BALTIC SEA ENVIRONMENT PROCEEDINGS

No.48

THE BALTIC SEA JOINT COMPREHENSIVE ENVIRONMENTAL ACTION PROGRAMME

HELSINKI COMMISSION
Baltic Marine Environment Protection Commission
1993

For bibliographic purposes this document should be cited as:
HELCOM, 1993
The Baltic Sea Joint Comprehensive Environmental Action Programme
Balt. Sea Environ. Proc. No. 48

ISSN 0357-2994

Helsinki - Government Printing Centre

TABLE OF CONTENTS

FOREWORD

As requested in the Baltic Sea Declaration, adopted by Prime Ministers and high political representatives at the Ronneby Conference in September 1990, the ad hoc high level Task Force of the Helsinki Commission (HELCOM TF) submitted for ministerial consideration a Baltic Sea Joint Comprehensive Environmental Action Programme at the Diplomatic Conference on the Protection of the Marine Environment of the Baltic Sea Area, Helsinki, Finland, 9 April 1992. For several reasons the Programme was presented in a preliminary version.

The Diplomatic Conference approved the Programme with regard to its strategic approach and the principles for setting priorities. The Conference further adopted (1) the Baltic Sea Environmental Declaration, 1992, concerning action to be taken to implement the programme and (2) Resolution 5, regarding the establishment of a Programme Implementation Task Force within the framework of the Helsinki Commission to initiate, facilitate and monitor co-ordination of the implementation of the Programme and to finalize and periodically update the Programme.

After the Diplomatic Conference the Programme was finalized by the HELCOM Programme Implementation Task Force. Since the period of implementation is assumed to extend over decades. economic and technological development and environmental changes of the Baltic Sea may warrant further reviews of the Programme.

The Programme in its finalized form is hereby submitted to the Helsinki Commission.

Göte Svenson
Chairman of the HELCOM ad hoc high level Task Force
and the HELCOM Programme Implementation Task Force

EXECUTIVE SUMMARY

INTRODUCTION

The Diplomatic Conference on the Protection of the Marine Environment of the Baltic Sea Area adopted the Baltic Sea Environmental Declaration, 1992, which endorsed the strategic approach and principles of the Baltic Sea Joint Comprehensive Environmental Action Programme (Programme). The Programme was developed in response to the Baltic Sea Declaration adopted at the level of Prime Ministers at the Baltic Sea Environment Conference in Ronneby, Sweden on September 3, 1990. At Ronneby, the Ministers established the long-term objective of ensuring the ecological restoration of the Baltic Sea and the preservation of its ecological balance. The Programme addresses these issues by identifying problems and priority actions in all the countries within the Baltic Sea catchment area.

The long term Programme encompasses both preventive actions to promote sustainable use of the Baltic Sea environment, and curative actions to rectify the legacy of environmental degradation from point and non-point source pollution. In addition to these investments, the Programme will support development of appropriate environmental policies and legislation, promote the use of economic incentives to encourage environmentally sound actions, strengthen institutional capacity and human resources, and increase the local capacity to finance environmental measures.

The Programme was elaborated by the ad hoc high level Task Force established within the framework of the Helsinki Commission (HELCOM TF). The members of HELCOM TF were all the Contracting Parties to the Helsinki Convention (Denmark, Estonia, Finland, Germany, Lithuania, Poland, Russia, and Sweden), the Czech and Slovak Federal Republic, Latvia, Norway and the Commission of European Communities (CEC), as well as four multilateral financial institutions - the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Nordic Investment Bank (NIB), and the World Bank. The International Baltic Sea Fishery Commission participated as an observer. The Coalition Clean Baltic (CCB), Greenpeace International, and the World Wide Fund for Nature (WWF) had an opportunity to comment on the draft pre-feasibility studies and the draft Joint Comprehensive Environmental Action Programme.

BACKGROUND

The Task Force used a variety of studies and sources of information to develop the Programme. These included national plans prepared by the States who were Contracting Parties to the Helsinki Convention, as well as by the Czech and Slovak Federal Republic, Latvia, Lithuania and Norway. Pre-feasibility studies of environmental issues, the sources and magnitude of pollution loads, and options for pollution control and improved environmental management throughout the Baltic Sea catchment area. Special studies were also made of agricultural runoff, wetlands, and the impact of emissions into the atmosphere. The pre-feasibility studies and special studies were financed by grants totalling about 5 million ECU from the Denmark, Finland, Germany, Norway, Sweden and the Commission of the European Communities, Nordic Project Export Fund (NoPEF), and the World Wide Fund for Nature (Sweden).

THE PROBLEM: DEGRADATION OF THE BALTIC SEA

As late as 1950 the Baltic Sea was still regarded as environmentally "healthy". Large-scale industrialization throughout the basin had not yet made its impact, automobiles were few, and intensive agriculture and forestry, based on a heavy use of chemical fertilizers, was only commencing. Since then the situation has changed considerably. Pollution now threatens the entire Baltic Sea catchment area as well as the Baltic Sea itself, and ultimately the health and well-being of the 80 million people who live there.

The Baltic Sea is naturally vulnerable to pollution due to its semi-closed character and particular hydrography. The shallow, narrow Belts and the Sound permit only a slow water exchange between the Baltic Sea and the North Sea. As a result, the water in the Baltic Sea has a long residence period of between 25 to 40 years, which promotes the accumulation of pollutants.

The natural vulnerability is seriously aggravated by anthropogenic causes of environmental change and degradation. Municipalities and industries in the catchment area discharge pollutants directly to the numerous rivers that feed into the Baltic Sea, and to the many estuaries, bays and gulfs. In addition, many pollutants are transported to the Baltic Sea through the atmosphere, and agricultural practices, including intensive livestock husbandry, are major contributors to the high nutrient load on the Baltic Sea. Although concentrations of heavy metals in fish and shellfish have not increased significantly since the early 1980s, the concentrations of cadmium, lead, copper and nickel are higher than the background values and those in North Sea biota.

Eutrophication is a problem of special concern. It is caused by excessive growth of biomass stimulated by the large influx of nitrogen and phosphorus compounds which come from agricultural and forestry runoff, atmospheric transport, in part from outside the catchment area, as well as discharges from municipalities and industries. The decay of this vast biomass causes oxygen depletion and threatens marine life. A significant source of the nitrogen input is from either atmospheric deposition directly to the Baltic Sea or assimilated from atmospheric nitrogen. Much of the pollution load originates from sources outside the Baltic region and calls for efforts to reduce long-range transboundary pollution.

LONG-TERM PROGRAMME TO ADDRESS THE PROBLEM

Nearly twenty years of scientific work by HELCOM committees, and studies conducted for the HELCOM ad hoc high level Task Force, have followed ecological developments in the Baltic Sea catchment area and demonstrated the need to reduce pollution loads reaching the Sea in order to restore its ecological balance. The preparatory work for the Programme concluded that **preventive and curative actions** are necessary in all the Baltic Sea catchment area countries to reduce the pollution load reaching the Sea. Some of these actions are already underway. For example, some state owned enterprises with polluting production activities have shut down; wastewater treatment plants are planned or partly constructed; new protected areas have been created, and environmental controls have been strengthened. These on-going activities require support; in particular, new environmental policies and pollution control programmes need to be formulated and adopted in the formerly centrally planned economies.

The underlying **strategy** on which the Programme is based consists of actions by each concerned government to carry out needed policy and regulatory reforms, capacity building, and investments to control pollution from point and non-point sources, safely dispose of or reduce the generation of waste, and conserve ecologically sensitive and economically valuable areas. To complement these activities, the Programme also includes elements to support applied research, environmental awareness and environmental education. Actions will be phased to keep pace with the gradually increasing capacity to mobilize financial resources and pay for recurrent costs of environmental management in these transforming economies. In the first years,

emphasis will be placed on creating the enabling policy environment and institutional arrangements, on limited investment in the highest priority projects, including pilot and demonstration projects, and on promoting private investment and initiative through concessions and incentives. Environmental investment programmes in the northern and western part of the Region are also an integral part of the Programme and are expected to be financed from local resources.

The Programme consists of **six components** which comprise broad and distinct areas of action:

- **policy, legal, and regulatory reforms** - to establish a long-term environmental management framework in each country, including macro-economic policies and incentives; financial facilities, policies and controls; environmental standards, laws, and appropriate systems for monitoring and enforcement of regulations. Actions would include studies of new legal regulatory arrangements and drafting of governmental and parliamentary decision documents; policy studies of options, costs and benefits; investment in new monitoring equipment, upgrading of laboratory equipment and procedures, upgrading of data processing and analytical capacity; and development of new organizational structures and arrangements to carry out management functions;

- **institutional strengthening and human resources development -** build the organizational and human capacity to enforce regulations; plan, design, and implement environmental management systems including infrastructure; and manage natural resources efficiently. The focus of the Programme is on training people to use new concepts of management and new technology, and developing the organizational and administrative framework for them to work effectively and efficiently;

- **infrastructure investment -** to invest in specific measures to control **point source and non-point sources of pollution,** and minimize and dispose of wastes, including the rehabilitation and modernization of existing infrastructure and the development of new infrastructure. This would include actions to address non point source pollution from agricultural runoff, forestry, livestock operations and rural settlements. It would also encompass selected actions for control of point, mobile and area sources of air pollution;

- **management of coastal lagoons and wetlands -** to formulate and carry out programmes to manage these environmentally sensitive and economically valuable areas which serve as important buffers of pollution before it reaches the Sea, and provide critical habitat for diverse flora and fauna including commercially important fisheries. These management systems will include land use controls and limited infrastructure, and in some cases will be integrated with compatible eco-tourism and recreation developments possibly through public/private joint ventures or private investment;

- **applied research -** to build the knowledge base needed to develop solutions, transfer technology, and broaden understanding of critical problems. Specific priority topics include environmental trends, evaluation of critical loads, assessment of risks to human health, future trends on transportation and its environmental management, and management of coastal lagoons and wetlands; and

- **public awareness and environmental education -** to develop a broad and sustainable base of support for the implementation of the Programme. The participation of non-governmental organizations, and the development of effective environmental education programmes are essential activities in promoting public awareness and political commitment.

THE EXPECTED ENVIRONMENTAL BENEFITS OF THE PROGRAMME

Implementation of the Programme and the realization of major beneficial changes in the ecological balance of the Baltic Sea will necessarily require decades. Nevertheless, gradual and visible improvements can be expected, and locally, major economic and important environmental benefits can be realized in the relatively near term.

The Programme is also expected to have major economic and environmentally beneficial impacts on the rivers of the Baltic Sea catchment area. Reductions in pollution loads and restoration of river ecosystems through implementation of the Programme will lower water treatment costs, increase the reliability and quality of water services by reducing the load on frequently overtaxed treatment facilities, and decrease groundwater depletion and saltwater intrusion in coastal areas.

Coastal waters can be expected to improve most rapidly. The current widespread closure of Baltic Sea beaches due to contamination from untreated waste, odours, and massive algal blooms has caused serious loss of hard currency income and employment from tourism as well as local recreation opportunity. Treatment of municipal and industrial wastewaters and other inputs containing bacteria, viruses and other harmful organisms will allow the beaches to open again and contribute to establishing favourable conditions for new investment in this important sector.

Restoring the quality of the open waters of the Baltic Sea will be considerably slower. The overall reduction in the load of nutrients brought about by greater pollution control under the Programme will reduce algal production and possibly make algal blooms less frequent. With decreased eutrophication and sedimentation, oxygen conditions will improve. These changes can be expected to have a major positive impact on fishery resources in the coastal waters and the open sea.

The nutrient loads that have caused extensive eutrophication and upset the riverine and marine ecosystems will be reduced mainly by improved environmental management in the agriculture and livestock sectors, decreased atmospheric pollution, and expanded and more efficient municipal and industrial wastewater treatment. Conservation and improvement of wetlands is also expected to have a significant impact on nutrient loads and will contribute as well to an increase in biodiversity. These nutrient load reductions will have widespread beneficial impacts on health, environmental values, and significant economic benefits through reductions in costs and improved conditions for investment.

A quite different but strategically important benefit will stem from the strengthening of local capacity to plan, finance, and manage the measures required under the Programme, and from the transfer of know-how that will have long-term benefits for environmental management.

THE COSTS AND FINANCING OF THE PROGRAMME

Unprecedented political and economic changes have affected the entire Baltic Sea region since the Ronneby Conference in September, 1990. The implications for the financing of the Programme are grave. The formerly centrally planned economies are going through a dramatic economic restructuring, which has in the short run limited their creditworthiness and reduced capacity to produce goods and services. The acute demands for basic items such as energy, food and medicine will undoubtedly impede the financing needs of the Programme over the medium-term. In addition, some of the potential donor countries are suffering a protracted recession. Financing from foreign sources will be essential for Programme implementation; a significant share will take the form of loans from the multilateral financial institutions. Over time, the emerging market economies should be able to assume an increasing share of Programme financing.

Implementation of the entire long-term Programme in all countries of the Baltic Sea catchment area is expected to cost about 18

billion ECU over a twenty year period. It will be implemented in two phases: the first phase (1993-1997) is estimated to cost about 5.0 billion ECU; the second (1998-2012) is estimated at an additional 13.0 billion ECU. The Programme will include support for development of policy and regulatory reform, institutional strengthening and investment actions.

The Programme will focus on 132 **"hot spots."** As described in detail in the Programme, these "hot spots" comprise actions to address point and non-point source pollution in the Baltic Sea catchment area, and are estimated to cost about 10.0 billion ECU. Of the 132 hot spots, the Task Force has identified 98 actions at key hot spots with an estimated cost of about 8.5 billion ECU, in Belarus, the Czech Republic, Estonia, Latvia, Lithuania, Poland, Russia, the Slovak Republic, and Ukraine. The remaining 34 sites in Denmark, Finland, Germany and Sweden were selected by the countries concerned and have an estimated cost of approximately 1.5 billion ECU. Of the 98 hot spots, 47 were identified as priority hot spots estimated to cost about 6.5 billion ECU.

There are other substantial and important costs which should not be overlooked in considering the overall financing needs of the Programme. First, feasibility studies of the highest priority projects must be carried out in order to complete financing arrangements. These studies have been estimated to cost about 30 million ECU. However, the key constraint to undertaking this critical step is not likely to be funds or external support, but rather the identification of project sponsors willing and able to finance and manage the projects. Second, the respective Governments in the eastern and southern parts of the Baltic Sea region will need to incur substantial local costs in facilities. services, and human resources to develop and carry out the required policy and regulatory reforms, institutional strengthening, and planning and programming initiatives on which the smooth and timely implementation of the Programme will critically depend. Considerable external support for these activities is likely to be forthcoming, but the local commitments of staff, organization, and financial resources will remain substantial.

FINANCING THE PROGRAMME

Nearly two-thirds of the "hot spots" are located in countries whose combined population numbers about 60 million, and whose macroeconomic situation has often led to problems with creditworthiness makes ordinary loans and commercial financing difficult. These profound economic problems are expected to improve only slowly. The absence of creditworthy borrowers - either sovereign or individual - constitutes a great challenge and threat to the timely implementation of the Programme. It is already obvious that the Programme will have to depend upon a multiplicity of financing sources for its implementation. In mobilizing diverse sources of financing, sometimes for a single project, the sharing of financial risks will be an important principle. **Official support and participation** in project capital financing in such cases could take the form of sovereign guarantees that assume a part of the financial risk. This approach to public participation in project financing may also have the beneficial effect of lowering the overall cost of financing.

Despite the recessions and tight budgets in the wealthier countries, and fierce competition among regions for the resulting limited international development assistance, some combination of normal and concessional development lending, supplemented by outright grants, will be needed from the **bilateral and international financing agencies** lest the bulk of the Programme remain only a dream. Moreover, the concerned **Governments** will need to adopt a number of strategies to finance the Programme and overcome the limitations of slow growth, tightly constrained budgets, and competition for limited financial resources from other important and productive sectors,

The greatest opportunity to shift the burden of environmental financing away from the public budget, and reduce the absolute cost of environmental management, is to incorporate pollution control at the source into the **industrial** privatization, restructuring and modernization process that is an integral part of the ongoing transition to a market economy in the eastern and southern portions of the Baltic Sea region.

Responsibility for key public services including environmental management has almost entirely devolved to local government. There has been a sharp break with the past pattern of heavily subsidized and inefficient operations that predominate in planned economies. The imposition of user charges following the Polluter Pays Principle is one possibility of paying for at least operation and maintenance costs of environmental management facilities such as wastewater treatment plants. However, more innovative approaches such as joint ventures and long term concessions may be needed to attract capital financing, particularly from private and commercial sources. Limited government participation through guarantees and subsidies may be needed, at least for the mid-term, until users and local authorities are better able to support direct financing. The use of contracts between **municipalities** and private sector firms for the management and operation of water, wastewater and solid waste facilities presents an important opportunity to decrease demands on municipal government and improve performance.

IMPLEMENTATION OF THE PROGRAMME

While the main responsibility for implementing the Programme will of course have to be borne by the governments concerned, effective implementation of such a long-term and complex activity will require significant co-ordination in order to fulfill its objectives. To some extent, activities to promote co-ordination and reporting on progress of national action with regard to policy, regulation and institutional change come within the mandate of the Helsinki Commission (HELCOM) as spelled out in the Helsinki Convention. This also holds true for monitoring, periodic assessment of the environmental status, and analysis of the pollution load of the Baltic Sea. Because the Programme involves countries within and outside the region, as well as non-governmental organizations and multilateral financial institutions, a new mechanism is needed within the HELCOM framework to carry out these functions.

The proposed new mechanism is to establish a HELCOM Programme Implementation Task Force (PITF) within the Helsinki Commission framework to support the long-term implementation of the Programme. The PITF will be responsible for facilitating Programme coordination and monitoring. Other functions appropriate to such a body include periodic review and updating of the Programme in the light of economic and technological development and in consideration of changes in the environmental status of the Baltic Sea over time.

IMMEDIATE ACTIONS TO BE TAKEN

Since implementation of all the identified actions will take several decades, a phased approach will be required. Immediate action during Phase I, covering the period 1993- 1997, would focus on four priority areas:

- **Emergency support and warning systems.** To avoid serious public health risks and increased pollution of rivers and coastal waters, immediate support is needed to overcome the shortage of chemicals, replacements, and spare parts required for the continued operation and maintenance of water supply and treatment, and wastewater treatment facilities in Belarus, Estonia, Latvia, Lithuania, Russia and the Ukraine. Effective emergency warning and response systems are needed on major rivers and harbours in the region.

- **Improvements in combined municipal and industrial wastewater treatment systems.** The main benefit from these investments is in the reduction of organic pollution loads (BOD,) on the Baltic Sea and the coastal waters. Additional nutrient removal facilities (tertiary treatment) at municipal wastewater treatment plants, however, have only a small impact on the total nutrient load to the Sea, in particular if they are located upstream. In such cases, and unless there are good arguments based on local

benefits, investments in nutrient removal treatment systems should be deferred until substantial progress is made in nutrient load reduction in the agriculture sector and other, higher priority pollution reduction measures are completed.

Complete unfinished and inoperable treatment facilities;

Install or improve industrial pre-treatment;

Eliminate uncontrolled discharge of wastewaters into the environment;

Expand and improve safe disposal of sludges.

- **Rational industrial pollution control.** Wherever possible and both physically and economically sensible, industrial pollution problems should be considered separately from municipal systems. Pollution control measures should be specific to each industrial process so that pollution can be dealt with at the source. Rather than treating existing problems at the end-of-pipe or stack, each sector should be assessed to identify economically competitive and viable enterprises. Environmental audits should be conducted and an integrated strategy of environmental and process modernization developed for each plant.

- **Control of pollution loads from the agriculture sector.** The Programme will support the incorporation of environmentally oriented incentives into agriculture sector reform and development programmes, and the implementation and monitoring of pilot and demonstration projects to develop low-cost environmental control technology and practices. Significant impact on reduction of nutrient loads on the Baltic Sea and hence on the damaging effects of eutrophication can be achieved by introducing better manure handling and fertilizer application and storage practices. The widespread dissemination and adoption of these practices should be a high priority policy objective in the agriculture sector.

The **policy reform** agenda follows logically from the Phase I investment programme:

- rationalize and harmonize standards;
- establish incentives for environmental investment;
- implement the polluter/user-pays principles;
- establish viable mechanisms for the levy, collection, and retention of revenues to finance environmental projects particularly at the local level.

The **capacity building** agenda will focus on three areas:

- local capacity to finance and manage projects;
- environmental monitoring and regulatory systems;
- project preparation including environmental assessment.

The target level of **investment for Phase I** of the Programme is 5 billion ECU. It is anticipated that national governments, multilateral financial institutions, bilateral organizations and private sector interests will develop projects for implementation during Phase I based on Programme “priority hot spots.”

Chapter 1

INTRODUCTION

Environmental problems of the Baltic Sea have been the concern of the surrounding states during the past twenty years. In spite of the efforts of the countries, deterioration of the Baltic Sea has continued to increase and there is a threat that irreversible damage will be done to the sea, around which some eighty million people live.

Inspired by the 1972 UN Conference on the Human Environment, governments of the littoral states of the Baltic Sea in 1974 signed the Baltic Marine Environment Protection Convention (Helsinki Convention). Its implementation began immediately on a provisional basis, and the Convention formally entered into force in May 1980. The Helsinki Commission (HELCOM) is the steering agency for the Convention.

In accordance with the Convention, HELCOM has concentrated its efforts on the Recommendations for action formulated by the Contracting Parties; these recommendations were based on the available information on the state of the Baltic Sea and its pollution load. Within the work of the Helsinki Commission, the main pollution problems have been identified. In 1988, the Helsinki Commission met at the ministerial level and adopted a Declaration with far-reaching specific commitments and time-tables for reducing harmful inputs to the Baltic Sea.

The Recommendations are intended to serve as a guide for national implementation; neither the Helsinki Commission nor the Ministerial Declaration were meant to serve as enforcing agents. However, a system of periodical reporting on implementation has been introduced.

Although tangible progress in terms of enhanced environmental conditions has resulted from co-operation within the framework of the Convention, the present state of the Baltic Sea remains a cause for serious concern.

Given the grave environmental problems of the area and the urgent need to bring about more drastic reductions of pollution, the Prime Ministers of Poland and Sweden invited their colleagues from the other states within the catchment area of the Baltic Sea to a conference in Ronneby, Sweden, 2-3 September 1990. The conference was also attended by representatives of the Commission of the European Communities (CEC) and four multilateral financial institutions: the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Nordic Investment Bank (NIB) and the World Bank.

The participants in the Ronneby Conference adopted the Baltic Sea Declaration, which sets out a number of principles and priority actions necessary to enhance the Baltic Sea environment.

Among these was the elaboration of a Joint Comprehensive Programme to reduce emissions and restore the Baltic Sea to a sound ecological balance. The Programme would be based on concrete national plans to be provided by the countries within the catchment area of the Baltic Sea. When finalized, the Programme would be submitted for consideration and approval by Ministers responsible for the environmental protection of the Baltic Sea.

To prepare this Programme, the Declaration called for the formation of an *ad* hoc high level Task Force within HELCOM. The Task Force consisted of representatives of the Contracting Parties to the Helsinki Convention (then including Denmark, Estonia, Finland, Germany, Poland, Russia and Sweden), Czech and Slovak Federal Republic, Latvia, Lithuania, Norway

and the Commission of the European Communities as well as the four multilateral financial institutions participating in the Ronneby Conference.

The novelty of the approach set in motion by the Ronneby Conference, had two main characteristics: (1) the Programme is a joint one, i.e., priorities for implementing the various programme elements have, as far as possible, been set for the catchment area as a whole and not only within a national context; (2) the Programme has, to the extent possible, been spelled out in such terms that it can form the basis for considerations by the multilateral financial institutions participating in the Task Force, as well as by other financing agencies, including those involved in bilateral assistance programmes.

The Task Force held its first meeting in October-November 1990, which was followed by several more. These were interspersed with meetings of a special Steering Group, set up within the Task Force to follow closely the progress of Programme formulation and provide guidance.

A Task Force Secretary was appointed within the HELCOM Secretariat, and the Contracting Parties to the Helsinki Convention made special appropriations to a Task Force budget. Apart from direct participation in the Task Force, the multilateral financial institutions as well as the Commission of the European Communities acted as Executing Agencies for preparation of pre-feasibility studies and consultant reports on a number of priority areas.

The Helsinki Convention has now been revised within the framework of HELCOM to also include, inter *alia*, the internal waters of the Contracting Parties, and the concepts of the Precautionary Principle, Best Environmental Practice, and Best Available Technology. A Diplomatic Conference for the signing of the new Convention was convened in Helsinki in April 1992 by the Government of Finland. In addition to the littoral States of the Baltic Sea, also invited to the Conference were the following: the Commission of European Communities (CEC), the Governments of the States in the catchment area of the Baltic Sea, namely Belarus, Czech and Slovak Federal Republic, Norway and Ukraine. The multilateral financial institutions which are members of the HELCOM *ad* hoc high level Task Force also attended as observers, namely the European Bank for Reconstruction and Development, European Investment Bank, Nordic Investment Bank, World Bank, along with the International Baltic Sea Fishery Commission (IBSFC), an active observer of HELCOM.

Other observer organizations of HELCOM invited to the Conference included the Intergovernmental Oceanographic Commission (IOC), International Atomic Energy Agency (IAEA), International Council for the Exploration of the Sea (ICES), International Maritime Organization (IMO), Oslo Commission, Paris Commission, United Nations Economic Commission for Europe (ECE), United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Environment Programme (UNEP), World Health Organization (WHO), World Meteorological Organization (WMO), and several nongovernmental organizations, namely Coalition Clean Baltic (CCB), Greenpeace International, and World Wide Fund for Nature (WWF). This Conference coincided with the Ministerial Meeting which approved the Joint Comprehensive Environmental Action Programme. The present Helsinki Commission will continue to be the implementing body of the new revised Convention, once in force.

The Joint Comprehensive Environmental Action Programme presented in this report was unanimously adopted by the Task Force and approved by the Diplomatic Conference. The Programme is based on findings made in the framework of HELCOM proceedings, national reports to the Task Force, and the consultant reports. Furthermore, since the implementation period is expected to extend over decades, technological and other factors may warrant more or less frequent reviews. The report thus contains proposals for setting up special mechanisms for monitoring, updating and implementation of the Programme.

To assist in implementation of the Programme, the Diplomatic Conference also adopted a resolution regarding the establishment of a

Programme Implementation Task Force (PITF) within the framework of the Helsinki Commission to initiate, facilitate and monitor coordination of the Programme implementation.

Chapter 2

ENVIRONMENTAL CONDITIONS IN THE BALTIC SEA REGION

2.1 THE BALTIC SEA AND HISTORY OF THE ENVIRONMENTAL CHANGES IN THE SEA

The Baltic Sea is unique: the largest body of brackish (low-salinity) body of water in the world, it is also distinguished by its division into a series of basins of varying depths, separated by shallow areas or sills. The many rivers flowing into the Sea are the reason for its brackish character. Furthermore, the link with the North Sea is very narrow, the shallowest sill being only 18 m deep. Thus inflows of salt water must be extremely forceful to penetrate and renew the deepest waters of the Baltic Proper.

Nine countries share the Baltic Sea coastline; Sweden and Finland to the north. Russia, Estonia, Latvia and Lithuania to the east, followed by Poland in the south, and Germany and Denmark in the west. About 16 million people live on the coast, and around 80 million in the entire catchment area of the Baltic Sea. The catchment area includes part of Belarus, the Czech Republic, Norway, the Slovak Republic and Ukraine, as some of the rivers find their sources here.

The Baltic Sea is a semi-enclosed sea of about 4 15 000 km^2 (Figure 2-l). Proceeding from the northern end, it includes the Bothnian Bay and the Bothnian Sea. At the southern end of the Bothnian Sea, the island of Åland divides the Åland Sea from the Archipelago Sea. The Gulf of Finland is the eastern arm of the Baltic Sea. The central portion of the Sea, known as the Baltic Proper, includes the Eastern and Western Gotland Seas. To the east and south are the Gulf of Riga, and the Gulf of Gdansk. Moving to the west are the Bornholm and Arkona basins, followed by the Sound, the Belt Sea and the Kattegat. Division of the Baltic Sea into the sub-regions used in Task Force work and countries located in the catchment area are shown Figure 2-2.

In fact, the Baltic Sea has always been characterized by the interaction of fresh and saltwater sources. Geologically a young sea, it has undergone enormous changes since the last ice age. At the end of the Baltic Ice Lake period, about 10 000 years ago, cold saline water intruded into the area, forming the Yoldia Sea. which covered mainly the present **Baltic Proper** and the **Gulf of Finland.** At the end of this phase, only limited areas of stagnant ice remained in Sweden, and a progressive upheaval of land cut the oceanic connection to Baltic Sea basin, changing it to a fresh water basin (the Ancylus Lake). Because the continuing uplift was greater in the north, the floor of the lake tilted and a new contact with the ocean was established about 7 500 years ago, resulting in the Baltic Sea as we now know it.

The variable frequency of the saltwater inflows from the North Sea is primarily determined by complex meteorological processes over Northern Europe and the North Sea. Although the shallower water in the Baltic Proper is renewed by a more or less continuous inflow through the **Belt Sea and the Sound,** the deepest water is renewed only periodically. During this century, major inflows have occurred approximately every 11 years, but have recently been less frequent. The last major inflow of such saline water took place in 1976. The bottom water can remain stagnant for long periods in the main deep basins of the Baltic Sea. Thus there is a distinct layering of the water characterized by surface waters of lower salinity and a warm top layer in summer time, the deep water with higher salinity, and the near-bottom water which is the most saline.

The shallowest sills between the Baltic Sea and the North Sea are located in the **Belt Sea,** the **Sound and west of the Arkona Basin.** The sill depth is 18 m in the Belt Sea and 8 m in the Sound. The sills impede the inflow of saltwater, although certain meteorological and hydrographic conditions do occasionally permit highly saline water to pass the sills. If these waters are of greater density than the water which already occupies the deep basins, a replacement will occur.

The ecological importance of this infrequent renewal of the bottom water is related to oxygen consumption. Between inflows, oxygen is continuously consumed in the near-bottom water, principally through oxidation of organic material which sinks down from the upper layers. If the deepest water is not replaced by new inflows, its dissolved oxygen will be entirely consumed, creating anoxic conditions, leading to the formation of hydrogen sulfide, which is toxic to organisms. Thus the serious lack of oxygen in the bottom water is accompanied by a deterioration of the benthic community, followed by a disappearance of all higher forms of life. The size of the bottom areas with reduced conditions for life varies from year to year. The current area of "dead bottoms", which are found in the **Gulf of Finland, in the Baltic Proper, the Belt Sea and the Kattegat,** is 100 000 km^2, which is about one third of the entire area of the sea floor. Anoxic conditions in the bottom water also cause sediment-bound phosphorus to be released into the water.

The brackish character of the Baltic Sea also plays an important role in its ecology. Water circulation in the Baltic Sea is weak. Surface water movement is most affected by winds, a significant factor in water mixing and distribution of pollutants. In winter, the Baltic Sea is largely ice-covered, which renders it even more vulnerable to the effects of pollution. Finally, many rivers bringing freshwater, especially to the Baltic Sea Proper, also carry with them many polluting substances.

History of deterioration

The Baltic Sea is one of the best studied seas of the world. and this has contributed to a greater awareness among the public and politicians about its pollution problems. Today, intensive monitoring is coordinated in all the Baltic Sea countries and a periodic evaluation of the state of the Sea is carried out under the auspices of the Helsinki Commission.

Pollution of the Baltic Sea probably began as early as the Middle Ages, when wastewater from the medieval and post medieval towns of Europe, aggravated by poor hygienic conditions, was discharged into the Baltic Sea. This was later compounded by wastes from small industrial establishments. The first signs of marine pollution arose near the cities lying on the shores of the enclosed parts of the Baltic Sea. In these early times, marine pollution occurred only locally. In the late 19th and early 20th centuries, the marine areas affected by pollution grew in the regions where industrialization developed and use of fertilizers in agriculture intensified.

When recreational use of the sea became more popular, eutrophication and poor hygienic conditions caused unpleasant consequences in the coastal waters and beaches. The other natural resources of the sea were not yet threatened, however.

Since the middle of the present century, the environmental situation has deteriorated rapidly in many parts of the Baltic Sea. The areas affected by pollution have grown, especially along the coasts of the formerly centrally planned economies. The type of pollutants changed considerably, as industrial and agricultural wastes came to contain more toxic substances dangerous to living resources. Many coastal areas are now as seriously affected as some heavily polluted inland waters. The various airborne pollutants that have created "background contamination" in nearly all the oceans of the world have considerably affected the Baltic Sea region. Together with stagnation of the deeper water, the pollution of the Baltic Sea has now become a threat to its living resources.

Polluting substances

Many harmful or toxic and persistent substances not found in the natural environment, such as PCBs, DDT, polychlorinated camphenes, and

polychlorinated terphenyls (PCTs), have found their way into the Baltic Sea. Other examples of harmful substances detected in Baltic Sea biota in the 1980s are chlorinated terpenes, halogenated paraffins, polyaromatic hydrocarbons (PAH) and chlorinated pesticides, such as chlordane and dieldrine. These substances are highly toxic and some are also bioaccumulating. The ban on the use of mercury compounds, in particular in the pulp and paper industry, and a drastic reduction of mercury discharges from the chlorine-alkali industry, have resulted in some decrease of mercury concentrations in fish, but many coastal water areas are still seriously contaminated.

Human activity is also responsible for the increase of certain natural substances in the Baltic Sea, such as nutrients (phosphorus and nitrogen compounds), heavy metals and hydrocarbons. There are also other substances, such as artificial radioactive isotopes and by-products from industrial production of chemicals and pharmaceuticals, which are likely to cause harmful effects in the Baltic marine environment. Oil spills are another danger, the effects of which depend on the magnitude and location of the spill and the time of year. Coastal marine life, including birds, is the most sensitive to oil contamination.

2.2 STATE OF THE OPEN BALTIC SEA

Salinity and Oxygen

The lack of a major inflow of saltwater from the North Sea in the last 15 years has caused a decrease in salinity and therefore also lower density of the deep water. Furthermore, the temperature has increased in the deeper layers of the **Baltic Proper.** The current stagnation period in the **Eastern Gotland Basin** is considered to be one of the largest and most serious on record. In the deep layers, this has caused the most extreme changes that have been noted since oceanographic observations began.

Water exchange varies according to area. The water between **the Gulf of Bothnia and the Baltic Proper** is exchanged mainly through the **Åland Sea,** deeper and more open than the **Archipelago Sea.** These inflows are partly composed of low-salinity, low density surface waters of the Baltic Proper, and have small salinity and density variations. In the **Gulf of Bothnia,** vertical density difference is further reduced and therefore the stratification is considerably weaker than in the **Baltic Proper.** Water entering the **Bothnian Bay** comes primarily from the surface layer of the **Bothuian Sea.** Even strong winds can cause mixing of the layers. Salinity levels measured in the **Bothnian Sea and in the Bothnian Bay** have generally remained stable, although a slight decrease has been observed in the near-bottom layer during the last 15 years.

In **the Central Baltic Proper and the Gulf of Finland,** the area with insufficient oxygen conditions for macrofauna (currently about 100 000 km^2 with less than 2 ml oxygen/l in bottom water) has fluctuated in extension from year to year, but has not increased over the last 25 years. In the deepest areas of the **Eastern Gotland Basin,** however, the long stagnation period has led to a continuous decrease in oxygen, and hydrogen sulphide concentrations are now the highest ever measured. On the other hand, decreasing salinity and a consequent lowering of the halocline, together with increased vertical exchange, has allowed oxygen to penetrate more deeply into the intermediate layers (90-100 m) and improved life conditions at the sea floor in this depth range. In the late summers of the 1980s, eutrophication led to repeated oxygen depletion for the first time in the **Kattegat.** In **the Bothnian Sea,** vertical convection is suppressed during the winter, leading to oxygen decrease there, and a clearly negative trend was observed between 1965 and 1988. In the **Bothnian Bay,** however, no similar trend has been signalled. The large supply of fresh water to the Bothnian Bay together with weak stratification prevents the basin from stagnating. Oxygen depletion has never been detected in the near bottom water.

