

4 A new form of marine management

4.1 The ecosystem approach – the basis of a new management system

The ecosystem approach implies an integrated, interdisciplinary management system, which on the one hand recognises our right as human beings to use what the ecosystems produce, and on the other ensures that all ecosystem components (i.e. species, habitats, structures, genetic diversity) can be found to such an extent that their survival is guaranteed in the foreseeable future. Ecosystems cannot just be seen as a number of different species, each of which needs to be protected. The interaction among these species must also be safeguarded. The aim is to preserve the structure and function of the ecosystem and hence maintain its capacity to provide us with products and services.

The aim of an ecosystem approach is to analyse complex relationships and be able to manage systems that are constantly changing. Shipping, fisheries, toxic substances eutrophication and climate change also alter the prerequisites for efficient ecosystems. Action must be considered in a long-term perspective, where some measures perhaps do not produce the desired outcome until several decades later. The complexity of marine ecosystems means that a long-term and overarching working method is needed in order to rectify current environmental problems. The ecosystem approach necessitates broad participation by relevant actors. We must harness all available knowledge and coordinate all existing skills. Above all, it is important to evaluate the effects of implemented measures so as to be able to improve the efficacy of future ones. This is known as “adaptive management”. As described in Section 3.3 *Weaknesses in the current management system*, marine environment protection is currently characterised by a considerable lack of implementation and analysis. The situation is further complicated by the fact that current decision-making structures make it impossible

to apply an ecosystem approach since biological systems are subordinate to sector interests, national borders and international agreements.

The Commission on the Marine Environment proposes a number of national measures to reverse the negative trend in our seas and these are presented in Section 5, *A national marine strategy*. A number of necessary measures require international collaboration and the Commission on the Marine Environment therefore proposes the establishment of a new regional management system for the Baltic Sea.

4.2 Regional management – decouple the Baltic Sea

Geologically speaking, the Baltic is a young sea. In just 10,000 years, the water has changed from being a snowmelt basin to an Atlantic bay to an inland lake and to a semi-closed brackish sea. The brackish water means that only a small number of species can manage to live there. In all likelihood, an ecosystem with few species is more sensitive to environmental impact than a species-rich one since some ecosystem functions are maintained only by a few solitary species. The common sea mussel, for example, is the Baltic's only filtering demersal (bottom-dwelling) species and bladder wrack is basically its only species capable of forming seaweed belts. Furthermore, Baltic Sea species are in many cases genetically unique, which makes their populations difficult to replace should they disappear.

The Baltic is a relatively small sea, but it is ecologically unique as one of the world's largest brackish seas. The water exchange between the Baltic and the North Sea regulates the salt content and other physical processes but it is limited. As a result, it takes a long time to exchange all the water in the Baltic. This means that everything we discharge into the sea remains there for a long time.

For thousands of years, the Baltic has been the subject of trade and human contact, the nave surrounded by a rich exchange of culture and politics. When the Iron Curtain divided the region, environmental agreements in the Baltic Sea served as an arena for dialogue between East and West. Scientific collaboration was conducted within the framework of these agreements, bridging the political differences and paving the way for a unique archive of information about the state of the environment.

The Baltic is an inland sea with clearly defined geographical and legal borders (HELCOM's definition of the Baltic also includes the Öresund Sound and the Kattegat). Therefore, the area is well suited to the monitoring of activities and discharges and to the study of the effects and relationships in the marine environment. In addition, there is a sound institutional base on which to build.

The Helsinki Convention is an all-embracing environmental agreement. It includes the most important principles and obligations inherent in international law in order to protect the marine environment. Among the most important are the precautionary principle, the polluter-pays principle and the obligation to prevent and eliminate pollution in the marine environment. The Convention contains principles that describe the signatories' rights and obligations in general terms. Regarding concrete conservation measures, it is up to the convention signatories themselves to take decisions, but consideration must be taken of the general principles in the Convention and the recommendations issued by HELCOM.

The major shortcoming in the Convention is that HELCOM lacks the necessary authority to take binding decisions on detailed conservation measures.

A review of the Helsinki Convention

The Commission on the Marine Environment proposes that a review of the Helsinki Convention be carried out aimed at applying the ecosystem approach into concrete legal principles.

Despite many years of cooperation within the framework of HELCOM and OSPAR, the state of the marine environment in the seas around Sweden has not improved. The indications are that things will either remain the same or get even worse over the next one or two decades. Through the above-mentioned conventions, the signatories have nevertheless confirmed their determination to guarantee a natural recovery of the marine environment and to preserve ecological function. The countries declared that "the inherent value of the marine environment of the North-East Atlantic and the need to protect it in a coordinated fashion" (Government Bill. 92/93:237, Annex 2) was a common responsibility. In addition, they believe that "protecting and improving the marine environment of the Baltic Sea area is a task that cannot be effectively

carried out through national efforts only but also requires close regional cooperation and other appropriate international measures” (Government Bill 92/93:237, Annex 1). In a similar fashion, countries shall eliminate pollution from diffuse sources by promoting and implementing best environmental practice (Rule 2:8, Annex III).

