PCC, toxaphene), polychlorinated naphthalenes (PCNs), polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) in the Baltic biota, as well as chlorinated phenolic compounds.

# Oil

Estimates of the average petroleum hydrocarbon concentrations in water measured by ultraviolet fluorescence have given figures from 0.2 to 2.0 $\mu g\ dm^{-3}$ and show that there are no great variations in the vertical distribution of the hydrocarbon concentration in the waters of the open Baltic Sea.

While the previous estimate of the total input of petroleum hydrocarbons into the Baltic Sea was 50 000 - 100 000 tonnes per year,it is now suggested that the lower figure,that is, 50 000 tonnes per year, is more representative. However, estimates of atmospheric and land input are uncertain.

Oil spills in the Baltic Sea exert considerable local effects, depending on the location of the spills and the time of the year. Birds and coastal benthic communities are the parts of the ecosystem most seriously affected. Accidental discharges of petroleum hydrocarbons have shown that oil can drift long distances, decomposing only slightly, and causing severe pollution along coasts. By far, the major contribution to oil input to the Baltic Sea comes from long-term,low-level, land-based sources, for example,urban areas and oil refineries. Such accidental oil spillages and also chronic oil pollution has locally caused damage to the ecosystem.

## Pelagic Biology

The Assessment 1980 described the basic characteristics of the pelagic biological variables. However, the quantitative data available were not useful for comparisons. For the present assessment, older data have been compiled which showed that primary production rates and chlorophyll concentrations during the summer period were higher in 1980-1983 than in 1975-1978 in some parts of the Belt Sea and in the Arkona, Bornholm and eastern Gotland Seas.

Since 1980 exceptional blooms of plankton algae have occasionally occurred in the Kattegat and the Belt Sea area.

# Bottom Fauna

Bottom living animals are seriously affected by the depletion of oxygen in the near-bottom water layers. Temporary recolonization occurred in most of the previously depopulated areas of the Baltic Proper as a consequence of the 1975/1976 inflow of oxygen-rich water. The smaller inflow of 1979/1980 permitted the populations to increase temporarily in the southern part of the Baltic Sea. By 1983, the situation had again deteriorated to the level prevailing before the 1975/1976 inflow. In parts of the Belt Sea and the Kattegat, widespread mortality of bottom living animals due to oxygen depletion was observed for the first time in 1981.

National research programmes in the near-shore areas of the southern Bothnian Sea, the Åland Sea, the Baltic Proper, the Arkona Sea and Kiel Bay revealed an increase in the biomass of bottom-living animals compared with samples from the first decades of this century,up to 1965. Eutrophication is suggested to be the reason.

# Micro-organisms

Investigations on the uptake of different nutrients by bacteria, as well as on their role in self-purification processes, have been carried out. Such studies have, however, been areally restricted and the results cannot hold for the entire Baltic Sea.

Results for total number and biomass of micro-organisms obtained during an expedition to the South and Central parts of the Baltic Sea in 1982 were higher than those from an expedition in 1979. However, the data are still not sufficient from which to identify any trend. Although research activities in the field of microbiology have been increased in the Baltic Sea during the last decade, no monitoring has been carried out in the open sea areas on a routine basis.

The available information on the micro-organisms of the Baltic Sea is, thus, still rather scattered and does not, at this stage, provide a basis for a statistical identification of trends.

# General Conclusions on the basis of the Background Document

## Hydrography

The hydrography during 1979-1984 in the Baltic Sea was characterized by a stagnant period in the Eastern Gotland Basin since the inflows of salt- and oxygen-rich water into the Baltic Sea in 1975 and 1976. These large inflows, intensive enough to reach the central basins of the Baltic Sea, increased the density of the deep water, and improved the oxygen conditions in 1977 in the central Baltic Sea basins. After that, and despite the large variations of the sea level and Baltic Sea volume during the winters of 1983 and 1984, no such intensive inflows occurred, and the stagnation period has prevailed in the Eastern Gotland Basin since 1977.

During this period in the Eastern Gotland Basin

- the salinity and density have decreased beneath the permanent halocline,
- the depth of the halocline has descended, and
- the decrease in the deep-water oxygen concentration has been particularly strong.

At a depth of 200 m, hydrogen sulphide has been observed again since 1978 in the Gotland Deep, and the concentrations currently being measured are the highest ever observed at that depth. During the last three years, hydrogen sulphide has frequently been observed below 130-150 m in the central basins, sometimes up to 80 m in the Northern Gotland Basin. In the Kattegat and the Belt Sea Area, strong oxygen deficit was observed in the near-bottom water in late summer of 1981 and 1983. In September 1981, hydrogen sulphide was observed in the bottom water of Kiel Bight, Fehmarn Belt, Lübeck Bight and Mecklenburg Bight.

Generally during the period concerned, anoxic conditions were observed in near-bottom waters in the deepest basins in the Baltic Sea. From 1980 to 1982,the area1 extent with anoxic conditions was approximately as large as during the worst years at the turn of the decade from the sixties to the seventies.

Aside from deep water salinity, surface salinity has also been decreasing, except in the Gulf of Bothnia. This is owing to the fact that large and intensive inflows have occurred during the last ten years.

Long-term variations in some variables in the Baltic Sea hydrography indicate a close connection between climatological and hydrological variations and changes. These include a close air-sea coupling which can be seen for example, in air and water temperatures, and in the amelioration of ice conditions, corresponding to the general atmospheric heating during the last century. As to salinity, the fresh water run-off from rivers, in addition to the water exchange between the Baltic Sea and the North Sea, plays a central role in long-term salinity variations.

# Nutrients

Nutrients that are being discussed here are the inorganic and organic phosphorus and nitrogen compounds. Soluble inorganic silicate is of less significance for primary production in the Baltic Sea because of its relatively high concentrations, except in the Kattegat area.

## Mass balances

Mass balances of different origins revealed an annual gross input of 62 000 to 77 000 t phosphorus, and 800 000 to 1 200 000 t nitrogen and an annual net supply of 26 000 to 55 000 phosphorus and about 53 000 t nitrogen into the Baltic Sea. These figures are only rough estimates because quantitative statements are uncertain for some sources and sinks.

## Trends in the winter surface layer

The winter pool of nitrate or inorganic nitrogen compounds ($NO_3^- + NO_2^- + NH_4^+$) in the surface layer has increased significantly in all sub-regions of the Baltic Sea Area in recent decades. Phosphate or total phosphorus also increased,in general, in this layer except in the Gulf of Riga and in the Bothnian Bay.The overall trend of phosphate in this layer was interrupted by a period with a decreasing or steady tendency between 1976 and 1980 in the Baltic Proper, the Belt Sea and the Kattegat.