Nutrients

The significant increase in phosphorus and nitrogen concentrations observed in the open Baltic Sea until the late 1980s appears to have been stabilized, with the notable exception of

the **Kattegat and the Gulf of Riga**. However, concentrations of these nutrients are still so high that the resulting eutrophication has caused further deterioration of oxygen conditions in the **Baltic Sea deep water.** In addition to phosphate loads from outside sources, the high phosphate accumulation rates found in the deep waters of the central Baltic Proper since 1977 may be the result of remobilization of phosphorus from sediments in reaction to the increasing deoxygenation. Phosphate concentrations have remained at the same level in the entire **Gulf of Bothnia** since 1978. Nitrate concentrations have increased in both the surface layer and the deep water of the **Gulf of Bothnia,** although no eutrophication appears to have occurred in its open waters. Present estimates indicate that the total nutrient supply to the Baltic Sea (including the **Belt Sea and the Sound)** is about 730 000 tons nitrogen and 50 000 tons phosphorus per year. About 40% of the nitrogen supply comes directly from the atmosphere and through nitrogen-fixation, a natural process caused by some plankton algae, while only 10% of the phosphorus supply derives directly from the atmosphere. The total nitrogen concentrations in precipitation (a sum of nitrate and ammonium - see Table 3-1) show a slightly increasing trend during the period from 1986 to 1990, mostly due to increasing concentrations of ammonium. The nitrogen flux decreases from about 1 000 kg $N/km^2/year$ in the southern parts of the Baltic Sea to 700 kg $N/km^2/year$ in the north. These levels represent increases, since the turn of the century, in nitrogen loading by about 4 times and in phosphorus loading by 8 times.

Metals and Persistent Organic Compounds

Reliable data on trace elements and persistent organic compounds in the open Baltic Sea are limited. It should be noted that waterborne pollutants first enter the Baltic Sea in its coastal zones from local point sources; therefore, concentrations of harmful substances are generally higher in those areas than in the open Baltic Sea.

Trace element concentrations in fish and shellfish have not changed remarkably since the early 1980s. In general, mercury values in biota do not significantly differ from those in the North Sea and the North-East Atlantic. Compared with background levels, elevated mercury concentrations have been found in **the Sound and southern Bothnian Sea,** although there has been a decrease in the latter in recent years. Both mercury and lead loading are high in the **Kattegat** and the **Sound.** Cadmium concentrations have been on the rise in fish from the northern part of the **Bothnian Bay.** The reason for this is not fully understood, although the inverse relationship between salinity and cadmium uptake in the biota might explain the increase to a certain extent. Zinc and copper have shown similar trends. In the **Kattegat and the Belt Sea,** lead concentrations in fish and shellfish appear to be decreasing. It is possible that this is already an effect of the increased use of unleaded petrol. Metal loading from anthropogenic sources is lowest in the **Bothnian Bay** and increases southward to the **Baltic Proper,** although zinc loading is high in the **Bothnian Sea,** due to geological conditions. Loads of cadmium, lead and mercury are highest in the **Baltic Proper,** corresponding to five to seven times the background level.

As a result of the ban on certain harmful substances, some positive changes have been observed. DDT levels in biota have decreased since the 1970s and are currently stable. Following the ban on technical HCH, there is an ongoing decrease of alpha-HCH concentrations. Furthermore, concentrations of PCBs appear to be stabilizing at lower levels, especially in the **Baltic Proper,** as a result of its declining use since the 1960s. However, concentrations of organochlorine residues in fish from the **Baltic Proper** are still 3 to 10 times higher than in catches from the Northern Atlantic. Among several new contaminants that have been identified are a considerable number of organic substances potentially harmful to the environment. Toxaphene, lindane (gamma - HCH), dibenzofurans, dibenzodioxins and coplanar PCBs have been detected in the Baltic Sea ecosystems.

Plankton and bottom fauna

Unusually intense algal blooms indicating increasing eutrophication appear to occur more frequently in the **Kattegat and the Belt Sea and in the Gulf of Finland.** There is evidence that phytoplankton primary production has doubled

within the last 25 years in the area from the **Kattegat** to the **Baltic Proper,** reaching a high level in the 1980s. Primary production is accompanied by a doubling of the biomass and its subsequent sedimentation. Decomposition of algae decreases the oxygen levels in bottom waters. Consequently, low oxygen concentrations in late summer and autumn were often observed in the 1980s in the southern **Kattegat,** the **Belt Sea, the Sound and the Arkona Basin,** resulting in fish mortality and damage to bottom animals.

2.3 STATE OF THE COASTAL WATERS

In a discussion of the state of the coastal waters of the Baltic Sea, two general observations can be made:

- In the open Baltic Sea, it is difficult to differentiate rates of oxygen consumption caused by natural processes and by pollution. In coastal waters, this assessment is often much easier.

- The differences between the sub-regions of the Baltic Sea can be explained to some extent by differences in the amount and composition of land-based discharges to the area.

Monitoring and assessment on the state of the Baltic Sea has been carried out by the Baltic Sea States since 1979, in accordance with the joint guidelines for the Baltic Monitoring Programme agreed upon within the Helsinki Commission. In addition, the Baltic Sea States have national monitoring programmes. The principle agreed upon in the joint guidelines was that national monitoring programmes in territorial waters and input studies in coastal waters should be established to supplement the joint monitoring programme in the open sea. It was also decided that the compiled results of coastal monitoring should be regularly submitted to HELCOM. For various reasons, national submissions of study results for coastal waters have been rather poor; it was only in 1991 that the first periodic assessment of all coastal waters could be undertaken by an expert group of the Commission. The first pollution load compilation was published in 1987 and the second compilation, based on input data of 1990, has been recently completed.

Gulf of Bothnia

In the **Gulf of Bothnia,** heavy metals (such as arsenic, cadmium, mercury and lead) and persistent organic substances are a threat to the environment. Airborne and waterborne metal emissions can be traced in the sediments and organisms of the Gulf of Bothnia and along both the Swedish and Finnish coasts. Intensive pulp and paper production has affected the biota of many coastal ecosystems in the Baltic Sea. High concentrations of organochlorines are found in the sediments of coastal areas near pulp and paper mills. Nitrogen, especially NO_3, has increased since the 1970s. Although the Gulf of Bothnia is one of the few areas not suffering from eutrophication to the point of oxygen depletion, local effects of the land-based pollution load are seen in several coastal areas of both countries surrounding the Gulf.

Gulf of Finland

In the easternmost end of the **Gulf of Finland,** the **Neva - St. Petersburg region,** there is serious eutrophication, with high values of primary production and heavy algal blooms, some of which have been toxic. The Neva River is the principal carrier of pollutants. In comparison, the impact of pollution from other areas discharging to the Gulf of Finland is considerably smaller. On the southern coast of the Gulf of Finland, the Narva River is the chief source of nutrient discharge to the Gulf. The pollution level in the **Estonian** coastal waters is still high especially in the bay areas. Although improvements in water quality have been reported in many areas near the **Finnish** shoreline, thanks to more efficient water protection, there are still areas of poor water quality in the inner archipelago. Recent studies have also revealed that in winter, nutrient-rich waters originating in the easternmost part of the Gulf flow below the ice towards the Finnish archipelago, increasing vernal plankton production in the whole northeastern Gulf of Finland.

Gulf of Riga

Estonia, and **Latvia in particular,** discharge waste waters to **the Gulf of Riga**. The principal river discharging to this part of the Baltic Sea is the Daugava. However, the pollution problems of this shallow bay area are primarily due to local discharges. During the 1980s, freshwater run-off to the Bay was high, contributing to a decrease in salinity. In addition, phosphorus and nitrogen values have increased, oxygen concentrations have clearly decreased, and changes in the biota have been observed. A well-known problem in the Gulf of Riga is contamination of coastal waters by insufficiently treated sewage water discharges near the large beaches, which have now been closed to swimming and recreation for more than two years.

Eastern Baltic Proper

Vilnius and Kaunas, the largest cities in **Lithuania,** dispose of their wastewaters through the Nemunas River into the semi-enclosed Kur_iu Bay. Other sources include smaller municipalities, the pulp and paper industry and agriculture. Water quality is so deteriorated that the Bay is eutrophied and fish resources have decreased. To improve the situation, construction of a biological treatment plant has begun in Vilnius. Other pollution discharges to the coastal waters originate from Klaipeda and Palanga, both in Lithuania.

In the **Kaliningrad** region, discharges originating in the city of Kaliningrad, together with the industrial plants and farms located in the drainage area of the region cause local pollution problems in the coastal waters.

Gulf of Gdansk, Middle Polish Coast, Pomeranian Bay

A considerable amount of nutrients and toxic substances are discharged to the Baltic Sea from **Poland.** The majority of the pollutants is carried by river flows. The largest of the ten rivers flowing to the Baltic are the Vistula (draining the territories of Belarus. Poland, Slovak Republic and Ukraine) and the Oder/Odra (draining the territories of the Czech Republic, Germany and Poland). While increasing eutrophication is a consequence of elevated nutrient inputs, some of the coastal waters are polluted also by toxic substances, such as heavy metals, chlorinated hydrocarbons and oil. The most polluted areas of the Polish coastal waters are the Gulf of Gdansk and the Pomeranian Bay, both of which absorb significant pollution loads through river outflows. Intensive primary production has been observed in these areas. Along the more open Polish coast, the problems are similar to those in the open Baltic Sea. In the late 1980s, hydrogen sulphide was detected in the Gulf of Gdansk in high concentrations. The decrease in fish catches along the entire Polish coast during the last decade has been attributed to changes in living conditions for fish, but overexploitation of certain fish stocks may have played an important role in these changes as well.

Arkona Basin

The coastal waters are characterized by increasing eutrophication. Several areas are seriously deteriorated by a high nutrient input, and recreation has been significantly limited in these areas. Coastal effluents are subject to high organic and nutrient loads.

The Belt Sea, the Sound and the Kattegat

In **Denmark,** summer conditions in the coastal waters depend principally on nitrogen input. The coastal waters, especially the closed inlets, can retain and decompose nutrients, usually during the summer, whereas the major part of nitrogen runoff during the winter months reaches the open waters. Increases in winter concentrations of nitrate and phosphate in the waters have been recorded annually during recent decades. Heavy algae production. especially in the spring, is a common phenomenon in Danish open waters, and in many inlets and bays mass occurrence of plankton algae, some of them toxic, has become an annual phenomenon. During the 1980s, oxygen depletion in Danish waters was more frequent, longer lasting and stronger than ever before.

Although only part of **Germany** is located in the catchment area of the Baltic Sea, its coastal waters are also subject to ecological problems,

particularly around Mecklenburg-Vorpommem. Thanks to effective measures in the catchment area of Schleswig-Holstein, considerable reduction in discharges of nutrients and other harmful substances has been achieved, especially from urban areas.

In many local areas of **Sweden,** especially in the archipelagoes, eutrophication is the main problem, particularly in relation to the nitrogen cycle. Together with Denmark, Sweden has contributed to the heavy nutrient loading of the Kattegat and the Sound. The Laholm Bay in particular suffers from eutrophication, which has resulted in fish mortalities and large scale damage to marine life.

2.4 STATE OF LIVING RESOURCES

Natural resources, fish and fisheries

In the brackish water of the Baltic Sea, fish are a mixture of marine and freshwater species. Marine species such as herring, sprat and cod dominate in open waters, while both marine and freshwater species inhabit coastal areas. Extreme increases in catches have occurred during the last 50 years, when the annual yield has grown from some 100 000 to 1 000 000 tons. Between 1965 and 1975, there was an apparent increase in the productivity of fish in the Baltic Sea. Herring, sprat and cod represent about 90% of the total catch. Salmon and eel are also economically important. Yearly, somewhat more than 100 000 tons of the Baltic Rügen herring is caught in waters adjacent to the Baltic Sea.

The value of the catches, which amounts today to about 540 million ECU per year, is an indication of the considerable economic importance of these living resources. Another important aspect is the fact that considerable quantities of nitrogen and phosphorus are removed from the Baltic via this activity.

Currently the situation of the pelagic and demersal stocks of the Baltic Sea as a whole varies considerably. While herring and sprat stocks are in good condition and even underexploited, there has been a drastic decline of the two cod stocks (the eastern stock more depleted than the western) mainly because of naturally caused poor recruitment and high fishing pressure during the last decade. The year-classes since 1986 are believed to be among the lowest on record. The International Baltic Sea Fishery Commission was obliged to drastically reduce the Total Allowable Catch (TAC) for the entire Baltic Sea.

Of great importance to the fishery are the coastal areas of the Baltic Sea which serve as spawning, nursery and feeding areas for several species of fish. Data on the state of the coastal waters, mainly with regard to eutrophication and metal contamination, have recently been compiled by HELCOM. The effects of eutrophication are limited to observations on phytobenthos. Two processes in particular have been noted: a change in the species composition and a restriction of the depth range of the vegetation zone. Both processes have had negative impacts on the coastal fish populations. Along many of the coasts around the Baltic Sea there are problem areas regarding eutrophication and/or metals. Fresh water species, which occur mainly in the archipelagos, may be subjected on a local scale to considerably more pollutants than the marine species.

The effects of eutrophication in archipelago areas are well documented outside Helsinki, where herring have disappeared from the most polluted areas. Changes in fresh water species correspond well with changes observed in eutrophied lakes. In the Stockholm archipelago, similar changes have also been noted. In the Polish coastal waters, where oxygen levels have declined drastically due to pollution. this has resulted in considerable decreases in the abundance of cod. In some shallower parts ot the Polish coast, there has been a decreasing trend in the appearance of whitefish. Studies ot areas close to pulp and paper industries along the Swedish coast of the Gulf of Bothnia, where both nutrients and organic substances are discharged, indicate changes in the fish community similar to those reported from the Helsinki area. In many river systems in the Baltic Sea catchment area salmonid species have disappeared. A common feature in the shifts of the fish communities due to

environmental degradation is a decrease in the abundance of the commercially more important fish species.

Oxygen deficiency in the bottom waters during the summer and autumn has had serious effects on the stock of Norway lobsters in the **Kattegat** and on commercial demersal species in the **Belt and Arkona Seas.** Oxygen deficits may also be linked to an increased occurrence of certain viral diseases in the dab population in the Kattegat.

It is difficult to distinguish between the effects of pollution, fishing and natural factors on fish stocks in the open Baltic Sea. Fish populations are known to be influenced by changing salinity and by oxygen conditions in the deep waters. This applies particularly to cod. This species, spawning in deep waters in the **Bornholm Sea, Gotland Deep and Gdansk Deep** has been seriously affected by the decreasing salinity of the Baltic Sea and the low oxygen concentrations of the bottom waters. The pelagic cod eggs require a minimum salinity of eleven permil to float and an oxygen level of at least 3 ml/l to survive. The northern border for reproduction is the Gotland Deep and successful spawning is dependant on an influx of saline water from the North Sea. Successful reproduction of cod in the Baltic Sea has not been observed for the last IO years. At present, the only significant area where salinity levels and oxygen conditions are conducive to cod spawning is the Bornholm Basin.

The low level of development of industries and agriculture in the formerly centrally planned economies, has permitted a comparatively high level of biological diversity to remain in the coastal ecosystems. However, the economic restructuring process now occurring could amplify the threat to the considerable biological diversity of coastal wetlands and their important role as natural filters.

Seals and birds

At the turn of the century, the Baltic Sea seal populations comprised several hundred thousand individuals. During recent decades, harbour seal, ringed seal and grey seal populations have declined rapidly. Several reasons, among others, hunting and modern fish gear, have contributed to this almost catastrophic reduction in seal populations. However, from an environmental point of view the most important cause in recent times is considered to be toxic substances. Because the seals are at the top of the food chain, the accumulation of toxic substances has caused reproductive failures. Thanks to measures taken by the Baltic Sea States, a slow recovery of the populations has begun. Baltic grey seals are now estimated to number about 3 000 and ringed seals about 5 500-6 000. The harbour seal is found only in the western Baltic Sea and is represented by only about 200 individuals. Organochlorine levels (DDT, PCBs and HCB) are still very high in the seals (higher than the levels permitted for human consumption of fish).

Other effects of pollution on the living resources concern toxic chemicals and oil spills. The main known effect, discovered in the 1970s, of DDT and also to a certain extent of PCBs in the Baltic Sea, was the decrease in eggshell thickness of birds feeding on fish and mussels. This was particularly true for razorbills, guillemots, black guillemots, and white-tailed eagles. Oil spills and discharges are a danger especially in sheltered coastal waters, where currents and wave action are weak and oil accumulates. Birds are extremely vulnerable, as the oil coats their feathers, and mass mortalities can occur even from relatively small spills.

Aquaculture

Aquaculture is the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. The most important fish farming activity in the Baltic Sea countries is salmon and trout farms located on rivers, lakes and in coastal waters. Fish production in freshwater includes both the cultivation of young fish for transfer to coastal farms, where they are fed intensively to reach a marketing size, and the production of smaller "portion-size" fish for direct marketing. While aquaculture has been seriously affected by pollution of coastal waters, it can itself constitute a source of pollution. Trends towards intensification in some coastal regions have caused ecological impacts such as eutrophication and changes in the coastal

ecosystems. The type and scale of any ecological change associated with coastal aquaculture depend on the method of aquaculture, the level of production and the biological, chemical and physical characteristics of the coastal waters.

The significance of fish farming as a nutrient source for the Baltic Sea as a whole is marginal. Total annual production is somewhat less than SO 000 tons. It has been estimated that, in 1989, fish farming accounted for 1.5% of total phosphorus and 0.4% of total nitrogen loads to the Baltic Sea and Skagerrak. Although the effect on the Baltic Sea as a whole is minimal, adverse effects have appeared on a local scale. All fish farming results in discharges of pollutants such as organic matter and nutrients to the aquatic environment, but the natural conditions of the recipient waters determine to a great extent the character and extent of the effects. While nutrient enrichment and eutrophication of open coastal waters is unlikely, this can occur in semi-enclosed coastal areas, such as fjords, inlets, lagoons and archipelagos, which have a restricted exchange of water.

It has also been suggested that the release of dissolved organic compounds together with other components of the diet such as vitamins, influence the growth or toxicity of particular species of phytoplankton in the surrounding waters. There is also concern that the use of pharmaceuticals and antibiotics in the fish farms will lead to undesirable effects outside the farm's boundaries. Net cages in lake and coastal fish farms are often treated with antifouling pesticides, some of which contain organotin compounds that can have harmful effects on the environment.

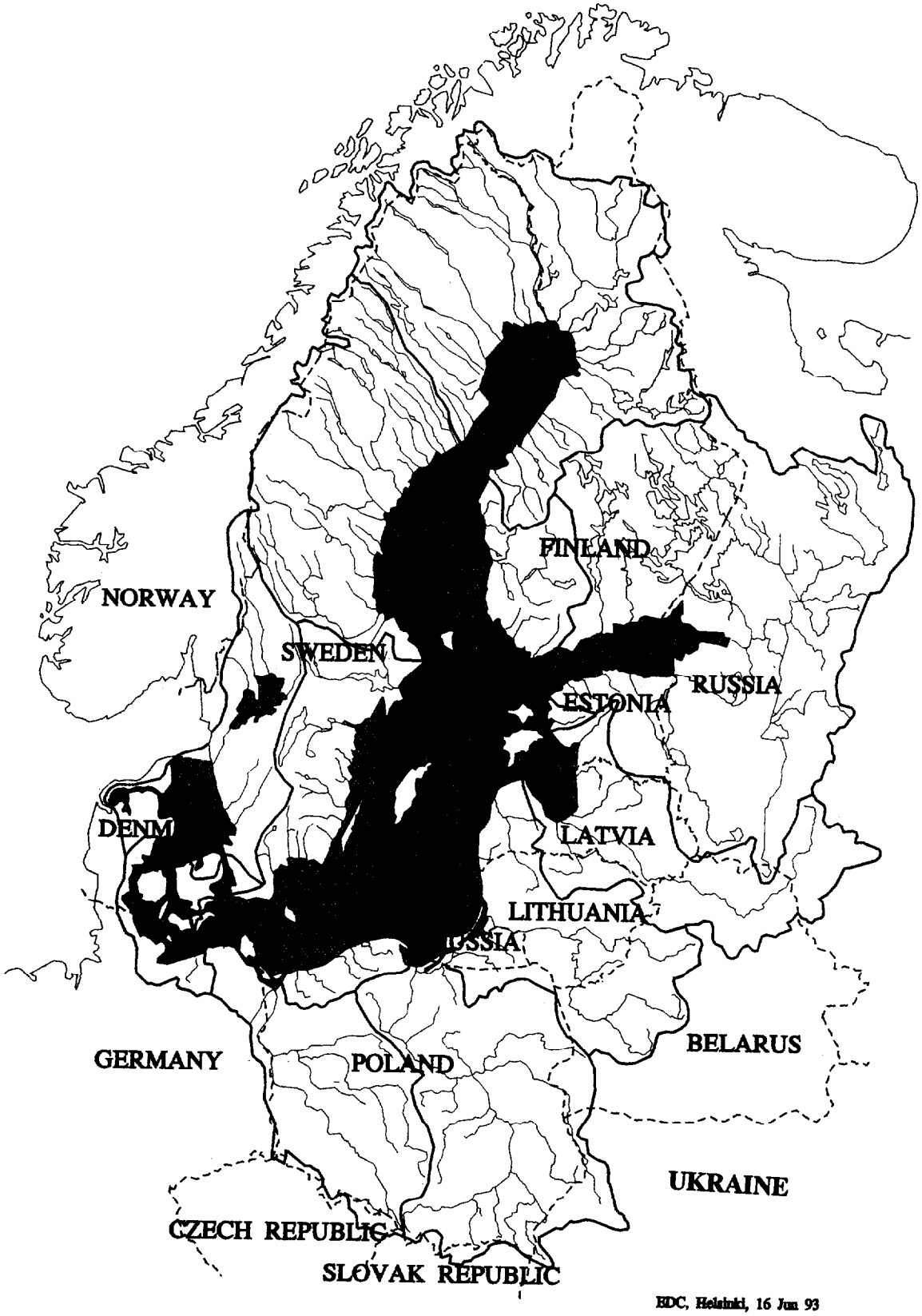

Figure 2-1 The Catchment Area of the Baltic Sea

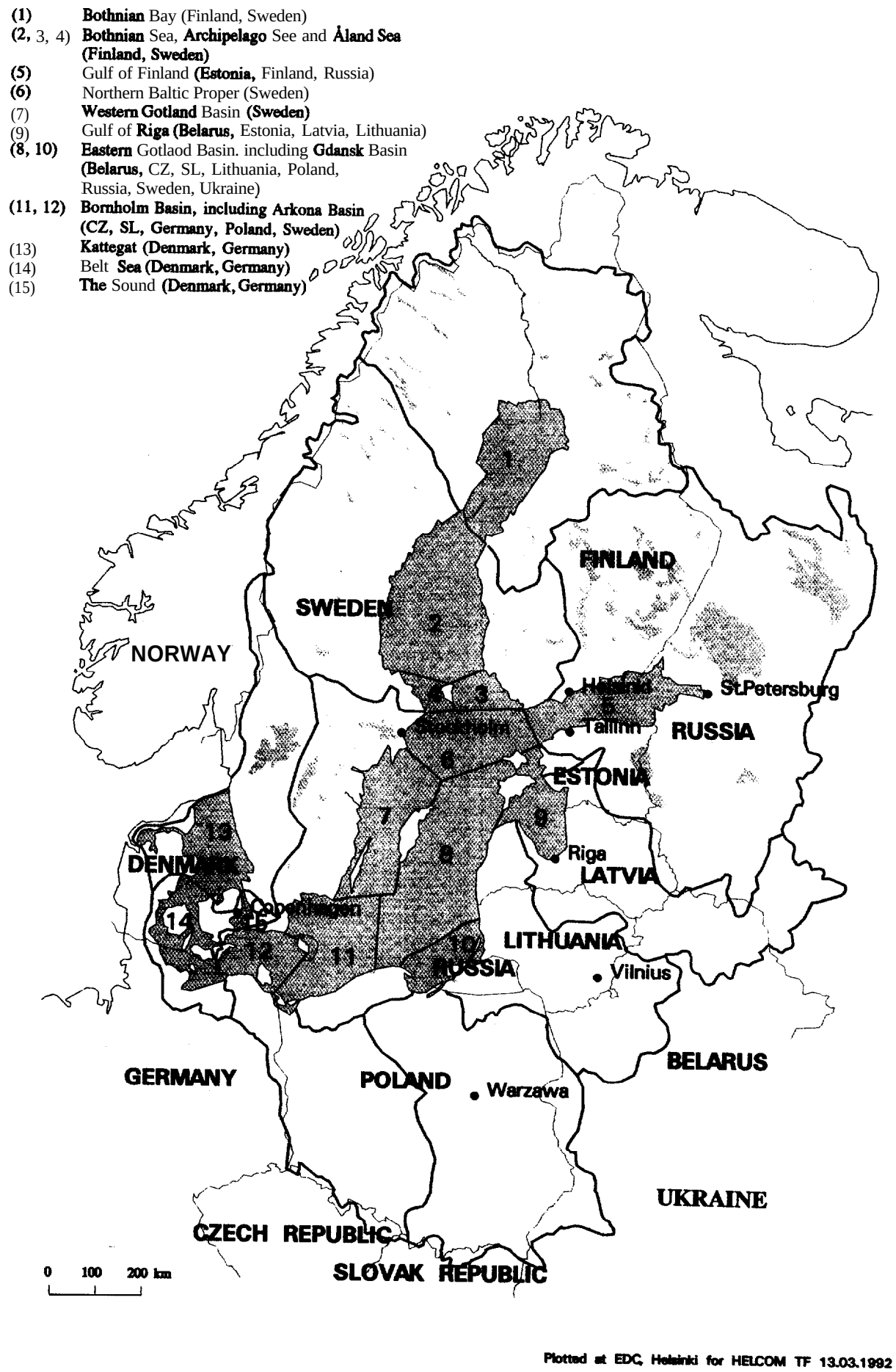

Figure 2-2 Division of the Baltic Sea into sub-regions used in the Task Force work and countries located in the catchment area

Chapter 3

THE CAUSES OF ENVIRONMENTAL CHANGE AND DEGRADATION

3.1 INTRODUCTION

As late as 1950 the Baltic Sea was still regarded as environmentally "healthy". Large-scale industrialization had not yet made its impact, there were few automobiles, and intensive agriculture and forestry making widespread use of fertilizers and pesticides was only commencing. However, since then the situation has changed dramatically. Pollution now threatens the waters, land and air in the entire catchment area - and ultimately the health and well-being of the 80 million people who live there.

There is a wide diversity of pathways by which pollutants reach the Baltic Sea environment. Coastal outfalls discharge directly to estuaries, bays and sea gulfs. Rivers act as large-scale collectors and carriers of wastewater from diverse sources within their drainage basins and offload them to the Sea. Many contaminants are transported to the sea directly through the atmosphere — about 40% of the total nitrogen input is deposited in this way (see Table 3-l).

The precise data on polluting aqueous inputs to the Baltic Sea were not available during the preparation of the Joint Comprehensive Programme due to the fact that the pollution load compilation (PLC-2) based on 1990 data followed its initial timetable, which differed from the Task Force schedule. Although pollution load data presented by the countries in the National Plans of 1991 were very useful for preparation of the Programme, their aggregation proved to be more difficult. At present, the Second Pollution Load Compilation (PLC-2) has been completed. The summarized load data is presented in Tables 3-2, 3-3 and 3-4. This data should prove useful during implementation of the Programme. Further Pollution Load Compilations shall also serve the Programme in the long run as a follow-up instrument. The structure and the coverage of the Pollution Load Compilations in future would, however, require revisions according to Programme needs.

An important factor contributing to the degradation of the Baltic Sea is the destruction of its wetlands, particularly in the western parts of the catchment area. Mostly during the last century, coastal wetlands were ditched and drained in order to meet the demands of expanding modern, intensive agriculture. Wetlands have also been dredged or filled to make room for urban and industrial developments, including harbours. The consequences were not so visible until anthropogenic pressure on the Baltic Sea intensified. In recent decades, however, the disappearance of wetlands has had deleterious effects on nutrient balances.

A host of political and economic causes also contribute to the environmental change and degradation of the Baltic Sea. These include inadequate economic policies, inefficient economies, legislation without appropriate enforcement mechanisms, weak institutional arrangements and many others. These causes vary for each of the countries of the Baltic Sea catchment area.

In the market economy countries (Denmark, Finland, Norway, Sweden and the old Länder of Germany), municipal and industrial pollution loads have been significantly reduced in the last decades, and new policies are being introduced to better control waterborne and airborne emissions from industrial sources. Product control measures have also been introduced which have reduced the use of hazardous compounds. There is still scope for improved control of some industries, such as pulp and paper plants. The total farming area in these countries is much smaller than in the other Baltic region countries, but because intensive

agricultural practices involve high use of chemical fertilizers, better policies are needed to control nutrient releases.

The situation is different in the formerly centrally planned economies (Belarus, the Czech Republic, Estonia, Latvia, Lithuania, Poland, Russia, Slovak Republic, Ukraine and the new Federal Lander of Germany). The overall pollution load from different sources is high. Several concrete programmes are being undertaken to alleviate the situation (some of them with foreign assistance), but the economic situation of these countries seriously constrains the possibilities of a quick recovery.

In the following paragraphs, the principal causes of environmental change and degradation of the Baltic Sea are discussed, with reference to its sub-regions as shown in Fig. 2-2 in Chapter 2. To the extent possible, municipal, industrial and agricultural pollution sources are identified. As a significant proportion of the pollution load is from the atmosphere, the local sources of air pollution as well as the contribution of long-range transport are discussed.

3.2 THE CAUSES

3.2.1 Bothnian Bay

The catchment area of the Bothnian Bay (277 000 km^2) is divided between Sweden (131 000 km^2) and Finland (146 000 km^2). The Swedish and Finnish populations in the area are 389 000 and 241 000 inhabitants, respectively. The Bay is the most northerly part of the Baltic Sea. It has no significant eutrophication problems and there is no oxygen deficit even in the deep waters. Phosphorus is considered to be the limiting production factor and nitrate is not completely consumed during the season of high biological activity. As a consequence of the significant waterborne and airborne supply, nitrate has accumulated during the last 20 years in both the surface layer and the deep water of the Bay.

Municipalities: There are several municipalities in the catchment area of the Bothnian Bay, but only 8 Swedish and 16 Finnish are larger than 10 000 p.e. (population equivalents). All major municipal wastewater treatment plants are equipped with either biological, chemical or biological-chemical treatment facilities.

Traffic is not a major pollution source, due to the low population density.

Industries: The pulp and paper industry in both countries is responsible for sizeable discharges of oxygen-consuming substances, nutrients and persistent organic compounds. There are 4 Finnish mills in this area. Two of them produce bleached kraft pulp (Veitsiluoto Oy and Metsä-Botnia Oy). Only one of the five plants on the Swedish coast produces bleached kraft pulp. In several plants, both in Finland and Sweden, various installations are being added to reduce emission loads (extended cooking, oxygen delignification, chemical flotation, activated sludge treatment, etc.).

There are substantial emissions of heavy metals (e.g. airborne arsenic) from the two non-ferrous heavy metal smelters located in Rönnskär and Kokkola. A programme to reduce these emissions is being implemented. There are 3 iron and steel plants and several mines in the drainage area of the Bothnian Bay.

Agriculture: There are about 113 000 ha and 544 000 ha of arable land, in Sweden and Finland, respectively. In the Swedish part of the catchment area, farming is low-intensive and small scale. Forests occupy about 11 500 000 ha of the sub-region, divided about equally between the two countries.

Main problems: Occurrence of arsenic (caused more by old deposits in the bottom sediments than by current emissions) and discharges of harmful organic substances and nutrients from pulp and paper mills.

3.2.2 Bothnian Sea, Archipelago Sea, and Åland Sea

The catchment area of this sub-region belongs to Finland (39 500 km^2) and Sweden (1 80 000 km^2). There is a population of 432 000 and 1 123 000 inhabitants respectively. The Bothnian Sea is a basin between the Northern Baltic Proper and the Bothnian Bay. Signs of eutrophication can be observed especially in some of the coastal regions of the Bothnian Sea.

Municipalities: There are several hundred municipalities in this sub-region, but only 19 in Finland and 24 in Sweden are larger than 10 000 p.e. The largest city is Turku with about 200 000 inhabitants. In all larger municipalities phosphorus removal has been effective since the 1980s. Nitrogen removal has been introduced in Turku with an efficiency rate of over 40 percent.

Industries: There are 22 Swedish pulp and paper mills in the sub-region, of which 7 produce bleached kraft pulp. Sweden's largest mill producing bleached kraft pulp is located in Husum. There are 1 I Finnish pulp and paper mills in the sub-region, of which four produce bleached pulp. A number of internal and external steps have been taken since 1987, resulting in a substantial reduction in discharges of AOX and COD. Further measures to reduce both water and air emissions are planned.

There are several metallurgical and chemical plants in the area. Of special significance are the alumina smelter in Sundsvall (emissions of tar containing polyaromatic hydrocarbons), Kemira Oy Vuorikemia in Pori, which manufactures titanium dioxide pigment and ferrous sulphate (direct discharges of iron and H2SO4), and Harjavalta non-ferrous heavy metal smelter (atmospheric emissions of cadmium and arsenic). Mining waste sites at Dalälven in Sweden leach annually (1 987) about 675 tons of zinc, 22 tons of copper, and 0.8 tons of cadmium. Planned measures will reduce the leachate by 75 percent by the year **2000.**

Fish farming in Finland causes local problems, especially in the Archipelago Sea. In the Swedish part of the area fish farming is rather small.

Agriculture: There are about 330 000 Swedish ha and 1141 000 Finnish ha in this area. Farming in Finland has become so intensive that it causes serious problems locally and contributes to eutrophication of the central part of the Finnish archipelago. Forests cover about 9 million ha in Sweden and 3 million ha in Finland.

Main problems: Discharges of harmful organic substances and nutrients by pulp and paper industry, nutrients from agriculture and forestry, and metals from industries and mining waste sites.

3.2.3 Gulf of Finland

The catchment area of the Gulf of Finland is 42 1 000 km^2 (Estonia 35 000 km^2, Finland 110 000 km^2 , Russia 276 000 km^2). The Gulf is one of the most heavily loaded parts of the Baltic Sea. The city of St. Petersburg and the adjacent region, Karelia, and Estonia are main contributors to the pollution of the Gulf. The phosphorus load is especially critical. About 25 percent of the phosphorus point-source load for the whole of the Baltic Sea is discharged into the Gulf of Finland.

Municipalities: There are three capital cities located on the coast of the Gulf of Finland: St. Petersburg, Tallinn and Helsinki. St. Petersburg is the most populous. Several other cities located in the Baltic Sea catchment area face problems similar to St. Petersburg and Tallinn.

St. Petersburg Together with its suburbs, the city of **St. Petersburg** is the largest municipal emission source in this area. It has about five million inhabitants and more than 2 000 large industrial enterprises (metal, electrical, chemical, textile, paper and construction) discharging untreated wastewater into

municipal sewers. Due to extensive water consumption, municipal sewage treatment plants are overloaded and unable to adequately treat the wastewater. The poor condition of the sewer network and the inevitable leakages add to the problem. St. Petersburg is responsible for about 40 percent of the total BOD point-source load and about 50 percent of the total phosphorus point-source load discharged to the Gulf. In 1990, the city discharged 5 l 500 tons of BOD, 20 000 tons of tot-N, and 3 300 tons of tot-P. Three biological treatment plants are under construction. The biggest problems related to wastewater management in St. Petersburg are insufficient pre-treatment of industrial wastewater, discharge of untreated sewage from about two million city inhabitants, and insufficient nutrient removal rates at the central and suburban wastewater treatment plants. The discharge of untreated sewage is partly due to the lack of treatment facilities (about 40 percent) and partly to insufficient treatment capacity and frequent by-passes (about 60 percent).

Municipal and industrial wastes (including hazardous and toxic substances), as well as wastewater sludge, are of great concern. In the city of St. Petersburg alone, over 70 percent of municipal wastes are taken to landfill sites. At Krasnyj Bor, about l million cu m3 of hazardous wastes have been deposited during the past 20 years, and the area will be filled within two to three years. The surface water from Krasnyj Bor drains to the tributaries of the Neva and ultimately reaches the Gulf. Sewage sludge from the city wastewater treatment plants is stored in an earth basin area. Leakage is considerable. The city of St. Petersburg is responsible for about 90 percent of all copper and chromium discharges to the Gulf of Finland (108 tons/year and 69 tons/year respectively). This load is generated primarily by about 300 plating industry plants located in the city.

The main part of the SO2 emissions generated in the city of St. Petersburg and the surrounding region originates in thermal electric power plants. In recent years, about 70 percent of the city plants have been converted to natural gas, and the same tendency is observed in the St. Petersburg region. In spite of these measures, in the late 1980s, SO2 and dust emissions in St. Petersburg and region amounted to 184 600 tons/year and 16 100 tons/year, respectively.

Tallinn The city of **Tallinn** has some 500 000 inhabitants (about one third of the total population of Estonia). All industrial enterprises in the city are connected to the sewer system. In 1990, effluents from the wastewater treatment plant (mechanical and chemical treatment; first phase of biological treatment to be completed in 1992) contained 12 300 tons of BOD7, 3 600 tons of tot-N, and 255 tons of tot-P. In other cities of Estonia, poor conditions of the sewer systems and pumping stations cause frequent sewage bypasses. These unsatisfactory conditions occasionally cause bacteriological pollution of the coastal waters of Estonia.