The Helsinki Convention covers protection of “the water-body and the seabed including their living resources and other forms of marine life” (Article 4). Fish are part of marine fauna and the extent to which the Helsinki Convention can protect them should be evaluated in relation to the restrictions engendered by the common European fisheries policy. It has been established both in Secondary Community Law and in the practice of the European Court of Justice that despite the Community’s sole right to regulate fisheries, each Member State is entitled to decree conservation measures within its own economic zone. All the Baltic Sea countries, apart from Russia, will become members of the EU on 1 July 2004. All have established an economic zone. This means that as far as fisheries are concerned, no part of the Baltic Sea will be “free”. A joint conservation decision would consequently exclude countries other than those around the Baltic from fishing there. Such a decision does not contravene EU law.

Concerning agricultural measures, there is nothing to stop the Baltic Sea countries from implementing comprehensive measures, as long as such measures are in line with the EU nitrate directive. The UN Convention on the Law of the Sea (UNCLOS) provides considerable scope for coastal states to take measures to combat substandard shipping.

These suggestions necessitate a revision of the Helsinki Convention to bring about sustainable use of the sea. A new form of management should be based on biological systems, on the ecosystem approach, and be implemented by using a modus operandi that is both broadly international and adaptive between different sectors.

Intensified cooperation with Russia

The active participation of Russia in managing the Baltic Sea is of paramount importance, not least in the light of the threat to the environment posed by its ever-increasing oil exports. At the same

time, due consideration has to be given to this strategic resource as crucial to Russia's chances of reaching its economic and social objectives.

The Northern Dimension initiative covers a large and diverse geographical area, which includes the Baltic Sea region. Its value lies in the synergy and cohesion it creates as the result of the different types of activities performed by all parties. EU enlargement means that the Northern Dimension will be able to make a substantial contribution when it comes to carrying the policies of the EU forward in relation to new neighbouring countries. The strategy used to finance and coordinate the Northern Dimension's environmental partnership can be applied.

Among the Northern Dimensions priorities is a more intensive environmental dialogue between EU and Russia aimed at monitoring and combating pollution throughout the region. Measures to tackle chemicals, persistent organic pollutants (POP), heavy metals, toxic and urban waste that are discharged into domestic watercourses and the Baltic Sea are top priority. A strengthened regional agreement creates better conditions for promoting political dialogue and concrete cooperation with Russia.

Strengthened marine cooperation in the region

By strengthening and extending the Helsinki Convention, institutional and political advances made in the region can be consolidated. The aim is to build up such a strong and comprehensive shield to protect the Baltic marine environment so that an efficient ecosystem can be recreated and long-term sustainable development guaranteed.

Strengthened cooperation can be based on HELCOM recommendations and incorporating IBSFC functions (or a future Regional Advisory Council for the Baltic Sea) to manage fisheries and achieve sustainable development objectives as found within the Baltic 21 framework. In addition, EU-based undertakings (the Habitat Directive, the common fisheries policy, relevant parts of the agricultural policy, the water framework directive, legal instruments for the protection of the marine environment, shipping and maritime safety), the International Council for the Exploration of the Sea (ICES), the Baltic Sea Regional Project (BSRP), the network of biosphere areas within UNESCO's Programme on Man

and the Biosphere (MAB), and relevant parts of ASCOBANS (Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas), could be developed to make up some of the integrated efforts to conserve the Baltic marine environment. The current structure for HELCOM observers should be expanded to enable broader participation.

The time is ripe for a Baltic Sea initiative in order to lend purposeful support to an integrated marine policy and an institutional approach within the framework of the European Union. The EU Commission's communication regarding a common marine strategy underlines the importance of introducing the ecosystem approach to manage the marine environment. The council conclusions on the communication, adopted by the Council of Ministers in March 2003, emphasise that the Community's marine environment protection policy must take regional conditions fully into consideration in order to deal with the considerable differences in marine ecosystems, e.g. seabeds, river estuaries and coastal areas, and that it is particularly important to apply the precautionary principle. The council conclusions also point out that it is necessary to take all anthropogenic activity that either impacts the marine environment or is associated with it into consideration, which may mean that adjustments have to be made to the current policy.

Common regional initiative

<p>The Commission on the Marine Environment proposes that Sweden immediately start preparing a common initiative by the heads of state and government in the Baltic Sea region, aimed at a review of the Helsinki Convention.</p>

The objective is for the heads of state and government to jointly appoint an action group to develop proposals aimed at a comprehensive review of the Helsinki Convention. This would allow the Baltic Sea countries to pave the way in international law for the conservation of rare and fragile marine ecosystems. This requires political support from all the countries in the catchment area, a pledge for a long-term commitment and a will to set aside funding. The participation of relevant actors, a survey of resources, research,

monitoring and the production of information material are important factors that will require financial resources.

The Commission on the Marine Environment's proposal means that, as a result of a jointly binding undertaking, based on a strengthened Helsinki Convention, the Baltic Sea countries can create regional political power. Regional adjustments can then be made to the common European fisheries policy and the relevant components of the agricultural policy to accommodate the Baltic Sea's sensitive environment. The Commission on the Marine Environment sees the Baltic Sea as a pilot region for a new management strategy and the work done should hence be evaluated so that useful experiences (both positive and negative) can be transferred to other sea-areas, such as the North Sea including the Skagerrak.