The long-term increase of nutrients was strongest in the Gulf of Finland, where it is characterized by an increase of roughly 0.05 $\mu mol/dm^3 \cdot a$ for phosphate, 0.07 $\mu mol/dm^3 \cdot a$ for nitrate, and lowest in the Gulf of Bothnia,where increases of 0.002 - 0.022 $\mu mol/dm^3.a$ for total phosphorus, and 0.07 to 0.18 $\mu mol/dm^3.a$ for nitrate, were found on the basis of values for the whole year.

## Trends in the deep and near-bottom water layers

It is more difficult to identify nutrient trends in the deep and near-bottom waters than in the winter surface layer because the concentrations of phosphorus and nitrogen compounds are influenced by dynamic processes in the Arkona Sea and the Transition Area. Phosphate liberation from the sediments and denitrification partly mask nutrient trends in anoxic deepandnear-bottom waters of the central Baltic basins. As a result, statistically significant increases have been found in recent decades, particularly in oxic deep and near-bottom waters as follows:

- Kattegat (>30 m) and Belt Sea (≥20 m) for inorganic nitrogen compounds and partly for total phosphorus,
- Gotland Sea (100 m) for nitrate (up to 1978 only), and for phosphate,
- Gdansk Deep (80 m) for nitrate and phosphate,
- Åland Sea (200 m) and Bothnian Sea (100 m) for nitrate, phosphate and total phosphorus,
- Bothnian Bay (100 m), and Gulf of Finland (70 m), and Gulf of Riga for nitrate only.

Significant increases of up to 0.075 $\mu mol/dm^3.a$ for phosphate (Gotland Deep) and 0.151 $\mu mol/dm^3.a$ for total phosphorus (Great Belt) were calculated. The nitrate trends in the oxic deep water (100 m) of the Gotland Sea were negative in the period 1978-1982. They range between +1.095 and -1.068 $\mu mol/dm^3.a$ in this layer during the period 1968-1982.

## Nutrient concentrations and salinity

Close correlations between nutrient concentrations and salinity(density) were found in the winter surface layer of the Baltic Proper including Gdansk Bay, thus indicating a growing upward transport of deep water rich in phosphate, nitrate and salt. This process,which is probably linked with the water exchange through the entrances of the Baltic Sea, accelerates remobilization of nutrients,increasingly accumulating in the deep water, as a consequence of land-based discharges and airborne depositions. Since no correlations exist between salinity and nutrients in the Gulf of Bothnia and the Gulf of Finland, and in the Kattegat and the Belt Sea,anthropogenic sources seem to be directly responsible for the increasing nutrient concentrations in the surface layers of these areas.

## Problem areas

Regardless of whether pollution or natural causes predominate, the rapid nutrient increase is becoming a serious problem in the Baltic Sea Area.One consequence expected is increasing biological production, including fish. Another consequence is the more frequent occurrence of oxygen deficits and hydrogen sulphide in the deep or near-bottom waters of the central and western parts of the Baltic Sea Area because increasing amounts of dead organic material must be microbially decomposed. This process consumes oxygen, and thus restricts the living space of fish and other aerobic organisms.

Microbial denitrification probably balances the supply of nitrogen compounds to the Baltic Proper to a certain extent, whereas for phosphate decrease, there is no comparable process other than sedimentation. Phosphate is thus insufficiently eliminated from the biogeochemical cycle. In areas without oxygen depletion, in the deep and near-bottom waters, denitrification is restricted to the sediment,and therefore nitrogen compounds become of increasing significance(i.e. the Kattegat and Belt Sea).

# Harmful Substances

## *Trace Metals*

### Trace metals in water

The description of the advances are mainly restricted to open Baltic stations; firstly because positions are more or less standardized (for example BY-Stations), thereby providing a good possibility for intercomparison of data; and secondly, because available reports from coastal regions are rather limited and mostly without any description of the hydrochemical parameters.

PROGRESS: CONCENTRATION LEVELS

Concentration levels throughout the Baltic have been reviewed for the elements Al, As, Cd, Co, Cr, Cu, Fe, Ge, Hg, Mn, Mo, Ni, Pb, Sb, Sn, U, V, and Zn. When the Baltic surface water values of some typical "anthropogenic metals" are compared with those of the adjacent regions, an increase is evident for Cd, Cu or Ni, in relation to the open North Sea and North Atlantic waters by factors of about 2 to 3 and 5 to 10, respectively.

The Hg levels are nearly identical, and Pb shows only slightly'elevated concentrations for the Baltic.

Considering these results, and taking also into account the relatively high fresh water fraction of the Baltic Sea, it must be concluded that Baltic offshore waters show comparatively low trace metal concentrations,thus indicating the anthropogenic impact on the water quality not to be alarmingly high.

DISTRIBUTION

Considerable progress for a number of metals has been made with respect to their types of distribution. Several elements reveal conservative behaviour when plotted against salinity. The elements U and Mo show a close positive linear relationship with salinity (horizontally and vertically throughout the Baltic), while for the Cd, Cu and Ni concentrations, a significant decrease with increasing salinities is observed for surface waters between the Bothnian Bay and central North Sea. Nutrient-type profiles(exhibiting surface depletion and enrichment at depth)are only observed,so far, for inorganic Ge (Ge $(OH_4)$)which is closely correlated to silica. Missing evidence for other "nutrient-type elements" is probably owing to relatively high metal background concentrations and rather low depths of the water column.

In areas with stagnant(anoxic) conditions,considerable gradients have been established in the profiles of dissolved As(III),Cd, Co, Cr, Cu, Fe, Mn or Sb(III), with observed maximum concentration changes across the $O_2$- $H_2S$ interface by factors of $\geq$ 100. There is a growing but incomplete understanding in predicting the metal concentrations in the sulfide-containing waters by thermodynamically oriented models.

# Trace metals in suspended particulate material

The assessment shows quite obviously that a wide scatter exists on the amount of suspended particulate matter(SPM) in Baltic waters. This variance seems to be mainly caused by two independent factors: firstly, by strong natural variabilities, in space and time (seasonal variations, variations with depth,or effects by erosion and resuspension processes); and secondly, by the use of different techniques in the collection of material as,for example, filter type, storage time before filtration, washing procedure,etc. The following statements should be drawn.

PROGRESS

For elements like Cd, Cu, Ni and Zn, the SPM concentrations of most samples contribute less than 20 % to the total metal concentrations, whereas for Al, Fe or Pb,the particulate forms predominate. An approximate order -with decreasing particulate fraction- can be formulated as:

Al-Fe-Pb-Co-Cu-Cd-Zn-Ni.