Helsinki Region The **Helsinki region** has a population of about 800 000, and in 1990 the effluent from its six wastewater treatment plants equalled some 2 040 tons of BOD7, 4 050 tons of tot-N and 96 tons of tot-P. Within the whole sub-region, there are 39 Finnish municipalities generating sewage loads of more than 10 000 p.e. each. Ten of these plants are on the coast.

Industries:

Russia There are 17 pulp and paper plants in the **Russian** part of the sub-region. Outside of the factories located in the city of St. Petersburg, the largest are the Volkhov aluminium and chemical plant in the St. Petersburg region and the Nadvoitsy aluminium plant in Karelia.

These industrial enterprises pollute both the water and the atmosphere. Their

atmospheric emissions, combined with those of traffic, have many detrimental effects on human health. The major Russian sources of atmospheric emissions are pulp and paper plants and the mining industry located in Karelia. By the end of the 1980s, the emissions totalled 141 800 tons/year of SO2 and 3 1 000 tons/year of dust. Almost 40 percent of the total SO2 emissions originated at the Kostamuksha mining combinate. The Nadvoitsy aluminium plant as well as the Pitkyaranta, Segezha, and Kondopoga pulp and paper plants are the other sources of primary importance.

Long-range atmospheric transport is directed towards Finland. Up to 30 percent of total sulphur deposition in southern and eastern Finland originates in Estonia and the Russian part of the Gulf catchment area. Nitrogen emissions from Russia account for 10 to 30 percent of the total NOx and 20 to 50 percent of the total reduced nitrogen deposition in Finland.

Estonia In **Estonia** there are two pulp and paper mills, a small sulphite mill in the center of Tallinn (present production reduced to about 20 000 tons due to wood shortage) and a sulphate mill at Kehra (production about 40 000 tons/year). Both Estonian mills have an adverse impact on water quality in the Gulf. The Kohtla-Järve industrial complex, including oil shale burning power plants, is of special significance. The total annual waterborne load generated by this complex amounts to 525 t/year of tot-N, 15 t/year of tot-P, 950 t/year of phenols, and 5 500 tons/year of BOD5. The Estonian Phosphorates located in the eastern part of Tallinn annually discharge 240 tons of tot-N, 50 tons of tot-P, and 320 tons of BOD5.

The critical sources of atmospheric emissions in Estonia are two large oil-shale burning power plants located near the city of Narva. The SO2 emissions from these plants equal about 75 percent of the Estonian total which, by the end of the 1980s, amounted to an estimated 288 000 t/year.

Finland There are **29 Finnish** pulp and paper mills in the sub-region, several of which are located on inland lakes. Five mills are on the coast and eight on the banks of rivers that directly affect the coastal waters. Two of these mills (Sunila Oy at Kotka and Kymin Paperiteollisuus Oy at Kuusankoski) produce bleached kraft (1990 production 660 000 tons). The rest of the mills produce mainly wood-containing paper (production in 1990 of 2 250 000 tons). Both in pulp and paper mills various internal and external measures have been taken to reduce discharges of organic substances and nutrients. Atmospheric emissions from the Finnish coastal pulp and paper industry do not affect the Baltic Sea because of the prevailing westerly winds and air pollution control measures.

Agriculture:

Russia In the **St. Petersburg** region there are several large-scale livestock farms with about 500 000 hogs, 30 000 head of cattle, and 11 000 000 fowls. Of the 5 million m3 wastewater generated annually by hog farms, over half is not treated at all or treated insufficiently. This wastewater is stored in huge open reservoirs built between earth dams. The ultimate leakage to the Gulf is considerable. Arable land in the Russian part of the sub-region occupies some I 930 000 ha (St. Petersburg region - 415 000 ha, Novogrodsky region - 504 000 ha, Pskovsky region - 934 000 ha and Karelia - 77 000 ha). The fertilizer (NPK) application rates in 1990, were on the order of 270 kg/ha in St. Petersburg and Karelia regions. In the Novogrodsky and Pskovsky regions they are lower than the above rates by about 100 kg/ha.

Estonia In **Estonia,** large-scale livestock production is also dominant, with large farms of more than 400 cows or 5 000 hogs (the largest hog farm situated near Viljandi has 35 000 to 40 000 head). Arable land occupies about 1.O million ha. In the 1950s, the usage of mineral fertilizers (NPK) was on the order of 40 kg/ha while in the late 1980s it

reached the very high level of 290 kg/ha. Last year mineral fertilizer and pesticide use decreased because of price increases.

Finland In **Finland,** arable land occupies about I .1 million ha. Forested area is equal to about 6 million ha. Agriculture contributes to a considerable nutrient load, due to a high application rate of N/P fertilizers. To reduce the load, the following measures, among others, have been taken: protective zones; introduction of fertilization taxation, based on the N and P contents of fertilizers; fertilizer usage according to yield expectation; and improved storage and spreading of manure.

Main problems: Municipal sewage and industrial wastewater flowing to the Gulf of Finland from Russia and Estonia are the principal causes of water quality problems in the Gulf. Large-scale livestock operations as well as municipal and industrial hazardous and toxic wastes contribute to the problem significantly. In addition, discharges from non-point sources are substantial. Large-scale pulp and paper industries, mainly located at inland lakes, discharge considerable amounts of organic substances and nutrients.

3.2.4 Northern Baltic Proper

The catchment area of the Northern Baltic Proper is located in Sweden (48 000 km^2) and in Estonia (the island of Hiumaa). The sub-region is inhabited by about 3 million people. The majority of the land area is drained by Mälaren-Norrström and Motala Strom. Their catchment areas include three of Sweden's largest lakes: Hjälmaren, Mälaren and Vättern. The lakes temper both water flow and transport of pollutants. They function also as sedimentation and denitrification basins.

Municipalities: There are 32 coastal municipalities, including Stockholm and its suburbs, of which 14 are larger than 20 000 p.e. All sewage water is subject to biological and chemical treatment with an efficiency of more than 90 percent in BOD and tot-P The level of phosphorus removal is high. Remedial measures already undertaken should result by 1995 in the reduction of direct discharges of tot-N from the current 5 500 t/y to 3 800 t/y and of tot-P from 110 t/y to about 80 t/y. Discharges of phosphorus into the Northern Baltic Proper derive largely from municipal wastewater treatment plants and agriculture.

Industries: There are 15-20 major industrial plants in the catchment area. On the coast is an integrated steelworks which is the largest single industrial source of emissions of nitrogen and PAH (Oxelösund), a n oil refinery (Nynäshamn), and a newsprint mill (Braviken).

Agriculture: Farming is quite intensive in the plains around Lake Mälaren and Lake Hjälmaren. Livestock density is relatively small.

Main problems: Nutrient discharges cause increasing eutrophication; several bottom areas are deoxygenated.

3.2.5 Western Gotland Basin

The catchment area of the Western Gotland Basin is located entirely in Sweden and has an area of 19 000 km^2. It is inhabited by approximately 300 000 people.

Municipalities: There are 27 coastal municipalities of which only four are larger than IO 000 p.e. Biological and chemical methods are in use at all municipal wastewater treatment plants with an efficiency of more than 90 percent in BOD and tot-P. The remedial measures already undertaken should result by 1995 in the reduction of direct discharges of tot-N from the current 900 t/y to 400 t/y and tot-P from 23 t/y to I3 t/y.

Industries: The only major industrial plant in the sub-region is the bleached kraft pulp mill located on the coast at Mönsterås.

There are plans to double production capacity of this mill, but steps have already been undertaken to reduce discharges of oxygen-consuming substances, nutrients and chlorinated organic compounds (reduction of AOX discharges from current 1 kg/t pulp to less than 0.5 kg/t is foreseen).

Agriculture: Farming is small scale and of low intensity in this part of Sweden.

Main problems: A large proportion of the pollution load reaches the Baltic Sea by direct atmospheric deposition. Atmospheric deposition of tot-N over the Western Gotland Basin is estimated to be around 25 000 t/year about 15 percent of which originates in Sweden. Agriculture as well as municipal wastewater treatment plants are significant pollution sources (nitrogen).

3.2.6 Gulf of Riga

The catchment area of the Gulf of Riga has a total area of 138 000 km^2, including Estonia (7 000 km^2), Latvia (59 000 km^2), Lithuania (10 000 km^2), Belarus (38 000 km^2) and Russia (24 000 km^2). Some 2.0 million people live in the Latvian part of the catchment area.

The catchment area is defined by the drainage basin of the Daugava River extending from Latvia to Belarus and Russia (87 900 km^2) and several smaller rivers such as Pärnu (5 200 km^2), Salaca (3 500 km^2), Gauja (8 900 km^2) and Lielupe (17 600 km^2). The total drainage area of small streams in the coastal areas is some 23 000 km^2. The Gulf of Riga is separated from the Baltic Proper by the two islands of Hiumaa (1225 km^2) and Saaremaa (2 650 km^2). These islands are important nature reserves and are protected as such.

Municipalities: The Pärnu River basin in **Estonia** is predominantly agricultural; the main pollution point-sources are the cities of Pärnu and Paide. Pärnu has an old-fashioned wastewater treatment plant, which treats only 65 percent of the total volume of sewage. Pre-treatment of industrial wastewater discharged into the municipal sewage system is practically non-existent. The situation in Paide is similar; about 80 percent of the total municipal sewage bypasses the wastewater treatment station.

In Western Estonia, the next largest city after Pärnu is Haapsalu (population I6 000), which discharges municipal and industrial (fish processing industry) wastewater directly to the Baltic Sea. The existing wastewater treatment plant is mechanical only and seriously outdated. Until the Second World War, Haapsalu was a holiday resort town well known all over Europe, thanks to the largest deposits of curative mud in Northern Europe.

The two largest cities in the **Daugava River basin** are Riga, the capital city of Latvia, and Daugavpils. The pollution load originating in these two cities makes up more than 70% of the total municipal wastewater load in Latvia. Although both cities have wastewater treatment plants (mechanical treatment only in Daugavpils), they are overloaded by the discharge of industrial wastewaters to the municipal systems, constituting 40-50% of the total amount of wastewater treated. This is in fact one of the characteristic features of municipal sewage systems all over the former USSR. Industrial wastewater is discharged into the municipal sewage systems with little if any pre-treatment, creating severe difficulties, in particular interruption of the processes of biological treatment. In other Latvian cities, wastewater disposal and treatment systems have been built mostly for the local industrial enterprises.

The quality and the level of maintenance of treatment facilities are generally low. In 1991, completion of the first stage of a new biological wastewater treatment plant in Riga (70-80 percent of total needs), greatly contributed to the reduction of the municipal pollution load. Discharges have been reduced from 35 000 to 1 950 tons/year in BOD5 and from 58 000 to 3 900 tons/year in COD.

Through the municipal sewage systems, large amounts of heavy metals and other harmful substances are discharged to the Daugava, its tributaries, and eventually to the Gulf of Riga. An issue of great concern is the high accumulation of heavy metals in the wastewater sludge and the resulting problem of sludge disposal.

In urban areas and around large point sources there are problems with local air pollution. Measurement data indicate high concentrations of carbon monoxide, dust and ammonia in urban air. Very high concentrations of benzene, polyaromatic hydrocarbons and other toxic compounds are reported from industrial areas. There are generally less problems with nitrogen dioxide.

Industries: There are several industrial plants in the sub-region, including pharmaceutical, chemical, biochemical and fertilizer plants. While they are often equipped with fairly up-to-date technology, pollution loads are heavy and poorly handled. For instance, the huge Pharmaceutical Industry "Latvbiofarm" in Riga has a wastewater treatment plant, but its capacity is only 25 percent of the actual need. Several types of hazardous waste are generated and all are dumped in nearby forests (groundwater pollution). There are many food processing plants, but most of their machinery is very old and worn out (e.g. yeast factory dating from 1940). Wastewater treatment facilities, if any, are often not functioning and raw wastewater is discharged to the local streams. Although the Vohma meat combine in the Pärnu River basin, for example, has an outdated wastewater treatment plant, the organic load is over twice the original design value.

There is no production of chlorine bleached pulp in Latvia. Pulp is produced in only one integrated pulp and paper mill (Sloka) which discharges its treated effluent to the Lielupe River. The Sloka mill is responsible for 7 670 tons/year of COD discharged to the Baltic Sea. The remaining three mills produce paper only.

Agriculture: The total area of cultivated land in the Latvian part of the catchment area is some 2 000 000 ha (arable land: I 630 000 ha). Once again, large scale livestock farming is dominant. There are about 30 hog farms with 5000 or more hogs and over 400 farms with 400 or more cattle. Emissions from agriculture and forestry are respectively 40 000 tons/year and 6 500 tons/year in N, and 800 tons/year and 100 tons/year in P.

Main problems: Rapid eutrophication of the Gulf of Riga. Moreover, the Gulf serves as a huge settlement tank; the rate of deposition of heavy metals is substantial.

3.2.7 Eastern Gotland Basin (including Gdansk Basin)

The catchment area of the Eastern Gotland Basin extends from the Nemunas River basin in the east to the Vistula River basin in the west. It is the most international part of the Baltic Sea catchment area, covering the territories of seven countries, namely Belarus (58 500 km^2), Lithuania (50 100 km^2), Poland (201 200 km*), Russia (42 700 km^2), Slovak Republic (2 000 km^2), Sweden (1 500 km^2), and Ukraine (I 1 000 km*). About 90 percent of this region falls in the drainage basins of the Nemunas (98 200 km^2) and Vistula (1 94 700 km^2) Rivers. The Swedish part of the catchment area is the Gotland Island which is sparsely populated.

The Vistula has the second largest drainage basin among the Baltic rivers, equalling 12 percent of the total catchment area of the Baltic Sea. It has a total area of 194 700 km^2 (Belarus -11 600 km^2, Poland - 169 100 km^2, Slovak Republic - 1 900 km^2, Ukraine -12 600 km^2) and is inhabited by 23,8 million people (Belarus 1,1, Poland 20,8, Slovak Republic 0,14. Ukraine 1,8 million). It is estimated that the annual average (1988- 1989) pollution load carried by the Vistula to the Gdansk Bay is about 103 000 tons of BOD,, 104 500 tons of tot-N (16.5 percent and 5 800 tons of tot-P (8 percent).

Municipalities:

Nemunas River Although there are five municipalities in the Nemunas River basin larger than 200 000 p.e., discharges from the three cities of Vilnius, Kaunas, and Klaipeda contain almost 80 percent of the total municipal discharges for the country. At present there are no treatment facilities whatsoever in Kaunas. The existing plant in Vilnius is designed for mechanical/biological treatment, but functions as a mechanical plant only due to lack of aeration equipment. In Klaipeda, wastewater also receives only mechanical treatment. Similar to other cities of the former USSR, a substantial industrial load is discharged to the municipal sewage systems. Municipal sludge is seriously contaminated by heavy metals; disposed of in landfills or old gravel pits, it has the expected negative impacts upon groundwater. There are several municipalities in the Belarussian part of the catchment area, the largest being the city of Grodno.

Kaliningrad The main cities in the **Kaliningrad region** are Kaliningrad (408 000 inhabitants), Sovetsk (40 000), and Chernyakhovsk (40 000), all of which have insufficient sewage treatment facilities. The sewage system of Kaliningrad is by far the most important pollution source. About 38 percent of the BOD and 92 percent of total phosphorus discharged from point sources in the region comes from this city. The treatment efficiency of the existing city plant is close to zero.

A major environmental problem is the solid waste disposal site in the city of Kaliningrad. This is a combined open landfill dump for municipal and industrial waste, situated not far from some of the drinking water reservoirs of Kaliningrad. The possibility of water contamination is high.

Polish Coast Along the **Polish coast,** the largest cities discharging their wastewater directly to the Gdansk Basin are Gdansk (956 000 p.e.) and Gdynia (441 000 p.e.); they are equipped mechanical treatment facilities only. Total annual input to the Baltic Sea from large cities in the early 1990s was some 19 700 tons of BOD7, 3 800 tons of tot-N, and 650 tons of tot-P

Vistula River Municipal wastewater is a major problem in the **Vistula River basin.** The main cities are Warsaw (ca. I 500 000 inhabitants), Bydgoszcz, Torun, Wloclawek, Lublin, Krakow and the Katowice region. In the early 1990s, municipal systems in Poland discharged about 900 000 million m3 of untreated sewage, while about 1 400 000 m3 were treated mechanically and/or biologically with an average treatment efficiency of 64, 64, 23 and 17 percent for BOD5, COD, N, and P respectively. The share of industrial wastewater in total discharges to municipal sewage systems is on the order of 27 percent. In Ukraine, the city of Lvov is a major industrial center and sewage disposal for its 800 000 inhabitants is highly unsatisfactory. Similar concerns may be raised for the city of Brest (280 000 pop.), one of the principal industrial centers of Belarus. In both cities, lack of pretreatment of industrial wastes discharged to municipal sewage systems is a serious problem. Disposal of municipal sludge is one of the critical environmental problems in the Vistula catchment area.

Industries:

***Nemunas* River** A large variety of industrial plants is located in the catchment area of the **Nemunas River,** including food processing industries, textile companies and tanneries, oil refineries, chemical plants, and pulp and paper mills (the two largest, Sovetsk and Neman, are situated in the Russian part of the catchment area). Generally, effluent discharges are high and few measures have been taken to reduce the flow. Initiatives to reduce discharges of various substances through internal actions are generally lacking. The major polluters of the Nemunas River and the Kur_iu Lagoon are sulphite mills discharging substantial amounts of BOD, N, and

AOX. Some food processing plants also discharge high loads of BOD. Heavy nutrient loads are discharged by the oil refinery, the biochemical plant in Kedainiai, and Industrial Amalg. Azotas (mostly air pollution). Some of these industries are old; without modernization of local industry in general, possibilities to reduce pollution through internal measures will remain quite limited.

Kaliningrad There are approximately 200 major enterprises using water in the **Kaliningrad region.** Few of these have installed treatment plants, and most of the water used for processing is discharged with little or no treatment. Many industries, especially the smaller ones, discharge their wastewater into the municipal sewage systems. The treatment efficiency of these municipal plants is often even less than those operated by the industries.

The four pulp and paper mills (Kalinigrad Nos.1 and 2, Sovetsk and Neman) constitute a major pollution source which is surpassed only by the sewage system in Kaliningrad city. The problem in all mills is the outdated process technology and the lack of wastewater treatment. It is estimated that their BOD loading is about 55 000 tons and the ammonium nitrogen loading about 3 220 tons per year.

The region has several food processing industries discharging considerable amounts of oxygen-consuming material and nutrients. This is especially serious for the smaller rivers. Several metallic industry plants are located in this area, although discharge figures from these enterprises are sparse and unreliable. The oil bunkering station in Kaliningrad harbour is one of the most serious and well defined pollution problems in the area.

The main source of air pollution in the Kaliningrad region are the pulp and paper mills, power and heating plants, boiler houses and motor vehicle traffic. In 1990, SO2 emissions from the 21 largest enterprises amounted to 53 000 tons.

Polish Coast There are several industrial plants located on the **Polish coast** of the Gdansk Basin: 7 metal works, 1 oil refinery, 3 chemical plants, 11 fish and food processing industries, and 5 energy and harbour installations. One large oil refinery in Gdansk is equipped with complete mechanical, chemical and biological treatment facilities. Total annual input of these plants is some I 200 tons of BOD7, 310 tons of tot-P (250 tons from GZNF, Gdansk) and 110 tons of tot-N.

Vistula River Given the noxious quality of their wastes, the chemical industry as well as the pulp and paper industries are of special concern in the **Vistula River basin.** Although about 85 percent of wastewater is treated (mostly mechanical; only 5 percent receive chemical treatment and 45 percent biological treatment), these industries discharge large amounts of non-biodegradable substances, such as refractive compounds which are fairly resistant to conventional wastewater treatment processes. The second largest industrial contributor to pollution loads is ferrous and non-ferrous metallurgy, located mostly in the heavily industrialized Katowice region. Irrespective of insufficient "end-of-pipe" waste treatment installations, this industry will require elimination of outmoded technologies.

In the **Ukrainian** part of the Vistula River basin, about 12,8 million tons of coal are produced annually in the mines of the Lvov-Wolynsk region. Nearby in Jaworow, about 7,4 million tons of sulphur ore is mined annually (strip mining and underground melting). Those mining operations, however, are smaller than similar activities elsewhere in Poland (Upper Silesia for black coal, and Tarnobrzeg for sulphur). Mining activities in the Vistula Basin, although located in the upper part of this area, have serious environmental impacts with regard to water quality of nearby rivers, land degradation and air pollution.

Agriculture:

Nemunas River There are several reasons for the comparatively high level of agricultural non-point pollution in the catchment area of the **Nemunas river.** Mineral fertilizers and pesticides are used in relatively large quantities, and are favored over use of natural manure. The quality of these mineral fertilizers is unacceptable (ballast includes toxic substances). Storage conditions are poor (average losses are 25 to 30 percent of active substances). Spreaders are of poor quality, causing uneven distribution and leading to excessive leaching. As in all regions of the former USSR, there is a problem of large-scale hog and cattle farms. Leakage from liquid manure reservoirs and agricultural storage is high. Because of the limited capacity of these reservoirs, manure is stored for much shorter periods than required.

In order to restore the ecological balance of the Kur_iu Lagoon which is a transit water route between Nemunas and the Baltic Sea, the influx of organic material, plant nutrients and toxic compounds must be drastically reduced.

Kaliningrad In the **Kaliningrad region,** agriculture is a major source of point and non-point pollution (in 1990, total area of arable land equal to about 382 000 ha). Handling of mineral fertilizers is a major problem. The fertilizer (NPK) application rate in 1990 was on the order of 250 kg/ha. Chemical fertilizers also constituted a serious problem until the recent drop in their use due to price increases. Imperfect storage and handling of manure from dairy, cattle and hog breeding farms are also prevalent in the region. Although a wide range of pesticides have been employed (about 70 different types), their use was restricted to collective farms with sufficient storage facilities (at present, pesticide use has dropped substantially because of price increases).

Polish Coast There is practically no agricultural land draining directly to the **Gdansk Basin.**

Vistula River About 62 percent of the nitrogen load from the **Vistula River basin** comes from non-point sources. Agriculture, of medium to low intensity compared to western European practices, contributes about 50 000 tons N annually. About 20 percent of the agricultural area is pasture. Fertilizer and pesticide application has been about 40 percent less than in western Europe; in the last two years there has been a substantial decrease in their use because of price increases.

Main problems: The catchment area of the Eastern Gotland Basin is the single largest source of waterborne and airborne municipal, industrial, and agricultural pollution in the Baltic Sea region. In the Polish part of the Vistula River basin alone, pollution sources are found in some 380 urbanized areas, including about 2 500 major industrial plants. Some of the largest deposits of mineral resources in Europe are located in the upper part of the Vistula River basin (the Upper Silesia region), where increasing development over centuries has created growing pollution problems. About one half of all agricultural land in the Baltic Sea catchment area is also located in this region. High fertilizer application rates could cause nutrient leaching of catastrophic proportions.

3.2.8 Bornholm Basin (including Arkona Basin)

The catchment area of this basin belongs to the Czech Republic (6 500 km*), Denmark (1 200 km^2), Germany (14 470 km^2), Poland (13 1 400 km^2), and Sweden (16 300 km^2). The largest river flowing to the Baltic Sea from this catchment area is the Odra/Oder. This river basin has a total area of 119 000 km^2, of which 89 percent is in Poland, 5.5 percent in the Czech Republic, and another 5.5 percent in Germany. The Odra/Oder's most important tributary is the Warta River. The Odra/Oder discharges into a large lagoon, the Zalew Szczecinski/Stettiner Haff, with an area of 700 km^2 and considerable self-purification capacity. The Polish coastal

basins extend from the Gdansk Basin in the east to the Zalew Szczecinski/Stettiner Haff in the west.

It is estimated that annual average pollution loads carried by the Odra/Oder at the mouth of the lagoon are some 56 000 tons of BOD, (23 percent of total discharges in the basin), 24 000 tons of tot-N (21 percent), 7 000 tons of tot-P (44 percent), 920 tons of heavy metals (59 percent) and 2 630 000 tons of chlorides and sulfates (100 percent). It should be noted that the river still has a significant self-purification potential and that sedimentation of heavy metals is significant (almost all of them are deposited in the Odra/Oder River below its confluence with the Warta). The pollution loads reaching the Baltic are less than the above values due to the effect of the lagoon.

Municipalities:

Polish Coast On the **Polish coast,** several large cities discharge their wastewaters directly to the sea. Four coastal municipalities are in the category of 50 000 to 500 000 p.e.: Szczecin (no wsstewater treatment or mechanical treatment only), Swinoujscie (mechanical treatment), and Koszalin and Kolobrzeg, (biological treatment). Five municipalities in the 10 000 to 50 000 p.e. category are provided mostly with mechanical treatment. Their total annual input to the Baltic Sea in the early 1990s was some 21 400 tons of BOD7, 3700 tons of tot-N, and 770 tons of tot-P.

Odra/Oder Heavy loads of municipal wastewater are discharged into the **Odra/Oder**, particularly in the urbanized upper part of the basin where heavy industrial and mining activities are located, especially the Ostrava region in Czechoslovakia and Katowice region in Poland. Other large sources of municipal pollution are Wroclaw, Zielona Gora, Lodz, Poznan, the coastal city of Szczecin, and Görlitz, Guben, and Frankfurt/O. Municipal systems discharge some 210 000 tons of BOD5 annually and are thus a major contributor to water pollution in the Odra/Oder basin. Although some 65 percent of sewage flows are treated, many treatment plants are old (average age in excess of 30 years), and BOD reduction efficiency is poor, on average only some 43 percent. Sludge disposal is also problematic in many regions.

Municipal wastes in the Odra/Oder basin are generated in quantities corresponding to 1 .O kg/inhabitant/day. Dump sites, which are by far the most usual method of disposal, are frequently filled close to capacity.

Germany The catchment area of the Arkona Basin covers the territories of new Federal Länder of Mecklenburg-Vorpommern immediately bordering the sea, and that of Brandenburg and Saxony. These Länder cover 60 percent and 22 percent of the **German catchment area** of the Baltic Sea respectively. In the new Länder, about 86 percent of the population of larger urban centers (more than 20 000 population) are connected to municipal treatment plants. In smaller communities this percentage is usually much lower - around 25 percent. A low percentage of biological treatment is characteristic for municipal sewage treatment plants (on average, only 12 percent of the population is connected to biological treatment facilities). The remainder of the population is connected to mechanical treatment only, or none at all. There are no facilities for elimination of nutrients.

Denmark The population of the Danish part of the area is about 100 000 inhabitants. However, in the summer period this figure may perhaps be higher by 50 000 as the islands of Bornholm, Lolland and Mon are popular holiday areas with many vacation houses and camping areas. In 1990, nitrogen discharge was 470 tons and phosphorus 110 tons. Most Danish wastewater treatment plants discharging to the Baltic Sea have been or are being upgraded to meet the requirements of the National Action Plan for the Marine Areas. The extended capacity and capability shall be fully developed by 1993.

Sweden In the **Swedish** part of the catchment area, there are 22 coastal municipalities, of which 10 are larger than 10 000 p.e. Almost all those living in densely populated areas are served by biological and chemical treatment plants. There are several municipalities inland (the largest city Kristianstad of 160 000 inhabitants), all provided with similar sewage treatment facilities. Improvements being introduced currently should result in a further reduction of phosphorus and nitrogen discharges.

Industries:

Polish Coast There are several industrial plants located on the **Polish coast** of the Baltic Sea. Most of the 8 fish and food processing plants are provided with mechanical wastewater treatment installations only. In addition, there are 5 chemical industry plants, 3 metal works, 2 energy and harbour installations, and 2 wood fibre plants. Total annual input of the Polish coastal industrial plants discharging their wastewaters to the Bornholm Basin is some 3450 tons of BOD7, 210 tons of tot-P (130 tons from the Police fertilizer plant), and 610 tons of tot-N.

Odra/Oder The main culprits in industrial BOD discharges to the **Odra/Oder river basin** (about 32 000 tons annually) are food processing, forestry and textile industries. The fertilizer and steel industries located mainly in the Katowice area in Poland and Ostrava in Czech Republic, account for most of the nitrogen loads from industry. Phenols discharged by coke ovens and the chemical industry are a special problem; about 100 tons per year are released.

The large non-ferrous mining and foundry industries located in the basin, such as the copper complex at Legnica-Glogow, are major generators of heavy metals pollution. Accumulated refuse from many years of mining and metal working activities is also a source of sizeable, but not well quantified pollution by heavy metals. Solid wastes of industrial origin include large quantities of phosphogypsum from a phosphate fertilizer plant. Many dump sites, such as for coal mines, are not systematically identified, and this is likely to be a major problem in any clean-up effort. As regards recent trends, the decrease in activity observed in many industries, such as iron and steel works, has contributed to a lower level of emissions. However, economic difficulties have also exacerbated funding problems for investments in less polluting production processes.

With regard to air pollution, the Odra/Oder River basin region in Poland accounts for some 1.6 million tons per year of SO2 emissions (total country emission in 1988 was 4.3 million tons), some 360 000 tons of NOx emissions (country total 1.5 million tons), and 840 000 tons of particulate (country total 3.4 million tons). Much smaller, although still significant quantities of airborne pollutants are emitted in the Ostrava region of the Czech Republic. The largest emitters are enterprises often run on high sulphur coal. Approximately 50 percent of the sulphur and 6 percent of the nitrogen thus emitted to the air are deposited in the basin. However, it is estimated that Polish air pollutant emissions only account for some 20 to 30 percent of total deposits in the Odra/Oder basin. The major contributions come from the Czech Republic and from outside the basin area. Because of reconstruction and shutdowns in the industrial sector of the new Lander, Germany's contribution to airborne deposition in the Odra/Oder catchment area decreased significantly over the last two years.

A comparison of heavy metal pollution flows from airborne deposition and from waterborne sources shows that the quantities are of the same order of magnitude (some 100 to 300 tons per year each). However. it should be remembered that only a small fraction of airborne heavy metal deposits ends up in the

Odra/Oder due to runoff, estimated at 5-7 percent of the total.

Germany Industrial wastewater discharges in the **German part of the catchment area** were significant due to obsolete production technologies, excessive water use, low water recirculation rates and insufficient capacities of existing wastewater treatment plants. This situation, however, changed rapidly during the last two years. For example, it is estimated that production cutbacks, shutdowns, and changes of industrial production profiles have reduced annual BOD5 discharges by about 7 800 t/y as compared to the 1987 levels (more than 62 percent).

Denmark The **Danish part of the catchment area** has little industry; the total direct discharge amounts to less than 500 p.e.

Sweden The **Swedish** industrial plants include, among others, four pulp and paper mills (three of them located on the coast), several small glassworks, a scrap aluminium smelter and a number of food manufacturing plants. The pulp and paper mills discharge large quantities of nutrients and oxygen-consuming material. Two of them manufacturing bleached chemical pulp discharge chlorinated organic substances. Further reduction of nutrients and chlorinated organic substances is necessary, in particular to offset eutrophication in Hanö Bay.

Agriculture:

Odra/Oder In the **Odra/Oder** river basin, by the end of the 1980s, about 30 000 tons per year of N and 1 100 tons per year of phosphorus were leached from farming operations. Recently, however, agriculture has been strongly influenced by economic factors. The increase in fertilizer prices has caused a decrease of N emission over the past few years in excess of 50 percent, although it can be expected that former fertilizer consumption levels will again be reached in the longer term. The situation is similar for pesticides.

Germany The **German part of the catchment area** draining to the Bornholm Basin is a region of intensive farming. In the new Lander, cattle stocks were concentrated in mass farms with a high output of liquid manure. Storage capacities were insufficient and there were no adequate transportation and distribution facilities. Additional risks were posed by open air fertilizer and pesticide storage spaces and by trench silos.

Economic conditions following German re-unification have brought about changes in agricultural infrastructure and some reconstruction of existing plants. German expertise has become available to the new German Lander, but to reach the level of the old German Lander will require some time.

Denmark While comparable to agriculture elsewhere in **Denmark,** the area of the catchment is small. In 1990 total input to the Baltic Sea was 1 840 tons of nitrogen and 41 tons of phosphorus.

Sweden Farming in the **Swedish part of the catchment area** is quite intensive. To reduce the agricultural pollution load, Sweden has decided (target year 1995) to reduce livestock density, to build storage capacity of 8 months for cattle manure and 10 months for pigs and poultry, to prohibit manure application during winter and autumn, and to require that at least 60 percent of arable land has growing crops in autumn and winter.

Main problems: Substantial inputs of nutrients by agriculture, industries and municipalities. A large proportion of the pollution load reaches Bornholm Basin by atmospheric deposition. This is estimated to be on the order of 55 000 tons per year for nitrogen and 600 tons per year for phosphorus. There is a substantial deposition of heavy metals. Information on pesticide residues is lacking.

3.2.9 The Sound

Together with the Great Belt, the Sound is a connecting link between the Baltic and the seas west of Sweden. The catchment area of this part of the Baltic Sea belongs to Sweden (2 600 km^2) and Denmark (1 730 km^2).

Municipalities: In the **Swedish part of the catchment area** there are 33 municipalities but only 12 of them are larger than 10 000 p.e. Of the latter, 6 are located on the coast, including Malmö (about 400 000 inhabitants). Practically all urban populations are connected to chemical and biological sewage treatment plants.

In the **Danish** part of the area, the total wastewater treatment capacity is some 3 million p.e., serving a population of about 1.5 million inhabitants plus connected industrial facilities. The single biggest wastewater treatment plant is the Lynetten of Copenhagen with more than 2 million p.e. This plant alone is responsible for about half of the total input of nutrients and oxygen-consuming substances to the Sound. The Danish National Action Plan requires that this plant be upgraded before 1995 from biological treatment alone to full nitrogen and phosphorus reduction.

Industries: Three metallurgical works and two inorganic chemical plants represent the most important sources of industrial pollution on the **Swedish** coast of the Sound. Technological changes are being introduced to diminish radically their impact on the environment. Fertilizer production in Landskrona leads to discharges of nutrients to water and air emissions of NOx, but it was decided to close the plant by June 1992.

Most **Danish** industries are usually connected to municipal wastewater treatment plants. However, eight plants still have direct inputs to the sea. Of these, only one plant with a pulp mill (250,000 p.e.) makes inputs in excess of IO 000 p.e. The plant is expected to be in compliance with the requirements of the national action plan and to halve its inputs **by 1993.**

Agriculture: In the **Swedish** part of the catchment area, agriculture is very intensive, with a high proportion of arable land and open cultivation. Mild winters with rare periods of ground freeze is a factor contributing to the high level of nutrient leaching. A part of the nutrients remain in the watercourses, but since there are not too many lakes in the area retention is relatively low.

Agricultural activity in the **Danish** part of the region is low and insignificant.

Others: The environmental impact of a fixed link between Denmark and Sweden will be assessed according to the Espoo Convention. An independent international expert panel will advise the Danish and Swedish governments on the environmental consequences.

Main problems: The main problem is the input of nutrients from agriculture and municipalities. Measures are now under way to achieve at least a 50 percent reduction of 1985 levels by 1995. Water exchange through the Sound is essential for the entire Baltic Sea. Therefore, all activities with eventual effects on water exchange should be avoided.

3.2.10 Belt Sea

The **German** part of the catchment area of the Belt Sea has an area of 8 916 km^2, 3 716 km^2 belonging to Schleswig-Holstein and 5 200 km^2 to Mecklenburg-Vorpommern. Infrastructure, production and technical equipment vary considerably **in** these two German Lander. For Mecklenburg-Vorpommern, environmental problems are the same as those in the German part of the catchment area of the Bornholm Basin. **Denmark** occupies 12 382 km^2 of the catchment area.

Municipalities: About 85 percent of the population of Schleswig-Holstein in **Germany** is now connected to the central wastewater disposal systems providing mechanical/biological treatment of sewage discharges.

In the **German part of the catchment area,** a heavy enrichment of sediments with organic matter has in various instances resulted in considerable silting and in the accumulation of anaerobic sludge, e.g. in the Flensburg Fjord, Schlei Bay, the inshore part of the Bay of Lübeck (it has been observed in the Darss-Zingst Bodden chain as well, contributing to the pollution of Bornholm Basin). Symptoms of oxygen deficits are increasingly being observed in the Kiel Bight, the Bay of Lübeck and the Mecklenburg Bight.

Most of the **Danish** wastewater treatment plants in the area discharging directly to the marine environment have now been upgraded to include nitrogen and phosphorus removal. The total capacity is about 5 million p.e. With the present level of treatment, a population of little less than 2 million, and considerable industry, this implies that the total annual output amounts to about 5 000 tons of nitrogen and about 1 100 tons of phosphorus.

Industries: In the **German** part of the catchment area, Schleswig-Holstein industries do not have their own treatment plants. Smaller factories mainly concerned with food production discharge their wastewater to municipal treatment plants. The situation of Mecklenburg-Vorpommern is described in paragraph 3.2.8. on the Bornholm Basin.