There are good examples of instances when urgent issues have received political priority for a period of time and this has acted as a catalyst for international cooperation. When the attention of heads of government has been directed towards specific issues, the countries have been able to close ranks and really commit themselves to solving the problem. Below two examples describe where international cooperation has resulted in decisions that had not been possible without the breakthrough provided by political prioritisation.

The 1990 Environmental Conference in Ronneby, southern Sweden

In 1990, the prime ministers of Sweden and Poland invited their colleagues from the whole Baltic Sea catchment area to an environmental conference in Ronneby in southern Sweden. This conference resulted in the now historic Baltic Sea Declaration, in which the heads of state and government announced their intention to develop and implement a "joint comprehensive programme to restore a sound ecological balance in the Baltic Sea". The programme became known as the JCP (Joint Comprehensive Programme). JCP was developed by a special action group, which included all the countries and institutions (amongst them various international development and investment banks) who had been represented in Ronneby. JCP listed the 132 point sources, so-called "hot spots", that required special attention. Measures were developed and the funding to radically reduce harmful emissions

from these sources was made available. The programme has been very successful and today, 50 of the point sources identified have been taken off the list.

Task Force on Organized Crime in the Baltic Sea Region (Police cooperation among law enforcement authorities in the Baltic Sea region)

Cooperation in the Baltic Sea region aimed at combating organised crime began in 1993. At the outset, it took the form of traditional international cooperation with annual meetings, which did not lead to any significant results. Only when the heads of state and government put international crime fighting on the political agenda at the Baltic Sea countries summit in Visby in 1996 did the cooperation project gather speed. At the summit, it was decided that a high-level action group would be established with personal representatives of the various heads of government. The fight against organised crime received political priority, which paved the way for stronger and more purposeful cooperation. The action group received an unequivocal mandate with the task of proposing solutions and measures as soon as possible and of implementing them without further ado.

4.3 A strengthened legal framework

The Commission on the Marine Environment proposes that the recommendations procedure within the Helsinki Convention be replaced by a procedure for adopting legally binding decisions. The proposal aims to create an effective instrument for the protection of the marine environment.

A number of proposals are highlighted below as examples of how fisheries, shipping and eutrophication can be tackled within the framework of a legally strengthened Helsinki Convention. The Convention could then create the necessary conditions for dealing with the problems in these areas in real earnest. With regard to airborne nitrogen deposition (which is responsible for 30 per cent of the environmental load) it is anticipated that it will be dealt with in the course of European air quality initiatives. Zoning is a necessary

tool in order to strike a balance between sustainable use and conservation of the marine environment. Regarding toxic substances, it is obviously necessary to implement joint measures around the Baltic Sea but since a large proportion of the toxins in the sea come from countries outside the region, it is more urgent to make efforts within the EU and in global conventions to reduce their dispersion. For more information on measures to combat toxic substances, see Section 5.2, *More detailed interim targets and measures as a complement to the work being done to achieve the environmental quality objectives*.

There are a number of principles from adjoining international environmental agreements that are applicable but the values and principles of UNCLOS should be taken into consideration first and foremost. This convention specifies the obligations and rights of a country as regards the law of the sea and contains rules on dividing the sea up into water areas, what jurisdiction states have over these water areas and a comprehensive regulatory framework providing for the conservation of the marine environment. The marine environment conservation provisions in UNCLOS do not contain any detailed obligations. They are instead to be transposed into concrete legal measures through specific agreements for each sea area, taking into account the special needs of each of these areas. This is seldom applied today, but would be complementary to a strengthened regional agreement. The most important provisions in UNCLOS are:

- Part XII of UNCLOS – *Protection and Preservation of the Marine Environment* – includes a comprehensive regulatory framework for the protection of the marine environment. By accepting this part, the signatories have undertaken to safeguard the marine environment and to take measures to reduce emissions that may cause pollution.
- UNCLOS has a unique mechanism for resolving conflicts. If a conflict on how to interpret the provisions of the Convention arises, there is always a legal instance that is authorised to deal with the conflict, on the initiative of one of the parties, and make a decision that is legally binding for both parties. This mechanism should resemble the provisions on the settlement of disputes in UNCLOS (part XV) or other mechanisms that have been developed in recent years within some environmental fields, such as climate change and within WTO. All such

mechanisms shall guarantee effective and rapid resolution of disputes and provide scope for “interim measures”. This might mean a requirement for an activity that constitutes a potential threat or may seriously damage the marine environment to be suspended pending the resolution of the conflict.

In addition to UNCLOS, suitable principles from other environmental agreements should be taken into account, primarily:

- The Convention on Biological Diversity (CBD)
- The FAO code of conduct for responsible fisheries.
- The Ramsar Convention on Wetlands of International Importance.
- UNEP Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities.

Zoning

The Commission on the Marine Environment proposes that the entire Baltic Sea be divided into zones where different forms of use and activity are permitted:

- A core of marine conservation areas where the extraction of resources is not permitted,
- A major system of protected areas where certain types of activities are permitted,
- The remaining marine environment where integrated coastal zone planning shall be effected in order to take both users and the environment into consideration, in accordance with the principles for the fisheries, shipping and other activities that are presented in this report.