The particulate trace metal content for investigated elements in Baltic waters is significantly higher than in the adjacent areas by factors of between 3 and 10, and by 10 to > 200 for the North Sea and Northeast Atlantic waters, respectively. This demonstrates the load of resuspended,remobilized (from anoxic sediments) and land-derived inorganic matter on the distribution of elements such as Al, Fe, Mn or Co, and also the anthropogenic influence on the PTM levels of metals like Cu, Pb or Zn.

There is general agreement in the reviewed literature that about 50% of the Baltic suspended particulate matter

(SPM) consists of organic material. However, it is only for some metals that preliminary conclusions can be drawn, with respect to their SPM concentrations. Average values from recent investigations show the following "typical" Baltic concentrations: 1.5% Fe; 0.15% Mn; 120 $\mu g\ g^{-1}$ Pb; 70 $\mu g\ g^{-1}$ Cu; 20 $\mu g\ g^{-1}$ Ni; 6 $\mu g\ g^{-1}$ Co, and 2.5 $\mu g\ g^{-1}$ Cd.

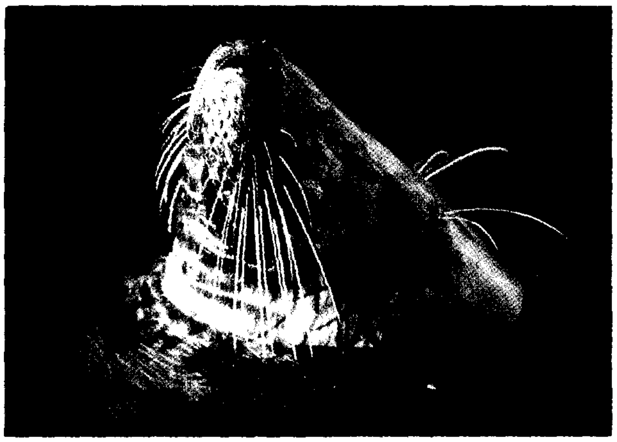
## Trace metals in sediments

In most of the reviewed investigations, emphasis was given to the upper layers (O-20 cm) and to the analysis of elements such as Hg, Cd, Pb, Cu, Zn, Cr, Ni, Co, Fe and Mn.

PROGRESS

Generally, the concentration ranges reported in the 1980 Assessment were confirmed for most of the elements. However, the data of the recent findings are much more consistent with respect to the different sediment types and applied analytical methods ( i.e. decomposition procedures).

Results on the spatial distribution pattern of metals in the surface sediments reveal distinct concentration maxima in special coastal areas, which must be attributed to the discharge of industrial and municipal sewages. Trace metal enrichments in offshore regions, however, are no longer exclusively attributed to anthropogenic activities. At least three other major controlling factors have to be considered when metal contents in Baltic sediments are discussed; namely the particle size composition, the organic matter content (several metals are positively correlated with this parameter), and the redox conditions at the sediment/water interface (resulting in remobilization, precipitation or

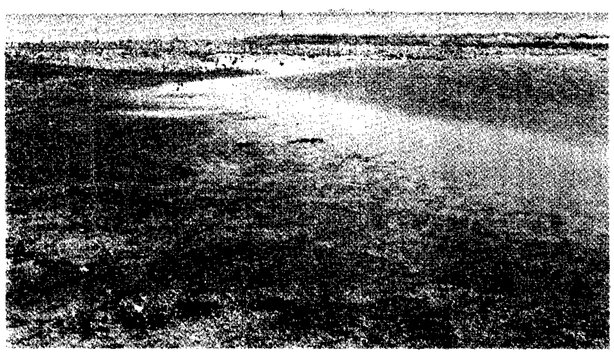


Smile of a grey seal.
Photo: Pekka Eriksson

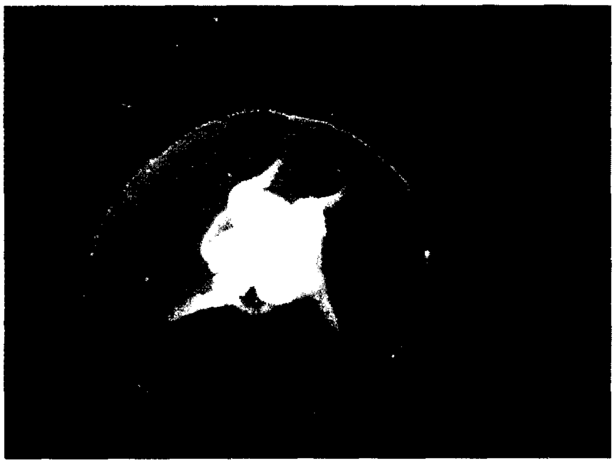
Plankton sampling in April,
Bothnian Bay.
Photo: Pentti Kangas

Hensen phytoplankton net in
use in the Belt Sea.
Photo: Gunni Ærtebjerg

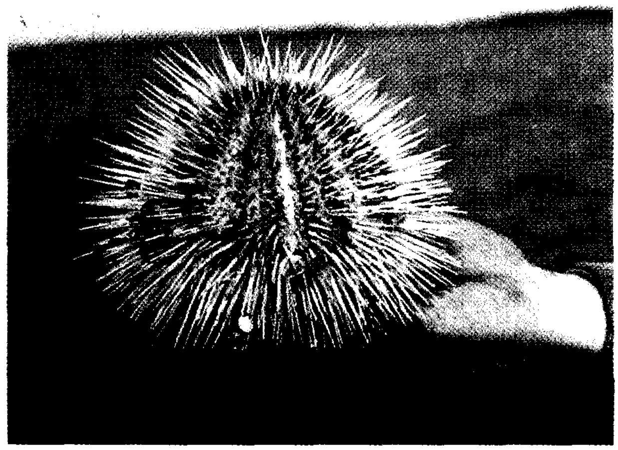
Winter fishing in the Quark
Photo: Curt Nyman