In **Denmark,** most industries are connected to municipal wastewater treatment plants. The biggest industrial plants of the area in terms of environmental impact belong to the food industry. There are 5 sugar factories, each of which discharges wastewater in excess of 10 000 p.e., totalling 270 000 p.e. The effluents consist of sugar that is lost in processing. There is one pharmaceutical industry. A pulp plant in the area has recently ceased production.

Agriculture: In **Schleswig-Holstein,** 70 percent of the catchment area are filled-land areas and another 20 percent are used for grassland farming. The principal environmental problem caused by agricultural activities is runoff of nitrogen and phosphorus and a wide range of pesticides. The situation of Mecklenburg-Vorpommern is described in paragraph 3.2.8. on the Bornholm Basin.

Agricultural activities are significant in the **Danish** part of the catchment area, both in terms of livestock breeding and crop production. In 1990, the input from the cultivated areas amounted to about 30 000 tons of nitrogen. Reduction of the input of nutrients from diffuse sources is the target of the Danish Action Plan for the Marine Areas, which was recently revised to reduce inputs from diffuse sources.

Others: According to a Danish environmental impact assessment, the bridge and tunnel across the Great Belt will cause no significant environmental effects.

Main Problems: The dominating polluting substances are nutrients. The Danish Action Plan of Marine Pollution requires measures to be implemented by municipalities, industry and agriculture before 1993. Additional measures to further control diffuse sources have been adopted.

3.2.11 The Kattegat

The catchment area of the Kattegat is 25 800 km^2, with 15 800 km^2 belonging to Denmark and about 10 000 km^2 located in the territory of Sweden. The Norwegian contribution to the Kattegat is negligible and it is not discussed here as such.

Municipalities: In the **Swedish** part of the catchment area there are 300 municipalities out of which 32 are larger than 10 000 p.e. Of the latter, 10 are located on the coast and discharge directly to the Kattegat. Nearly all the population is served by biological and chemical treatment facilities. Nevertheless, a 50 percent reduction of current N and P discharges is foreseen.

Most **Danish** wastewater treatment plants discharging to the Baltic Sea have been or are being upgraded to meet the requirements of the Danish National Action Plan for the Marine Areas. The extended capacity and capability should be fully developed by 1993. The population of the area is about 1 million inhabitants. Total capacity of the municipal wastewater treatment plants in the area is a little under 3 million p.e. The total output in 1990 from these plants was 3 560 tons of nitrogen and 680 tons of phosphorus.

Industries: The principal industrial pollution sources located on the **Swedish** coast include one pulp mill manufacturing bleached kraft pulp, three oil refineries and one steelworks. There are other plants located on the coast not considered to be of particular importance for the Kattegat. A number of industrial plants whose discharges may affect the Kattegat, are located inland; among them are four pulp and paper mills on the shores of Lake Vänern and an inorganic chemical plant in Bohus. A large number of technology changes are being introduced to reduce the pollution load from these plants.

While some **Danish** industry is connected to municipal wastewater treatment plants, others have permits for direct discharge to the Baltic Sea. Among these are chemical works, a distillery and a few sea-food industries. In total, these discharge about 250 000 p.e. This figure should be reduced significantly following improvements in treatment capability in 1993.

Agriculture: Agricultural activity in the **Swedish** part of the catchment area of Kattegat varies. In the south and on the coast, farming is extremely intensive by Swedish standards. The proportion of permeable soils is relatively high, as is the density of livestock and poultry. The climate, characterized by the country's highest rainfall and winters without much ground freezing, means that leaching of nutrients is high. Somewhat less intensive farming is found in the plains around Lake Vänern. The rest of the region is mainly forest and mixed countryside.

In **Denmark,** the Limfjord area that represents about half of the catchment area of Kattegat is a renowned agricultural area. Intensive cultivation contributed an input of 30 250 tons of nitrogen and 607 tons of phosphorus in 1990. The pollution load from land based sources entering the Kattegat Proper from the enclosed fjord is much less as most of the nutrients are recirculated in the fjord.

Main problems: The major environmental impacts are from land-based sources of nutrient inputs, primarily from agriculture.

3.3 CONCLUSIONS

There are multiple causes of environmental change and degradation of the Baltic Sea, not all of which have been sufficiently documented to date.

Municipalities: The areas of the Baltic Sea receiving excessive amounts of untreated or insufficiently treated municipal wastewater are the Gulf of Finland, the Gulf of Riga and the Eastern Gotland and Bomholm basins. Existing facilities (including sewer systems and treatment plants) are insufficient, overloaded, and poorly maintained and operated. Moreover, large quantities of highly toxic industrial wastewater are discharged to municipal sewage systems. Pre-treatment of industrial wastewater is an absolute necessity for biological treatment

processes to operate efficiently. Without pre-treatment, there are also serious problems with sludge disposal.

In other parts of the Baltic, there have been substantial reductions in the pollution load discharged by municipalities during the last twenty years. The load of organic substances has been reduced from 50 to 95 percent and that of phosphorus from 75 to 90 percent. For example, in Sweden and Finland, the average reduction efficiency for BOD and phosphorus in municipal sewage treatment plants exceeds 90 percent.

Industries: In the Baltic Sea region, the pulp and paper industry plays (beside river-borne humus) a significant role in the discharge of oxygen consuming, nutrient-rich and slowly degradable substances to the receiving waters. A distinction must be made between old and new mills. The old sulphite mills are characterized by heavy discharges into water of organic substances or substantial emissions of SO,, or both. Most of the old mills are located in the formerly centrally planned economies (Karelia, St. Petersburg region, Estonia, Latvia, Lithuania and Poland).

Pulp and paper production is concentrated in Sweden and Finland. In the former, the region with the highest concentrations is the catchment of the Bothnian Sea and the Bothnian Bay. The Finnish pulp and paper industry is located in the catchments of both the Gulf of Finland and the Gulf of Bothnia. Over the past five to ten years, discharges of chlorine compounds have been minimized by internal process measures and by improved wastewater treatment (especially activated sludge treatment which also results in less discharges of organic matter and nutrients). Intensive R & D is carried out in order to achieve closed circulation of process water in chemical bleaching and to further substitute chlorine and sulphur containing chemicals. Some mills have already ceased to use chlorine bleaching chemicals. It is expected that gradually chlorine-free production will dominate.

In the formerly centrally planned countries, the legacy of the past is monumental. Although industrial restructuring is taking place, it will be many years before environmental effects are more visible. As industrial enterprises in those countries become economically more efficient, environmental improvements will to a large degree be side effects of the overall change, provided that the principles of Best Available Technology and Best Environmental Practice are fully recognized and applied.

Solid wastes: In the Baltic Sea catchment area, about 400 million tons of solid waste are generated annually. In Denmark, Finland. Sweden and Germany, hazardous wastes are handled separately from both household waste as well as from regular industrial waste and are properly treated. Unfortunately, this is not the case in the remaining countries of the Baltic Sea, where there are thousands of uncontrolled dumpsites which contribute significantly to contamination of local aquifers, rivers, and ultimately the Baltic Sea.

A major problem with dumpsites in Belarus, the Czech Republic, Estonia, Latvia, Lithuania, Poland, Russia, the Slovak Republic and Ukraine is the lack of separation of various kinds of waste. Moreover, very large volumes of solid waste have already been deposited. The St. Petersburg landfills and dumpsites contain about 195 million tons of mineral wastes. In Poland, the accumulated amount of solid wastes is estimated at 1 500 million tons. The destruction of solid waste through uncontrolled incineration, without proper flue gas treatment, often causes pollution over a wide area. In addition to the above mentioned disposal of waste on land, it should be noted that hazardous substances such as oil from sunken ships, poisonous gases, ammunition and industrial waste are known to be present in the Baltic Sea, due to intentional or accidental dumping.

International trading in industrial and hazardous waste has been attempted in the region (export to the formerly centrally planned economies). To date, all the littoral countries of the Baltic Sea region, except for Lithuania, had signed the Base1 Convention. It has also been signed by the CEC. Estonia, Finland, Latvia, Norway and Sweden have ratified this Convention, which came into force on 1 May, 1992.

Radioactive discharges: Radioactive substances are present in the Baltic Sea naturally and as the result of human activities. The main source of artificial radionuclides in the Baltic Sea is fallout (radiocaesium) from the Chernobyl accident. The second most important source is fallout (radiocaesium and radiostrontium) from nuclear weapons tests in the atmosphere. Furthermore, minor amounts of radioactive pollution from European reprocessing plants (Sellafield and La Hague) are found in the Baltic Sea from the inflow of saline North Sea water. Normal authorized discharges from the nuclear power plants in the Baltic Sea area can only be detected locally in very small amounts (Denmark, Estonia, Latvia, Norway, and Poland have no nuclear power plants). Some local soil contamination from uranium ore processing and military uses of radioactive materials does occur.

With regard to nuclear waste disposal, Sweden has one for low and intermediate radioactive waste at Forsmark. The repository is constructed in bedrock at about 60 meters depth under the seabed and is accessible through two tunnels to the shore. There is one such repository in Finland, on land close to the seashore and below the local seabed level. At Sillamäe in northeastern Estonia, there is a waste deposit, probably with radioactive waste, close to the Baltic Sea shore; investigation of the character of the waste and the management of the deposit should be carried out to determine the risks and assess the need for possible measures to be undertaken. Latvia has one low-level waste storage located close to the Daugava river. Recently, it has been modernized and should not be a cause of concern. In Lithuania, tritium concentrations in groundwater in the region of the radioactive depository of the Ignalina nuclear power plant are from 1000 to 10 000 times higher than the background values. Russia is also known to have some low level waste storage facilities, but no more information on this subject was available to the Task Force. Safety features of all these installations should be subject to regular inspection and control.

Transportation: Approximately two-thirds of the total NO, emissions from mobile sources in the Baltic Sea catchment comes from engines fueled by petrol and one-third from diesel engines. The use of unleaded petrol is still very limited in ail the countries located on the southern and eastern shores of the Sea.

The contribution of NO_x from mobile sources to total NO, emissions in the Western and Northern European countries varies from 60 percent in Finland to 76 percent in Norway, while in the Eastern European countries it does not exceed 35 percent, since almost all major point sources of NO, are coal-burning electric power plants.

In the Nordic countries and Germany, several measures to reduce traffic emissions have recently been taken or will be in the near future. Regulations concerning car and lorry exhaust have been passed, according to which Best Available Technology must be applied. There is a wide use of lead-free petrol, reduction of lead content for other petrols, and of the sulphur content of diesel oil. It is indicative that in Finland, for example, prior to marketing of lead-free petrol and tax reductions for catalytic converters, the share of traffic in lead emissions was over 90 percent. Economic incentives (lower priced lead-free petrol) have been introduced and will be further used to enhance the above measures. Research activities as well as control measures will also be intensified.

Agriculture: Impacts of nitrogen and phosphorus from agriculture on the Baltic Sea contribute significantly to the overall nutrient load. The total contribution from atmospheric deposition and runoff from agriculture is about 400 000 tons/year, which is about 40 percent of the total nitrogen load to the Baltic Sea. Somewhat over 50 percent of this amount (206 000 tons/year) comes from agricultural runoff from the areas bordering the eastern and southeastern Baltic coast (from St. Petersburg region to Schleswig-Holstein region). It is estimated that about 10 percent of the total phosphorus load originates in agriculture.

The nutrient inputs from agriculture include ammonia volatilization, nitrogen leaching (nitrate and organic nitrogen), phosphorus leaching and erosion, and discharge of farm waste such as effluents from animal houses, manure storage, and silage heaps. Ammonia

volatilization and nitrate leaching have an almost equal share in the nitrogen load of the Baltic Sea. The source of atmospheric ammonia is almost exclusively animal manure, produced not only in the Baltic Sea catchment area but also, among others, in the North Sea catchment in Germany, the Benelux countries, and France. Nitrate leaching derives in general from the overuse of both commercial and animal fertilizers, but also from the low utilization efficiency of animal manure. The impact of pesticides on the Baltic Sea is not fully studied as yet, but it is a serious problem which deserves special attention in further investigations.

Important agricultural areas are located in Russia, Estonia, Latvia, Lithuania and Poland, with the latter accounting for about 40 percent of arable land in the entire catchment area. Except in Poland, large former state owned farms dominated; their average size was more than 5 000 ha. In Poland, the ownership structure is different; the farms are mostly privately owned with an average size of about 5 ha only. Agricultural productivity can be characterized as medium to low intensive. Although livestock density is low, large animal farms or the so called "bio-industries" are the cause of the most serious and difficult problems in handling animal manure.

Southern Sweden is cultivated intensively. In Finland, the most intensive farming is located in the southwest and also in the catchment area of the Gulf of Bothnia (e.g. Ostrobothnia); however, dairy farming is nowadays most intensively practiced in the east.

Danish agriculture is very intensive in the use of fertilizers. For example, in the Danish part of the Belt Sea catchment (total area of 12 382 km^2), input of nitrogen from cultivated areas to the Sea equals some 30 000 tons annually. Just to indicate how much agriculture in the Baltic Sea catchment area may vary, the total annual input of nitrogen from Polish agriculture in the Vistula river basin (166 400 km^2) is some 50 000 tons annually.

New agricultural strategies must be developed for the formerly centrally planned economies in the Baltic Sea catchment area. As agriculture intensifies, the overuse of chemical fertilizers and pesticides must be avoided and alternatives developed. Large-scale livestock husbandry should also be abandoned. In Denmark, Sweden, Finland and Germany, there is also a need for further control of nutrient leaching.

Product control measures: Several measures have been taken in some of the Baltic Sea countries in order to reduce the use of hazardous substances such as pesticides, cadmium and mercury. A serious effort, however, should be made to implement HELCOM recommendations concerning product control.

Table 3-1. Deposition of oxidized and reduced nitrogen to the Baltic Sea in the period 1985-1990 (in 100 t N). O = Oxidized R = Reduced T = Total

Table 3-1. Deposition of oxidized and reduced nitrogen to the Baltic Sea in the period 1985-1990 (in 100 t N)
O = Oxidized R = Reduced T = Total

Major Emitter Country	1985			1987			1988			1989			1990 (provisional)		
	O	R	T	O	R	T	O	R	T	O	R	T	O	R	T
Belgium	28	13	41	21	10	31	29	11	40	29	12	41	34	13	47
Czechoslovakia	83	25	108	56	18	74	66	20	86	59	17	76	45	11	56
Denmark	79	152	231	81	150	231	75	131	206	86	141	227	89	149	238
Finland	60	30	90	62	31	93	58	27	85	48	22	70	57	26	83
France	65	40	105	47	27	74	69	33	102	75	32	107	84	40	124
German Dem. Rep.	123	104	227	134	100	234	143	96	239	138	92	230	133	94	227
Fed. Rep. of Germany	324	99	423	275	86	361	332	95	427	306	86	392	347	101	448
Netherlands	68	55	123	54	44	98	68	51	119	67	47	114	84	60	144
Norway	18	7	25	21	6	27	18	6	24	22	7	29	22	7	29
Poland	157	163	320	164	161	325	188	155	343	156	138	294	127	110	237
Sweden	111	67	178	101	63	164	104	61	165	112	65	177	11s	64	179
Soviet Union	129	267	3%	155	286	441	128	257	385	67	169	236	83	162	245
United Kingdom	158	42	200	145	37	182	171	38	209	176	37	213	250	53	303
Others	248	193	441	236	174	410	244	180	424	234	172	406	262	181	443
TOTAL	1 651	1 257	2 908	1 552	1 193	2 745	1693	1 161	2 854	1 575	1 037	2 612	1732	1071	2 803

Source: Norwegian Institute for Air Research (NILU). The Topical Area Study for Atmospheric Deposition of Pollutants. Based on data from EMP/MSC-W Report 1/91.

TABLE 3-2 BOD7 Load to the Baltic Sea in 1990- Tons/year				
Sub-region	Rivers	Urban Areas	Industries	Total
BOB	79 792.9750	2 730.5000	18 457.0000	100 980.4750
BOS	88 536.1300	1 055.3000	58 298.0000	147 889.4300
ARC	7 780.0000	741.7000	202.0000	8 723.7000
GUF	201 934.9000	70 027.2400	14 323.8800	286 286.0200
GUR	101 806.9000	38 923.4000	862.6070	141 592.9070
BAP	> 529 861.6200	> 60 002.9794	19 336.2216	> 609 200.8210
WEB	> 4 528.2600	20 804.4326	24 141.9754	> 49 474.6679
SOU	> 488.9400	8 147.7683	> 8 021.6627	> 16 658.3710
KAT	> 8 227.1550	4 843.1191	10 934.9755	> 24 005.2496
Total	> 1 022 956.8800	> 207 276.4393	> 154 578.3222	> 1 384 811.6416

TABLE 3-3 Total-N Load to the Baltic Sea in 1990[1] Tons/year				
Sub-region	Rivers	Urban Areas	Industries	Total
BOB	35 033.7000	1 629.5000	1567.4260	38 230.6260
BOS	42985.0000	1398.6000	3 096.9840	47 480.5840
ARC	7 870.0000	939.5000	1 101.0960	9 910.5960
GUF	109 529.5000	30 045.0000	867.9050	140442.4050
GUR	11 730.0000	5 060.5000	28 1.0900	17 07 1.5900
BAP	159 175.8000	24 660.1750	2 462.8100	186298.7850
WEB	38 821.0000	7 071.9739	1582.9420	47 475.9159
SOU	7 591.0000	6 815.1100	311.1370	14 717.2470
KAT	41 340.0000	4 373.7970	851.4680	46 565.2650
Total	454 076.0000	81 994.1559	12 122.8580	548 193.0139

TABLE 3-4 Total-P Load to the Baltic Sea in 1990[1] Tons/year				
Sub-region	Rivers	Urban Areas	Industries	Total
BOB	2 134.1500	49.2000	162.1190	2 345.4690
BOS	1 850.6400	56.0000	355.8570	2 262.4970
ARC	664.0000	30.9000	139.5300	834.4300
GUF	7 641.7000	4 078.1060	70.2950	11 790.1010
GUR	2 704.9000	649.4600	34.2800	3 388.6400
BAP	> 14 158.1300	2 902.2010	746.9300	> 17 807.2610
WEB	1 699.2300	964.1658	123.9090	2 787.3048
SOU	223.9800	1 558.1920	100.1010	1 882.2730
KAT	1 280.7000	327.6810	117.8700	1726.2510
Total	> 32 757 4300	10 615.9058	1 850.8910	> 44 824.2268

source: Second Pollution Load Compilation
(Direct inputs to the Baltic Sea)
1 Excluding atmospheric contribution

BOB	=Bay of Bothnia	GUF	=Gulf of Finland	WEB	=Belt Sea and Western Bays
BOS	=Bothnian Sea	GUR	=Gulf of Riga	SOU	=The Sound
ARC	=Archipelago Sea	BAP	=Baltic Proper	KAT	=The Kattegat

Table 3-2 BOD, Load to the Baltic Sea in 1990
Table 3-3 Total-N Load to the Baltic Sea in 1990
Table 3-4 Total-P Load to the Baltic Sea in 1990

Chapter 4

ENVIRONMENT AND ECONOMY: INVESTMENT POLICIES AND SUSTAINABLE DEVELOPMENT

4.1 INTRODUCTION

The Baltic Sea unites more than it separates the peoples who live within its catchment area. As the division of Europe into Western and Eastern blocks vanishes and the countries of the Baltic region lose their peripheral location, they may regain their historical position as one of the major crossroads of economic exchange, as in the time of the Hanseatic League, when important trade flows crossed the Baltic Sea without major political obstacles. Certainly past and recent cooperation confirm this possibility, as can be seen from the examples of HELCOM, the recently founded Union of the Baltic Cities, and the establishment of the Baltic Council of Ministers of Foreign Affairs.

The Joint Comprehensive Environmental Action Programme proposed by the HELCOM ad hoc high level Task Force is another example of this regional cooperation. The Programme is an effort to restore this valuable common resource to a healthy ecological balance, allowing it to effectively contribute to increased economic well-being of all the countries concerned.

4.2 A REGION OF ECONOMIC CONTRASTS

The Market Economies of the Nordic Countries and Germany. The states to the north and west of the Baltic Sea have among the highest standards of living, productivity and wage levels in the world, with a Gross Domestic Product (GDP) per capita of 16 500 ECU. International trade and foreign investment play an important role in their economies. Germany is the second most important trading nation in the world, and the share of exports and imports in comparison to GDP is particularly high for all Nordic countries. The Nordic members of the European Free Trade Association (EFTA) have privileged relations with several other European countries. Germany and Denmark are members of the European Community, while Finland and Sweden recently decided to apply for membership. Association agreements between the European Community and certain East European countries have also recently been concluded.

The Formerly Centrally Planned Economies. The economies of the countries covering the eastern and southern parts of the Baltic Sea catchment area were based on a model of centralized economic planning and collective ownership of means of production. This system resulted in considerable economic growth, especially of heavy industry. Trade patterns were also centralized, with the former Soviet Union as the leading partner, and employed a series of well-defined specializations between the supply of raw materials and energy on the one hand and the manufacture of industrial goods on the other. A key feature of the system was the lack of a free pricing mechanism.

Relative to the Nordic countries and Germany, however, the formerly centrally planned economies are characterized by much lower levels of income with GDP averaging around 1 500 ECU per capita. Their present economies are characterized by overdeveloped primary and secondary economic sectors, low labour productivity, and distorted pricing mechanisms. The fundamental political changes taking place in all of these countries are paralleled by drastic economic upheavals, and can be seen as a response to the inadequacies of the centralized model in ensuring sustainable economic development. But this transition toward a market economy is not an easy one; it has led to sharp drops in economic production and a surge in unemployment. Inflation is now averaging over 100 percent annually in many of the countries. The balance of payments was also

affected, veering sharply into deficit and causing foreign debt service problems. The economic outlook for all of the formerly centrally planned economies appears highly uncertain and hinges on effective stabilization policies and a rapid supply response to structural reforms.

4.3 A COMMON REGIONAL ENVIRONMENTAL OBJECTIVE

While economic structures vary considerably, there are many regional issues of common concern, in particular, the environmental quality of the Baltic Sea. It is also of immediate economic importance, given the environmental impacts of pollution on all sectors. Although priorities may differ depending on local situations, there is broad agreement that a healthy environment is an important policy objective.

4.4 ENVIRONMENTAL DEGRADATION IN THE BALTIC SEA REGION

The Nordic Countries and Germany. Within the Nordic countries and Germany, a number of environmental problems need to be addressed. Although municipal wastewater treatment is generally well developed, further improvements are foreseen (especially nitrogen and phosphorus removal). In some industries, such as chemicals, pulp and paper, ferrous and non-ferrous metallurgy, and leather tanning, effluent problems remain serious. Non point source pollution from agricultural runoff, as well as air pollution from industry, agriculture and transport continue to be sources of grave environmental concern.

In addition to their own environmental improvements, the Nordic countries and Germany have an interest in promoting environmental investment in neighbouring countries. On the one hand, the effects of transboundary pollution will be mitigated, and on the other, their competitive environmental industries may be able to assist in the design and implementation of pollution control facilities in the economically reforming countries of the region. Thirdly, new technology will reduce pollution and at the same time make the reforming countries more competitive on the world markets.

The Formerly Centrally Planned Economies. The deep changes that have come about in Eastern and Central European countries have also underlined grave environmental problems. Several of these are the result of the many years when production was pursued as a goal regardless of the harm done to the human and natural environments. The lack of effective environmental controls has resulted in serious environmental problems as regards air, water and solid waste pollution. Air pollution, deriving principally from coal combustion, metallurgy and chemical production, has caused considerable human health problems, corrosion of materials, and adverse effects on vegetation. Water pollution has deteriorated many rivers and groundwater resources, often making them unfit for human consumption or even industrial use. Soils have been contaminated by heavy metals and organic substances.

In the formerly centrally planned economies, the acquisition of reliable data on environmental issues was very uneven. Hence the economic and social impacts of environmental degradation cannot be quantified in many instances. However, estimates for the damage in terms of gross national product range from 3-4 percent, double or triple the share in developed countries. Human health, and with it worker performance, is sometimes seriously affected by air pollution in selected areas where ambient concentration levels are several times the level of international standards.

The challenge of restoring the environment by breaking with ineffective past systems should constitute one of the cornerstones of the overall reform process. Continued disregard of the environment will not only affect the quality of life of the population, but also ultimately reduce economic productivity and increase production costs, by undercutting the natural and human resource base of these economies. Thus, environmental improvements must proceed hand in hand with economic structural reforms. These reforms also need to be accompanied by

policy, legal and regulatory measures to ensure that the environmental problems known to accompany market economies are contained to the fullest extent possible.

4.5 THE ENVIRONMENTAL IMPLICATIONS OF RESTRUCTURING

The political upheaval and democratization process ushered in the push for economic reform from centrally planned to market driven economies. This transformation is naturally proceeding at a different pace depending on the countries. The Czech Republic, Poland, and the Slovak Republic, for example, have taken very bold steps to establish the preconditions for the transition, such as sweeping price liberalization, ambitious privatization programmes, and efforts to establish currency convertibility. In other countries, such as Estonia, Latvia, Lithuania and Russia, the greater political and economic complexities of the situation imply that the pace of economic reform will be slower. However, in all cases the gravity of the economic situation inherited from the centralized planning model has made movement towards reforms inevitable. Some of the key items of the reform programmes, which will also play an important role in environmental improvements, are:

- Introduction of clearly defined private property rights;
- Programmes for the privatization of the majority of enterprises and production resources;
- Price and tax changes to establish proper economic signals and practices;
- Establishment of Western-type banking and capital markets systems;
- Liberalization of trade, both internally and for export/import;
- Setting up of regulatory frameworks for enterprises;
- Liberalized currency and exchange rate policies; and
- Programmes for the creation of an accurate public land and real estate ownership register.

Given that an important share of pollution in the Baltic Sea is of transboundary origin, the "Polluter Pays Principle", which is the major guideline for most Western European environmental policies, cannot be the sole regulator in the Baltic Sea region. First, the countries with reforming economies within the region do not yet have the necessary capital or human resources to provide for the required pollution control investments during their period of restructuring. Secondly, the higher income countries of the region are experiencing steeply rising unit costs for pollution control. Third, all are subject to transboundary pollution. Therefore, a case can be made for complementing the "Polluter Pays Principle" with a "transboundary" approach to environmental investments for domestic pollution reduction, by providing support for cost-effective actions in other countries to reduce transboundary pollution.

4.6 THE CHALLENGES OF ECONOMIC TRANSITION

Introducing Market Based Prices. In a market economy, prices are basically determined by market forces. Likewise, a key for the transition from centrally planned economies to market economies is the liberalization of pricing mechanisms. The application of prices reflecting economic scarcity for energy and other natural resources will have a profound effect on environmental management in the countries concerned, acting as a powerful and pervasive incentive for the conservation of these resources.

Creating New Administrative Structures and Regulations. Good environmental management requires an effective institutional and regulatory framework. As the importance of environmental policy came to be internationally recognized, environmental institutions and

ministries were set up in the formerly centrally planned economies. However, they clearly did not achieve the necessary impact. Hence the issue becomes one of restructuring to achieve successful environmental management instruments in the new market economy framework. Likewise, ineffective regulatory norms and mechanisms must be transformed into operative management tools. For instance, the promulgation of unrealistically severe air or water quality standards, which have been routinely exceeded without any real sanctions, must give way to realistic and economically cost-effective pollution control and abatement programmes.

Developing the Human Resources for a Modern Market Economy. The human resource factor is recognized as critical in any development process. The special requirements and longer time frames required for training, teaching, and skill improvement lend a particular dimension to human resource policy. Concerted efforts are needed to achieve gradual progress in this field, and foreign assistance will play a crucial role.

Closing the Uncompetitive Segments of the Economies. As markets are opened up, firms in the reforming economies will experience challenges to their competitive position. Responses will range from structural changes which increase competitiveness to the outright demise of parts of or whole enterprises and groups of enterprises in the economy, in particular in the historically large heavy industrial sectors such as steel making and mining, as well as the manufacturing and chemical subsectors. A side effect of the closure of industries is that these firms no longer contribute towards pollution, although the negative effects on employment offset this gain in the short-term. The dilemma of Eastern Europe is that it has to face such adjustment simultaneously on all fronts.

4.7 THE ENVIRONMENTAL CHALLENGES OF ECONOMIC TRANSITION

Overcoming the Legacy of Pollution. The economic structure in many of the formerly centrally planned economies has been skewed towards heavy industry and energy use, mainly based on coal. This sectoral specialization as well as resource-intensive production technologies and the extraordinary price distortions which encouraged wasteful consumption patterns, have resulted in economies which use 2-3 times as much materials and energy per unit of economic output as market economies. The negative environmental impacts of such a structure are often exacerbated by the geographic concentration of industries and inefficient transportation of raw material. Another reason is the absence of an effective tax system available to the state. The institutional framework as well as the lack of a mechanism for popular participation also renders the implementation of environmental controls very difficult.

Using Natural Resources Efficiently. Improved productivity resulting from economic restructuring and environmental regulations result in a lower consumption of inputs per unit of output produced. This, together with realistic pricing mechanisms for raw materials will reduce the strain on the environment for a given unit of output.

Balancing Development and Conservation. Agriculture has been a key sector of the formerly centrally planned economies and is likely to remain so in the foreseeable future. The transition to a market economy will be accompanied by the modernization of agriculture which will result in lower levels of employment in the sector. In some countries, as in Poland, the tendency will be toward larger farms, whereas in other countries, such as Estonia, Latvia and Lithuania the farms will initially tend to become smaller. Policy and technical actions should be taken to improve the application of natural fertilizers and avoid the overuse of chemical fertilizers and pesticides. It is expected that large-scale livestock operations will be restructured, in many instances, resulting

in smaller operations. Actions should also be taken to improve the management of livestock wastes. Development plans for the agriculture sector should embrace environmentally sustainable approaches.

Modernization and expansion of forest industries should include specific actions to avoid adverse effects on the role of forests as wildlife habitats and change in forest composition, and minimize the drainage of wet forests. Measures should be taken to reduce the threat to woodlands coming from air pollution. The development of nature-based tourism should be carefully planned to avoid overuse and increased strain on these resources. Management plans should be prepared and implemented to protect natural wetlands from potential threats, including for agriculture, filling for urban and industrial use, and the development of solid and hazardous waste disposal facilities.

Managing Waste Generation and Disposal. Due to lower living standards and less consumer orientation, especially less emphasis on packaging, in the former centrally planned economies, the household wastes generated in many urban areas of these countries are of a different quality than those generated by the wealthier market economies. As living standards rise in the reforming economies, so will the amount of municipal solid wastes produced and their quality will change (more plastic, etc.>. Without an adequate waste disposal infrastructure, problems of solid waste management will tend to grow, since backlogs in adequate disposal as well as future growth in the solid waste stream will have to be addressed.

Overcoming the legacy of past neglect and achieving effective environmental objectives requires a response to these and other challenges. It is clear that environmental and economic reforms of the formerly centrally planned economies must be undertaken together. The difficulties of successfully matching these objectives are of course enormous, yet they can be surmounted. The Joint Comprehensive Environmental Action Programme proposes to take steps toward achieving these objectives.

Chapter 5

ENVIRONMENTAL ACTION PROGRAMME

5.1 KEY CONCERNS AFFECTING THE FORMULATI ON OF A STRATEGY

The Task Force has considered several key concerns that have a major influence on the formulation of a comprehensive strategy as well as the Programme of specific environmental management actions to restore a sound ecological balance in the Baltic Sea and its catchment area.

Balance and Linkage Between National and Regional Benefits. The Programme is designed to address the common need to protect and restore the Baltic Sea as a significant multi-use regional resource; however, the realization of this objective can only be achieved by national interventions. Hence, the success of the Programme rests on the implementation of a series of complementary national environmental programmes designed, wholly or in part, to result in benefits to the Baltic Sea that are enjoyed by all the riparian countries. To be politically acceptable and financially viable, country level activities addressing the regional problems of the Baltic Sea should be consistent with national environmental strategies and priorities.

Relationship to the Process of Privatization, Economic Restructuring and Decentralization. In the eastern and southern portions of the Baltic region a restructuring process is occurring in the formerly centrally planned economies; it will not be possible or even desirable, to implement the Programme independent of this process of political, economic and administrative change. From an environmental perspective, some of the most important changes will be in the industrial sector, where former practices resulted in significant pollution and waste of resources. The most viable and competitive industrial enterprises in these countries will undergo a process of reinvestment to improve efficiency and increase productivity. Another major change is the decentralization of authority from the central to local governments for many key environmental management tasks. These local authorities will be responsible for financing investment as well as operation and maintenance, and hence will have to develop full capability to plan and handle technical and financial aspects of environmental management.

Competition Among Different Priorities for Resources. Environmental concerns must compete with other priority areas for access to human and financial resources, especially in the formerly centrally planned economies of the Baltic Sea region. Some priority environmental investment activities may need to be deferred in order to allow for the economic situation to stabilize. Notwithstanding these constraints, timely action on grave environmental issues may ultimately assist in this stabilization process and benefit the region as a whole. It is therefore vital that environmental investments be made on the basis of rational priorities rather than in an ad-hoc manner. The timing and targeting of investment activities is especially important given the institutional, human resources and financial constraints.

Political Commitment and Public Awareness. The successful implementation of the Programme will require a long-term political commitment. Although the political and economic situation in the region has significantly altered since the Ronneby Conference in 1990, interest in protecting the Baltic Sea has not waned. For this political commitment to remain strong, a solid base of public support is vital. This is especially important as the major part of the burden for funding the activities of the Programme will ultimately rest with domestic financial

resources and be borne by the public either directly through user charges or possibly indirectly through increased costs for goods and services.

5.2 OBJECTIVES OF THE ENVIRONMENTAL ACTION PROGRAMME

Development of the Programme has been mandated by the Baltic Sea Declaration endorsed at Ronneby, Sweden in September 1990. The Declaration expresses the firm determination of the parties to:

> "Assure the ecological restoration of the Baltic Sea, ensuring the possibility of self-restoration of the marine environment and preservation of its ecological balance."

To achieve this objective, the Declaration calls for the endorsing parties to:

> Urgently prepare a joint comprehensive programme for decisive reduction of emissions in order to restore the Baltic Sea to a sound ecological balance."

The decision to develop the Joint Comprehensive Programme reflects the recognition that the environmental problems of the Baltic Sea, its coastal zone and its catchment area are inextricably bound together and that their solutions represent an issue of common concern which can most effectively be addressed by cooperative action. The Programme has also been designed to support implementation of existing commitments of the Contracting Parties to the Helsinki Convention, HELCOM Recommendations, and especially the priorities established in the Declaration on the Protection of the Marine Environment of the Baltic Sea, which was adopted by the Ministers of Environment of the Contracting Parties in 1988. The structure of the Programme, in both analysis and implementation, recognizes the commonality of problems and the benefits resulting from environmental actions to correct them.

5.3 KEY PRINCIPLES OF THE ENVIRONMENTAL ACTION PROGRAMME

The Programme strategy is based on a series of key principles which constitute a framework for the formulation of the specific actions and approaches of a comprehensive long-term Programme. These principles are briefly described below.

A Long-term Perspective. Planning and implementation of the Programme can only take place over the long-term. The modest success achieved to date in reducing pollution in the Nordic countries and the western portion of Germany has taken nearly thirty years. While production cutbacks in the formerly centrally planned economies have caused some emissions of pollutants to decline in the last several years, such "successes" may be short lived once economic activity picks up again. This potential pollution rebound may be partially offset if modernization and restructuring in the industrial sector yield a more environmentally friendly product mix or lead to the widespread adoption of environmentally sound technologies. In any case, the Programme's overall impact will be incremental, its success measured in step-by-step improvements. In the long-term, the adoption of environmentally sound policies and practices in agriculture, industry, transportation and urban development will be the key human factors in restoring the ecological balance of the Baltic Sea.

Recognize Important Role of Natural Factors. The periodic inflows of salt water through the Danish straits are the dominant physical factor in determining the quality of the open waters of the Baltic Sea. Good oxygen conditions can only be maintained in the bottom waters of the Sea by frequent salt water inflows. These conditions can be supported in part trough significant reductions in the nutrient load. New agricultural practices in handling manure and fertilizers, as well as water treatment facilities, will play a significant role in the nutrient load reduction. The critical role played by healthy wetlands and coastal lagoons in reducing these loads, and hence, in the maintenance of the Baltic ecosystem also deserves special attention because they serve as traps for nutrients and

other pollutants, allow for natural treatment and provide extensive habitat for their specific fauna and flora.

Harmonize Economic and Environmental Objectives. A sustainable development pattern is required if an ecological balance is to be restored and maintained in the Baltic Sea and its catchment area. Economic policy objectives, instruments, and programmes adopted by the concerned countries for agriculture, energy, forestry, industry, transportation, physical planning and land use and nature conservation should reflect environmental concerns in a sustainable way.