The establishment of zones covering the entire Baltic Sea with different levels of marine protection is one of the most important measures for minimising the negative impact on the marine environment. The designation of different types of nature reserves is an internationally tried and tested form of protection. There are examples of how both the number of individuals and the species diversity of flora and fauna are on the increase in areas where potentially harmful activities have been restricted. International experience also shows that local acceptance of the regulatory

system is of fundamental importance implementing effective protection and minimising monitoring costs.

The conclusion of the Commission on the Marine Environment is that zoning is a crucially important step in our quest to achieve sustainable use of all the ecosystems in the Baltic Sea. The region must be managed from a holistic perspective and planning must be based on a definition of those areas that require stronger protection and those where greater use of the biological resources is possible. An all-embracing zoning system is well in line with the fundamental premise of major marine ecosystems, where biodiversity is favoured as the result of a broad spectrum of measures. The aim of zoning is to restore and preserve naturally efficient ecosystems, whilst still promoting sustainable use.

There is a good basis for establishing zones that can be afforded comprehensive protection in the territorial waters of the various Baltic coastal states. The foundations of such a protection system can be found in HELCOM's guidelines and its network of protected sea and coastal areas, Baltic Sea Protected Areas (BSPA), and in Natura 2000 areas. However, the existing system must be substantially developed and afforded legal standing regarding the harmonisation of national conservation measures and the enforcement of implementation and sanctions. If this occurs, the region could be at the cutting edge internationally when it comes to the application of global marine agreements.

When applying comprehensive zoning, it may help to consider the Baltic Sea as a "rare and fragile ecosystem" since Article 194 of UNCLOS underlines the need to protect rare and fragile ecosystems. However, this label does not involve an immediate benefit but should be seen as an instrument in the development of international law concerning marine conservation areas. Applying the ecosystem approach, combined with the protection of vulnerable ecosystems, can strengthen the position of the countries surrounding the Baltic Sea in the long term when it comes to implementing change or securing supportive measures from countries outside the region whose activities nevertheless impact the Baltic Sea. In addition, such an initiative could also improve the countries' chances of being able to impose stricter measures on shipping.

Flags of convenience and substandard shipping in the Baltic Sea

Within the framework of a reviewed Helsinki Convention and by cooperating with the IMO, the Commission on the Marine Environment proposes the establishment of the following minimum requirements for shipping standards in the Baltic Sea:

- All Baltic Sea ports shall have both the equipment and the arrangements for disposing of waste, including oily waste.
- A requirement that all hazardous cargo, including oil, may only be transported by high-quality tankers, that ships must not be blacklisted following previous visits to ports (in the Baltic Sea region and elsewhere), that vessels must be fitted with transponders and/or other control and tracking equipment (in accordance with the Helsinki Convention, Annex IV), and be classified by a well-reputed classification society.
- Shipping lanes and traffic regulations shall be designed so that sensitive areas are avoided and damage from oil spills will be as limited as possible should they occur.
- Emissions of ballast water shall be controlled to minimise the spread of non-indigenous organisms.
- Measures shall be coordinated within the framework of HELCOM cooperation to board, inspect and detain commercial vessels suspected of violating national environmental laws.

The transportation of oil and other hazardous cargo constitutes a growing threat to the marine environment, not least in the Baltic Sea. Part XII of UNCLOS supports the use of relatively stringent measures that can be implemented when vessels are in port. The Baltic Sea countries can exercise considerable influence over shipping and the activities of ships at sea by tightening conditions of entry to ports. This further strengthens the argument that regional coordination and focus of measures might standardise, improve and drive through provisions in the region. This would increase the scope for implementing measures to improve maritime safety in the Baltic Sea.

In 2001, the FAO adopted the so-called International Plan of Action to Prevent, Deter and Eliminate Illegal Unreported and Unregulated Fishing. The plan of action instructs states to close

their ports to fishing vessels flying the flag of convenience, and close their markets to products that have been landed by such vessels. It also instructs states to dissuade or prevent citizens and industry from owning, manoeuvring, chartering, working on or in some other way doing business (e.g. insuring or supplying provisions) with fishing vessels flying the flag of convenience. Both the UN General Assembly and the World Summit on Sustainable Development (WSSD) have approved the plan of action.

The problem with flags of convenience and substandard shipping in the Baltic should be handled in a similar manner. Within the frame of the strengthened cooperation, the aim is to coordinate measures concerning the boarding, inspection and detention of commercial vessels that are suspected of either violating or threatening to violate national environmental laws. This can lead to limited access to ports and markets for commercial vessels and their cargoes if they sail under flags of convenience. It may also lead to restrictions for companies that wish to own, charter or carry on some other commercial activity using ships that are registered in these countries. For the longer term, Sweden and the other Baltic Sea states should try to bring about the abolition of flags of convenience to redress the imbalance in legal rights which currently prevails between "flag states" (where the vessel is registered) and coastal states. Pending this, the above proposals for measures should be considered.

Fisheries

The Commission on the Marine Environment proposes a time-limited "state of emergency" where the common European fisheries policy is harmonised with a strengthened Helsinki Convention.

The Commission on the Marine Environment proposes a total ban on the fishing of all stocks that are currently below biologically safe limits in the Baltic Sea.