Purple sulphur bacteriae on seaweed in
sheltered bay.Saltholm.Gunni Ærtebjerg



Jelly fish, *Aurelia aurita*
NE Kattegat
Jan Damgaard



Sea urchin, *Echinus esculentus*
NE Kattegat
Holger Knudsen

Sea anemone, *Metridium dianthus*
NE Kattegat
Jan Damgaard

*Hyas araneus* and *Echinus esculentus*
on lobster pot, The Sound
Jan Damgaard

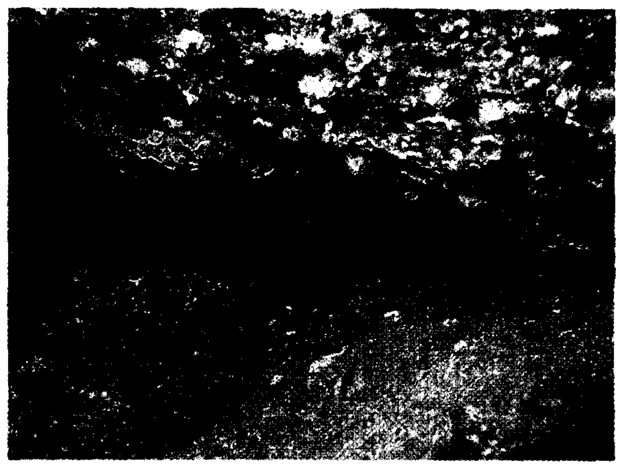
Winter fishing in the Quark
Photo: Curt Nyman

Purple sulphur bacteriae on seaweed in sheltered bay. Saltholm. Gunni Ærtebjerg

Brush worm, *Sabella sp.*
The Sound
Photo: Holger Knudsen

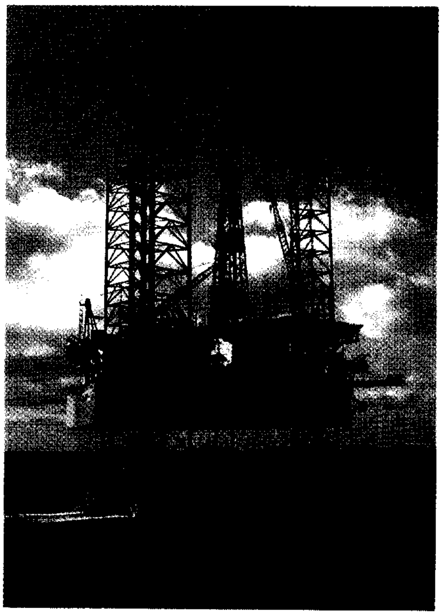
*Alconium digitatum,* on stone.
NE Kattegat
Photo: Jan Damgaard

Starfish, *dsterias* rubens,feeding on blue mussel, *Mytilus edulis.*
Photo: Jan Damgaard



Labrus ossifagus on sea bottom.
NE Kattegat
Photo: Jan Damgaard

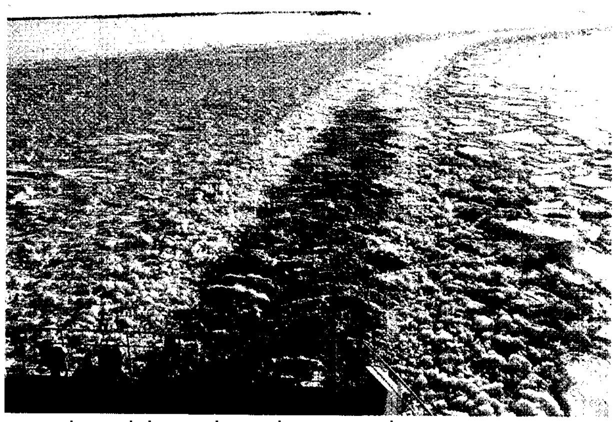
Green algae, *Cladophora sp.* growing on stones, The Sound off Saltholm.
Photo: Gunni Ærtebjerg



*Eider duck, Somateria mollissima.*
*Photo:* Seppo Keränen

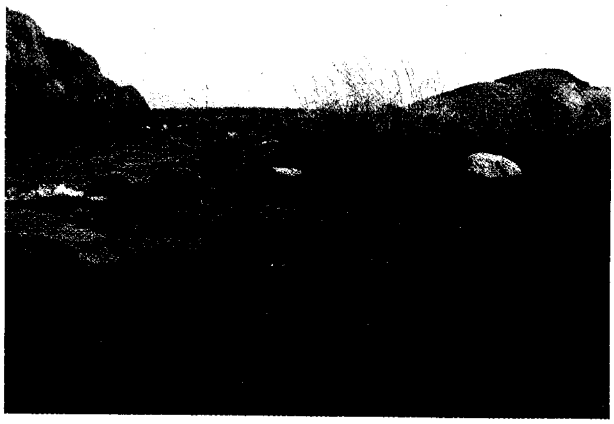
Drilling platform, *Dyvi Epsilon,* Western Baltic.
Photo: Birger Kruse

Typical stony shores in the Quark.
Oil in stones is a threat to birds.
Photo: Curt Nyman



Ice-breaking in the Quark.
Photo: Pertti Sevola

Phytal research, Utö.
Photo: Hilkka Autio



Bladder wrack cast ashore in autumn
Photo: Pentti Kangas

co-precipitation processes for a number of elements).

There are growing activities on the investigation of segmented and dated sediment cores throughout the Baltic.A major result of these studies is the growing awareness of the fact that significant metal fractions undergo post-depositional processes which are probably mainly controlled by the position and gradient of the "redoxcline" (the conversion point between oxic and anoxic conditions), and which are believed to be partly responsible for the observed trace metal maxima in the sediment cores.

## Trace metals in biota

A great weakness of the data is the missing information on the physiological variables for most species, which would possibly limit the variation in residue concentrations being caused by differences in the sample material. Additionally, in spite of intercalibration programmes, methodological problems still seem to exist in Baltic laboratories (especially for low Cd and Pb concentrations). The possibility,therefore, of differences being caused by analytical discrepancies cannot be ruled out. In spite of these reservations, some general statements can be made,nevertheless.

PROGRESS

*Mercury*

The results tend to confirm that the Hg content in fish muscle -herring and cod- is generally low, at about 0.03 mg/kg wet weight, except in some parts of the southern Bothnian Sea, the eastern Gulf of Finland and the Kattegat area(Fladen). Elevated concentrations have been also found in flounders and blue mussels from the Sound, and in blue mussels from the Gulf of Riga.

Generally, the open Baltic Sea fish values are comparable to "natural" levels in the central North Sea and North Atlantic.

### *Cadmium*

The muscle tissue of Baltic fish shows for most samples Cd values of <0.02 mg/kg wet weight, in comparison to accepted "natural" marine levels of 0.00x g/kg. The fish liver concentrations are generally higher, however, and highly scattered,indicating analytical problems probably. Blue mussels and Macoma baltica show elevated concentrations only in western Baltic coastal areas, with about 6 mg/kg dry weight in Fehmarn Sound and Lübeck Bay.

### *Lead*

Similar to the findings of Cd, the Pb values show rather large variations in both fish muscle and liver tissues, thereby not allowing any conclusions on regional and temporal tendencies ( values range from < 0.01 to about 1.0 mg/kg). The same is true for blue mussels and for Macoma baltica, which vary from 1 to 13, and 1 to 4 mg/kg dry weight, respectively.