Harmonize National Development and Regional Environmental Objectives. Measures should be taken to ensure that development goals on a national or sectoral basis are not contradictory to long-term regional environmental objectives. Given the importance of trans-boundary air pollution in nutrient transport to the Baltic Sea, special measures should also be taken to address these regional issues in a long-term perspective, recognizing the large costs involved in the restructuring of the energy and industrial sectors required to achieve a significant reduction. Especially important in this regard will be the coordination of activities of the Programme with European and regional initiatives to address the management of mobile sources of pollution from transportation.

Undertake "Preventive" and "Curative" Actions. The Programme strategy encompasses both "preventive actions" to promote proper environmental management and "curative actions" to address existing environmental problems. Curative actions include key initiatives for development of new and/or revised policies, support for institutional and human resources development to enhance local capacities, and phased investment in pollution control focused on rehabilitation, retrofitting and new construction of facilities. Preventive actions consist of national development plans which integrate environmental concerns into their basic priorities, clear policies concerning the review and selection of technologies for use in production processes and pollution control, and the expanded use of environmental planning techniques, including the preparation of environmental assessments and audits, in project planning and review processes.

Control Pollution at the Source. In addition to undertaking activities for pollution abatement, emphasis should be placed on pollution prevention through policy, regulatory and technical interventions. Such efforts will minimize costly "end-of-pipe"/"end-of-stack" control technologies, and help to reduce the total volume of materials to be treated. Critical to the effective control of pollution at source are environmental audits in industrial enterprises which examine the causes of environmental problems and identify options for their management in a comprehensive manner.

Establish Conditions for Private Sector Participation. A favourable institutional and policy environment is needed to encourage private investment in environmental management. Among the key factors are long-term plans with regard to environmental standards, and the resolution of questions of financial liability for pre-existing environmental pollution and clean-up efforts. In the industrial sector, newly privatized enterprises can be encouraged through a variety of incentives to undertake timely and comprehensive investments in waste management in order to comply with environmental laws and regulations. Private sector investment in and operation and maintenance of what is traditionally public infrastructure, such as municipal waste treatment, can also be promoted through concessional approaches such as Build-Own/Operate-Transfers (BOTs), publicly regulated joint stock companies, or through the use of service contracts.

Take Action to Overcome Constraints and Build Local Capacity. Policy reforms, institutional strengthening and human resources development are needed to overcome administrative and management constraints to effective environmental management. The development of local capabilities to finance and manage water and wastewater utilities will receive special emphasis, as will programmes addressing environmental issues regarding agricultural runoff, livestock wastes and rural settlements.

Expect Gradual Improvement of Key Environmental Parameters. While significant progress has been made in addressing environmental issues in the northern and western parts of the Baltic Sea catchment area over the last 20 years, decades of work remain ahead to reverse past trends and prevent potential future problems. Activities supported under the Programme should result in gradual changes, although more demonstrable impacts on a local and/or subregional scale may be evident more rapidly. For example, progress in the northern and western portions of the basin is the result of a long-term process of change in industrial structure, higher energy prices, stringent environmental standards and strong public pressure for a better environment.

5.4 DEVELOPMENT OF THE ENVIRONMENTAL ACTION PROGRAMME

There have been two major problems to overcome in formulating the Programme. The first is to meet the challenge of presenting a comprehensive but implementable and affordable series of activities to promote environmentally sustainable development in an era of severe resource constraints. The second is to identify the critical linkages between cause and effect, between sources of pollution and their impacts, when existing data collection and environmental monitoring systems are in a generally rudiment state in large parts of the Baltic Sea catchment area. Notwithstanding these problems and limitations, the Task Force has carried out a systematic programme of investigation that has permitted the identification of a prudent and potentially effective action Programme.

Approach. The Task Force carried out prefeasibility level studies of the catchment area of the Baltic Sea, in which it reviewed significant environmental issues and evaluated their impacts with regard to ecological systems, public health and the economy. In order to assure proper coverage of air quality impacts, the study area encompassed the airshed of the Baltic Sea which includes parts of Western, Central and Eastern Europe beyond the catchment area. The studies placed emphasis on both point and non-point contributions of air and water pollution on water quality in the catchment area and the Baltic Sea itself.

Information used to formulate the Programme was developed from the following sources: existing HELCOM data; Concrete National Plans submitted by all states in the Baltic Sea region; eight pre-feasibility studies of those portions of the catchment area which may require international funding; three topical studies which examined air quality, agricultural runoff, wetlands management on a regional scale; a series of review studies on special topics; and the input of the specialists on the Task Force. The studies prepared by the Task Force have been placed in the permanent files of HELCOM where they are available to the public for consultation. Outside inputs to the work of the Task Force were provided through meetings with representatives of the concerned Governments at the national and local level, consultations with non-governmental organizations, meetings with scientists, and a series of public hearings on the findings and recommendations of the pre-feasibility studies conducted in Gdynia (October 1991), Kaliningrad (December 1991), St. Petersburg (December 1991), Szczecin (January 1992), Tallinn (March 1992), and Vilnius (February 1992).

5.5 PROPOSED COMPREHENSIVE ENVIRONMENTAL ACTION PROGRAMME

Strategy. The Programme strategy to restore the ecological balance of the Baltic Sea and its catchment area involves a long-term series of coordinated actions by each concerned government to carry out needed policy and regulatory reforms, capacity building, and capital investments to control pollution from point and non-point sources, eliminate or reduce the generation of waste, and conserve environmentally sensitive and economically valuable areas, support applied research and undertake activities to promote public awareness and environmental education.

In the countries of the eastern and southern parts of the region Programme actions would be phased to keep pace with the gradually improving stability and increasing capacity for project finance of these transforming economies. In the first years, emphasis will be placed on policy reform, limited public investment in the highest priority projects, and promotion of private investment and initiative through concessions and incentives (see section 5.6). Environmental investment programmes in the northern and western portions of the basin will also form an integral part of the strategy.

Major environmental actions will be planned for all concerned countries. The identification of investment priorities will be based on economic feasibility, ecological impacts including public health, and financial resources. The strategy embraces technical support, human resource development, and capital investment activities in the eastern and southern portions of the Baltic Sea region, through the mobilization of financial resources from local, national, bilateral and multilateral financial institutions.

5.6 PROJECTED COST OF THE PROGRAMME

Investment Costs of the Programme. Implementation of the entire long-term Programme is estimated to cost at least 18.0 billion ECU over a twenty year period (Table 5-1). This programme will be implemented in two phases: the first phase (1993-1997) is estimated to cost 5.0 billion ECU; the second phase (1998-2012) is estimated at an additional 13.0 billion ECU. This Programme will include support for development of policy and regulatory reform, institutional strengthening, investment actions, (for point and non-point sources of pollution), management of coastal lagoons and wetlands, applied research and public awareness and environmental education. This first phase of the Programme will focus on high priority actions while later phases will concentrate on the expansion and consolidation of environmental activities. The costs for the recommended priority actions to be taken under the Programme are presented by country in Table 5-2. The long-term nature of the Programme requires that these figures be viewed as an estimate of the magnitude of the costs and their relative distribution between international and domestic sources of financing.

The Programme will focus on 132 "hot spots". As described in detail in the Joint Comprehensive Programme, these "hot spots" comprise actions to address point and non-point source pollution and the management of coastal lagoons and wetlands in the Baltic Sea catchment area, and are estimated to cost about 10.0 billion ECU (Tables S-2 and S-3).

Of the 132 "hot spots", the Task Force has identified 98 actions at key "hot spots" in Belarus, Czech Republic, Estonia, Latvia. Lithuania, Poland, Russia, Slovak Republic, and Ukraine, out of which 47 have been identified as "priority hot spots". The cost for these 98 actions is estimated at 8.5 billion ECU. Of the 8.5 billion ECU, 6.5 billion ECU will cover the 47 "priority hot spots". In the case of Poland, which is the most populated country and the largest single polluter in the catchment area, the estimated cost for the 40 recommended actions, at both "hot spots" and "priority hot spots", exceeds 4.0 billion ECU. The remaining 34 actions at sites in Denmark, Finland, Germany and Sweden have been selected by the countries concerned and have an estimated cost of approximately 1.5 billion ECU.

The Programme includes the identification of actions which are required to control pollution at "hot spots", such as municipalities and industries, which often are significant point sources of pollution. The tables also provide cost estimates for pilot activities in a number of countries which include the management of agricultural runoff, large scale livestock operations and support for management programmes for coastal lagoons and wetlands. These sites have been selected on the basis of the significance of their impact to ecological conditions, human health and the economy. "Hot spots" are located both in coastal areas and in the catchment area of the Baltic Sea. Of these, 47 are priority "hot spots" and are the primary focus of the first phase of investment activities. In many cases, the "hot spots" are individual sites where there is a discharge of municipal or industrial pollution (air, water,

solid wastes), but several large urban-industrial complexes have also been identified as important "hot spots", including northeastern Estonia, Katowice, Ostrava, Riga and St. Petersburg.

Table 5-3 provides pre-feasibility level estimates of investment and annual operational costs, and estimates of load reduction and unit costs, for the "hot spots". Their area distribution is shown in Figure 5-1. More detailed information concerning the project proposed at each specific "hot spot" is available in the pre-feasibility studies prepared for the Task Force, and in reports by national governments for the northern and western countries. It should be noted that the "hot spots" differ between these two regions in both their type and level of impact, reflecting the historically higher levels of investment made in environmental protection, modernization of technology, and conservation of higher-priced energy and raw materials in the northern and western portion of the Baltic Sea region.

Programme actions include pilot and demonstration projects to develop practical systems and technologies to control pollution from large livestock operations and other agricultural practices, especially the use of fertilizers and pesticides. There is great uncertainty at present over the future course of this key sector during the ongoing economic transformation, and over the estimated cost for pollution control measures. Hence the Programme places considerable emphasis on pilot activities in key sub-regions for which very preliminary cost estimates are given in Table 5-3. Similar estimates are given for management programmes for coastal lagoons and wetlands. These sites have been selected on the basis of the significance of their impact to ecological conditions, human health and the economy.

Other Programme Costs. There are other substantial and important costs which should not be overlooked in considering the overall financing needs of the Programme. First, feasibility studies of the highest priority projects must be carried out in order to complete financing arrangements. These studies have been estimated to cost at least five percent of the projected investment costs for major projects. However, the key constraint to undertaking this critical step is not likely to be funds or external support, but rather the identification of project owners or sponsors willing and able to finance and manage the projects. Second, the respective Governments in the eastern and southern parts of the Baltic Sea region will inevitably incur substantial local costs in facilities, services, and human resources to develop and carry out the required initiatives on which the smooth and timely implementation of the Programme will critically depend. Considerable external support for these activities is likely to be forthcoming, but the local commitments of staff, organization, and financial resources will remain substantial.

Basis of Cost Estimates. The cost estimates are preliminary figures developed on the basis of pre-feasibility studies. They are based on cost data derived from 1992 prices for similar projects undertaken in Western and Northern Europe and have been adjusted to reflect local costs for key parameters such as labour, materials and land acquisition. The estimate of domestic costs for activities in the formerly centrally planned economies has proven to be extremely difficult due to the fluctuations in currency values, large scale inflation in some countries and rapid changes in prices for goods and services. The cost estimates have been reviewed through a consultative process involving representatives of the multilateral financial institutions, national study coordinators, and the study consultants. Domestic costs have been reviewed by local members of the consultant groups. Nevertheless, feasibility studies will have to follow an international standard to refine the selection of technology and design concepts, and to determine more accurate cost estimates required for project financing.

Investment costs include expenditures for design, construction supervision, land purchase, civil works, and the supply and installation of equipment. However, they do not include expenditures for interest during construction or taxes. Annual operational costs include personnel, energy, chemicals and spare parts, but not depreciation of equipment and facilities. Cost breakdowns are provided for projects which will require the use of both international and domestic sources of finance. In these

projects, it is anticipated that foreign currency will be used for the procurement of specialized goods and consulting services. Domestic funds available for such projects will be used to purchase land for facilities, for "right-of-ways" for collection and disposal systems, most civil works, some equipment, and consulting services. In implementing the Programme, it will be necessary to ensure not only that sufficient foreign and domestic funds have been secured but also that adequate domestic physical resources, especially building materials, will be available for completion of projects.

5.7 OUTLINE OF THE LONG-TERM PROGRAMME

The long-term Programme of specific actions is grouped into six components:

- Policy, legal, and regulatory measures;
- Institutional strengthening;
- Investment in point and non-point source control;
- Management programmes for coastal lagoons and wetlands;
- Applied Research;
- Public awareness and environmental education.

The remaining sections of this Chapter describe the key elements of each component of the programme, outline the immediate actions to be taken in the first phase of Programme implementation, summarize the basis for setting investment programme priorities and describe the benefits of the programme.

5.7.1 Policy, Legal and Regulatory Measures

This element of the Programme focuses on putting in place the policies and regulatory measures that establish a long-term environmental management framework in each country, including a system of incentives and legal arrangements. The initial legal framework is being established in the eastern and southern parts of the region, while most of the laws, policies, and regulatory systems are already in place in the northern and western parts of the region. The Programme will focus on filling gaps, identifying needed policy reforms and actions, and strengthening these evolving frameworks.

Policy reforms should support clear and practical goals and be consistent with the evolving macroeconomic policy and institutional framework in each country. Regulatory measures, including environmental standards, such as those adopted in the HELCOM Recommendations, should be enforceable and realistic under prevailing economic conditions and should lead to the phased achievement of national and regional objectives over the long term. Specific actions included in this component of the Programme are outlined below.

Development of Policies, Laws and Regulations. The Programme will support the preparation and revision of environmental policies, laws and regulations in the formerly centrally planned economies with a view to their general harmonization with those used in the European Community. This process recognizes the significant variations in the development of legal and administrative infrastructure, access to funds for investment and currently limited enforcement capability in these countries. Proposed legal and regulatory changes will be reviewed with regard to administrative requirements, economic implications, health benefits and environmental implications. Special support will be provided for the development, evaluation and implementation of environmental standards under the Programme on a priority basis during the initial implementation period.

Emerging Policy Issues. The Programme will include development of analyses examining, on a regional and national scale, the environmental implications of emerging policy issues. These include alternative development policies in sectors which have a potentially significant

impact on the Baltic Sea and its catchment area such as agriculture, energy, industry and transportation. This element of the Programme will be supported by applied research activities providing detailed information concerning development alternatives, their costs and environmental benefits.

Use of Economic Measures. The Programme promotes the use of a range of economic measures for the management of environmental quality. Three areas will form the initial focus of this initiative:

- **Adoption of Polluter Pays Principle.** The "Polluter Pays Principle (PPP)," places the financial burden for the prevention and control of pollution on the party responsible for its generation, leading to careful evaluation of technological alternatives when making investment decisions, the adoption of cost effective control measures, and ultimately to the prevention of pollution at source. Adoption of this principle calls for strengthened monitoring and enforcement capabilities within environmental regulatory organizations as well as improved environmental management capabilities for key personnel of major polluters.

- **Adoption of Realistic User Charges.** To assure efficient use of resources and the proper operation and maintenance of facilities, activities funded under the Programme will include provisions for cost recovery through user charges. They will also support the establishment of a legal framework including the authority to charge and retain revenues. In many cases, this will require significant institutional strengthening and human resources development to provide, for example, suppliers of water and wastewater services with the capacity to establish, collect, allocate and account for fees or tariffs.

- **Cost Sharing in the Case of Transboundary Pollution.** An important share of pollution in the Baltic Sea is of transboundary origin. Hence, the "Polluter Pays Principle", which is the major guideline for most Western European environmental policies, cannot be the sole regulator in the Baltic Sea region. In view of the common objectives and potential benefits, the higher income countries could consider providing support in appropriate cases to the countries with transforming economies for setting up cost-effective programmes directed at transboundary pollution.

Support for Strengthening of Environmental Standards and Regulatory Measures. The application, in the formerly centrally planned economies, of environmental standards and regulatory measures similar to those of the European Community can only be accomplished in a phased manner due to the high costs involved in retrofitting facilities and the need to develop an effective monitoring and enforcement system. The Programme will support phased compliance with these standards and focus on the use of management techniques to reduce pollution loads on an interim basis. The standards developed under the Programme will be accompanied by guidelines for their application, including provisions for phased project implementation, and thus more cost effective use of limited funds. The ultimate goal should be to comply with the environmental standards of the European Communities or, where applicable, with other stricter standards.

Best Environmental Practice and Best Available Technology. The Programme seeks to promote the adoption of Best Environmental Practice and the use of Best Available Technology to prevent pollution at source, consistent with the 1992 Helsinki Convention and HELCOM Recommendations. In the selection of processes for new industries and the modification and/or rehabilitation of existing facilities, priority will be given to technologies which make efficient use of energy, water and raw materials. The Programme will promote waste minimization and recycling. Emphasis will be given to improving site selection for industrial facilities in many of the countries in the region. The concept of Best Environmental Practice will be promoted through its use in training courses, public awareness activities and investments.

Support for the Transfer of Technology. The Programme will support actions which promote the transfer of technology between and within cooperating countries in a meaningful and practical manner. Full participation of local experts, from the public and private sector, in the identification, planning, design, implementation and evaluation of Programme activities will be encouraged. Special emphasis will be placed on strengthening local commercial, scientific and technical capabilities to provide independent consulting services. The Programme will also promote, where economically and financially viable under market conditions, the development of local environmental technology and supply industries.

5.7.2 Institutional Strengthening and Human Resources Development

The second component of the Programme focuses on building the organizational and human capacity to develop and implement effective environmental management systems, and to plan, design, and operate pollution control measures required by the Programme. Special emphasis will be given to developing local project capital and recurrent cost financing capacity and to strengthening local organizations such as water companies.

Environmental Management Capacity. A crucial factor in achieving the Programme's objectives is the development of enhanced environmental management capacity at the national and local level. At the national level, Programme activities will emphasize strengthening the capabilities of the principal organizations responsible for the environment. The focus of these activities will include improving the planning and administration of programmes, establishment of objectives and implementable work plans, personnel management and staff training, and financial management and accounting. The Programme will also support the development of local level institutions to handle of decentralized environmental management in the formerly centrally planned economies. This support focuses on the training and provision of equipment needed to address issues of planning, review, enforcement and finance. Programme activities will be designed to help define and strengthen the roles of both central and local government authorities in the new and evolving legal arrangements for local government and administration. Their design will also allow for political independence in decision making and an ability to evaluate proposed actions in a broader planning and economic context.

Environmental Planning and Management Measures. The Programme will support the establishment and/or expansion of environmental planning and management measures. Such measures are vital to transforming the "reactive" approach based on control, which was used by environmental authorities in the formerly centrally planned economies, into a "proactive" approach based on environmental management objectives. Priority will be given to support for:

- Environmental Planning;
- River Basin Management:
- Coastal Zone Management; and
- Protected Areas Management.

Special emphasis will be placed on management activities involving cooperation between two or more countries, such as the management of coastal lagoons and transboundary rivers.

Special Support for Authorities Responsible for Water Supply, Wastewater and Solid Waste. Consistent with the objective of decentralization of environmental management is Programme support for the development of effective local authorities responsible for water supply, wastewater and solid waste. Planning and management of these services in an integrated manner, the establishment of appropriate tariffs, and effective systems for collection of user fees will be promoted. A critical measure would be the upgrading of capabilities for the operation and maintenance of facilities. Special attention will be given to upgrading financial planning and management skills, given the increased responsibilities of local governments to finance construction,

operate and maintain facilities. The Programme will promote demonstration activities concerning contract management of facilities by private sector interests.

Enforcement Programmes. Lack of effective enforcement remains a major constraint to the achievement of environmental management objectives in the formerly centrally planned economies of the Baltic Sea region. Both regulatory techniques and financial incentives will be required to effectively address environmental problems in a number of sectors. The Programme will support the training of personnel in new techniques for the planning of enforcement activities and provide necessary equipment for field investigations. It will also work on the policy level to assist in strengthening the application and collection of environmental fines.

Environmental Monitoring, Data Collection and Analysis. Strengthening these activities is a Programme priority on the regional, national and local level. There is a serious need to make all types of environmental monitoring data available in a timely manner to a wide variety of users. In many countries in the region, use of water quality data for management decisions is less developed than for research activities, and is constrained by slow processing, poor quality control and lack of dissemination to local level users. National statistical organizations may play a key role in strengthening these data systems. One Programme objective will be to support standardization of basic water quality data collection in order to allow for effective comparison of the status and trends of rivers draining into the Baltic Sea with those in other parts of Europe such as the Rhine and Elbe Rivers.

Environmental Health Data in Decision Making. Support for formal links between environment and health authorities at the national and local level will increase the use of environmental health data in decision making, as will data base improvement and directed investigations of priority environmental health issues. Cooperation with the Regional Center for Europe of the World Health Organization should be established with respect to environmental health issues. Special attention will be given to expanded evaluation of environmental health conditions and trends in major "hot spot" areas selected for investment activities under the Programme. Twinning arrangements will be encouraged between various scientific institutions and management organizations concerned with environmental health issues.

Environmental Assessment. The Programme will support needed legal reforms and provide technical assistance to ensure routine preparation of environmental assessments for major programmes and/or projects in the Baltic Sea catchment area. These studies will be designed to evaluate the incremental impact of discharge to the Baltic Sea and the affected coastal zones. This approach will apply to all activities, whether funded by domestic or foreign sources and/or implemented by the public or private sectors. Environmental assessments should be prepared with public participation, and in consultation with local nongovernmental organizations. In the case of projects which may result in a transboundary impact, the provisions of the Espoo Convention should be applied (United Nations Economic Commission for Europe, Convention on Environmental Impact Assessment in a Transboundary Context).

Industrial Environmental Audits. The Programme will support the development of local capacity to carry out environmental audits through the training of personnel from local industries, consulting firms and regulatory organizations for their planning, conduct and application. The findings and recommendations of audits will provide the basis for a wide variety of activities to improve environmental management at the plant level, through strengthening of plant level management, process supervision, operation and maintenance, and other environmental management activities. These training activities will be designed to complement those which are currently under implementation in Poland with support from Norway and the World Bank and. on a regional level, by the United States Agency for International Development.

Cooperative Programmes. Given their important role in addressing a wide variety of administrative, management, technical and "know-how" issues related to environmental concerns, the Programme will encourage and assist the expansion of cooperative programmes. This element will build on the experience of the many programmes which have been successfully undertaken in the region, including, but not limited to, programmes involving: technical agencies, research institutes, governments, professional associations, farmers and nongovernmental organizations. The Programme will also encourage twinning arrangements between cities, regions and technical agencies for direct exchange of experience, on-the-job training and technical assistance.

5.7.3 Investment Activities

The third component of the Programme consists of investments in measures to control point and non-point sources of pollution. The multiple causes and sources of environmental pollution and degradation in the Baltic Sea and its catchment area, and the resulting wide range of physical, technical and economic conditions and requirements to adequately address these problems, call for a diversity of investment actions. The Programme comprises:

Point source pollution control investments:

- Emergency support and warning systems;
- Municipal wastewater treatment;
- Combined municipal and industrial wastewater treatment;
- Pulp and paper industry environmental control;
- Environmental control at other industries;
- Solid and hazardous waste management:
- Air quality management; and

Non point source pollution control investments:

- Runoff from agriculture, forestry, livestock operations and rural settlements:
- Pollution from fish farming;
- Air pollution from mobile sources of emissions; and
- Air pollution from area sources of emissions.

In the future, measures may need to be taken to address environmental impacts on the Baltic Sea from former military installations.

Establishing Investment Priorities. The major constraint affecting the setting of priorities and the choice and sequencing of investments is the limited capacity to mobilize financial resources to meet investment and operational costs. While the Programme encompasses initiatives to help relieve this constraint, it is nevertheless expected to be a critical factor in the early stages of Programme implementation. These considerations will dictate a phased approach in which each investment is an incremental, planned and integral part of an overall system to be developed over the longer term.

While a wide array of factors can influence the selection of specific investment priorities, the following key criteria will be the most important:

- **Impact.** lnvestments for curative and preventive actions will be made on the basis of their influence on human health conditions, significance to the maintenance and/or restoration of ecological systems, and their impact on the economy. In assessing potential investments, consideration will be given to the effectiveness of the proposed action in reducing and/or preventing negative impacts. Although environmental impact parameters are difficult to quantify in terms of their physical, economic and social cost, they are critical to the decisions on the allocation of scarce resources.

- **Preparation of Adequate Feasibility Studies.** Arrangements to finance and implement projects identified in the Programme will require detailed feasibility studies fulfilling international standards. These studies will only be undertaken where there are real probabilities of implementation. A key condition that needs to be met is the availability of project sponsors and their willingness to invest within a sufficiently brief time frame. This is necessary to insure that a feasibility study undertaken over the next year or two will remain valid for the period of implementation of the project. The studies will include the analysis of alternatives, selection of technologies and design concepts, detailed cost estimates, and the preparation of environmental assessments as appropriate. In most instances, feasibility studies would be prepared by independent consultants who have no interest in the sales of construction services or equipment, or who hold rights to specific technologies. Proposed projects should have a financial plan which provides for operation and maintenance costs in all cases, and for the repayment of capital costs on projects which are funded by loans.

- **Control of "Hot Spot" Point Source Pollution.** Given the magnitude of the environmental problems, their impacts on public health, ecology and/or the economy of the country as well as their cumulative impact on the Baltic Sea, the identified "hot spots" represent major opportunities for cost effective and timely investments by national/local authorities and international funding institutions when foreign support is required. In the absence of convincing evidence to the contrary, the problems at these "hot spots" should be addressed first.

- **Part of a Long-Term Programme of Environmental Improvement.** Projects which fit logically within a broader integrated framework should be given a priority to make the most cost-effective use of limited funds. This approach maximizes the full benefits to be achieved from the completion and operation of whole systems, as well as the indirect benefits from complementary investments. The benefits of ad hoc and isolated projects are often less than expected or are lost within a brief period. Hence it will be essential for authorities to formulate and regularly update a concrete and integrated plan for environmental management that provides a rational framework for investment choice.

- **Least Cost Approach.** Given the severe constraint on the availability of capital financing, investments in environmental improvements should be developed on a phased implementation basis. Capital costs can be distributed over a longer time period yet facilities can begin to function and yield benefits more quickly. Funding for projects which have been partially completed or involve the rehabilitation of existing facilities will be given priority. Assuming the basic viability and technical soundness of a partially completed investment, the sunk cost component, particularly in wastewater collection systems, provides a higher rate of return.

- **Targets Economically Viable Industries.** The evaluation of investment programmes in the industrial sector will be based on a determination of the market competitiveness and viability of the enterprises. The industry must be assured of a future in the international market place. This is an especially important issue in selection of environmental improvements in the chemical, metallurgical, and pulp and paper industries. Limited funds available for environmental improvements will not be directed to industries which are expected to close due to economic restructuring.

Key Elements of the Investment Component of the Programme. Key elements of the Programme's investment component include:

Emergency Support and Warning Systems

- **Emergency Spare Parts and Chemicals.** To avoid serious public health risks to local populations, increased pollution of major rivers and impacts to the Baltic Sea, special short-term actions are required for the continued operation and maintenance of water supply and wastewater systems in Belarus, Estonia, Latvia, Lithuania, Russia and the Ukraine. At present, supplies of chemicals, replacements, and spare parts, which are critically needed for treating domestic water supplies and the operation of wastewater treatment plants, are unreliable either because they are in limited quantities or simply unavailable. In the medium term, measures should be taken to encourage the private sector to develop local/regional production capacity to produce these chemicals and spare parts. In addition, such elements as pumps and aerators, are required for the operation of water supply and wastewater systems.

- **Warning Systems.** <Effective emergency warning systems are needed on the major rivers, including the Daugava, Nemunas, Vistula and Oder/Odra, to protect drinking water supplies in the case of significant spills of hazardous and toxic substances.

Point Source Pollution

- **Rationalization of Water Consumption.** To conserve water resources and to decrease the volume of wastewater discharged for collection, treatment and disposal, the Programme will support national and **local** activities to rationalize water consumption by agricultural, industrial and municipal users. These activities include support for policy reforms in setting water charges and increasing user charges for water and wastewater, implementation of effective metering and billing systems, water conservation studies for key users, investments in distribution networks and major facilities to reduce waste, and public education activities. A decrease in domestic and industrial wastewater will permit effective expansion of the capacity of existing treatment plants and possible reductions in the size and costs for proposed collectors, treatment plants and disposal systems. This should result in reductions in investment, operation and maintenance demands for water supply, freeing funds for investments in wastewater management.

- **Municipal and Industrial Wastewater Treatment.** The reduction of municipal and industrial wastewater loads is a central objective of the Programme and will involve a number of complementary actions. While considerable improvements have been realized in the countries of the northern and western parts of the region in the treatment of municipal and industrial wastewaters, significant steps need to be taken in order to reach acceptable treatment levels in the eastern and southern portions of the catchment area where investments have proceeded at a slower pace. A critical problem in the development and implementation of effective wastewater management activities in these areas is the tradition of having industrial plants discharge their wastewaters, generally with little or no pre-treatment, into the municipal wastewater systems for collection, treatment and disposal. The Programme will support actions to address the special management problems which occur in these combined municipal and industrial systems. It will also support the treatment of wastewater and industrial facilities which discharge directly to rivers and coastal areas. Special priority should be given to addressing wastewater treatment needs of the major industrial polluters of the Baltic Sea catchment area, particularly pulp and paper, chemical and metal production/processing industries.

- **Upgrade Existing Facilities and Completion of Facilities Under Construction.** The Programme will support investment to upgrade existing facilities and complete facilities under construction for municipal and industrial wastewater treatment, since in the short and medium term, this approach is commonly the most cost effective means of reducing wastewater loads. Priority will be given to facilities that are routinely bypassed, heavily overloaded and/or not running at optimal conditions. Support will be provided for completion of facilities under construction, subject to design modification to achieve a least-cost approach, and replacement of any substandard civil works. There are a number of such projects among the "hot spot" areas including Kaliningrad, Klaipeda, Liepaja, Tallinn and Vilnius. Upgrading and/or completion of plants which treat significant amounts of industrial wastewater will only be funded if complementary regulatory and industrial pre-treatment programmes are concurrently implemented to assure effective operation of the treatment plant and minimize damage to the collection network. Key operational problems such as plant instrumentation to increase treatment levels and improve process reliability, energy efficient equipment to reduce operational costs, and staff training will also be addressed. Such Programme activities will allow governments and industries to obtain the environmental benefits from the substantial expenditures already made for these facilities.

- **Construction of New Wastewater Treatment Facilities.** The Programme will support the construction of new municipal and industrial wastewater treatment facilities where none presently exist in "hot spot" areas. Support for municipal systems will include complementary investments in water consumption rationalization and network upgrading; collection, treatment and disposal systems for wastewater; and sludge management. Funding for new municipal wastewater treatment plants will be subject to the same regulatory and pre-treatment requirements as above. All Programme supported construction projects will include training of personnel in the operation and maintenance of the facility. Given the major expenditures required for such facilities, the Programme will give preference to projects which allow for phased construction and operation.

- **Sludge Management.** Sludge management is emerging as a major environmental issue on a regional basis, and the Programme will undertake initiatives to address this problem. It is especially acute in the eastern and southern portions of the Baltic region where existing problems with sludge dewatering and disposal have been made more difficult by significant increases in energy and transportation costs. Heavy metal contamination of sludge from industrial sources discharging to wastewater systems renders the sludge unusable in agriculture or forestry as a soil additive and creates serious disposal problems, including the risk of leachate percolating into surface and groundwaters.

- **Pulp and Paper Industry Environmental Control.** Apart from agriculture and livestock husbandry, forest product industries, particularly the pulp and paper industry dominate in the region. While this industry is perhaps the most modem in the world in the northern and western parts of the region, it is arguably one of the most outdated and inefficient in the eastern and southern portions. In both cases, there are serious pollution problems particularly with persistent organic chlorinated substances. In the eastern and southern portions of the

region, there is a lack of effective and efficient treatment facilities at most mills. These problems must be given a high priority because of the magnitude of their environmental impact on rivers and coastal waters and the economic importance of the sector. However, these problems should be addressed and significant investments made only in the context of the likely competitiveness and viability of individual mills. High priority should be given to the development and implementation of low-cost, non-investment approaches to environmental management in the non-competitive mills that will have to be eventually closed.

- **Environmental Control at Other Industries.** The Programme will also support the treatment of wastewater at other industrial facilities which discharge directly to rivers and coastal areas. Special priority will be given to addressing wastewater treatment needs of the major industrial polluters of the Baltic Sea region, particularly chemical, and metal production\processing industries. The approach, as with the pulp and paper industrial sector, must consider the competitiveness of individual enterprises as a starting point. Incentives and new mechanisms may be needed to channel financial resources to small and medium enterprises during the early phases of Programme implementation.

- **Saline Discharges to Rivers.** The discharge of large amounts of highly saline water from mines in the Oder/Odra and Vistula River Basins, although having no direct impact on the Baltic Sea, creates extreme water management and utilization problems in these basins and requires priority attention. The salinity levels make the rivers unusable for many agricultural uses, as well as for domestic and industrial water supply, and cause massive corrosion if used in district heating systems or as cooling water. The water is also corrosive to engineering structures and vessels using these rivers, especially in the upper reaches. Although large scale funding will be required to remedy the severe economic and environmental impacts, in the long-term this will be more cost effective and environmentally beneficial than current expenditures for developing alternative water sources. The Programme will provide support to address this problem following the completion of a detailed technical and economic evaluation of alternative approaches prepared under the supervision of an independent board of experts.

- **Solid and Hazardous Waste Management.** Support under the Programme for investments in solid and hazardous waste management will be provided in cases where existing disposal is unsafe, including sites presenting significant documented risks of pollution to the air and surface waters in the catchment area and/or the marine environment. The Programme will promote the development of safe disposal sites and processes with adequate controls, to reduce the amount of waste which may eventually end up untreated in the Baltic Sea through leakage and open-air burning. Such activities will be coordinated with the large number of on-going national initiatives for the proper management and disposal of solid and hazardous wastes. Complementary activities for development of waste minimization policies and evaluation of alternative approaches to waste management will be supported under other elements of the Programme. Accession to the Base1 Convention would enhance the development of national and environmentally acceptable waste management policies.

- **Air Pollution from Stationary Sources.** Identification of strategies and specific actions to eliminate or reduce airborne sources of pollution involve consideration of issues and opportunities in the broader context of national economic, industrial, and energy policies. Key issues concern the restructuring of energy use and supply, energy conservation, and

strategies for pollution abatement including pre-treatment of raw materials, primary measures in the fuel combustion process, and secondary measures in flue gas treatment. Improvement of air quality in the Baltic Sea catchment area requires not only measures to abate pollution generated in the industry and energy sectors; it also calls for restructuring of the energy sector and expanded use of natural gas in certain sectors.

In addition to activities related to policies, laws and regulations, the Programme should promote actions by countries and foreign parties to reduce pollution from the following sources: electricity and heat facilities, because of emissions of NOx and heavy metals, particularly mercury; non-ferrous metal industry, because of emissions of heavy metals, particularly arsenic, cadmium, copper, lead and zinc; and the chemical industry, particularly production of caustic soda and chlorine, because of emissions of mercury. Due to the high cost and complexity of interventions in this area, activities supporting the objectives of the Programme will be developed in coordination with the large number of on-going nationally and internationally financed projects for air pollution control, especially in the Czech Republic, the eastern area of Germany, and Poland, where the Sulfur Triangle Regional Environmental Programme is being developed. In order to avoid duplication, the Programme will restrict its efforts to activities which are outside the scope of current and/or planned projects and for high priority "hot spot" industries.

Non-Point Sources

- **Reduction of Runoff from Agriculture, Forestry, Livestock Operations and Rural Settlements.** Due to significant impacts from runoff of manure, fertilizers and pesticides to surface water, groundwater and finally to the marine environment, control of runoff from agriculture, forestry and livestock operations is a critical element of the immediate and long-term strategy to restore the ecological balance of the Baltic Sea. Central to addressing this problem are long-term policy measures to reduce use and increase efficiency of fertilizers and pesticides and to modify livestock management practices. Within the forestry sector, actions will be needed to improve practices for logging and forest road construction. Careful review should be made of proposals to drain wet forests for harvesting. While the Programme will support the continuation of activities to control agricultural run-off in the northern and western countries it is recommended that, until the direction of agricultural restructuring and land reform is clearer, efforts in the eastern and southern countries be restricted in Phase I to pilot activities. This is especially important with regard to investment activities for large scale livestock operations.