Recently, the catch capacity in most of the fishing waters has far exceeded the level at which stocks can maintain their productive capacity. During the post-war years, national ownership rights have therefore been abolished in favour of the establishment and extension of economic zones and by society decreeing total allowable

catches (TAC) for several of the species that are commercially significant. For EU Member States, this has been transferred from national sovereignty to the EU.

The way fisheries in the Baltic are currently managed is not sustainable in the long term. Established quotas are far too high and the size and efficiency of the fleet is not in proportion to the capacity of the ecosystem to produce fish. Overfishing, fish that are thrown overboard, illegal fishing and free access are the main reasons for the overexploitation of marine resources by the modern-day fishing industry and can be put down to the failure of the management system.

The Commission on the Marine Environment's proposal for a review of the Helsinki Convention creates the necessary scope for dealing with measures on a regional basis, where the overarching strategy should be that fish must first and foremost be seen as a component of the ecosystem and secondly as a resource. This implies that fish stocks must not be extracted to such an extent that their function in the ecosystem is noticeably affected. In those cases where we do not know where the limit at which noticeable change occurs, the precautionary principle must be applied.

Harmonising the EU fisheries policy with a revised Helsinki Convention should be coupled with an analysis of how shortcomings in the decision-making structure and management system can be rectified. These conclusions can then be used to tackle the problem of fisheries management within the EU.

The most important measure to combat the alarming problems with fish stocks is to reduce "fishing mortality", i.e. the proportion of fish stocks caught by the fishing industry, so that the productive capacity of the stocks is not impoverished. Estimates of cod stocks in the Baltic Sea were made in the spring of 2002, based on assessments by the International Council for the Exploration of the Sea (ICES). These estimates show that if cod fishing were banned completely for three years, Baltic Sea cod stocks could recover to within biologically safe limits, i.e. to such a degree that they were no longer threatened by collapse. Based on the same estimates and with only a 70-percent reduction in cod fishing, it might take up to seven years to reach the same level. In this context, it is also important to point out that stocks should be allowed to grow to levels well in excess of biologically safe limits. This ensures that stocks can be replenished to such a level that safeguards their

function in the ecosystem and maximises their biological production.

Fisheries management must, however, constantly adapt to new conditions. For example, massive saltwater penetration into the Baltic Sea, along with other factors, might also have a positive impact on cod reproduction. In other words, it is difficult to say by how much fishing must be reduced in general terms. The important thing is that management applies the precautionary principle and that biological advice is given top priority. According to the Commission on the Marine Environment, applying the precautionary principle means that, for example, fish stocks that are currently under biologically safe limits must not be extracted at all. In the light of this, the Commission proposes a total ban on fishing for such stocks until they have come above biologically safe limits. After that, the stocks should then be managed so that they reach a size that allows maximum biological production and which re-establishes the role of fish in the ecosystem. The Commission proposes additional national measures in Section 5.2 *More detailed interim targets and measures as a complement to the work being done to achieve the environmental quality objectives.*

Eutrophication

The Commission on the Marine Environment proposes that the countries around the Baltic Sea develop effect-based targets for eutrophication and adopt legally binding undertakings to reach these targets based on the most cost-effective solutions.

The Baltic Sea countries should be given the opportunity to direct the environmental subsidies which are part of the EU agricultural support system to the areas within the region where the greatest effect can be achieved.

The Baltic rim countries must agree on a new working method in order to implement cost-effective measures to combat marine eutrophication. A strengthened management system should develop the necessary instruments for an intersectoral analysis of anthropogenic impact on the marine environment. All the countries should harmonise their environmental evaluation and monitoring systems. More effort must be put into developing effect-

based objectives. As is the case with the LRTAP Convention, these effect-based objectives should only prescribe overarching emission reductions for the countries and not regulate in detail the measures that need to be taken in order to provide the countries with sufficient scope to choose the most cost-effective solutions themselves.

Agriculture is the single largest source of eutrophication. The EU programme for the environment and rural areas provides scope for awarding compensation for measures that reduce leakage from agricultural land. Within the framework of the forthcoming review of the EU programme for the environment and rural areas, the Baltic Sea countries should make joint representation to secure the greatest possible funding allocation. Coordinated management provides the opportunity for targeting resources at those areas in the region where the maximum effect can be achieved.

With its 39 million inhabitants, Poland is the country that discharges the most nutrients into the Baltic. Calculated per inhabitant, however, Sweden is responsible for major discharges of nitrogen and phosphorus. Our discharges are considerably higher than the average around the Baltic. Additional proposals for national measures to reduce nutrient discharges in Section 5.2 *More detailed interim targets and measures as a complement to the work being done to achieve the environmental quality objectives.*

5 A national marine strategy

The Commission on the Marine Environment proposes that Sweden develop a national marine strategy to reverse the negative trends in our surrounding seas. This marine strategy shall reconcile the disunion that currently characterises management of the marine environment. Efforts shall be based on planning and adaptive management, where research and continuous evaluation of implemented measures are linked together. The national environmental quality objectives for *A balanced marine environment, sustainable coastal areas and archipelagoes, Zero eutrophication and A non-toxic environment* should be supplemented with further measures.