### *Copper*

The Cu concentrations in fish muscle are generally below 1 mg/kg wet weight (similar to the North Atlantic), with little variations regardless of the source and the species of the fish. Values in the liver are considerably higher (about one order of magnitude) showing greater variance, but without any clear tendencies. The Cu levels in the blue mussels -about 8 mg/kg dry wet weight for Kattegat, the Sound and the Southern Baltic- are similar to the North Sea concentrations.

### Zinc

The average results of Zn in fish muscle are generally lower than 10 mg/kg wet weight ( range is 1.6 to 27 mg/kg) without distinct regional differences. These results are similar to available North Sea values. The liver values in cod and herring seem to be slightly higher. Evidence for sex-dependent Zn concentrations in the liver of flounders has been found in Danish waters. The Zn concentrations in mussels vary by factors of about 3 to 6, with ranges of 64 to 181 and 81 to 531 mg/kg dry weight for blue mussels and Macoma baltica, respectively, but without distinct tendencies.

As copper and zinc are physiologically regulated in the muscle tissue of fish and in mussels, it is questionable whether their concentrations reflect the environmental conditions, and whether these elements should be measured in muscle tissues of fish and in mussels for monitoring purposes.

## *Organic Substances*

### Chlorinated hydrocarbons

#### *DDT*

Significant decrease in the concentration level of DDT and its metabolites in the Baltic waters has been observed during the first step of the Baltic Monitoring Programme owing to the total ban on the use of DDT enacted by all Baltic countries in the 1970s. This decrease is followed by an evident decline -by about one order of magnitude- of DDT residue in guillemot eggs and fish soft tissues(herring and sprat muscle, cod liver). There is no evidence of any trends in the content of DDT in suspended matter and in living organisms from the lower trophic levels.owing to the lack of relevant data sets.

#### *PCBS*

Substantial difficulties in establishing trends for PCB in the marine environment owing to the poor comparability amongst laboratories are well recognized. The situation has, however, improved and the coefficient of variation in intercomparison studies has decreased, as analytical techniques have been more elaborate, although not yet to an extent where an assessment based on values from different sources is possible. Experienced analysts are, on the other hand, able to produce reliable data for trend monitoring purposes provided that only one laboratory is involved in the study concerned. Such spatial trends have been pronounced for the Baltic by a few authors and seem to be generally accepted. Time trends are less well documented, but at least two studies show statistically a significant decrease of PCB in the Baltic biota from several areas.

It is quite possible that some chlorinated organic compounds which behave similarly to PCBs( for example PCTs),in the course of common analytical procedures, contribute to the peaks recorded by GC, and might be misinterpreted and thus calculated as apparent PCB contents.

## Petroleum hydrocarbons

The Baltic Sea is sensitive to oil spillages, as well as to chronic oil pollution. This is because of its specific hydrographic features, including low temperature and the presence of ice in winter. At the same time, the probability of oil pollution is also high because of intensive shipping and the heavy industrialization of the Baltic Sea States.

Total input of petroleum hydrocarbons into the Baltic Sea is estimated to be 50 000 tonnes per year, but atmospheric input is unknown, and estimates of land input are uncertain.

The average concentrations of petroleum hydrocarbons in Baltic water, measured by UVF, are within the range from

0.2 to 2.0 ,ug $dm^{-3}$. Furthermore, there are no great variations in the total hydrocarbon concentration in the whole water column in the open Baltic.

It is not yet possible to document any widespread negative effects of petroleum hydrocarbons on biota in the Baltic Sea.

More studies are required on the concentration of petroleum hydrocarbons in sediments and biota, and specially on the polynuclear aromatic hydrocarbons (PAH) fraction.

Oil spillages in the Baltic Sea exert considerable local effects depending on the location of the spillage and the time of the year. Birds and coastal benthic communities are the worst affected parts of the ecosystem. Accidental discharges of petroleum hydrocarbons have shown that oil can drift long distances, decomposing only slightly, and causes severe pollution along coasts.

Chronic oil pollution, for example from oil refineries, has caused local damage to benthic communities. Improved water protection measures have resulted in the restoration of bottom fauna.

In order to set up realistic budgets and balances for petroleum hydrocarbons, more information is needed on their occurrence in all compartments of the Baltic Sea, especially in those areas affected by chronic oil input.

More efforts should be exerted in order to develop specific, accurate and relatively simple analytical methods in order to determine the most persistent and toxic individuals and groups of compounds originating from oil.

# »Newly Detected Contaminants«

Human activities are responsible for the introduction into the Baltic Sea of many harmful synthetic organic chemicals. Apart from the best known ( for example DDT, PCBs), the presence of other organic compounds has been documented: polychlorinated terphenyls (PCTs),chlordanes, toxaphene (PCCs) ,halogenated paraffins, lindane (HCH), hexachlorobenzene (HCB),hexachloro-cyclohexane,phthalic acid esters (PAE),polychlorinated naphthalenes (PCNs), chlorophenols, polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and others. Most of these substances appear to be highly toxic,bioaccumulating and persistent.

Most of these "newly detected contaminants" are complex organic mixtures which require sophisticated equipment, and highly experienced chemists to perform the analyses. A serious problem in terms of the study of these "newly detected contaminants" in the marine environment,is that today there are only a few such specialists who could perform the necessary analyses properly.

There is an evident lack of information on cycling and the fate of these "newly detected contaminants" in the Baltic Sea.

The "newly detected contaminants" are mainly chlorinated organic compounds. From the analytical standpoint, many of them behave similarly to PCBs (PCCs,etc.), so that it is very difficult to separate and identify them. This could be one of the reasons for the limited number of authors reporting a PCB decrease.

More restrictions are required on the further release of synthetic organic chemicals used on a large scale.

# Pelagic Biology

It is agreed that the observed overall trend in increasing nutrient concentrations being observed since 1969 will primarily affect the spring phytoplankton bloom. However, the effect on the spring bloom is masked by inadequate observation frequency.

## Information available: Baltic Proper and Kattegat

**New** data and a re-evaluation of older data, nevertheless, show clear signs of eutrophication if only the more stable summer period is considered. Danish measurements show an increase in the mean summer production in most parts of the Kattegat, in the Sound and in the Belt Sea from 1976 to 1981. Data supplied by the German Democratic Republic show higher concentrations of chlorophyll, and a higher level of primary production;possibly, the same holds for zooplankton in some areas of the Belt Sea,Arkona,Bornholm and eastern Gotland Sea, if mean summer values for the period 1975-1978 are compared with the period 1980-1983. Increasing zooplankton biomasses for the period 1951-1969 are shown by Polish studies. However, later studies do not show any clear trends. Studies in the Northern and Central Baltic Proper show no clear changes in the species composition and dynamics in comparison with earlier investigations. Some scientists are of the opinion that the species composition and biomass of phytoplankton indicate eutrophication in the southern part of the Baltic Proper.