  The Programme will include pilot activities for improved storage and application of chemical and natural fertilizers in the St. Petersburg region, Estonia, Latvia, Lithuania and the northern portion of Poland. These will involve construction of model storage and treatment facilities and testing of equipment used for manure spreading. The Programme will also support applied research and agricultural extension activities concerning the application of chemical fertilizer, manure and pesticides. Part of these activities should focus on the introduction of improved agricultural practices, including the use of catch crops and use of winter ground covers. Support should also be provided for small and medium scale projects on a demonstration and pilot basis which use eco-technology approaches to address these sources of water pollution. These may consist of use of ecological engineering approaches. including constructed wetlands and low technology wastewater treatment facilities. In many locations, these may prove to be more cost effective than traditional approaches,

Control measures involve a wide range of changes in farming practice including modifications in the timing manure application and tillage, the provision of on-farm infrastructure including larger capacity and more secure storage for fertilizers, manure and farm wastes, changes in water use, and new equipment including manure spreading and waste handling equipment. These measures could reduce the nitrogen load reaching the Sea by about 31%, and the phosphorus load by about 73%. Clearly in the case of nitrogen, more effort and innovation will be needed to reach the HELCOM requirement of a 50% reduction in load.

The introduction and dissemination of these practices, and the development and adaptation of new, more suitable and low-cost technology requires an effective extension and agricultural research system that does not currently exist in many parts of the region. Educational programmes and production of informational materials and guidelines for farmers would be an important activity.

Uncertainty concerning the future structure of land ownership and the fate of the large agricultural and livestock operations will have a significant effect on the pace at which the Programme can be developed and implemented. Hence, the Phase I of the Programme should focus on the use of well designed pilot and demonstration studies and projects, designed to identify suitable technologies, determine costs, and develop mechanisms for the dissemination and spread of these measures into practice.

- **Pollution from Fish Farming.** The Programme will support activities for the analyses and the development of cost effective interventions to address pollution problems resulting from fish farming in the lagoons, coastal waters and archipelago areas of the Baltic Sea. The Programme will support the development of fish production methods, in which discharges will be treated or eliminated. It will also support development of new types of fish diets with an emphasis on increasing energy values and reducing nutrient wastes. The Programme will include a pilot activity which addresses environmental issues concerning fish farms in the Archipelago Sea. It will evaluate potential environmental problems associated with the expansion of fish farming in the coastal lagoons and coastal waters, especially as the result of investments for improved water quality in the catchment areas.

- **Air Pollution from Mobile Sources of Emissions.** The Programme will support policy and investment activities to reduce air pollution from mobile sources including emission control technologies (three way catalysts) for vehicles, inspection programme for improved engine tuning and maintenance of control systems, and phasing out leaded petrol in favour of unleaded fuel. Due to the importance of proper environmental management in the transportation sector for the long-term conditions of the Baltic Sea, the Programme needs to be extremely closely coordinated with the activities of the regional-level Baltic Working Group for Transport and Environment.

- **Air Pollution from Area Sources of Emissions.** The Programme will support policy and investment activities to address the control of area sources of emissions. Heat production from small commercial and residential burners will be addressed by restructuring and expanding district heating systems, through greater use of natural gas, and the promotion of co-generation facilities. Activities under the Programme will be developed in coordination with the large number of on-going nationally and internationally financed projects for control of air pollution control from these sources. Activities to reduce ammonia emissions from livestock operations will include incorporation of air pollution concerns into the design of cattle barns, promotion of manure use as fertilizer, improved storage and treatment of

manure, and support for the acquisition of manure spreaders and top soil fertilizing equipment. This Programme area will be closely coordinated with activities to control water pollution from livestock operations and fertilizer use.

- **Former Military Installations.** The concentration of former Soviet Union military installations in the eastern and southern portions of the region presents special environmental problems due to the undetermined extent of hazardous, toxic and radioactive wastes which may exist at these facilities as well as the impacts from the wastes discharged by the large number of military personnel and their dependents who were stationed there. The specific curative activities needed to address the conditions at these facilities should be evaluated on a "case by case" basis following review by joint teams of specialized local and international experts. Incorporation of these activities in the Programme will follow the completion of such studies and will depend on the significance of their impact to the Baltic Sea environment.

5.7.4 Management Programmes for Coastal Lagoons and Wetlands.

The fourth component of the Programme concerns area-focused activities to manage environmentally sensitive and economically valuable areas. The critical role played by these habitats in the ecological system of the Baltic Sea is being increasingly recognized. They serve as important buffers for pollution to the Baltic Sea by acting as natural traps and providing variable levels of treatment of biodegradable wastes. They also provide critical habitat for a diversity of fauna and flora including migratory birds.

These programmes will be developed through the preparation of management plans in collaboration with concerned Governments, local authorities, international organizations, and specialized non-governmental organizations such as WWF and IUCN. The Programme will support regional, national and local level activities consistent with the Helsinki Convention and HELCOM recommendations to support the conservation of critical habitats, especially coastal lagoons and wetlands. Programme cost estimates include land acquisition, compensation, land and facility development, and control measures. On the policy level, the Programme will assist cooperating governments in development of plans for the implementation of Ramsar Convention, Bonn Convention and HELCOM Recommendations concerning the conservation of habitat and the protection of endangered species. The Programme will also support the development of criteria and guidelines for the identification of the most important wetlands in the Baltic Sea region.

In Phase I, the Programme will support the preparation and implementation of management plans for Matsalu Bay in Estonia, the Gulf of Riga shared by Estonia and Latvia, the Kur_iu Lagoon shared by Lithuania and the Kaliningrad Oblast in Russia, the Vistula Lagoon shared by the Kaliningrad Oblast and Poland, and the Oder/Odra Lagoon shared by Poland and Germany. Additional activities will be undertaken for the management and conservation of key areas on a national and local basis with Programme support. Consistent with the recommendations of the topical area study on the critical role of wetlands, prepared for the Task Force with support from the World Wide Fund for Nature (Sweden), the Programme will support the development of a series of demonstration activities concerning the use of natural and constructed wetlands for wastewater treatment, stormwater retention, and as traps for nutrients and other pollutants. Upon successful evaluation, these activities will be extended to additional areas.

5.7.5 Applied Research

The fifth component of the programme, applied research, aims to build the knowledge base needed to develop solutions, and widen and deepen the understanding of critical problems. The long-term success of the Programme calls for various applied research activities to resolve

current problems, examine new approaches and identify potential future issues. Increased applied research and exchanges of information concerning physical, chemical and biological systems in the Baltic Sea region will be supported to improve the monitoring and understanding of changes and impacts, in cooperation with HELCOM activities. But because the Programme is action and solution oriented, implementation of the applied research component will be guided by key individuals directly involved in formulation and implementation of Programme actions. This will ensure that there is sufficient operational feedback to guide the preparation and selection of research proposals. Advice and assistance should be sought from representatives of HELCOM, the Commission of European Communities, funding agencies, governments and independent scientific research organizations. Priority applied research tasks include, but are not limited to, the following:

Scientific Issues

- **Environmental Trends.** The Programme will include support for periodic analyses of the long-term responses of the ecosystem to natural and anthropogenic influences. This will include examination of the effects of such factors as the natural stagnation periods and long-term pollutants such as heavy metals and toxic bioaccumulating organic substances.

- **Systems Ecology.** The Programme will support applied research in systems ecology in recognition of the contribution of such investigations to the understanding of the inter-relationship of key factors in the ecology of the Baltic Sea and its catchment area. Programme support will focus on applied research to further define the critical relationships between the inputs to the catchment area, the coastal zone and the marine environment. The findings of such studies will assist in planning future remedial policies and activities.

Assessment of Risks and Impacts

- **Evaluation of Critical Loads.** The development and application of the "critical loads" concept for different pollutants in the Baltic Sea and its different sub-regions will be supported under the Programme. The results of this applied research will be used for the local management of wastewater discharges, on a pilot basis, until adequate funding is available to comply fully with HELCOM Recommendations on the reduction of discharges.

- **Environmental Health.** An expanded analysis of human health impacts and risks will be supported under the Programme to determine high priority activities and locations. A major focus of this element will be the analysis of the relationships between proposed Programme activities and the improvement of environmental health conditions in the Baltic Sea region. This Programme element will be structured to promote the expansion and formalization of linkages between environmental management and health specialists.

Issues in Key Sectors

- **Agricultural Development in the Baltic Sea Catchment Area.** An important issue for support under the applied research component of the Programme will be the evaluation of various scenarios for the development and/or redevelopment of agriculture within the Baltic Sea catchment area. Particular attention will be given initially to issues and environmental impacts associated with the potential restructuring of livestock and poultry management in the eastern countries of the region.

- **Future Trends in Transportation and their Environmental Management.** Increasing vehicle registration throughout the Baltic Sea region highlights the need for evaluation of the environmental

consequences of future trends and actions which should be taken to avoid and/or mitigate their potential adverse impacts. Applied research in this area should be fully coordinated with the regional level Working Group on Transport and Environment.

- **Restructuring of the Pulp and Paper Industry in the Former Soviet Union.** The break-up of the former Soviet Union presents important questions for the future of the pulp and paper industry located in Estonia, Latvia, Lithuania and Russia and concentrated in the Baltic Sea catchment area. The Programme will include studies to evaluate changes in sources of wood supply, transportation costs, energy costs and world market opportunities, which will determine decisions on both the restructuring of the industry and investments in environmental pollution control.

- **Best Environmental Practice and Best Available Technology.** The Programme will support activities focusing on demonstration and pilot activities, on a sectoral basis, of Best Environmental Practice and Best Available Technology. This will be done in cooperation with representatives of key government agencies, industrial enterprises, and other concerned parties, and will evaluate the cost-effective application of these concepts. Emphasis will be given to their application in agriculture, and in chemical and metal-plating industries. Priority will be given to activities which address the needs of small and medium scale agro-industrial and industrial enterprises.

Management of Critical Ecosystems

- **Function and Management of Coastal Lagoons.** Current information on the environmental function of major coastal lagoons of the Baltic Sea is insufficient to fully identify the key elements for effective environmental management activities. Given the importance of the coastal lagoons as habitat, recreational areas and for the natural treatment of wastewaters, measures must be taken to establish clear and implementable approaches for their management by national and local authorities. Special attention needs to be given to international cooperation regarding the Gulf of Riga and the Kur_iu, Vistula and Oder/Odra Lagoons which are shared by two nations.

- **Wetlands Management.** The Programme, recognizing the importance of wetlands as "multi-purpose ecosystems", will support applied research on the identification and evaluation of selected wetland areas, in a variety of locations within the Baltic Sea catchment area. Particular attention will be given to the identification of priority sites for wetland conservation/protection in the upper, middle, and lower portions of major drainage basins as well as in coastal areas. Support will be provided for the development of management plans for priority wetland areas.

5.7.6 Public Awareness and Environmental Education

The sixth component of the Programme aims to develop a broad and sustainable base of support for the implementation of Programme actions. The participation of non-governmental organizations and the development of effective environmental education programmes will be important in supporting both public awareness and political commitment. The Programme will support public awareness and environmental education activities to develop widespread understanding and popular support for the long-term activities required to restore the ecological balance of the Baltic Sea, its coastal zone, and catchment area. Mass media will be used extensively. These activities are vital to the development of a "political constituency" willing to accept the measures needed for this restoration, such as increased user fees and taxes. Programme funding will be made available to support participation of nongovernmental organizations in reaching out

to the "grass roots" level. In addition to current support from national governments for these activities, special funding will also be required for mass media campaigns to support and promote the objectives of the Programme. Efforts to promote and expand environmental education, particularly in the context of local environmental clean-up activities, will be given priority. An important element of public awareness will be public meetings of a variety of types to promote the objectives of the Programme.

5.8 IMMEDIATE ACTIONS TO BE TAKEN

Immediate Actions to Implement the Programme. Since, as noted earlier, implementation of all the actions that have been identified will take several decades, a phased approach will be required. Each phase will include a concrete programme of investment, policy reform, and institutional strengthening actions. A concrete programme for Phase I, covering the period 1993- 1998, is outlined below. Formulation of subsequent phases will address the highest priority actions that remain to be implemented, with adjustments and modifications based on experience gained in the earlier phase. Additional actions would be added to Phase II of the Programme, which although potentially important, were not included in the list of "hot spots" prepared for Phase I. These actions would also include important activities identified during the course of implementation of Phase I particularly in the area of solid and hazardous waste management. Later phases of the Programme could be expected to place increased emphasis on industrial pollution control activities following the results of industrial and energy restructuring in the formerly centrally planned economies.

The Phase I Investment Programme. There are four principal investment priorities during Phase I:

- **Emergency support and warning systems.** To avoid serious public health risks and increased pollution of rivers and coastal waters, immediate support is needed to overcome the shortage of chemicals, replacements, and spare parts required for the continued operation and maintenance of water supply and treatment, and wastewater treatment facilities in Belarus, Estonia, Latvia, Lithuania, Russia and the Ukraine. Effective emergency warning and response systems are needed on major rivers and harbours in the region.

- **Improvements in combined municipal and industrial wastewater treatment systems.** The main benefit from these investments is in the reduction of organic pollution loads (BOD,) on the Baltic Sea and the coastal waters. Additional nutrient removal facilities (tertiary treatment) at municipal wastewater treatment plants, however, have only a small impact on the total nutrient load to the Sea, in particular if they are located upstream. In such cases, and unless there are good arguments based on local benefits, investments in nutrient removal treatment systems should be deferred until substantial progress is made in nutrient load reduction in the agriculture sector and other, higher priority pollution reduction measures are completed. In this context a high priority has been assigned to the following types of projects included in Table 5-3:

- Complete unfinished and inoperable treatment facilities;

- Install or improve industrial pre-treatment;

- Eliminate uncontrolled discharge of wastewaters into the environment:

- Expand and improve safe disposal of sludges.

- **Rational industrial pollution control.** Wherever possible and both physically and economically sensible, industrial pollution problems should be considered separately from municipal systems. Pollution control measures should be specific to each industrial process so that pollution can be dealt with at the source. Rather than treating existing problems at

the end-of-pipe or stack, each sector should be assessed to identify economically competitive and viable enterprises. Environmental audits should be conducted and an integrated strategy of environmental and process modernization developed for each plant.

- **Control of pollution loads from the agriculture sector.** The Programme will support the incorporation of environmentally oriented incentives into agriculture sector reform and development programmes, and the implementation and monitoring of pilot and demonstration projects to develop low-cost environmental control technology and practices. Significant impact on reduction of nutrient loads on the Baltic Sea and hence on the damaging effects of eutrophication can be achieved by introducing better manure handling and fertilizer application and storage practices. The widespread dissemination and adoption of these practices should be a high priority policy objective in the agriculture sector.

Impact of the Phase I Investment Programme. Implementation of projects to address the 29 priority municipal and industrial "hot spots" for which adequate data are available, is projected to annually reduce BOD, by 300 000 tons, nitrogen by 33 500 tons, and phosphorus by 8 200 tons. This would include an estimated annual reduction, from 19 "priority hot spots" in the Vistula and Oder/Odra River Basins amounting to 160 000 tons of BOD,, 23 500 tons of nitrogen and 6 500 tons of phosphorus. The annual load reduction from IO "priority hot spots" in Russia, Estonia, Latvia, and Lithuania totals an additional 140 000 tons of BOD,, IO 000 tons of nitrogen and 1 700 tons of phosphorus. While the Programme will support a variety of interventions to reduce agricultural runoff, it has not been possible to accurately calculate the total load reductions. Major reductions in AOX have been achieved since 1987 in the pulp and paper industry in the Nordic countries. These reductions are expected to continue thanks to the introduction of process changes and of chlorine free pulp technology. Since both total and individual discharges of these pollutants are uncertain at present, estimates of load reduction cannot be made at this time. More reliable data will be available in the near future, with completion of the second HELCOM sponsored pollution load compilation.

Complementary Actions. The policy reform agenda follows logically from the Phase I investment programme:

- Rationalize and harmonize standards;
- Establish incentives for environmental investment;
- Implement the polluter/user-pays principles;
- Establish viable mechanisms for the levy, collection, and retention of revenues to finance environmental projects particularly at the local level.

As noted earlier, capacity building will be a principal focus of efforts during Phase I of Programme implementation in order to take advantage of the time needed for the transforming economies to generate project financing resources. The capacity building agenda will thus focus on three areas:

- Local capacity to finance and manage projects;
- Environmental monitoring and regulatory systems;
- Project preparation including environmental assessment.

Cost of the Phase I Programme. The target level of investment for Phase I of the Programme is 5 billion ECU. It is anticipated that national governments, multilateral financial institutions, bilateral organizations and private sector interests will develop projects for implementation during Phase I based on Programme "priority hot spots" indicated in Table 5-3.

Activities for Phase I were selected by the Task Force following pre-feasibility studies by

independent consultants, under the supervision of the multilateral financial institutions, analysis of available data and field visits, consultations with representatives of national and local governments, and input from a series of public hearings in the study areas. The criteria used in the selection of "hot spots" in Denmark, Finland and Sweden were based on evaluation of potential priorities, using the status of activities in 1990 as a baseline. Sites in Germany were selected on the basis of a pre-feasibility study supervised by the Federal Government and in consultation with representatives of the concerned Lander. As mentioned previously, selection of activities for Phase I is determined by potential impact on the water quality and ecological systems of the Baltic Sea, its coastal waters, and its catchment area, and by present institutional capacity, particularly for project preparation and financing in the eastern and southern portions of the region. In addition, the present limitations on public sector financial resources for environmental project investment, which strongly influence the size and sequencing of Programme actions, are expected to improve only slowly for several years. The target level of investment for Phase I reflects these concerns.

Other Immediate Actions. Three other immediate actions are vital to the initial success of the Programme:

- **Establishment of a Programme Implementation Mechanism.** According to the Baltic Sea Declaration, the key elements of the Programme should be under implementation by 1993. Even though the main responsibility for implementing the Programme will have to be borne by the governments concerned, co-ordination of many Programme activities is needed. Several existing activities of HELCOM, including monitoring of the open sea and coastal waters, as well as land-based pollution, both waterborne and airborne, may contribute directly to future activities under the Programme. However, further feed-back mechanisms may have to be developed. There are a number of new activities to be carried out which are not within the current terms of reference of HELCOM. These new activities include expanded monitoring of pollution and the impact of Programme actions, maintenance of an up-to-date and more comprehensive data base, co-ordination of policy and regulatory reforms, of technical assistance, and of research programmes and information exchange, as well as periodic updating of the Programme.

- **Funding of Feasibility Studies for Priority Projects.** The funding of feasibility studies for "priority hot spots" is critical to the rapid implementation of the Programme. Without good feasibility studies the various financial contributors will not have adequate information to decide on whether to support a particular project. The expressed desire of the Contracting Parties to minimize delays in implementing the Programme makes it imperative that commitments to fund and carry out feasibility studies be made as soon as possible. It is estimated that the initial sum required for the preparation of feasibility studies, including detailed environmental audits of industrial facilities, will be approximately 30 million ECU. The launching of the feasibility studies for specific investments would be subject to decision on a case-by-case basis, after identification of a project sponsor with the necessary implementation and fund-raising capabilities, and an expressed willingness to undertake the project.

- **Mobilization of Financial Resources for Investment Activities.** The mobilization of local, national, bilateral and multilateral financial resources to meet capital and recurrent costs for all aspects of the Programme will be critical for its successful implementation. The cooperating multilateral financial institutions could support the mobilization of resources in the context of their lending programmes on both a sectoral and project-specific basis. Measures need to be taken to increase the capacity and the willingness of government, industry and the public to

support the use of taxes and increased user charges to cover the costs of key environmental improvements. Recognizing the serious constraints presently encountered by the countries in the eastern and southern portions of the region, the potential levels of grant funding and allocations under lending programmes should be reviewed.

To this end, and in order to provide for the broadest possible financial support, it is proposed that an international funding conference for the Baltic Sea Joint Comprehensive Environmental Action Programme be held in early 1993. The co-operating multilateral financial institutions will assist in organizing the conference with the aim of mobilizing local, national, bilateral, and multilateral financial resources for implementation of the Programme. To be successful, the funding conference will have to be carefully prepared. In addition to the bilateral and multilateral financing institutions represented on the Task Force, invitations might be extended to selected members of the G-24 group, as well as to private, semi-public, and public merchant banks specialized in privatization, export credit agencies experienced in assembling financing for large contracts, and risk capital financiers that could invest in domestic enterprises to manufacture the equipment and supply the services necessary for the Programme.

5.9 THE EXPECTED ENVIRONMENTAL BENEFITS OF THE PROGRAMME

The Necessity for a Long-Term Perspective. Implementation of the Programme will necessarily require decades. Given the long-term pattern of periods of natural stagnation in the Baltic Sea and their negative consequences for the condition of its ecosystems, major sustained impact on the Baltic Sea environment cannot be expected for less than a generation. Nevertheless, gradual and visible improvements can be expected, and locally, major economic and important environmental benefits can be realized in the relatively near term. It should be noted that it is more difficult to forecast changes in response to Programme supported activities to reduce anthropogenic pollution in the Baltic Sea as a whole, than in the coastal waters and rivers.

Clean-up of the Rivers. The Programme is expected to have major economic and environmentally beneficial impacts on the rivers of the Baltic Sea catchment area. The region's rivers are presently the ma.jor source of water supply for domestic and industrial use. Large investments in water treatment have been and will be required due to severe pollution and ecological deterioration. Reductions in pollution loads and restoration of river ecosystems through implementation of the Programme will lower water treatment costs, increase the reliability and quality of water services by reducing the load on frequently overtaxed treatment facilities, and decrease groundwater depletion and saltwater intrusion in coastal areas. The framework of incentives adopted under the Programme will lead to reduced water consumption that will not only lower the cost of wastewater treatment but also help to defer expensive investment in new water supplies, particularly in sensitive coastal areas. The general improvement in the quality and reliability of potable water supplies will have significant benefits for the health and well being of the people.

Clean-up of the Coastal Waters. Coastal waters can be expected to improve most rapidly. The current widespread closure of Baltic Sea beaches due to contamination from untreated waste, odours, and massive algal blooms has caused serious loss of hard currency income and employment from the fishing industry and tourism as well as local recreation opportunity. Treatment of municipal and industrial wastewaters and other inputs containing bacteria, viruses and other harmful organisms will allow the beaches to open again and contribute to establishing favourable conditions for new investment in this important sector. An important prerequisite for the recovery of the eutrophied coastal waters is that measures be taken not only in municipalities and industry located along the coast, but also in all main

polluting installations and for non-point source pollution from agriculture and forestry in the upper portions of the catchment area. This problem concerns all countries in the Baltic Sea region where discharges from non-point sources still constitute a major problem.

Restoring Ecological Balance in the Baltic Sea. The overall reduction in the load of nutrients and contaminants brought about by greater pollution control under the Programme will imply a restoring process with changes in the food availability for fish, in benthic vegetation, in the sedimentation rate and in occurrences of algal blooms. With decreased eutrophication leading to less algal production and sedimentation, oxygen conditions will improve. These changes can be expected to have a major positive impact on fishery resources in the coastal waters as well as in the open sea. Benefits in this sector will include an increase in the number and diversity of fish species and equally important, increases in the number of commercially valuable species such as whitefish, cod and plaice. Of the commercially most important fish, cod is probably the species most negatively affected by eutrophication. Control of environmental degradation in riverine areas should allow salmonid species to reappear in these areas. The fish populations in rivers and coastal areas are foreseen to react more rapidly to improved environmental conditions than the offshore populations of fish. The support for management of coastal lagoons and wetlands will conserve and lead to the improvement of the critical habitats provided by these areas.

Reduction in Nutrient Loads. The nutrient loads that have caused extensive eutrophication and upset the riverine and marine ecosystems will be reduced mainly by improved environmental management in the agriculture and livestock sectors, decreased atmospheric pollution. and expanded and more efficient municipal and industrial wastewater treatment. Conservation and improved management of coastal lagoons and wetlands is also expected to have a significant impact on nutrient loads and will contribute as well to the maintenance of biodiversity. These nutrient load reductions will have widespread beneficial impacts on health, environmental values, and significant economic benefits through reductions in costs and improved conditions for investment. Phosphorus removal and costly but worthwhile investments in nitrogen removal from municipal wastewaters of large cities will have a significant sub-regional impact on coastal waters in many areas.

Reduction of Heavy Metals and Organic Substances. A substantial portion of the heavy metal input to the Baltic (lead, cadmium and mercury) is transported to the sea via the atmosphere. These substances end up in the considerable amounts in sediments of coastal areas and river mouths, and can be remobilized from the sediment to the water for one reason or another. In addition to the direct effects of heavy metals, the complex synergy of different heavy metals and organic substances magnify the harmful effects on the living resources. For the recovery of the Baltic Sea, it is essential that measures to reduce heavy metals be taken both for emissions to the atmosphere as well as to the waters. The implementation of the HELCOM Recommendations on the reduction of toxic substances will be a great leap forward towards a better environment. Because much of the atmospheric pollution entering the Baltic Sea originates in countries outside the region, cooperation within Europe for implementation of the United Nations/Economic Commission for Europe sponsored Convention on Long-Range Transboundary Air Pollution to reduce air-emissions is a prerequisite to controlling heavy metal pollution in the Baltic Sea.

The number of potentially toxic synthetic and organic substances is still increasing. Given the difficulty of controlling the input of these substances on an individual basis, the principles of Best Environmental Practice and Best Available Technology are seen as key elements in the protection of the Baltic Sea. Application of the precautionary principle may help to prevent the reoccurrence of the events of the 1970s, when some of the Baltic seals and other mammals and birds were in danger of extinction due to, among others, the presence of toxic. persistent, bioaccumulating organic substances in their environment and diet.

Strategic Gains from Capacity Building. A quite different but strategically important

benefit will stem from the strengthening of local capacity to plan, finance, and manage the measures required under the Programme, and from the transfer of know-how that will have long-term benefits for environmental management. The latter includes, for example, environmental audits, financial management at the local level, improvements in industrial management, and improved agricultural practices. The strengthening of environmental management capacity at all levels throughout the Baltic Sea region will be the most important action to ensure the achievement of the long-term goal of the Programme - the ecological restoration of the Baltic Sea.

Figure 5-1 Map of the Point Source Pollution "Hot spots"

ENVIRONMENTAL HOT SPOTS IN THE BALTIC SEA CATCHMENT AREA

Location/Country/Site Name/Type of Pollution

Bothnian Bay

1. Bothnian Bay/Sweden/Rönnskärsverken Metal Smelter/Air pollution control, wastewater treatment, heavy metals
2. Bothnian Bay/Finland/Metsä-Botnia Oy Kemi Pulp & Board Mill/Wastewater treatment

Bothnian Sea

3. Bothnian Sea/Sweden/Husum Kraft Mill - Pulp & Paper Mill/ Wastewater treatment, air pollution control
4. Bothnian Sea/Sweden/Östrand Pulp & Paper Mill/Wastewater treatment
5. Bothnian Sea/Sweden/Vallvik Pulp & Paper Mill/Wastewater treatment
6. Dalälven River/Sweden/Dal&en Mining Area/Mining waste (zinc, copper, cadmium)
7. Bothnian Sea/Finland/Outokumpu Group - Harjavalta Metal Smelter/Air pollution control
8. Bothnian Sea/Finland/Kemira Oy Vuocikemia - Titanium Dioxide (and Fccrosulphate) Plant in Pori/Wastewater treatment and waste management, air pollution control

Archipelago and Aland Seas

9. Arch & Åland Seas/Finland/Fish Farming in Archipelago and Åland Seas/Nutrient load on the sea
10. Archipelago Sea/Finland/Agriculture/Agricultural runoff programme for Finland (the Archipelago Sea)

Neva River Basin/Lake Ladoga

11. Lake Saimaa/Finland/United Paper Mills - Joutseno Pulp & Paper Mill/Wastewater treatment
12. Lake Saimaa/Finland/Kaukas Pulp & Paper Mill - Lappeenranta/ Wastewater treatment
13. Lake Saimaa/Finland/Enso-Gutziet Oy - Kaukopää Pulp & Paper Mill/Wastewater treatment
14. Lake Ladoga/Russia/Syasstroi Pulp & Paper Mill/Air pollution control and wastewater treatment
15. Lake Ladoga/Russia/Volkov Aluminium Plant/Air pollution control and wastewater treatment

Gulf of Finland

16. Gulf of Finland/Finland/Sunila Oy Pulp Mill - Kotka/Wastewater treatment
17. Gulf of Finland/Finland/Helsinki Region/Treatment of municipal wastewater
18. Gulf of Finland/Russia/St. Petersburg/Construction of new sewer connections
19. Gulf of Finland/Russia/St. Pcrccsbucg Urban Areas/Treatment of municipal and industrial wastewater
20. Gulf of Finland/Russia/.%. Pcrccsbucg Suburban Areas/Treatment of municipal and industrial wastewater
21. Gulf of Finland/Russia/St. Petersburg/Phosphorous removal From wastewater
22. Gulf of Finland/Russia/St. Petersburg Metal Plating Industry/ Heavy metals in wastewater and sludge
23. Gulf of Finland/Russia/St. Petersburg Hazardous Waste Plant/ Management of hazardous wastes
24. Gulf of Finland/Russia/St. Petersburg Region - Large Livestock Farms/Wastewater rceatmenr and sludge treatment
25 Gulf of Finland/Estonia/Narva Power Plant (Oil Shale)/Air pollution control, waste management and wastewater treatment
26 Gulf of Finland/Estonia/Kohtla Järve Industrial Area/Treatment of industrial and municipal wastewater, air pollution control, waste management
27 Gulf of Finland/Estonia/Kehra Pulp & Paqec Mill/Wastewater treatment and air pollution control'
28 Gulf of Finland/Estonia/Tallinn Wasrewater Treatment Plant/ Treatment of municipal and industrial wastewater
29 Gulf of Finland/Estonia/Tallinn Pulp & Paper Mill/Wastewater treatment and air pollution control
30 Gulf of Finland/Estonia/Agriculture/Agricultural runoff programme for Estonia (Gulf of Finland catchment area)

Western Estonian Coast

31. Estonian Coast/Estonia/Haapsalu Wastewater Treatment Plant/ Tccarment of municipal and industrial wastewater, waste management
32. Estonian Coast/Estonia/Matsalu Bay/Environmental management programme

Gulf of Riga/Daugava River Basin

33. Gulf of Riga/Estonia/Pärnu Wastewater Treatment Plant/ Treatment of municipal and food processing wastewater, waste management
34. Gulf of Riga/Estonia/Paide - Wastewater Treatment Plant/ Treatment of municipal and industrial wastewater
35. Gulf of Riga/Estonia/Võhma Meat Combine/Wastewater treatment
36. Gulf of Riga/Estonia-Latvia/Agriculture/Agricultural runoff ocoecamme for Estonia (Gulf of Riga catchmcnt area)
37. Gulf of Riga/Estonia-Latvia/ Gulf of Riga/Environmental management programme
38. Gulf of Riga/Latvia/Sloka Pulp & Paper Mill/Wastewater treatment and air pollution control
39. Gulf of Riga/Latvia/Olaine-Latbiofarm Pharmaceutical Plant/ Wasrewater treatment, waste management and air pollution control
40. Gulf of Riga/Latvia/Agriculture and Livestock Farming/ Agricultural runoff ocoecamme for Latvia
41. Gulf of Riga/Lithuania/Šiauliai Wasrewater Tcearmenr Plant/ Treatment of municipal and industrial wastewater
42. Daugava RB/Latvia/Riga Wastewater Treatment Plant - Phase II/ Treatment of municipal and industrial wastewater
43. Daugava RB/Latvia/VEF Plant - Riga/High heavy metal content in wastewater
44. Daugava RB/Latvia/RER Plant - Riga/High heavy metal content in wastewater
45. Daugava RB/Latvia/Riga - Various industrial plants/Wastewater treatment, waste management, air pollution control
46. Daugava RB/Latvia/Daugavpils Wastewater Treatment Plant/ Treatment of municipal and industrial wastewater
47. Daugava RB/Belarus/To bc determined/To be determined

Latvian Coast

48. Latvian Coast/Latvia/Liepaja City and Harbour/Treatment of industrial and municipal wastewater, oil combatting

Nemunas River Basin

49. Nemunas RB/Kaliningrad-Russia/Sovetsk Pulp & Paper Mill/ Wastewater treatment, air pollution control
50. Nemunas RB/Kaliningrad-Russia/Neman Pulp & Paper Mill/ Wastewater treatment, air pollution control
51. Nemunas RB/Lithuania/Kaunas Wastewater Treatment Plant/ Treatment of municipal and industrial wastewater
52. Nemunas RB/Lithuania/Jonava Azotaz Fertilizer Plant/Air pollution, clean technology, wastewater treatment
53. Nemunas RB/Lithuania/Kėdainiai Wastewater Treatment Plant/ Treatment of municipal and industrial wastewater
54. Nemunas RB/Lithuania/Kėdainiai - Fertilizer Plant/Air pollution control, clean technology, wastewater treatment
55. Nemunas RB/Lithuania/Panevežys Wasrewater Treatment Plant/ Treatment of municipal and industrial wasrewater
56. Nemunas RB/Lithuania/Panevežys Food Processing Industry/ Wastewater treatment
57. Nemunas RB/Lithuania/Mariiampolė Wasrewater Treatment Plant/Treatment of municipal and industrial wastewater
58. Nemunas RB/Lithuania/Alytus Wastewater Treatment Plant/ Treatment of municipal and industrial wastewater
59. Nemunas RB/Lithuania/Vilnius-Grigiskes Wasrewater Tcearmenr Plant/Treatment of municipal and industrial wastewater
60. Nemunas RB/Lithuania/Agriculture and Livestock Farming/ Agricultural runoff programme for Lithuania (Nemunas RB)
61. Nemunas RB/Belarus/Grodno Wastewater Tccarment Plant/ Treatment of municipal and industrial wastewater

Lithuanian Coast

62. Lirh. Coast/Lithuania/Mažeikiai Oil Refinery and Marine Terminal/Air Pollution Control, oil combatting and wastewater rceatmenr
63. Lirh. Coast/Lithuania/Klaipėda Wastewater Treatment Plant/ Treatment of municipal and indusrcial wastewater
64. Lith. Coast/Lithuania/KlaipėdaCardboard Factory/Wastewater treatment
65. Lith. Coast/Lithuania/Palanga Wastewater Tceaimcnt Plant/ Tccarment of municipal wastewater

Lithuanian/Kaliningrad Coast

66. Lithuanian-Kaliningcad Coast/Lithuania/Russia Kuršių Lagoon/ Environmental management programme

Kaliningrad

67. Kaliningrad/Russia/Kaliningrad Wastewater Tceatmcnr Plant/ Treatment of municipal and industrial wastewater
68. Kaliningrad/Russia/Kaliningrad Pulp & Paper Mill No 1/ Wasrewater treatment and air pollution control
69. Kaliningrad/Russia/Kaliningrad Pulp & Paper Mill No 2/ Wastewater treatment and air pollution control
70. Kaliningrad/Russia/Kaliningrad Hazardous Waste Plant/ Hazardous waste management

Location/Country/Site Name/Type of Pollution

71. Kaliningrad/Russia/Kaliningrad Oil Bunkering Station in Harbour/Oil combatting
72. Kaliningrad/Russia/Agriculture and Livestock Farming/ Agricultural runoffprogranme for Kaliningrad

Kaliningrad/Polish Coast

73 Kaliningrad-Polish Coast/Russia-Poland Vistula Lagoon/ Environmental management programme

Vistula River Basin/Baltic Coast of Poland

74. Baltic Coast/Poland/Koszalin Wastewacer Treatment Plant/ Treatment of municipal and industrial wastewater
75. Baltic Coast/Poland/Gdynia Dębogórze Wastewater Treatment Plant/Treatment of municipal and industrial wastewater
76. Baltic Coast/Poland/Gdańsk-Wschód Wastewater Treatment Plant and Oil Refinery/Treatment of municipal and industrial wastewater, air pollution control, oil combatting
77. Vistula/Poland/Świecie Pulp & Paper Mill/Wastewater treatment, air pollution control, waste management
78. Vistula/Poland/Bydgoszcz-Fordon Wastewater Treatment Plant/ Treatment of municipal and industrial wastewater
79. Vistula/Poland/Bydgoszcz-Kapuściaka Organika Zachem Chemical Plant/Wastewater treatment, air pollution control, waste management
80. Vistula/Poland/Toruń Wastewater Plant, Chemical Industry/ Treatmenr of municipal and industrial wastewater, waste management, air pollution control
81. Vistula/Poland/Włocławek-Chemical Industry, Pulp & Pape Mill/ Air pollution control, treatment of industrial and municipal wastewater
82. Vistula/Poland/Warsaw-Czajka Wastewater Treatment Plant/ Treatment of municipal and industrial wastewater
83. Vistula/Poland/Warsaw-Siekierki Wastewater Treatment Plant and Siekierki Power Plant/Treatment of municipal and industrial wastewater, air pollution control
84. Vistula/Poland/Warsaw-Pancerz Wastewater Treatment Plant/ Treatment of municipal and industrial wastewater
85. Vistula/Poland/Lublin-Hajdów Wastewater Trearmenr Plant/ Trearmenr of municipal and industrial wastewater
86. Vistula/Poland/Kraków-Płaszów Wastewater Treatment Plant/ Trearmenr of municipal and industrial wastewater
87. Vistula/Poland/Kraków - Nowa Huta Steel Plant, Kujawy Wastewater Treatment Plant/Air pollution control, treatment of municipal and industrial wastewater, waste management
88. Vistula/Poland/Katowice (Eastern Area) 10 Wastewater Treatment Plants, Various Industries/Treatment of municipal and industrial wastewater, air pollution control, waste management
89. Vistula/Poland/Jaworzno Organica Azot Chemical Plant/ Wastewater treatment, air pollution control, waste management
90. Vistula/Poland/Zgierz-Boruta Dyescuffs Plant/Wastewater treatment
91. Vistula/Poland/Oświecim-"Zakłady Chemiczne Organicznej Chemii(ZCHO)" Plant/Wastewater treatment, air pollution control
92. Vistula/Poland/Bukowna Zakłady Górniczo-Hutnicze "Boleslaw" Zinc and Lead Plant/Air pollution control. wastewater treatment, waste management
93. Vistula/Belarus/Brest Wastewater Treacmenr Plant/Treatment of municipal and industrial wastewater
94. Vistula/The Ukraine/L'vov Various Industries, Wastewater Treatment Plant/Air pollution control, treatment of municipal and industrial wastewater, waste management
95. Vistula/Poland/Agriculture and Livestock Farming/Agricultural runoff programme for Poland (Visrula RB)
96 Vistula/Poland/Vistula Upper Basin/Salt control