One of the tasks of the Commission on the Marine Environment has been to act as a complement to the work being done to achieve the environmental objectives. Experience and specialist knowledge have been gathered both nationally and internationally. The Commission established at an early juncture that there is considerable disharmony among the various actors, interests and users of the marine environment. It is not altogether obvious how this disharmony is reconciled most effectively and the problems are not unique to Sweden.

Australia presented its national "Oceans policy" in 1998. The conclusion of this was that despite the reasonably healthy state of the marine environment around Australia, comprehensive measures were still required to reverse the negative trends. The sea is exposed to the ever-increasing impact of fisheries, shipping, agriculture, physical disturbance, other resource extraction, tourism and recreation. An American marine environment commission, the Pew Oceans Commission, published the results of its three-year long tenure at the beginning of June this year. It draws the conclusion that overwhelming evidence points to the

marine environment facing a crisis and that the current sectorised form of marine environment management has been unsuccessful.

Both reports advocate an ecosystem approach, where a central authority coordinates a system of regional councils, thereby facilitating regional and local adjustments and intersectoral cooperation. Comprehensive planning of how the coast and the sea are to be used is necessary to reduce the damage being caused to marine ecosystems.

The analysis and conclusions of the Swedish Commission on the Marine Environment mostly concur with the overarching conclusions of these two reports, illustrating that the problems are similar for many countries around the world. Intensive efforts to deal with marine environment issues in many parts of the world mean that it is not only possible to gather experience from other countries but also to make the marine environment a common, and urgent, concern at the highest political level.

In Section 3.2, the Commission on the Marine Environment outlined the shortcomings caused by the current system with sector responsibility – no-one is responsible for the sea in its entirety and there is neither a holistic approach nor coordination. For a national marine environment strategy to succeed, these shortcomings must be rectified. In addition, the relevant sectors (fisheries, agriculture, shipping, industry) need to work together to a greater extent within river and sea basins to minimise impact on the marine environment.

The development of a national marine strategy also serves to complement and reinforce the work being done to achieve the environmental quality objectives and in Section 5.2, we submit proposals for more precise interim targets and measures with regard to the environmental quality objectives of *A balanced marine environment, coastal areas and archipelagoes*, *No eutrophication* and *A non-toxic environment*.

5.1 Zoning and adaptive management of Sweden's seas

The Commission on the Marine Environment proposes the following measures within the framework of a national marine strategy:

1. The Swedish Environmental Protection Agency (Swedish EPA) shall be given the overall responsibility for the marine environment.
2. The Swedish EPA shall be charged with the task of drafting a planning basis for Sweden's marine environment, in partnership with relevant actors.
3. Zoning shall regulate the use of these. The Swedish EPA shall be responsible for planning and implementing zoning, preferably in partnership with relevant actors.
4. The effect of implemented measures shall constantly be evaluated. Evaluation results are to be used in an adaptive management system, adjusted to suit each river basin, coastal zone and sea basin.
5. Information initiatives shall stimulate active participation and changes in attitude.

The Commission on the Marine Environment proposes actions that should be taken immediately pending the implementation of the more comprehensive measures recommended in previous chapter:

- a) As a first step to zoning the sea, the Commission supports the proposal to extend the trawling limit.
- b) Four areas with fishing bans in both the Baltic Sea (excluding the Kattegat) and the North Sea (including the Skagerrak and the Kattegat) shall be established based on available knowledge. In each of these specified sea areas, two coastal and two deep-sea sub-areas are to be established.
- c) All shipping shall be moved south and east of Hoburg Bank.
- d) The Swedish EPA shall be charged with developing a preliminary planning basis using the available knowledge. This planning basis shall then be regularly reviewed using information from inventories and surveys that will be carried out as part of the inventory programme proposed in point 2 above.

Current marine management employs protection and conservation measures for individual species and areas only when acute threats are posed. Regulating fish extraction, protecting specific sites and the granting of permits for physical exploitation all occur disjointedly instead of being based on a holistic assessment. In contrast, management of the environment and natural resources on land is characterised by comprehensive planning in the form of overall plans, detailed plans, etc. These specify how whole areas are to be utilised.

Current marine management involves the implementation of rather costly measures without their effects being evaluated in a satisfactory fashion. This is why we currently lack understanding as to what effect measures, such as those taken within agriculture to reduce nitrogen leakage, have had on nutrient levels in the marine environment. We also have little understanding of the effects that the additional nitrogen treatment in Swedish wastewater treatment plants has had.

We need to test and evaluate the effects of implemented measures to a considerably greater extent than at present in order to improve future measures. In order to achieve this, research needs to be coupled to management, and environmental monitoring has to be designed so that it plays a central role in the follow-up and evaluation of implemented measures.

Current management is characterised by a lack of coordination. Every authority and sector focuses on its own efforts, but there is no analysis of how well “the big picture” is functioning. Future management in line with zoning requires cooperation among sectors to promote common problem-solving and follow-up. This will clarify their holistic responsibility for the marine environment. It will also increase the potential for learning lessons from previous experiences and facilitate the acceptance of necessary measures.