In the Kattegat and some parts of the Belt Sea,exceptionally strong blooms of red-tide algae such as Gyrodinium aureolum, Prorocentrum minimum and Ceratium species have occurred. These blooms have caused depletion of oxygen in near-bottom waters, and indicate a large-scale disturbance of the marine ecosystem. Gyrodinium aureolum and Prorocentrum minimum occurred for the first time in this area in 1981. tiyrodinium aureolum is toxic to fish and invertebrates.

## Gulf of Finland

In the open Gulf of Finland, no clear changes were found in the phytoplankton, indicating an increase in the trophic degree in the late 1970s. However, changes in the phyto-plankton composition connected to the increase in salinity and/or nutrients were observed. The same is valid for the Archipelago Sea.

## Gulf of Bothnia

The recently published literature does not show clear changes in comparison to earlier investigations of the phytoplankton occurrence in the Gulf of Bothnia. The compilation of phytoplankton and chlorophyll data, collected within the Baltic Monitoring Programme(BMP) during 1979-1983 does not show significant changes during the monitoring period, or when compared with chlorophyll values from 1969-1975. Long-term studies on zooplankton in the open area of the Bothnian Sea in 1969-1983, reveal a slightly increasing trend in abundances. This increase could be related to the increased salinity of the area and does not necessarily mean increased zooplankton production.

## Information contradiction

The conclusions presented here are primarily based on published papers and synthesis of data compiled by the different countries of the Baltic. At the present stage, the BMP material available is too scanty to give a reliable picture of changes in the pelagic community of the Baltic. The low sampling frequency and the uneven coverage of the biological year limit the possibility to detect trends. Owing to methodological differences, it is still very difficult to make reliable comparisons with older material, and with results originating from different laboratories.

It has not been possible to use the common data base of the BMP, since the coding of the biological variables has not yet been completed. This is a necessary condition for a computer-based analysis of the rapidly increasing numbers of biological data collected within the BMP programme.

## Zoobenthos

In the first half of this century, the deeper parts of the Baltic Proper were inhabited by macrofauna communities, consisting usually of at least 5 species from Bivalvia, Crustacea, Polychaeta and some other taxonomic units. Later on, this situation changed radically, as a result of oxygen deficiency. A large area of the Gotland Basin has been a macrobenthos desert since the mid-fifties.This desert often stretched south to include the deeper part of the Bornholm Basin and the Bay of Gdansk. Periods of temporarily improved environmental conditions are marked by the occurrence of a poor bottom community, generally represented by the hemipelagic species, Harmothoe, and sometimes by a few other polychaetes.

The last inflow of high saline water which brought oxygen into the deep parts of the Baltic occurred in 1975/1976, four years before the Baltic Monitoring Programme started.

But the deep areas of the Western Gotland Basin (Station BY 38), the most unfavourable part of the Baltic with regard to oxygen conditions, was not influenced, and no macrofauna has been found during the monitoring period. At Station BY 28 in the northern part of the Baltic Proper there was just a short recolonization by the polychaet Harmothoe, but this population disappeared already after 1979. A slight improvement was also detected in the Gdansk Deep (Station P1) in 1978.

A smaller inflow of high saline water apparently occurred in winter 1979/1980, which affected the southern part of the Baltic Proper. At Station BCS III-JO, biomass and abundance of the macrofauna increased drastically in 1980, but dropped to very low figures from 1982 onwards. For Station BY 5 (Bornholm Deep), the situation was similar.

In the Arkona Sea (Stations BY1 and BY2) in 1980, the situation was typical for an inflow of salt- and oxygen-rich water, which provided favourable conditions for the development of the macrozoobenthos. High species number, biomass and abundance were observed, four polychaeta species appeared which had not been recorded in the preceding years. The biomass ,however, decreased considerably during the subsequent years, caused by oxygen deficiency.

There were no apparent trends in 1978-1983 in the BMP stations in the Gulf of Finland and the Gulf of Bothnia. However, oxygen deficiency in near-bottom waters below the halocline was observed in national monitoring programmes in various regions of Mecklenburg Bay, Kiel Bay, the Danish Belt Sea and the southern Kattegat, with subsequent mortality of large parts of the bottom fauna.

National research programmes in near-shore areas of the southern Bothnian Sea, the Åland Sea, the Baltic Proper, the Arkona Sea and Kiel Bay revealed an increase of macrofauna biomass compared with samples from the early decades of this century up to 1965. Eutrophication is supposed to be the reason.

In recipient areas along the shores of the Baltic Sea, the situation differs. Unfortunately, there are areas practically devoid of macrofauna because of pollution. But there are examples, too, that waste water treatment has led to recolonization of damaged zones and to increased benthic diversity.

## Microbiology

microbiological indices have not been as yet included in the Baltic Monitoring Programme. As monitoring should always be preceded by basic research, an optimal monitoring programme can be developed only on the basis of the results of such initial investigations.

Scientific information on the bacterial population of the open Baltic Sea has been obtained during complex ecological Soviet-Swedish investigations in 1976, 1978, 1979 and 1982. Although a slight increase in the average values of the total number and biomass of micro-organisms in some areas has been indicated from 1979 to 1982, these data are far from sufficient to identify trends in numbers, biomass, and physiological activities of micro-organisms in the Baltic Sea. In 1982 the average value of the production/ biomass ratio for bacterioplankton in the open sea was equal to 2.2, which is indicative of significant activity of microbiocenoses.

Some additional data on populations, their composition and distribution have been provided by research institutes of the Baltic Sea States. These relate to separate coastal areas and bays, and the data allow interpretations on the level of contamination in the separate areas of the Baltic Sea. However, they are not fully comparable owing to the use of different parameters and methods.

In addition, some research work has been carried out on the uptake of different nutrients by bacteria, as well as their role in processes of self-purification. These studies are, however, restricted to small areas, and it is not possible to extrapolate the results to a larger area or the whole Baltic Sea, at present.

# Action Required

## Hydrography

The following actions are needed in the research:

- Intensifying of investigations in the straits area (Kattegat, the Belt and the Sound,the Åland Sea area, the Northern Quarck area), with respect to the exchange processes between the different sea areas.

- Intensifying of investigations of the water exchange, stagnation, and renewal processes in the Baltic deep basins.