Oder-Odra River Basin

97 Oder-Odra/Poland/Szczecin-Pommerana Wastewater Treatment Plant/Treatment of municipal and industrial wastewater
98 Oder-Odra/Poland/Szczecin-Police Fertilizer (Zakłady Chemiczne Police), food processing, pulp & paper industry/ Wastewater treatment, air pollution conrrol, waste management
99 Oder-Odra/Poland/Poznań Wastewater Trcatmenc Plant/ Treatment of municipal wasrewater
100 Oder-Odra/Poland/Łódz Wastcwacer Treatment Plant/Treatment of municipal wastewater
101 Oder-Odra/Poland/Zielona Góra Wasrewater Treatment Plant/ Treatment of mainly municipal and some food processing wastewater
102 Oder-Odra/Poland/Legnica-Głogów Region - Copper Mining, Fertilizer (N) and Food Processing Industry/Wastewater treatment (heavy metals, salinity), waste management, air pollution control

Location/Country/Site Name/Type of Pollution

103. Oder-Odra/Poland/Wrocław Wastewater Treatment Plant/ Treatment of municipal and industrial wastewater
104. Oder-Odra/Poland/Wrocław Chemical, Food Processing, Textile Industry/Wastewater treatment, waste management. air pollution control
105. Oder-Odra/Poland/Ubocze-Lubán Region - Fertilizer Industry/ Wastewater treatment, heavy met&
106. Oder-Odra/Poland/Bolesławiec - Fertilizer Industry/Wastewater treatment
107. Oder-Odra/Poland/Katowice (Western Area) - Ruda, Bytom, Zabrze, Gliwice/Wastewater treatment planrs, Various Industries/ Treatment of industrial and municipal wastewater
108. Oder-Odra/Poland/Katowice (Western Area) - Ruda, Bytom, Zabrze, Gliwice/Coke, Steel, Fertilizer and Other Industries/ Salinity, heavy metals, air pollution control, waste management, wastewater treatment
109. Oder-Odra/Czech Republic/Ostrava area/ 16 wastewater Treatment Plants/Treatment of municipal and industrial wastewater
110. Oder-Odra/Czech Republic/Ostrava Area/Coal Mining, Steel, Chemical, Pulp & Paper and Other Industries/Wastewater treatment (s&icy, heavy metals), air pollution control, waste management
111. Oder-Odra/Czech Republic-Poland/Odra River - Upper Basin/ salt control
112. Oder-Odra/Poland/Agriculture and Livestock Farming/ Agricultural runoff programme for Poland (Odra River catchment area)
113. Oder-Odra/Poland-Germany/Odra Lagoon/Environmental management programme

Arkona Basin

114. Arkona Basin/Germany/Greifswald Wastewater Treatmenr Plant/ Treatment of municipal and industrial wastewater
115. Arkona Basin/Germany/Neubrandenburg Wastewater Treatment Plant/Treatment of municipal and industrial wastewater
116. Arkona Basin/Germany/Stralsund Wastewater Treatment Plant/ Treatment of municipal and industrial wastewater
117. Arkona Basin/Germany/Stavenhagen-Malchin Wastewater Treatment Plant/Treatment of municipal and industrial wastewater
118. Arkona Basin/Germany/Agriculture/Agricultural runoff programme for Germany (Arkona Basin)

Belt Sea

119. Belt Sea/Germany/Lübeck Wastewater Treatment Plant/ Treatmenr of municipal and industrial wastewater
120. Belt Sea/Germany/Wismar Wastewater Trearmenr Plant/ Treatmenr of municipal and industrial wastewater
121. Belr Sea/Germany/Rostock Wastewater Treacmenr Plant/ Treatment of municipal and industrial wastewater
122. Belr Sea/Denmark/Agriculture/Agricultural runoff programme for Denmark (Belt Sea)

The Sound

123. The Sound/Denmark/Copenhagen Wastewater Treacmenr Plant/ Treatment of municipal wastewater
124. The Sound/Denmark/Agriculture/Agricultural runoff programme for Denmark (The Sound)
125. The Sound/Sweden/Agriculture/Agricultural runoff programme for Sweden (The Sound)

Kattegat

126. Göta Älv River/Sweden/Skoghall Pulp & Paper Mill/Wastewater treatment
127. Katcegat /Sweden/Göteborg Wastewater Treatment Plant/ Treatment of municipal wastewater
128. Kattegat/Sweden/Agriculture/Agricultural runoff programme for Sweden (Kattegat)
129. Kattegat/Denmark/Agriculture/Agricultural runoff programme for Denmark (Kattegat)

Swedish Coast

130. Swedish Coast/Sweden/Stockholm Wastewater Treatmenr Plants (Käppala, Henriksdal, Himmerfjärden, Bromma)/Treatment o f municipal wastewater

Bornholm Basin

13 I. Bornholm Basin/Sweden/Nymölla Pulp & Paper Mill/Wastewater treatment
132. Bornholm Basin/Sweden/Agriculture/Agricultural runoff programme for Sweden (Bornholm Basin)

BALTIC SEA JOINT COMPREHENSIVE ENVIRONMENTAL ACTION PROGRAMME
TABLE 5-1 - SUMMARY OF ESTIMATED COSTS BY PROGRAMME ELEMENT

	Element	Phase I Millions ECU (1993-1997)	Phase II Millions ECU (1998-2012)	Total Millions ECU (1993-2012)
1	Policies, Laws and Regulations	5	5	10
2	Institutional Strengthening and Human Resource Development	70	140	210
3	Investment Activities			
3A	Point Source Pollution			
i	Immediate Support and Warning Systems	50		50
ii	Municipal Wastewater Treatment	1,000	2,000	3,000
iii	Combined Municipal and Industrial Wastewater Treatment	1,600	4,000	5,600
iv	Pulp and paper Industry Wastewater Treatment	400	1,000	1,400
v	Environmental Control at Other Industries	300	1,000	1,300
vi	Solid and Hazardous Waste Management	200	800	1,000
vii	Air Quality Management	460	1,200	1,660
3B	Non-Point Source Pollution (agricultural runoff, livestock operations, rural settlements)	800	2,700	3,500
4	Management Programmes for Coastal Lagoons and Wetlands	loo	120	220
5	Applied Research	10	20	30
6	Public Awareness and Environmental Education	5	15	20
	TOTAL	4,985	12,965	17,950

Table 5-1 Summary of Estimated Costs by Programme Element

BALTIC SEA JOINT COMPREHENSIVE ENVIRONMENTAL ACTION PROGRAMME
TABLE 5-2 - SUMMARY OF ESTIMATED INVESTMENT COSTS FOR HOT SPOTS BY COUNTRY

	COUNTRY	COSTS Million ECU (preliminary cost estimates)
1	Sweden	451.0
2	Finland	424.7
3	Russia (St. Petersburg Region)	1,077.8
4	Estonia	1,555.0
5	Latvia	427.3
6	Lithuania	512.0
7	Russia (Kaliningrad Region)	319.2
8	Belarus	(incomplete) 31.0
9	Poland	4,040.0
10	Ukraine	214.0
11	Czech Republic I Slovak Republic	113.6
12	Germany	360.0
13	Denmark	312.5
14	Norway	0.0
ESTIMATED TOTAL		9,838.10

Table S-2 Summary of Estimated Investment Costs for Hot Spots by Country

Table 5-3 Summary of Spots" by Study Area

BALTIC SEA JOINT COMPREHENSIVE ENVIRONMENTAL ACTION PROGRAMME
TABLE 5-3 - SUMMARY OF PRELIMINARY COSTS AT HOT SPOTS BY STUDY AREA

Location • = Priority Hot Spot	Country	Name/Site	Type	Mil
BOTHNIAN BAY				
Bothnian Bay	Sweden	Rönnskärsverken	Industry (Metal Smelter)	
Bothnian Bay	Finland	Metsä-Botnia Oy Kemi	Industry (Pulp & Paper)	
BOTHNIAN SEA				
Bothnian Sea	Sweden	Husum Kraft Mill (1)	Industry (Pulp & Paper)	
Bothnian Sea	Sweden	Östrand (I)	Industry (Pulp & Paper)	
Bothnian Sea	Sweden	Vallvik (1)	Industry (Pulp & Paper)	
Dalälven River	Sweden	Dalälven	Mining Waste	
Bothnian Sea	Finland	Outokumpu Group	Industry (Metal Smelter)	
Bothnian Sea	Finland	Harjavalta Kemira Oy Vuorikemia	Industry (Titanium oxide)	
ARCHIPELAGO AND ÅLAND SEAS				
Arch & Åland Seas				
Archipelago Sea	Finland	Fish Farming	Fish Farming	
	Finland	Agriculture (2)	Agricultural Runoff	
NEVA RIVER BASIN/LAKE LADOGA				
Lake Saimaa	Finland	YPT Joutseno	Industry (Pulp & Paper)	
Lake Saimaa	Finland	Kaukas Lappeenranta	Industry (Pulp & Paper)	
Lake Saimaa	Finland	E-G Kaukopää	Industry (Pulp & Paper)	
Lake Ladoga	Russia	Syasstroi	Industry (Pulp & Paper)	
Lake Ladoga	Russia	Volkhov	Industry (Aluminum)	
GULF OF FINLAND				
Gulf of Finland	Finland	Sunila Oy-Kotka	Industry (Pulp & Paper)	
Gulf of Finland	Finland	Helsinki Region	Municipal	
• Golf of Finland	Russia	St. Petersburg	Connection Sewers	
• Gulf of Finland	Russia	St. Petersburg (Urban) (3)	Municipal & Industrial	
• Gulf of Finland	Russia	Sc. Petersburg (Suburban)	Municipal & Industrial	
Gulf of Finland	Russia	St. Petersburg	Phosphorous Removal	
Gulf of Finland	Russia	St. Petersburg	Industry (Metal Plating)	
Gulf of Finland	Russia	St. Petersburg	Hazardous Waste	
• Gulf of Finland	Russia	St. Petersburg Region	Large Livestock Farms	
• Gulf of Finland	Estonia	Narva	Power Plants (Oil Shale)	
Gulf of Finland	Estonia	Kohtla Järve	Area Municipal & Industrial	
Gulf of Finland	Estonia	Kchra	Industry (Pulp & Paper)	
• Gulf of Finland	Estonia	Tallinn	Municipal & Industrial	
Gulf of Finland	Estonia	Tallinn	Industry (Pulp & Paper)	
Gulf of Finland	Estonia	Gulf of Finland	Agricultural Runoff Programme	
WESTERN ESTONIAN COAST				
Estonian Coast	Estonia	Haapsalu	Municipal & Industrial	
• Estonian Coast	Estonia	Matsalu Bay	Management Programme	

BALTIC SEA JOINT COMPREHENSIVE ENVIRONMENTAL ACTION PROGRAMME TABLE 5-3 - SUMMARY OF PRELIMINARY COSTS AT HOT SPOTS BY STUDY AREA				Total Cost	Investment Cost		Operating Cost
					Foreign	Local	
Location • = Priority Hot Spot	Country	Name/Site	Type	Million ECU	Million ECU	Million ECU	Million ECU/Year
GULF OF RIGA/DAUGAVA RIVER BASIN							
. Gulf of Riga	Estonia	Pärnu	Municipal & Industrial	18.0	14.0	4.0	2.1
Gulf of Riga	Estonia	Paide	Municipal & Industrial	4.1	1.5	2.6	1.0
Gulf of Riga	Estonia	Vohma Meat Combine	Industry	3.7	1.4	2.3	0.2
Gulf of Riga	Estonia	Gulf of Riga	Agricultural Runoff Programme	105.0	11.0	94.0	tbd
• Gulf of Riga	Estonia/Latvia	Gulf of Riga Mgt	Management Programme	20.0	5.0	15.0	tbd
• Gulf of Riga	Latvia	Sloka	Industry (Pulp & Paper)	72.0	72.0	0.0	tbd
. Gulf of Riga	Latvia	*Latbiofarm*	Industry (Pharmaceuticals)	19.0	19.0	0.0	tbd
• Gulf of Riga	Latvia	Agriculture/Livestock	Agricultural Runoff Programme	200.0	20.0	180.0	tbd
• Gulf of Riga	Lithuania	Siauliai	Municipal & Industrial	25.0	10.0	15.0	1.5
• Daugava RB	Latvia	Riga (WWTP Phase II)	Municipal & Industrial	62.5	50.0	12.5	thd
Daugava RB	Latvia	VEF Plant (Riga)	Industry (Metals)	tbd	tbd	tbd	tbd
Daugava RB	Latvia	RER Plant (Riga)	Industry (Metals)	tbd	tbd	tbd	tbd
Daugava RB	Latvia	Riga	Industry (Various)	tbd	tbd	tbd	tbd
• Daugava RB	Latvia	Daugavpils	Municipal & Industrial	38.8	31.0	1.8	tbd
Daugava RB	Belarus	to be determined	to be determined	tbd	tbd	tbd	tbd
LATVIAN COAST							
• Latvian Coast	Latvia	Liepaja (3)	Municipal & Industrial	25.0	15.0	10.0	tbd
NEMUNAS RIVER BASIN							
• Nemunas RB	Russia	Sovetsk	Industry (pulp & Paper)	3.5	2.5	1.0	0.4
• Nemunas RB	Russia	Neman	Industry (Pulp & Paper)	4.7	3.2	1.5	0.5
• Nemunas RB	Lithuania	Kaunas	Municipal & Industrial	85.0	35.0	50.0	5.0
Nemunas RB	Lithuania	Amalg Azotaz	Industry (Fertilizer)	35.0	3s .0	0.0	tbd
Nemunas RB	Lithuania	Kedainiai	Municipal & Industrial	6.0	2.4	3.6	1.0
Nemunas RB	Lithuania	Kedainiai	Industry (Chemicals)	tbd	tbd	tbd	tbd
Nemunas RB	Lithuania	Panevezys	Municipal & Industrial	6.0	2.4	3.6	4.0
Nemunas RB	Lithuania	Panevezys	Industry (Food)	25.0	10.0	15.0	1.5
Nemunas RB	Lithuania	Marijampole	Municipal & Industrial	13.0	5.0	8.0	2.0
Nemunas RB	Lithuania	Alytus	Municipal & Industrial	45.0	21.0	24.0	6.0
• Nemunas RB	Lithuania	Vilnius/Grigiskes	Municipal & Industrial	200.0	20.0	180.0	tbd
• Nemunas RB	Lithuania	Agriculture/Livestock	Agricultural Runoff Programme	tbd	tbd	tbd	tbd
Nemunas RB	Belarus	Grodno	Municipal & Industrial				
LITHUANIAN COAST							
Lithuanian Coast	Lithuania	Mazeikiai	Oil Refinery/Marine Terminal	tbd	tbd	tbd	tbd
• Lithuanian Coast	Lithuania	Klaipeda	Municipal & Industrial	27.0	11.0	16.0	2.5
Lithuanian Coast	Lithuania	Cardboard Factory	Industry (Paper)	30.0	19.0	11.0	0.8
Lithuanian Coast	Lithuania	Palanga	Municipal	tbd	tbd	tbd	tbd
LITHUANIAN/KALININGRAD COAST							
• Lithuanian/Kaliningrad Coast	Lith/Russia	Kursiu Lagoon	Management Programme	30.0	10.0	20.0	thd

BALTIC SEA JOINT COMPREHENSIVE ENVIRONMENTAL ACTION PROGRAMME TABLE 5-3 - SUMMARY OF PRELIMINARY COSTS AT HOT SPOTS BY STUDY AREA				Total Cost	Investment Cost		Operating Cost
Location • = Priority Hot Spot	Country	Name/Site	Type	Million ECU	Foreign Million ECU	Local Million ECU	Million ECU/Year
KALININGRAD							
• Kaliningrad	Russia	Kaliningrad	Municipal & Industrial	50.0	20.0	30.0	4.0
Kaliningrad	Russia	Pulp & Paper No. 1	Industry (Pulp & Paper)	1.5	1.0	0.5	tbd
Kaliningrad	Russia	Pulp & Paper No. 2 (4)	Industry (Pulp & Paper)	182.0	152.0	30.0	tbd
Kaliningrad	Russia	Kaliningrad	Hazardous Waste	12.5	5.0	7.5	4.0
Kaliningrad	Russia	Oil Bunkering Station	Industry	tbd	tbd	tbd	tbd
Kaliningrad	Russia	Agriculture/Livestock	Agricultural Runoff Programme	40.0	5.0	35.0	tbd
KALININGRAD/POLISH COAST							
• Kaliningrad/Polish Coast	Russia/Poland	Vistula Lagoon	Management Programme	20.0	5.0	15.0	tbd
VISTULA RIVER BASIN/ BALTIC COAST OF POLAND (5)							
• Baltic Coast	Poland	Koszalin	Municipal & Industrial	44.2	12.2	32.0	2.5
• Baltic Coast	Poland	Gdynia - Debogorze	Municipal & Industrial	21.0	17.0	4.0	4.1
• Baltic Coast	Poland	Gdansk - Wschod	Municipal & Industrial	129.0	41.0	88.0	7.3
Vistula	Poland	Swiecie	Industry (pulp & Paper)	13.0	5.7	7.3	1.0
• Vistula	Poland	Bydgoszcz - Fordon	Municipal & Industrial	42.1	14.6	28.1	2.1
Vistula	Poland	Bydgoszcz - Kapusciska	Industry (Chemical)	75.0	22.0	53.0	3.5
• Vistula	Poland	Torun	Municipal & Industrial	95.0	27.7	67.3	7.3
• Vistula	Poland	Wloclawek	Municipal & Industrial	31.5	11.4	20.1	1.5
Vistula	Poland	Warsaw - Czajka	Municipal & Industrial	76.0	21.0	55.0	4.7
• Vistula	Poland	Warsaw - Siekierki	Municipal & Industrial	119.0	36.0	83.0	5.6
Vistula	Poland	Warsaw - Pancerz	Municipal & Industrial	232.0	75.0	157.0	11.6
Vistula	Poland	Lublin - Hajdow	Municipal & Industrial	18.0	7.0	11.0	5.2
• Vistula	Poland	Krakow - Plaszow	Municipal & Industrial	95.0	32.0	63.0	7.6
• Vistula	Poland	Krakow - Kujawy	Municipal & Industrial	100.0	31.0	69.0	5.4
• Vistula	Poland	Katowice - East (6)	Municipal & Industrial	153.0	50.0	103.0	23.0
Vistula	Poland	Jaworzno Organico Azot	Industry (Chemical)	1.7	0.6	1.1	0.1
Vistula	Poland	Zgierz - Boruta Dye-stuffs	Industry (Chemical)	3.5	1.4	2.1	0.3
Vistula	Poland	Oswiecim - ZCHO Chem.	Industry (Chemical)	16.5	6.6	9.9	tbd
Vistula	Poland	Z&lady Gorniczo	Industry (Metals)	7.0	2.8	4.2	1.0
Vistula	Belarus	Brest	Municipal & Industrial	31.0	11.0	20.0	4.2
• Vistula	Ukraine	Lvov	Municipal & Industrial	214.0	81.0	133.0	6.3
• Vistula	Poland	Agriculture/Livestock	Agricultural Runoff Programme	1.300.0	1,150.0	150.0	tbd
Vistula	Poland	Upper Basin (7)	Salt Control	tbd	thd	tbd	tbd

BALTIC SEA JOINT COMPREHENSIVE ENVIRONMENTAL ACTION PROGRAMME
TABLE 5-3 - SUMMARY OF PRELIMINARY COSTS AT HOT SPOTS BY STUDY AREA

Location • = Priority Hot Spot	Country	Name/Site	Type	Total Cast Million ECU	Investment Cost Foreign Million ECU	Investment Cost Local Million ECU	Operating Cost Million ECU/Year
ODER/ODRA RIVER BASIN (5)							
• □≙ℕ□•□≙□◎	Poland	Szczecin	Municipal & Industrial	83.6	16.7	66.9	6.7
• □≙ℕ□•□≙□◎	Poland	Szczecin	Industry (Fertilizer. Food, P&P)	13.6	2.7	10.9	1.0
Oder/Odra	Poland	Poznan	Municipal & Industrial	128.8	25.8	103.0	10.3
• □≙ℕ□•□≙□◎	Poland	Lodz	Municipal & Industrial	202.9	40.6	162.3	16.2
Oder/Odra	Poland	Zielona Gora	Municipal & Industrial (Food)	38.8	7.8	31.0	3.1
• Oder/Odra	Poland	Legnica - Glogow	Industry (N-Fer, Cu, Food)	105.3	21.1	84.2	8.4
odcrlodra	Poland	Wroclaw	Municipal & Industrial	149.7	29.9	119.8	12.0
Oder/Odra	Poland	Wroclaw	Industry (Chem, Food, Textiles)	19.6	3.9	15.7	1.4
Oder/Odra	Poland	Ubocz - Luban	Industry (Fertilizer)	0.8	0.2	0.6	0.1
Oder/Odra	Poland	Boleslawiec	Industry (Fertilizer)	0.8	0.2	0.6	0.1
. Oder/Odra	Poland	Katowice-West	Municipal & Industrial	194.5	38.9	155.6	15.6
. Oder/Odra	Poland	Katowice-West	Industry (Coke, Metallurgy, Fert.)	a.5	1.8	7.0	0.6
• Oder/Odra	Czech Republic	Ostrava	Municipal & Industrial	78.6	15.1	62.9	6.3
• Oder/Odra	Czech Republic	Ostrava Area	Industry (Chem, P&P, etc.)	35.0	7.0	28.0	2.5
Oder/Odra	Czech	Upper Basin (7)	Salt Control	tbd	tbd	tbd	tbd
. Oder/Odra	Rep./Poland	Agriculture/Livestock	Agricultural Runoff Programme	500.0	50.0	450.0	tbd
• Oder/Odra	Poland Poland/Germany	Odra Lagoon Mgt.	Management Programme	20.0	5.0	15.0	tbd
ARKONA BASIN							
Arkona Basin	Germany	Greifswald	Municipal & Industrial	45.0		45.0	tbd
Arkona Basin	Germany	Neubrandenburg	Municipal & Industrial	40.0		40.0	tbd
Arkona Basin	Germany	Stralsund	Municipal & Industrial	30.0		30.0	tbd
Arkona Basin	Germany	Stavenhagen - Malchin	Municipal & Industrial	25.0		25.0	tbd
Arkona Basin	Germany	Agriculture	Agricultural Runoff Programme	tbd		tbd	tbd
BELT SEA							
Belt sea	Germany	Lübeck	Municipal & Industrial	60.0		60.0	tbd
Belt Sea	Germany	Wismar	Municipal & Industrial	50.0		50.0	tbd
Belt Sea	Germany	Rostock	Municipal & Industrial	100.0		100.0	tbd
Belt Sea	Denmark	Agriculture (8)	Agricultural Runoff Programme	40.0		40.0	tbd
THE SOUND							
The Sound	Denmark	Copenhagen	Municipal	212.5		212.5	16.3
The Sound	Denamrk	Agriculture (8)	Agricultural Runoff Programme	20.0		20.0	tbd
KATTEGAT							
Göta Älv River	Sweden	Skoghall	Industry (Pulp & Paper)	40.0		40.0	tbd
Kattegat	Sweden	Göteborg	Municipal	50.0		50.0	tbd
Kattegat	Sweden	Agriculture	Agricultural Runoff Programme	10.0		10.0	9.0
Kattegat	Sweden	Agriculture (8)	Agricultural Runoff Programme	40.0		40.0	tbd
SWEDISH COAST							
Swedish Coast	Sweden	Stockholm	Municipal	250.0		250.0	tbd

BALTIC SEA JOINT COMPREHENSIVE ENVIRONMENTAL ACTION PROGRAMME TABLE 5-3 - SUMMARY OF PRELIMINARY COSTS AT HOT SPOTS BY STUDY AREA				Total Cost	Investment Cost		Operating Cost
					Foreign	Local	
Location • = Priority Hot Spot	Country	Name/Site	Type	Million ECU	Million ECU	Million ECU	Million ECU/Year
BORNHOLM BASIN							
Bornholm Basin	Sweden	Nymölla	Industry (Pulp & Paper)	14.0		14.0	tbd
Bornholm Basin	Sweden	Agriculture	Agricultural Runoff Programme	5.0		5.0	5.0

Notes: Figures in the table should be considered as preliminary estimates.

TBD = To be determined.
NA = Not available

(1) Figures provided by Sweden include expenditures made after 1990.
(2) Figures provided for agricultural runoff programmes should be considered as preliminary and subject to modification in the future.
(3) Cost estimates are based on professional judgment and rquirc further evaluation.
(4) Facility is proposed for complete reconstruction.
(5) Air quality management programmes for Poland and the Czech Republic are not included in the table as thy are being addressed by other complementary investment programmes.
(6) Cost estimate does not include industrial pre-treatment costs which would be significant.
(7) Figures for salt control programmes will be added upon completion.
Some proposals would require up to 1.0 billion ECU in investment costs.
(8) The estimated total cost for the control of agricultural runoff in Denmark for both the Baltic Sea and North Sea catchment areas is 100 million ECU.

Chapter 6

FINANCING THE ENVIRONMENTAL ACTION PROGRAMME

6.1 BACKGROUND

Unprecedented political and economic changes have affected the entire Baltic Sea region since the Ronneby Conference in September, 1990. These changes have serious implications for Programme financing.

The formerly centrally planned economies are going through a dramatic economic restructuring, which has in the short run seriously impaired their creditworthiness as well as the capacity to produce goods and services. Although generalizations should be used with caution - the Czech Republic is able to borrow in the international capital markets and Poland has been successful in obtaining support from the international community - the short-term prospects for major economic improvements are limited. The acute demand for such basic items such energy, food and medicine in Estonia, Latvia, Lithuania and Russia will undoubtedly impede the use of local financing for the Programme over the short to medium-term. However, despite the current difficulties, the transformation into market economies should permit them over time to assume an increasing share of Programme financing.

At the same time some of the potential donor countries are suffering a deep and protracted recession which limits their possibilities to provide grant financing. The recession also hampers both the capacity and willingness of private corporations in these countries to invest in environmental improvements using modern and less polluting technology in the Baltic Sea region, either directly or indirectly through joint ventures.

To support implementation of the Programme, a High Level Conference on Resource Mobilization for the Baltic Sea Joint Comprehensive Programme will be held in March 1993 in Gdansk Poland. The conference would be the logical sequel to the finalization of the Joint Comprehensive Programme and would initiate the first year of Programme implementation.

6.2 TYPES OF COSTS

The effort to restore the Baltic Sea to a sound ecological balance entails costs for three activities: the initial pre-feasibility studies that define a strategy and identify the sources of non-point and point source pollution; the subsequent feasibility studies that will analyze alternative solutions for implementing the projects and ascertain their feasibility; and finally the investments under the Joint Comprehensive Programme.

Until now the Programme costs have been limited to the eight pre-feasibility studies. To date, around 5 million ECU has been spent for these through grants from Denmark, Finland, Germany, Norway, Sweden, the Nordic Project Fund (NoPEF), and the Commission of the European Communities.

The next and crucial phase consists of the feasibility studies. Initially only selected priority "hot spots" will go on to this stage, given the probable difficulty in obtaining financing for the full Programme. Good feasibility studies are central because of the way financing agencies approach their funding decisions. For a project to be "bankable", its technical, economic, financial, and institutional feasibility need to be demonstrated. In other words, the project must achieve its set objectives at the least economic cost, its cash-flow must be assured both during construction and during the phase of operations, and the

institutional capacity to operate and maintain the project facilities must be developed. The absence of any one of these elements of feasibility will result in serious problems in project implementation which would impair the efficient use of limited financial resources. Additionally, a realistic assessment of the opportunity for implementation will determine which studies will be undertaken.

The Task Force has identified a series of 47 proposed actions in "priority hot spots" of point source and non point source pollution control and protection of coastal lagoons and wetlands. These were selected on the basis of the significance of their impact on the environment, human health and economy. The estimated cost for an initial series of feasibility studies for a selected number of the point source spots is 30 million ECU; additional funding will be required for actions to address non point source pollution and management of coastal lagoons and wetlands. This figure does not include the funding required for preparation of feasibility studies for key activities to be undertaken in Denmark, Finland, Germany, and Sweden.

Finally, the implementation of the recommendations of the Joint Comprehensive Programme over the long-term, including the 132 "hot spots" presently identified, is projected to cost at least 18 billion ECU. The first phase of the investment programme, to be implemented during 1993-1997, is estimated to accounts for about 5 billion ECU. Out of this amount, about 1.5 billion ECU would be required in terms of public and private investment in Denmark, Finland, Germany, and Sweden. The costs for actions in countries in the southern and eastern regions of the Baltic Sea catchment area, are estimated to cost about 3.5 billion ECU. The Programme includes as a high priority the use of approximately 50 million ECU to address emergency support needs. The funds would be used to supply water treatment chemicals, critical spare parts and for rehabilitation of selected facilities which would provide significant short-term benefits.

6.3 THE MACROECONOMIC BACKDROP

Over three quarters of the "hot spots" are located in countries whose combined population numbers about 60 million, and whose macroeconomic situation has often led to problems with creditworthiness, making ordinary loans and commercial financing difficult. These profound economic problems are expected to improve only slowly. The limited number of creditworthy borrowers - either sovereign or individual - constitutes a great challenge and threat to the timely implementation of the Programme. Therefore, the Programme will have to depend upon a multiplicity of financing sources for its implementation.

Pollution abatement investments in the industrial sector are clearly conditional on an industry's economic and financial viability. Under the macroeconomic reform process, with its fundamental changes in prices and supply/demand relationships, the viability of industries is necessarily being redefined. All investments in industry, including those for environmental improvements, are therefore a function of the results of this restructuring. In this process, some sectors, such as food processing, will have better perspectives than others, such as certain sections of heavy industry. The sectors with the best future economic potential will by the same token be the prime candidates for environmental improvement investments and process changes which produce less pollution. They will also be in the best position to secure financial means, through their own funds and loans, for such investments.

6.4 DOMESTIC FINANCING

An example of **local** sources of finance in the municipal area are the tariffs and local contributions of the inhabitants of a project city. Such tariffs are the correct way of paying for at least the operations and maintenance costs, and increasingly for debt service, according to the Polluter Pays Principle. However, the virtual

absence of modern utilities that meter and charge for their services signifies that local tariff revenue will only build up gradually as the utilities' administrative capacity increases through training programmes and investments in metering and modern institutions. Falling consumer income levels, which are already low, also imply that operating surpluses will be hard to achieve in the short run. It would appear then that at least during the early years of the Joint Comprehensive Programme, local funding sources will not be able to play an adequate role in investment financing. It is therefore all the more urgent to develop and implement the administrative, legal and technical systems to build a reliable and growing revenue base. Building up this institutional capacity is difficult and time-consuming; however, it would increase the availability of local funds and lead to improved creditworthiness.

National budgets might play a more important role in providing part of the local currency funding needs. Financing could come from a National Pollution Control Fund, such as the one set up by Poland. National funds could be financed through fines and pollution charges levied on industry and on inputs such as fertilizer. The viability of such national funding is contingent upon firm budgetary policies and upon the speed at which the agricultural and industrial sectors of the nascent market economies can become competitive and self-supporting.

The evidence from the formerly centrally planned economy that has come the furthest along the road toward a market economy - what has become the new Lander of Germany - does not augur well for the possibilities to generate local revenue. Massive environmental investments have so far been started and funded with transfers from the old Lander of Germany rather than with local budget revenue. Several years after unification, the economic difficulties remain formidable. In those countries that lack the close financial and technical support that the new Lander enjoy, the macroeconomic transition may even be more difficult and long-lasting.

In Poland, the initial popular acceptance of the need for austerity and budget surpluses is now waning, and the budget deficit is on the rise. In this context, the undeniable achievements of Poland's National Environmental Protection Fund should be underlined. The National Fund was established in 1989 and collected 9 million ECU in 1990. However, its income from water and wastewater charges comes from companies that are state-owned and often subsidized. Thus, the revenues of the National Fund are eventually derived from the public budget and contribute to its deficit.

Finally, competition for budget funds is keen: the environmental sector has to contend with the demand for food supplies, health care, housing and social services. It thus appears unlikely that national budget financing will be much more than an illusory source of financing of environmental investments until these economies have stabilized.

6.5 FOREIGN FINANCING

Foreign funding will be a principal source of financing the investments of the Joint Comprehensive Programme. This indeed is the hope of the countries most in need of environmental investments.

Bilateral Funding Sources

Bilateral flows constitute one means of covering some of the foreign currency costs under the investment phase. Such bilateral flows may be expected from the wealthier countries of the region, i.e. Denmark, Finland, Germany, and Sweden and from other members of the G-24. The current annual funding levels from each of the Nordic countries for environmental improvements in Eastern Europe are around 15-20 million ECU. There are indications that these levels might rise in the future when concrete projects to support materialize. However, the current recession in some of these potential donor countries has resulted in large national budget deficits which limits the scope for bilateral concessional funding.

Despite the constraints on foreign resource transfers, some level of grant financing will be necessary. Certainly it will be in the best interests of the economically stronger of the region's countries to support stability in the region and improve the shared environment in the most cost-effective way. What is crucial will be **how** these limited funds will be used to support the overall programme. In most cases it may be more effective to have funds channelled through the multilateral financial institutions that could lend their expertise in project analysis and implementation to achieve maximum cost efficiency. Experience shows that procurement on the basis of international competitive bidding could also make for lower programme implementation costs.

Commission of the European Communities

The **Commission of the European Communities (CEC)** could provide financial support for implementing the Programme. While most of the CEC's financial instruments are limited to the member states of the European Communities, several instruments could fund actions in the non-member states of the Baltic Sea region. These include **PHARE,** which provides support for Czech Republic, Estonia, Latvia, Lithuania, Poland and the Slovak Republic; **TACIS,** which provides support to Belarus, Russia and Ukraine; and **LIFE,** which supports activities in Europe's regional seas, including the Baltic. These programmes are important source of grant assistance for studies, technical assistance, institutional strengthening and training in a wide range of sectors. Depending on proposals submitted by national governments, these programmes could provide support for a number of activities, including feasibility studies in some cases. Furthermore, through the auspices of the **Task Force of the European Environmental Agency,** the existing standardized network of geographic and environmental information and mapping (CORINE) is to be expanded to the whole Baltic Sea region by 1993/94. This is being done in cooperation with all countries in the Baltic Sea region and the United Nations' regional organizations. Additional financial instruments of the CEC could fund other specific efforts such as the cooperation between coastal states; the establishment of policies and action programmes; and the creation of administrative and regulatory structures in the environment field.

Multilateral Financial Institutions

The four **multilateral financial institutions** that have been members of the Task Force would seem to be natural leaders in assembling the financing packages for certain investment projects. In some cases, they could become the focus for assembling loan funding from export finance agencies and from commercial banks for projects of reasonable risk. The multilateral financial institutions could also tap the potential for both domestic and foreign private investors, through their imprimatur of thorough project analysis. In order to realize their possibilities for assisting the Programme financially, sound feasibility studies need to be prepared for high priority projects which meet banking criteria.

The experience and possibilities of the four multilateral financial institutions differ. The **European Bank for Reconstruction and Development (EBRD)** could be expected to play an important role in implementing the Programme. Its achievements will be conditioned by country policies which encourage private sector participation, since EBRD statutes stipulate that 60% of its lending should be directed at private sector projects. The EBRD has identified the environmental sector as one of its lending priorities and is in the process of elaborating its sector strategy, which will take account of the Joint Comprehensive Environmental Action Programme.