Broader commitment creates acceptance for an ecosystem-based management system and the active participation in and accountability for decision-making from various interest groups should therefore be considered. Successful application of the ecosystem approach also requires work to be structured so as to promote broad participation. Clear decision-making processes that are adjusted to this working method must also be developed. The Government communication *A comprehensive policy for nature conservation* (2001/02:173) and the report by the Committee on Swedish Democracy, *Sustainable democracy* (SOU 2000:1), both

advocate the more active participation of the individual. Ecological sustainability requires discussion, collective analysis and joint decision-making.

1. The Swedish Environmental Protection Agency (Swedish EPA) shall be given the overall responsibility for the marine environment.

The Commission on the Marine Environment is of the opinion that the Swedish EPA should be given the overall responsibility for the marine environment. The EPA should be charged with the task of identifying shortcomings and proposing necessary changes to ensure that sector responsibility develops and becomes sufficiently coordinated. The EPA shall propose delimitations and the remit of each sector respectively, the sector authority's role in relation to the various actors in the sector, and the distribution of roles among the authorities that have a responsibility for marine issues. This should also include a proposal for how intersectoral coordination is to be guaranteed.

2. The Swedish EPA shall be charged with the task of drafting a planning basis for Sweden's marine environment, in partnership with relevant actors.

The existing information is not comprehensive. The Swedish Maritime Administration, the Geological Survey of Sweden (SGU) and the Swedish Meteorological and Hydrological Institute (SMHI) have been charged with the task of producing information on the marine environment within their respective remits. However, no agency has been assigned to produce or retrieve general biological information for the marine environment. Biological information within restricted, military areas, should also be made available as far as possible. In addition, professional fishermen, anglers and other actors possess information that should be used.

In a report (RRV 1998:62) published in 1998, the National Audit Board states that national inventories, using uniform methodology and clear criteria for the assessment of natural values, have been a strong driving-force behind the conservation of certain nature types on land. With few exceptions, there are no coherent inventories of Sweden's water environments, neither for the sea and coastal waters nor for lakes, rivers and streams. The inventories

that do exist have not been performed consistently and lack a uniform methodology, which makes it difficult to compare and compile the material. In a report from 2001/02 (2001/02:173), the Government states that a national inventory of lakes, rivers and streams as well as coastal waters (in accordance with the definitions in the water framework directive) should be performed.

The Commission on the Marine Environment feels that this inventory should be extended to include the entire Swedish economic zone. As yet, only a fraction of this area has been audited in a way that provides sufficient management basis. There is a considerable need for the planning of different forms of use both in coastal and in deep-sea areas. Such planning can provide the basis for a holistic approach with which to deal with and allocate the various marine activities. A detailed draft plan would, for example, provide baseline information for where to locate shipping lanes and windpower turbines so as to cause the least damage. It would also enable a holistic view of how specific marine environments should be protected and how the coastal zone should be used.

Planning coastal zones requires advanced maps. Such maps should be digital and GIS-based and supply comprehensive information regarding depths, type of seabed, currents, marine environments with their characteristic species and breeding grounds. The map should also contain information on different types of use such as fisheries, aquaculture, shipping lanes, marinas, tourism and different forms of physical exploitation. Major environmental problems such as oxygen-deficient seabeds, overgrown bays and toxic sediments should also be indicated.

The Commission on the Marine Environment is of the opinion that the Swedish EPA should be given the task of designing a programme and a timetable for the coordination and funding of marine inventories in coastal and deep-sea areas. This would be the necessary foundation on which to build planning initiatives. The programme should be designed in partnership with coastal municipalities, county administrative boards, the Maritime Administration, the Geological Survey of Sweden, SMHI, the National Board of Fisheries, the Swedish Species Information Centre and the marine research establishments. The planning basis should also highlight how inventories are to be carried through and coordinated with regular marine surveys at the afore-mentioned authorities. The programme should also specify what existing material can be used, what can be done on a regular basis and what

requires supplementary funding. The scope for making use of marine surveys that have been done by other authorities, such as the Swedish Armed Forces, should be investigated.

The Swedish EPA shall also develop the first planning basis using currently available knowledge. This planning basis shall then be regularly updated using information from the inventories and surveys carried out in connection with the programme.

3. Zoning shall regulate the use of the sea. The Swedish EPA shall be responsible for planning and implementing zoning, preferably in partnership with the relevant actors.

Marine management is currently based on the right to use the sea. In cases where there is an acute need to limit use, different forms of protection have been introduced, such as nature reserves, bird and seal sanctuaries, trawling bans, etc. The surface area of the sea that is protected is small, however, compared to the amount of protected area found on land. Unrestricted use is the norm and every intrusion into such use has to be well motivated. The Commission on the Marine Environment wishes to underline the importance of adopting the opposite approach. This is in harmony with both the ecosystem approach and the precautionary principle. Good examples of how this can be applied include the Great Barrier Reef.

The Commission on the Marine Environment proposes that all of Sweden's territorial waters be divided into zones for different types of use. There will be zones, for example, where no extraction of biological resources is to occur and where access may even be restricted in certain cases (e.g. noise-free zones as proposed by the Environmental Objectives Committee), zones for limited types of use and areas for all types of use guided by the principles outlined in this report for fisheries, shipping and other activities.