- Giving further attention to studies, and understanding of the interaction and variations between atmospheric and oceanographic phenomena. This is relevant for example for further understanding of the exchange and renewal of Baltic waters, as well as for recognizing the observed signs and predicted changes especially in the global atmosphere, respectively.

## Nutrients

Efforts should be further continued to reduce the nutrient load and thus the eutrophication of the Baltic Sea Area. Simultaneously, high priority should be given to studies mentioned below:

- Long-term variations and mass balances of nutrients in connection with eutrophication,

- Exchange of nutrients between sea water and atmosphere, sediments and organisms, and across the halocline, as well as inputs from rivers and other land-based sources,

- Exchange of nutrients between the North Sea and the Baltic Sea,

- Transfer of nutrients between the different links of the food web,

- Small- and meso-scale inhomogeneities in nutrient distributions in space and time (patchiness).

## Trace Metals

The following actions are needed:

- Surveys on the concentration and types of distribution in water should be continued, with emphasis on coastal zones, and extended to the "rest" of elements,

- Speciation studies on different chemical forms should be intensified,

- High priority should be given to themeasurement of trace metal fluxes -the determination of the rates of inputs and sinks- with emphasis on atmospheric deposition and river discharges,

- Studies on the suspended particulate material should be intensified with regard to its origin, properties and fate,

- More efforts should be made on the fraction and distribution of metals in the highly abundant organic and/or inorganic colloidal material in Baltic waters,

- Investigations on sediments should be primarily oriented for further information on the pollution history, on processes related to the early diagenis of deposited material, and on sediment-related budgets and balances of metals,

- There is a strong need for the analysis of further biological material, with a report on as many biological parameters as soon as possible,

- There is a further need for standardization and intercomparisons with respect to the sampling and anaylsis of suspended particulate and biota material.

## Chlorinated Hydrocarbons

There is a need for the following actions:

- Selection and measurements of single PCB compounds should be recommended in order to understand the impact of PCBs in biota, their pathways and temporal changes in the Baltic ecosystem.

- The detailed input data are practically not available within the Baltic Sea Area. Permanent input of PCBs through the atmosphere (for instance effluents) and via water courses (and run-off) is still possible. The tracing of PCB sources should be recommended in the frame of the monitoring programme.

- To set up a reliable budget for the organochlorines as typical anthropogenic contaminants,the systematic measurements of their content in run-off, fall-out, and in different compartments of the Baltic ecosystem are necessary,at least to the same extent as a realistic evaluation of the masses of the contaminated materials.

- After the ban on the use of DDT and the restrictions on the use of PCB in the Baltic Sea, other halogenated organic compounds have been identified. They contribute to the total load of organohalogens in the marine environment with the possibility of synergism. The studies on these "newly identified compounds" in different compartments of the Baltic Sea should be recommended.

- There is an urgent need for certified reference materials for all contaminants from different compartments. These materials should be used to enhance the analytical quality and the quality control and recovery studies of the laboratories.

- It is recommended that standards from one source are brought forward and used in the analyses of the Baltic to minimize discrepancies due to standards.

## Petroleum Hydrocarbons

The following actions are required:

- More studies on atmospheric and land input of petroleum hydrocarbons into the Baltic Sea is necessary.

- More studies are required on the concentration of petroleum hydrocarbons in sediments and biota, and especially on the polynuclear aromatic hydrocarbons (PAH) fraction.

- In order to set up realistic budgets and balances for petroleum hydrocarbons, more information is needed on their occurrence in all compartments of the Baltic Sea, especially in those areas affected by chronic oil input.

- More efforts should be exerted to develop specific, accurate and relatively simple analytical methods to determine the most persistent and toxic individuals and groups of compounds originating from oil.

## »Newly Detected Contaminants«

The action required are:

- More studies on the occurrence of "newly detected contaminants" as well as studies on their cycling and fate in the Baltic Sea are required.

- Baltic laboratories, as well as analysts, should be encouraged to undertake studies on the toxicity, the occurrence and fate of synthetic organic chemicals in the Baltic Sea.

- More restrictions are required on the further release of persistent organic chemicals used by the Baltic countries on a large scale.

## Pelagic Biology

There is need for action as follows:

- There are still methodological differences between the laboratories. The existing Guidelines must be closely followed, and intercalibration workshops are necessary to maintain compatibility even in the future.

- It is essential that an efficient computer-based data storing and retrieval system is implemented as soon as possible. The complex biological data base will, otherwise, be unusable for future assessments.

- A better synchronization, as well as additional research cruises, are needed in order to cover the highly dynamic biological year in the pelagic system.

## Macrozoobenthos

The following actions are required:

- The station grid for macrozoobenthos gives sufficient results for the situation below the halocline, including trend analyses. The most important changes were observed in the coastal areas not covered by the Baltic Monitoring Programme (BMP). Therefore, national programmes in these regions should be intensified.

- The BMP should be continued, and the participants of the BMP should be motivated to keep to the Guidelines as follows:

    - all stations should be sampled and sampling should be done from November to March;
    - intercalibration methods should continue and concentrate on species determination;

- data from national programmes should be included, and all data should be presented uniformly according to the Biological Data Reporting Format, and should be calculated to 0.1 $m^2$.

## Microbiology

There is a need for the following:

- Surveys on the microflora, its distribution and activity should be continued and extended.

- Intercalibrations with respect to the sampling and analysis of microbiological parameters.

- More interest and efforts should be placed on studying secondary production, and the role of bacteria in the carbon and nutrient cycles.

- In order to expand knowledge on the role of micro-organisms in the decomposition of organic pollutants and their intermediate products, a close cooperation between microbiologists, organic chemists and biologists, is necessary.

# Annex 1

## EXAMPLES OF PROBLEM AREAS INDICATED IN THE ASSESSMENT OF THE STATE OF THE BALTIC SEA IN 1980 COMPARED WITH THE ACTION BY THE COMMISSION IN 1981-1986

| Problem Area as stated in the 1980 Assessment | Action taken by the Commission |
|---|---|
| **Organochlorine Compounds** | |
| Problems in analyses of organochlorine compounds; need for intercalibraticm | Intercalibration of organochlorines to be carried out in the Federal Republic of Germany in 1985/1987 |
| **Phytoplankton** | |
| Problems in the species identification of the phytoplankton | Unified checklist of species of the Baltic Sea prepared by experts for the use of the Commission<br>Project for phytoplankton identificationsheets started in1935 |
| **Zooplankton** | |
| Zooplankton biomass estimation method insufficient | Methods presented by the Baltic Marine Biologists (BMB) on the request of the Commission |
| **Water Balance** | |
| Lack of knowledge in freshwater surplus and questions concerning changes in water balance | The summary 'Water Balance of tie Baltic Sea" will be published in the Baltic Sea Environment Proceedings in 1986, results of the International Hydrological Programme (IHP) |