The chief objective of the **European Investment Bank (EIB)** is lending to the private and public sectors in its member countries, i.e. the European Community members. This puts EIB in a privileged position to support environmental investments in Denmark and in Germany, in particular in the new German Lander. In Denmark, average EIB lending volume is around 500 million ECU per year; in the new German Lander, where financing started in 1990, almost 1.5 billion ECU has so far been signed or approved. This includes the first loans for projects designed to

protect the environment or with substantial environmental side-benefits, for example switching to less polluting energy sources. In addition, the EIB has extended loans to Central and Eastern European countries within the framework of assistance by the European Community. In a first phase starting in 1990, total available loan amounts for Hungary and Poland are one billion ECU, and since 1991, another 700 million ECU are available to Bulgaria, the Czech Republic, Romania and the Slovak Republic. These loans cover in principle all economic sectors. By early 1992, loans signed totalled 500 million ECU (234 million ECU for investments in Poland, with an additional 400 to 600 million ECU worth of projects in advanced phases of assessment). EIB generally requires State guarantees under these lending programmes and also enjoys the counter-guarantees from the European Community. An extension of these programmes is foreseen in the context of the association agreements recently signed between the European Community and Hungary, Poland and the Czech and Slovak Federal Republic. An extension of EIB loan finance to Estonia, Latvia and Lithuania could be envisaged in the future.

The **Nordic Investment Bank** (NIB) has been lending to Eastern and Central European countries since 1983, under a special allocation, the Project Investment Loans (PIL), that is guaranteed to 90% by the five Nordic countries. In practice, the use of PIL-funds is restricted by the fact that the loans are limited to fully creditworthy countries or where satisfactory guarantees can be arranged. Another constraint is the total allocation for Project Investment Loans, which amounts to SDR 1 000 million (1150 million ECU) for all sectors and all borrowing countries. About SDR 700 million of this amount has already been committed.

It should be noted that NIB has been a major financier of environmental projects in the industrial and municipal sectors in Denmark, Finland and Sweden and in projects where there has been a beneficial effect upon the Baltic Sea. In recent years, annual funding levels have been on the order of 200 million ECU. This support is expected to continue but is contingent upon the existence of creditworthy borrowers in the Nordic countries who are willing to borrow from NIB for environmental projects.

The Nordic countries established the **Nordic Environmental Finance Corporation (NEFCO)** in 1990. NEFCO is administered by NIB and is in a position to support joint ventures between Nordic and domestic partners in the entire Baltic region where there would be a positive environmental impact. Because it is funded with budgetary appropriations from the Nordic countries, NEFCO is not dependent upon sovereign guarantees from creditworthy borrowing countries. NEFCO's support can finance joint ventures in countries that could supply domestic environmental services and equipment and also joint ventures for industrial restructuring with an environmental impact. Either way, NEFCO's support could be pivotal, as many projects can only be profitably financed and implemented through the long-term involvement of foreign partners. NEFCO's principal constraint is its small capital base of SDR 36 million (40 million ECU).

Among the multilateral financial institutions, the **World Bank** could be expected to be a major contributor to support the Joint Comprehensive Programme through policy dialogue on environmental issues associated with structural and sector reform loans and through direct interventions under traditional project lending. The World Bank has already made over 1 .O billion ECU in loans to Poland for support of environmental management, energy conservation, rationalization of district heating, modernization of industry, and improved agricultural practices. Presently it is in the process of developing major loans focused on industrial pollution control, management of municipal water and wastewater, air pollution control at major power plants, increased efficiency in the energy sector, and expansion of the use of natural gas.

The World Bank will provide key support for implementation of the Programme through its preparation of national level sector reviews and associated policy discussions with national Governments, which are conducted as part of its routine economic and sector work to support member countries. These include key sectors such as agriculture, energy, environment, industry and transportation. Among examples of this work are the major studies of environmental issues in Belarus, the Czech

Republic, Poland, Slovak Republic and Ukraine, which the World Bank has prepared in collaboration with the governments and other development organizations. It has also initiated field based country environmental reviews in Estonia, Latvia, and Lithuania.

The World Bank Group will also support the Programme through the activities of its affiliated organizations and programmes. The **International Financial Corporation (IFC)** could support joint ventures in the environmental field and also projects concerning industrial restructuring. It has already started its activities in the region and has conducted studies of potential private sector environmental investments. The **Economic Development Institute (EDI)**, offers a wide range of training activities for senior decision makers from member countries, many of which are focused on the integration of environment and economic issues.

The World Bank administers the **Global Environment Facility (GEF),** in cooperation with the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP), which can provide support for innovative projects of international significance in the areas of climate change, international waters and biological diversity. The first GEF project to be funded worldwide is the Poland Forest Biodiversity Protection Project which supports activities in the Sudety Mountains in the upper Oder/Odra River Basin and the Bialowieza Primeval Forest in the eastern Vistula River Basin; it is complemented by the Belarus Forest Biodiversity Project, which supports activities in the portion of the Bialowieza Forest in Belarus.

In addition to the financing institutions above there are others that could play an important role. For example, the **Kreditanstalt für Wiederaufbau (KfW)**, in Germany is an experienced and large financier of projects all over the world whose support of the Joint Comprehensive Programme would be welcome and potentially substantial.

6.6 PRIVATE INVESTORS AND COMMERCIAL BANKS

Private capital, complemented by commercial bank loans, could play a role in the financing of those industrial restructuring projects where export is possible. However, it appears that such financing will not be forthcoming until the formerly centrally planned economies show signs of stabilizing. In the early phases of the Programme, private investors will only be able to make a difference if legislation concerning privatization and foreign investments is enacted. Even so, private investors may be deterred by the very high risks that characterize investments in these economies.

6.7 TYPES OF FINANCING NEEDS

The funding needs of the "hot spots" are so large and diverse that they will require financial solutions tailored to each project. Financing solutions will vary for industrial restructuring projects and municipal water and wastewater utilities projects. Lending for **industrial projects** will be determined by the criteria of commercial returns. Often the best project returns can be achieved through joint ventures with foreign partners who provide know-how and part of the financing. Remaining funding could come from multilateral and commercial banks, export credit agencies and other sources. Project would be decided on a case-by-case basis and some polluting industries might be closed. Official financial support will often be necessary in the form of **official guarantees** that would assume the financial risks.

Municipal projects call for more novel techniques. On the one hand, the sharp break with the past pattern of heavily subsidized and inefficient operations present municipal operations with new requirements in terms of modem financial and technical management. A basic condition, as outlined previously, is the establishment of adequate tariff and revenue collection systems. The transition to decentralized management will require that emphasis be given to long-term technical assistance and transfer of know-how. On the

other hand, this transition period should create the opportunity to implement new practices.

One alternative that might be actively considered is the system of **management contracts and concessionaire management** of municipal sewage treatment. Under this system, municipal authorities call for bids from private operators, specialized in water and sewage treatment, in which domestic and/or foreign private operators would indicate the costs at which they would be willing to either manage or invest in and operate the cities' water supply and sewerage systems over an extended period of time.

The concession system would enlist the experience and talent of the best specialized companies. It would also take municipal sewage treatment out of the public sector. The public sector would provide support with the appropriate legal framework. Foreign subsidies will likely be needed at least during the initial years of operations to cover deficits until consumers have the financial means to pay for tariffs. With rising income levels, consumers could gradually be expected to take over an increasing share of the costs. The goal should be to make the services self-liquidating according to the Polluter Pays Principle.

In mobilizing diverse sources of financing, sometimes for a single project, the sharing of financial risks will be an important principle. Official support and participation in project capital financing in such cases could take the form of sovereign guarantees that assume a part of the financial risk. This approach to public participation in project financing may also have the beneficial effect of lowering the overall cost of financing.

Chapter 7

FUTURE COOPERATION

7.1 INTRODUCTION

According to the Baltic Sea Declaration, the key elements of the Joint Comprehensive Programme should be under implementation by 1993. The Programme in its entirety will probably take several decades to implement. While the main responsibility for implementing the Programme will of course have to be borne by the governments concerned, effective implementation of such a long-term and complex activity will require significant co-ordination in order to fulfill its objectives. To some extent, activities to promote co-ordination and reporting on progress of national action with regard to policy, regulation and institutional change come within the mandate of the Helsinki Commission (HELCOM) as spelled out in the Helsinki Convention. This also holds true for monitoring, periodic assessment of the environmental status, and analysis of the pollution load of the Baltic Sea. Because the Programme involves countries within and outside the region, as well as non-governmental organizations and multilateral financial institutions, a new mechanism is needed within the HELCOM framework to carry out these functions. At the Diplomatic Conference on the Protection of the Marine Environment of the Baltic Sea held in Helsinki in April 1992, the HELCOM ad hoc high level Task Force proposed that a HELCOM Programme Implementation Task Force be established within the Helsinki Commission to support the long-term implementation of the Programme.

Immediately following the Diplomatic Conference, the HELCOM Programme Implementation Task Force was established within the framework of the Helsinki Commission for periodic review and updating of the Baltic Sea Joint Comprehensive Environmental Action Programme and for coordinating measures necessary to secure implementation of the Programme.

7.2 MEMBERSHIP AND OPERATION OF THE HELCOM PROGRAMME IMPLEMENTATION TASK FORCE

The HELCOM Programme Implementation Task Force consists of representatives of the Contracting Parties to the Helsinki Convention - the Commission of the European Communities, Denmark, Estonia, Finland, Germany, Lithuania, Poland, Russia and Sweden. In addition to the signatories of the Convention, other countries of the catchment area of the Baltic Sea - Belarus, Czech Republic, Latvia, Norway, Slovak Republic and Ukraine - also participate in the Task Force, together with multilateral financial institutions - European Bank for Reconstruction and Development (EBRD), European Investment Bank (EIB), Nordic Investment Bank (NIB), Nordic Environment Finance Corporation (NEFCO), and the World Bank (WB) - and nongovernmental organizations - Coalition Clean Baltic (CCB), Greenpeace International, and the World Wide Fund for Nature (WWF). The International Baltic Sea Fishery Commission (IBSFC) is also a participant in the Task Force. The HELCOM Programme Implementation Task Force elects its Chairman and Vice-Chairmen, as appropriate, from among its members. The HELCOM Programme Implementation Task Force meets twice a year. Organizations wishing to attend HELCOM Programme Implementation Task Force meetings as observers, including intergovernmental and nongovernmental organizations, will participate under the procedural rules of the Helsinki Commission.

It is assumed that meetings of the Helsinki Commission will occasionally be held at ministerial level and will include participation of those Governments and institutions represented in HELCOM Programme Implementation Task Force without being Contracting Parties to the Helsinki Convention.

7.3 KEY FUNCTIONS OF THE HELCOM PROGRAMME IMPLEMENTATION TASK FORCE

The HELCOM Programme Implementation Task Force is responsible for facilitating Programme coordination and monitoring. Other functions appropriate to such a body include periodic review and updating of the Programme in the light of economic and technological development and in consideration of changes in the environmental status of the Baltic Sea over time. Establishment of the HELCOM Programme Implementation Task Force within the HELCOM framework will permit use of the resources, knowledge and competence of the Commission, reduce HELCOM Programme Implementation Task Force operational costs, and avoid redundancy. While the Helsinki Commission provides a Secretariat, operational procedures for the HELCOM Programme Implementation Task Force's activities are formulated in accordance with its specific orientation and structure.

The key functions of the HELCOM Programme Implementation Task Force are, inter alia, to:

- Initiate and facilitate co-ordination necessary to support the implementation of the Programme for the Baltic Sea;
- Prepare an annual report which reviews and assesses the development of environmental policies and actions pertinent to restoring the ecological balance of the Baltic Sea, including a review of ongoing investment activities and their status;
- Periodically review, and propose updating, of the Programme, taking into account economic and technological developments as well as changes in the environmental status of the Baltic Sea; and
- Advise the Helsinki Commission on further action which may seem appropriate in order to meet the objectives set forth in the Baltic Sea Environmental Declaration 1992, which was adopted by the Diplomatic Conference.

Annex 1

Members of the HELCOM ad hoc high level Task Force

Governments

Czech and Slovak Federal Republic
Kingdom of Denmark
Republic of Estonia
Republic of Finland
Federal Republic of Germany
Republic of Latvia
Republic of Lithuania
Kingdom of Norway
Republic of Poland
Kingdom of Sweden
Russian Federation

Regional Organizations

Baltic Marine Environment Protection Commission
-Helsinki Commission-

International Institutions

Commission of the European Communities
European Bank for Reconstruction and Development
European Investment Bank
Nordic Investment Bank/NEFCO
World Bank

Observer

International Baltic Sea Fishery Commission (IBSFC)

Members of the Steering Group of the HELCOM TF

Mr. Göte Svenson, Chairman of the HELCOM TF and of the Steering Group
Mr. Janusz Kindler, Vice-Chairman of the HELCOM TF, Chairman of the Drafting Group
Mr. Dimitri Zimin, Vice-Chairman of the HELCOM TF
Mr. Harald Velner, Chairman of the Helsinki Commission
Mr. Fleming Otzen, Executive Secretary of the Helsinki Commission
Ms. Terttu Melvasalo, Task Force Secretary of the Helsinki Commission
Mr. Tony Garvey, European Bank for Reconstruction and Development
Mr. Guy Clausse, European Investment Bank
Mr. Axel Hörhager, European Investment Bank
Mr. Klas Ringskog, Nordic Investment Bank
Mr. Stephen F. Lintner, The World Bank

Contact **persons** of the HELCOM ad hoc **high level** Task Force

Mr. Lubomir Kopaj, **Czech** and Slovak Fedeml Republic
Mr. Vitezslav Kazimour, Czech and Slovak Federal Republic
Mr. Filip Facius, Denmark
Mr. **Tonny** Niilonen, Denmark
Mr. T&is Kaasik, Estonia
Mr. **Tõnu** Miller, Estonia
Mr. **Ain Lääne,** Estonia
Mr. Olli Ojala, Finland
Mr. Risto Rautiainen, **Finland**
Mr. Tapani Kohonen, Finland
Ms. Vappu **Tervo,** Finland
Ms. Dagmara Berbalk, Germany
Mr. Ulrich **Kremser,** Germany
Mr. Valdis **Seglinš,** Latvia
Mr. Valts **Vilnītis,** Iatvia
Mr. Evaldas **Vebra,** Lithuania
Mr. Rapolas **Liužinas,** Lithuania
Mr. Per **Erik Iversen,** Norway
Mr. **Janusz Kindler,** Poland
Mr. Piotr **Krzyzanowski,** Poland
Mr. **Göte** Svenson, Sweden
Ms. Ulla-Britta **Fallenius,** Sweden
Ms. Susan **Linton,** Sweden
Mr. Hans **Wrådhe,** Sweden
Mr. Dimitri **Zimin,** Russian Federation
Mr. Sergey Tveritinov, Russian Federation
Mr. Claude Pleinevaux, Commission of the European Communities
Mr. Peter **Hirschfeldt,** Commission of the European Communities
Mr. Piotr **Wilczynski,** European Bank for Reconstruction and Development
Mr. Tony **Garvey,** European Bank for Reconstruction and Development
Mr. **Michel** Deleau, European Investment Bank
Mr. Guy **Clausse,** European Investment Bank
Mr. **Axel Hörhager,** European Investment Bank
Mr. Peter **Laurson,** Nordic Investment Bank
Mr. Klas Ringskog, Nordic Investment Bank
Mr. Tore Selvig, Nordic Investment Bank
Mr. Thorsteinn Olafsson, Nordic Project Fund
Mr. Stephen F. **Lintner,** The World Bank
Mr. Zbigniew **Bruski,** International Baltic Sea Fishery Commission
Mr. Ingemar **Olsson,** International Baltic Sea Fishery Commission

Annex 2

Organizations Participating in the Work of the HELCOM ad hoc High Level Task Force

Czech and Slovak Federal Republic

Masaryk Water Research Institute
Ministry of Environment, Czech Republic
Ministry of Environment, Slovak Republic

Denmark

Carl Bro a/s
COW1 Consult a/s
Danish Water Quality Institute
I Kruger Consult a/s
Rambøll & Hannemann a/s

Estonia

Estonian Ministry of Environment
Institute of Ecology and Marine Research
Tallinn Technical University, Water Protection Laboratory

Finland

Ekono
Enviro Data Ltd
IVO International
Jaakko Pöyry
NLK-Celpap
Outokumpu Ecoenergy Ltd
Plancenter Ltd
Vesi-Hydro Consulting Ltd

France

BCEOM, French Engineering Consultants
SAGE Services
Sogreah Ingénierie

Germany

Lahmeyer International GmbH

Latvia

Latvian Environmental Protection Committee

Lithuania

Environmental Protection Department of the Republic of Lithuania
Pram Project

Norway

Norconsult a.s.
Norwegian Institute for Air Research (NILU)
Norwegian Institute for Water Research (NIVA)

Poland

Hydroprojekt
Institute for Meteorology and Water Management (IMGW)
Ministry of Environmental Protection, Natural Resources and Forestry
Prosan
Stolica

Sweden

K-Konsult Water Projects
SWECO
Swedish Environmental Research Institute (IVL)
Swedish Development Consulting Partners
Swedish Meteorological and Hydrological Institute (SMHI)
ÅF-IPK Ab

Russian Federation

Association "Baltec"
Centre "Ecobaltic" (Moscow)
Kaliningrad Environmental Protection Committee
Ministry of Ecology and Natural Resources of Russian Federation
St. Petersburg Environmental Protection Committee

Non-governmental Organizations

World Wide Fund for Nature

Consultants of the Helsinki Commission

Ekono Environment Technology, Finland
PI Process Consulting Ltd, Finland
P.I.C.- Scandinavian Ltd, Sweden
Soil and Water Ltd, Finland
Expert from Denmark, Mr. Torben Bonde
Experts from Estonia, convened by Mr. Ain Lääne
Expert of HELCOM MORS, Ms. Anneli Salo
Experts from Sweden, Mr. Stig Fonselius and Mr. Fredrik Wulff
Experts of the Umweltbundesamt, Germany
Experts from Russian Federation
The Environment Data Center of the National Board of Waters and the Environment in Finland

BALTIC SEA JOINT COMPREHENSIVE ENVIRONMENTAL ACTION PROGRAMME

REFERENCES

I NATIONAL PLANS

Federal Committee for the Environment, **Czech and Slovak Federal Republic,** 1991. National Plan for the Czech and Slovak Federal Republic for Protection of the Environment in Odra/Oder Basin. 78 pp.

Ministry of the Environment, **Kingdom of Denmark**, 1991. National Agency of Environmental Protection, No 1. Environmental Impacts of Nutrient Emissions in Denmark. 208 pp.

Ministry of the Environment, **Kingdom of Denmark,** 1990. Ends and Means in the Environment Policy. 46 pp.

Ministry of the Environment, **Republic** of **Estonia,** Estonian National Board of Waters, 1991. National Plan for the Protection of the Baltic Sea of the Republic of Estonia. 38 pp.

Ministry of the Environment, **Republic of Finland,** 1991. National Plan for Reduction of the Load of Pollution on the Baltic Sea 87 pp. (mimeogr.)

Federal Ministry for Environment, Nature Conservation and Nuclear Safety, **Federal Republic of Germany** 199 1. National Action Programme for the Protection of the Baltic Sea in the Federal Republic of Germany. 39 pp. (mimeogr.)

Environmental Protection Committee, **Republic of Latvia,** 199 1. Supporting studies for the preparation of the Joint Comprehensive Programme. (mimeogr.)

Environmental Protection Department, **Republic of Lithuania,** 1991. Information on the national environmental protection measures. (mimeogr.)

State Pollution Control Authority, **Kingdom of Norway,** 1991. National Plan for Reduction of the Load of Pollution to the Baltic Sea. Norwegian contribution. Possible inputs and plans. (mimeogr.)

Republic of Poland, 1991. National Plan for Reduction of the Load of Pollution on the Baltic Sea. 132 pp. (mimeogr.)

Environmental Protection Agency, **Kingdom of Sweden, 1991.** National Plan for the Swedish Marine Environment. Annexes 1-6. Report 3880. 141 pp.

Environmental Protection Agency, **Kingdom of Sweden,** 1991. National Plan for the Swedish Marine Environment. Annex **A-K.** Report 3881.

State Committee for Environment Protection, **Union of Soviet Socialist Republics,** 1991. Filled-in formats pertaining to the programme of environment protection measures. 122 pp. (mimeogr.)

II PRE-FEASIBILITY STUDIES IN THE STUDY AREAS

1. St. Petersburg, St. Petersburg Region, Karelia and Estonia

Ministry of the Environment, Finland, 1991. Environmental priority action programme for Leningrad, Leningrad Region, Karelia and Estonia. Synthesis Report. Plancenter Ltd. 191 pp.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 1. Implementation of the phosphorus removal at waste water treatment plants of the city of Leningrad. Plancenter Ltd. 26 pp.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 2. Construction of suburban waste water treatment plants in Leningrad. Plancenter Ltd. 26 pp.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 3. Pretreatment of heavy metal containing waste waters in Leningrad. Plancenter Ltd. 40 pp.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 4. 1991. Connection of the direct discharging sewers to the collectors of the treatment plants in Leningrad. Plancenter Ltd. 32 pp.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 5. Hazardous waste management in Leningrad. Plancenter Ltd. 32 pp.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 6. Development of livestock farming waste management in the Leningrad Region. Plancenter Ltd. 33 pp.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 7. Reduction of the environmental effects of Syasstroy pulp and paper mill and Volkhov aluminium factory. Plancenter Ltd.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 8. Reduction of the environmental effects of Svetogorsk pulp and paper mill. Plancenter Ltd. 5 pp.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 9. Reduction of the environmental effects of Kostamuksha combine. Plancenter Ltd. 14 pp.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 10. Reduction of the environmental effects of the town of Petrozavosk. Plancenter Ltd. 28 pp.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 11. Reduction of the environmental effects of Segezha pulp and paper mill and Nadvoitsy aluminium factory. Plancenter Ltd.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 12. Reduction of the environmental effects of Pitkyaranta pulp and paper mill. Plancenter Ltd. 5 pp.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 13. Reduction of the environmental effects of the power plants in Narva. Plancenter Ltd. 3 1 pp.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 14. Reduction of the waste water load of the city of Tallinn. Plancenter Ltd. 25 pp.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 15. Reduction of the environmental effects in Kohtala-Järve district and Eesti Tsement. Plancenter Ltd.

Ministry of the Environment, Finland, 1991. Pre-Feasibility Study No 16. Reduction of the environmental effects of Kehra and Tallinn pulp and paper mills. Plancenter Ltd.

2. Western Coast of Estonia

Plancenter Ltd, Swedish Environmental Research Institute (IVL), Swedish Meteorological and Hydrological Institute (SMHI), Ministry of the Environment of Estonia, 1992. Environmental Pre-Feasibility Study of the Western Coast of Estonia, Volume 1: Synthesis Report. Prepared for the Nordic Investment Bank and World Bank, with support from Governments of Estonia, Finland and Sweden. 66 pp.

Plancenter Ltd, Swedish Environmental Research Institute (IVL), Swedish Meteorological and Hydrological Institute (SMHI), Ministry of the Environment of Estonia, 1992. Environmental Pre-Feasibility Study of the Western Coast of Estonia, Volume 2: Technical Report. Prepared for the Nordic Investment Bank and World Bank, with support from Governments of Estonia, Finland and Sweden. 157 pp.

Plancenter Ltd, Swedish Environmental Research Institute (IVL), Swedish Meteorological and Hydrological Institute (SMHI), Ministry of the Environment of Estonia, 1992. Environmental Pre-Feasibility Study of the Western Coast of Estonia, Volume 3: Supplemental Environmental Studies in Estonia. Prepared for the Nordic Investment Bank and World Bank, with support from Governments of Estonia, Finland and Sweden. 108 pp.

3. The Gulf of Riga and the Daugava River Basin

Carl Bro a/s Consulting Engineers and Planners in cooperation with Latvian Republic Environmental Protection Committee (LREPC), Swedish Development Consulting Partners (SDCP), Swedish Environmental Research Institute (IVL), Swedish Meteorological & Hydrological Institute (SMHI), NLK-Celpap, 1992. Pre-Feasibility Study of the Gulf of Riga and the Daugava River Basin, Volume 1: Synthesis Report. Prepared for the Nordic Investment Bank, with support from Governments of Latvia, Denmark and Sweden. 79 pp.

Carl Bro a/s Consulting Engineers and Planners in cooperation with Latvian Republic Environmental Protection Committee (LREPC), Swedish Development Consulting Partners (SDCP), Swedish Environmental Research Institute (IVL), Swedish Meteorological & Hydrological Institute (SMHI), NLK-Celpap, 1992. Pre-Feasibility Study of the Gulf of Riga and the Daugava River Basin, Volume 2: Technical Report. Prepared for the Nordic Investment Bank, with support from Governments of Latvia, Denmark and Sweden. 99 pp plus annexes.

4. Lithuanian Coast and the Nemunas River Basin

K-Konsult, Water Projects Ab in Joint Venture with I. Krüger Consult AS, ÅF-IPK AB, MFG Environmental Research Group, National Bacteriological Laboratory, Rambøll & Hannemann A/S, Water Quality Institute, Lithuanian Republic Environmental Protection Department, Pramproject, 1992. Pre-Feasibility Study of the Lithuanian Coast and the Nemunas River Basin, Synthesis Report. Prepared for the Nordic Investment Bank, with support from Governments of Lithuania, Denmark and Sweden. 109 pp.

K-Konsult, Water Projects Ab in Joint Venture with I. Kruger Consult AS, ÅF-IPK AB, MFG Environmental Research Group, National Bacteriological Laboratory, Rambøll & Hannemann A/S, Water Quality Institute, Lithuanian Republic Environmental Protection Department, Pramproject, 1992. Pre-Feasibility Study of the Lithuanian Coast and the Nemunas River Basin, Technical Report. Prepared for the Nordic Investment Bank, with support from Governments of Lithuania, Denmark and Sweden. 180 pp.

5. Kaliningrad Region and the Pregel River Basin

Norconsult International A.S. in joint Venture with Jaakko Pöyry, 1992. Pre-Feasibility study of the Kaliningrad region and the Pregel River Basin, Synthesis Report. Prepared for the European Bank for Reconstruction and Development and the Nordic Investment Bank, with support from Governments of Russia and Norway and the Nordic Project Fund (NOPEF).

Norconsult International AS. in joint Venture with Jaakko Pöyry, 1992. Pre-Feasibility study of the Kaliningrad region and the Pregel River Basin, Technical Report. Prepared for the European Bank for Reconstruction and Development and the Nordic Investment Bank, with support from Governments of Russia and Norway and the Nordic Project Fund (NOPEF).

6. Vistula River Basin and Baltic Coast of Poland

Sweco, COWIconsult, VKI in association with Hydroprojekt and Stolica, 1992. Pre-Feasibility Study of the Vistula River Basin and Baltic Coast of Poland, Part I, Synthesis Report. Prepared for the World Bank, with support from the Governments of Poland, Denmark and Sweden.

Sweco, COWIconsult, VKI in association with Hydroprojekt and Stolica, 1992. Pre-Feasibility Study of the Vistula River Basin and Baltic Coast of Poland, Part II A, Technical Report. Prepared for the World Bank, with support from the Governments of Poland, Denmark and Sweden.

Sweco, COWIconsult, VKI in association with Hydroprojekt and Stolica, 1992. Pre-Feasibility Study of the Vistula River Basin and Baltic Coast of Poland, Part II B, Technical Report Appendices. Prepared for the World Bank, with support from the Governments of Poland, Denmark and Sweden.

7. Oder/Odra River Basin

BCEOM, French Engineering Consultants with SAGE Services, Sogreah, IMGW, Prosan, Lahmeyer International, T.G.M. WRI, 1992. Pre-Feasibility Study of the Oder/Odra River Basin, Executive Summary. Prepared for the European Investment Bank, with the support of the Governments of the Czech and Slovak Federal Republic, Germany, Poland and the Commission of the European Communities.

BCEOM, French Engineering Consultants with SAGE Services, Sogreah, IMGW, Prosan, Lahmeyer International, T.G.M. WRI, 1992. Pre-Feasibility Study of the Oder/Odra River Basin, Synthesis Report. Prepared for the European Investment Bank, with the support of the Governments of the Czech and Slovak Federal Republic, Germany, Poland and the Commission of the European Communities. 154 pp.

BCEOM, French Engineering Consultants with SAGE Services, Sogreah, IMGW, Prosan, Lahmeyer International, T.G.M. WRI, 1992. Pre-Feasibility Study of the Oder/Odra River Basin, Technical Report 1. Point Pollution Sources - Industries. Prepared for the European Investment Bank, with the support of the Governments of the Czech and Slovak Federal Republic, Germany, Poland and the Commission of the European Communities. 198 pp.

BCEOM, French Engineering Consultants with SAGE Services, Sogreah, IMGW, Prosan, Lahmeyer International, T.G.M. WRI, 1992. Pre-Feasibility Study of the Oder/Odra River Basin, Technical Report 2. Point Pollution Sources - Municipalities. Prepared for the European Investment Bank, with the support of the Governments of the Czech and Slovak Federal Republic, Germany, Poland and the Commission of the European Communities. 217 pp.

BCEOM, French Engineering Consultants with SAGE Services, Sogreah, IMGW, Prosan, Lahmeyer International, T.G.M. WRI, 1992. Pre-Feasibility Study of the Oder/Odra River Basin, Technical Report 3. Non Point Pollution Sources. Prepared for the European Investment Bank, with the support of the Governments of the Czech and Slovak Federal Republic, Germany, Poland and the Commission of the European Communities. 79 pp.

BCEOM, French Engineering Consultants with SAGE Services, Sogreah, IMGW, Prosan, Lahmeyer International, T.G.M. WRI, 1992. Pre-Feasibility Study of the Oder/Odra River Basin, Technical Report 4. Institutional and Environmental Impact Assessment. Prepared for the European Investment Bank, with the support of the Governments of the Czech and Slovak Federal Republic, Germany, Poland and the Commission of the European Communities. 192 pp. plus annexes.

8. North German Baltic Coast

Lahmeyer International, 1993. Pre-feasibility Study on the reduction of the pollution load on the Baltic Sea. Prepared for the Government of Germany. (mimeogr.)

III TOPICAL STUDIES

Nordic Project Fund (NOPEF), 1991. Environmental Situation and Project Identification in Latvia. 125 pp.

Nordic Project Fund (NOPEF), 1991. Oy Vesi Hydro Ab. Study on Sewage Treatment Plants in the Baltic Countries. 42 pp.

Nordic Project Fund (NOPEF), 1990. Environmental Situation and Project Identification in Leningrad and Leningrad Region. 68 pp.

Nordic Project Fund (NOPEF), 1990. Study of Environmental Protection, Poland. 40 pp.

Nordic Project Fund (NOPEF), 1989. Study of Environmental Protection, Estonia and partly Latvia and Lithuania. In co-operation with PI-Consulting Ltd and PI-Est. 56 pp.

Norwegian Institute for Air Research (NILU), 1992. The Topical Area Study for Atmospheric Deposition of Pollutants, Final Synthesis Report. Prepared for the European Bank for Reconstruction and Development, with support from the Government of Norway. 41 pp.

Norwegian Institute for Air Research (NILU), 1992. The Topical Area Study for Atmospheric Deposition of Pollutants, Final Technical Report. Prepared for the European Bank for Reconstruction and Development, with support from the Government of Norway. 141 pp.

Norwegian Institute for Water Research, NIVA, 1992. Topical Area Study for Agricultural Runoff, Final Synthesis Report. Prepared for the European Bank for Reconstruction and Development, with support from the Government of Norway. 75 pp.

Norwegian Institute for Water Research, NIVA, 1992. Topical Area Study for Agricultural Runoff, Technical Report. Prepared for the European Bank for Reconstruction and Development, with support from the Government of Norway. 96 pp.

World Wide Fund for Nature, WWF, 1991. Wetlands-Vital Ecosystems for Nature and Societies in the Baltic Sea Region. 114 pp. (mimeogr.)

IV BALTIC SEA ENVIRONMENT PROCEEDINGS OF HELCOM

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. 20 First Baltic Sea Pollution Load Compilation. 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. 27A Guidelines for the Baltic Monitoring Programme for the Third Stage; Part A. Introductory Chapters. 1988

No. 27B Guidelines for the Baltic Monitoring Programme for the Third Stage; Part B. Physical and Chemical determinants in Sea Water. 1988

No. 27C Guidelines for the Baltic Monitoring Programme for the Third Stage; Part C. Harmful Substances in Biota and Sediments. 1988

No. 27D Guidelines for the Baltic Monitoring Programme for the Third Stage; Part D. Biological Determinants. 1988

No. 30 Second Seminar on Wastewater Treatment in Urban Areas, 6-8 September 1987, Visby, Sweden. 1989

No. 31 Three years Observations of the Levels of some Radionuclides in the Baltic Sea after the Chernobyl Accident Seminar on Radionuclides in the Baltic Sea 29 May 1989, Rostock-Warnemünde, German Democratic Republic. 1989

No. 32 Deposition of Airborne Pollutants to the Baltic Sea Area 1983- 1985 and 1986. 1989

No. 34 Study of the Risk for Accidents and the Related Environmental Hazards from the Transportation of Chemicals by Tankers in the Baltic Sea. 1990

No. 35A Second Periodic Assessment of the State of the Marine Environment of the Baltic Sea, 1984- 1988; General Conclusions. 1990

No. 35B Second Periodic Assessment of the State of the Marine Environment of the Baltic Sea, 1984-l 988; Background Document. 1990

No. 36 Seminar on Nutrients Removal from Municipal Waste Water 4-6 September 1989, Tampere, Finland. 1990

No. 37 Activities of the Commission 1990 -Report on the Activities of the Baltic Marine Environment Protection Commission during 1990 including the Twelfth Meeting of the Commission held in Helsinki 19-22 February 199 1 -HELCOM Recommendations passed during 199 1. 1991

No. 38 Third Biological Intercalibration Workshop 27-3 1 August 1990, Visby, Sweden. 1991

No. 39 Airborne Pollution Load to the Baltic Sea 1986-l 990. 199 1

No. 40 Interim Report on the State of the Coastal Waters of the Baltic Sea. I99 !

No. 41 Intercalibrations and Intercomparisons of Measurement Methods for Airborne Pollutants. 1992

No. 42 Activities of the Commission. 1991

V Other Reference Material

Food and Agriculture Organization (FAO), 1991. Reports and Studies No. 47

HELCOM ad hoc high level Task Force, 1991. The Baltic Sea Joint Comprehensive Programme, Interim Report. 10 pp.

International Baltic Sea Fishery Commission (IBSFC). "Proceedings of the 18th Session of the International Baltic Sea Fishery Commission, 1992"

Mäkinen, Timo (ed.), 1991. Marine Aquaculture and Environment, Nord 1991, 22, 126 pp.

Kamicki, Z.S. Management and Fisheries.

Thurow, F., 1991. Fish and fisheries in the Baltic Sea.

ACRONYMS AND ABBREVIATIONS

AOX	Absorbable organic halogen
BITS	Swedish Agency for International Technical and Economic Cooperation
BOD	Biological oxygen demand
c c	Combatting Committee of the Helsinki Commission
CCB	Coalition Clean Baltic
CEC	Commission of the European Communities
COD	Chemical oxygen demand
CORINE	Coordination of Environmental Information, a pilot program of the Directorate for Environment of the European Community (19851991)
CSFR	Czech and Slovak Federal Republic
EBRD	European Bank for Reconstruction and Development
EC	Environment Committee of the Helsinki Commission
ECU	European Currency Unit
ED1	Economic Development Institute
EFTA	European Free Trade Association
EIB	European Investment Bank
FRG	Federal Republic of Germany
GDP	Gross domestic product
GEF	Global Environment Facility
HCB	Hexachlorobenzene
HELCOM	Baltic Marine Environment Protection Commission - Helsinki Commission
IAEA	International Atomic Energy Agency
IBSFC	International Baltic Sea Fishery Commission
ICES	International Council for the Exploration of the Sea
IMGW	Institute for Meteorology and Water Management, Poland
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission
IUCN	World Conservation Union
IVL	Swedish Environmental Research Institute
KFW	Kreditanstalt fir Wiederaufbau, Germany
MC	Maritime Committee of the Helsinki Commission
NEFCO	Nordic Environmental Finance Corporation
NGO	Nongovernmental Organization
NIB	Nordic Investment Bank
NILU	Norwegian Institute for Air Research
NIVA	Norwegian Institute for Water Research
NoPEF	Nordic Project Fund
NPK	fertilizer (nitrogen, phosphate and potassium)
PAH	polyaromatic hydrocarbons
PCB	polychlorinated biphenyls
PCT	polychlorinated terphenyl
PHARE	Program for Aid for Central and Eastern Europe

PITF	HELCOM Program Implementation Task Force
PPP	Polluter Pays Principle
SMHI	Swedish Meteorological and Hydrological Institute
TC	Technological Committee of the Helsinki Commission
tot-N	total nitrogen
tot-P	total phosphorus
UNECE	United Nations Economic Commission for Europe