-cont'd.-

# EXAMPLES OF PROBLEM AREAS INDICATED IN THE ASSESSMENT OF THE STATE OF THE BALTIC SEA IN 1980 COMPARED WITH THE ACTION BY THE COMMISSION IN 1981-1986

| Problem Area as stated in the 1980 Assessment | Action taken by the Commission |
|---|---|
| **Atmospheric Pollution** | |
| Scarce information about the atmospheric fallout to the open Baltic Sea, and about the fate of pollutants discharged from land-based pollution sources | Joint monitoring programme on airborne pollution with a recommended list of parameters and a network of stations was started in 1985; HELCOM Recommendation 7/1 |
| Need for reliable methods for collecting representative atmospheric fallout material | First stage of intercalibrations and intercomparisons of sampling and analytical methods will be coordinated by Sweden in 1986 |
| | Seminar on matters related to modelling of tie originand transport of air pollutants arranged by the German Democratic Republic in 1986 |
| **Trace Metals in Biota** | |
| Baseline data on trace metal concentrations in biota insufficient for most parts of the Baltic Sea | Intercalibration on tracemetals in biota carried out by ICES in association with the baseline study of contaminants in fish and shellfish in 1995 |
| | Proposal for ICES to review the guidelines for monitoring of contaminants in marine organisms |
| **"Newly Detected Contaminants"** | |
| Unknown environmental impact of some potentially harmful or toxic substances identified in the Baltic Sea | Relevant information concerning "newly detected contaminants" currently collected by the Lead Country, Denmark |

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**ANNEX 1 ant'd.**

**EXAMPLES OF PROBLEM AREAS INDICATED IN THE ASSESSMENT OF THE STATE OF THE BALTIC SEA IN 1980 COMPARED WITH THE ACTION BY THE COMMISSION IN 1981-1986**

| Problem Area as stated in the 1980 Assessment | Action taken by the Commission |
|---|---|
| **Newly Detected Contaminants** (cont'd.) | |
| PCTs were recently reported to be present in the Baltic Sea biota | PCTs moved from Annex II (noxious substances) to Annex I (hazardous substances) of the Convention in 1983<br><br>HELCOM Recommendation 6/1 on the elimination of the use of PCBs and PCTs |
| **Sediments and Microbiological Determinands** | |
| Gaps in the monitoring programme concerning sediments and microbiological determinands | ICES was requested to carry out a project concerning the state of sediments with proposals to the Commission in 1987<br><br>The Federal Republic of Germany is coordinating a study to make proposals for relevant monitoring programmes for microbiological determinands |
| **Municipal and Industrial Discharges** | |
| Lack of input data from municipal and industrial discharges; lack of data on heavy metal discharges | First pollution load compilation under preparation including also data on heavy metals submitted by the Baltic Sea States to be published in 1986/87<br><br>Progress reports on Cadmium, Mercury, and Copper and Zinc prepared by Lead Countries (Sweden, USSR and GDR respectively) to be published in the Baltic Sea Environment Proceedings in 1986, |

**EXAMPLES OF PROBLEM AREAS INDICATED IN THE ASSESSMENT OF THE STATE OF THE BALTIC SEA IN 1980 COMPARED WITH THE ACTION BY THE COMMISSION IN 1981-1986**

| Problem Area as stated in the 1980 Assessment | Action taken by the Commission |
|---|---|
| **Municipal and Industrial Discharges** (cont'd.) | |
| | as well as the report on Lead, prepared by the Federal Republic of Germany, in the nearest future |
| | HELCOM Recommendations for limiting discharges of mercury and cadmium (6/3, 6/4, 6/5, 6/6) |
| | HELCOM Recommendations for measures aimed at the reduction of discharges from urban areas (7/3,7/4,7/5) |
| **Wood-processing industry** | |
| River humic content as well as input from mod-processing industry insufficiently known | Discharges from pulp and paper industries to be consideredby the project established and to be coordinated by Finland and Sweden |
| | Need for action against pollutants from pulp and paper industries in the list of high priority action of the Medium-Term Plan of the Commission (Resolution 5/A) |
| | Proposal for a seminar in 1987 |
| **Oil pollution** | |
| Chronic oil pollution near oil refineries and oil harbours, harms of oil spills, knowledge of effects of oil in nature insufficient | Joint seminar on oil questions to be arranged in Sweden in 1986 |
| | Inform&ion on oil currently collected by Finland |

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ANNEX 1 ant'd.

## EXAMPLES OF PROBLEM AREAS INDICATED IN THE ASSESSMENT OF THE STATE OF THE BALTIC SEA IN 1980 COMPARED WITH THE ACTION BY THE COMMISSION IN 1981-1986

| Problem Area as stated in the 1980 Assessment | Action taken by the Commission |
|---|---|
| **Oil Pollution** (cont'd.) | |
| | HELCOM Recommendations to limit discharges of oil from land-based sources (5/1, 6/2), and from ships |
| **Eutrophication of the Sea** | |
| Increasing eutrophication in some coastal areas clearly resulting from nutrient discharges | HELCOM Recommendations concerning limitation of nutrient discharges from urban areas and industry(6/7) |
| | HELCOM Recommendations for measures aimed at the reduction of discharges from agriculture(7/2) |
| | HELCOM Recommendations for measures aimed at tie reduction of discharges from urban areas (7/3, 7/4, 7/5) |
| | Projects started for limiting discharges from urban areas (coordinated by Sweden) and from agriculture (coordinated by Denmark) |
| **Protection of e.g. seals from toxicants** | |
| Decrease in egg-thickness of some Baltic birds caused by DDT and PCB s, as well as rapid decrease in seal populations due to organochlorines | HELCOM Recommendations concerning elimination of discharges of DDT,PCBs and PCTs (3/1, 3/2, 6/1) |
| | HELCOM Recommendations concerning protection of seals in the Baltic Sea Area (3/3) |

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**EXAMPLES OF PROBLEM AREAS INDICATED IN THE ASSESSMENT OF THE STATE OF THE BALTIC SEA IN 1980 COMPARED WITH THE ACTION BY THE COMMISSION IN 1981-1986**

| Problem Area as stated in the 1980 Assessment | Action taken by the Commission |
|---|---|
| **Protection of seals....**(cont'd.) | |
| | Current collection of relevant information by Lead Countries: Poland on DDT, Denmark on PCBs, PCTs and "new contaminants" |
| | ICES to follow up the seal populations of the Baltic Sea upon the request of the Commission |

# MAP OF THE MONITORING STATIONS IN THE BALTIC AREA