The planning basis proposed under point 2 shall form the backbone of a zoning system in the marine environment. Prior to this basis being developed, the protection of specific environments is to be established immediately and evaluated in an adaptive system of management. These areas should be coordinated with areas that have already been planned, e.g. as part of the Natura 2000 system.

In order to initiate zoning of the Swedish marine environment, the Commission supports the proposal by the National Board of Fisheries for an extended trawling limit. This measure could form

the basis of a large coastal conservation area with various fishing gear regulations and other statutes.

Zones where fishing is banned

There are currently no areas in Sweden, where a permanent ban on all fishing is imposed. Internationally, however, this is a tried and tested form of protection. There are many international examples of how the amount and diversity of fish and other species are increasing in such areas (known internationally as marine reserves). Areas where fishing is not permitted can have a positive impact on stocks of commercial species. There are also scientific studies that show that other of the ecosystem change when fish are plentiful and when they can be found in different sizes. Such an effect can only be achieved and evaluated by establishing conservation sites where fishing is banned.

Sweden's environmental objectives include the establishment of an area where fishing is banned by 2010. According to the Commission, this objective falls short of the mark. It will not generate enough information on the value of fishery-free areas and will not help achieve a rapid solution to the stocks problem. Instead the Commission proposes to establish at least four areas in both the Baltic (excluding the Kattegat) and the North Sea (including the Skagerrak and the Kattegat), two coastal and two deep-sea areas as a preliminary measure pending the development of a planning basis that maps out a more comprehensive zoning system. The aim with establishing zones where fishing is banned is to help reduce the risk of populations collapsing, to build up fish stocks with a diversified size distribution and a natural genetic composition, to protect other natural values and to function as reference areas for research and management.

Zoning of shipping lanes

The negative impact of shipping is often associated with certain places, e.g. along shipping routes, where illegal discharges of oil are commonplace, and in areas that are difficult to navigate and where the risk of shipping accidents is considerable. The risk of oil spills as a result of accidents is ever-present, regardless of the measures

implemented to improve the quality of shipping vessels. Protecting the most valuable areas is therefore a matter of the utmost urgency. Zoning must therefore, also include shipping lanes, where a marine environment impact assessment should be the guiding maxim.

As a first stage in the zoning of shipping lanes, the Commission on the Marine Environment proposes that all shipping is moved south of Hoburg Bank. This should be done to reduce damage to Natura 2000 sites and other valuable areas caused by commercial shipping accidents along the east coast of Gotland. The Swedish EPA jointly with the National Board of Fisheries should be charged with this responsibility. The proposal is further elaborated on Section 5.2 *Shipping*.

Before zoning is in place the planning needs to be based on extensive background material. Use that requires considerable space and resources such as trawl fishing, aquaculture, sea-based wind turbines and other physical exploitation including harbour construction, gravel pits, dredged material dumps etc., must be considered during the planning.

Zoning and the restrictions of use that it implies must be evaluated and followed by improved measures and a zoning review. Adaptive management will be needed for this.

4. The effects of implemented measures shall be constantly evaluated. Evaluation results are to be used in an adaptive management system, adjusted to suit each river basin, coastal zone and sea basin.

Considerable emphasis must be placed on evaluating, analysing and adjusting or modifying the measures that are employed for specific objectives, in line with an adaptive management scheme.

Relevant marine research and environmental monitoring must be adjusted so that they can be used as adaptive management tools. Environmental monitoring must be strengthened so that it can show the effects of implemented measures. Substantial funding should be made available to develop and apply a more strategic environmental monitoring system. Local, regional and national monitoring must be conducted with common quality requirements. First, the aim of environmental monitoring must be broken down in more detail and incorporated into an adaptive management system where every measurement will be used as a basis for evaluating the effects of implemented measures. More information needs to be exchanged on the local, regional and national level by

making comparable, high-quality data available. All environmental monitoring data must also be made easily accessible to all researchers irrespective of whether they are involved in the environmental monitoring programmes or not. Good coordination leads to more efficient use of resources, better quality of data and considerably more information being exchanged.

The responsibility for research and environmental monitoring in our marine areas is currently spread among several actors. The Swedish EPA is responsible for designing the marine monitoring programme on the national level, whilst day-to-day monitoring activities are carried out by authorities, marine research establishments or individual university departments. On the local level, the county administrative boards, municipalities and water conservation societies conduct measurement programmes, but there is no coordination, common quality requirements or consolidated design. The quality of data therefore varies, which makes it difficult to use the information to evaluate the state of coastal areas. This is also true of monitoring activities in recipient water bodies. These are not coordinated with other measurement activities nor are they subject to common quality requirements. In some areas, coastal water conservation societies have been formed which have led or will lead to better coordination and quality, but it is crucial that coordination also occurs at the national level. The fact that environmental monitoring is being increasingly outsourced distances it from research. Hence the participation of researchers/university departments is declining, which in turn makes adaptive management more difficult.

Eutrophication and toxic substances in the marine environment are largely the result of land-based activities. The EU Water Framework Directive implies substantial efforts in tackling water quality issues throughout the entire catchment area. The focus is on land-based measures that will lead to better water quality. In Sweden, five regional water authorities have been proposed, each being responsible for implementing the water framework directive in Sweden (SOU 2002:105). This implementation may imply a shift towards a more applied, intersectoral approach, where the results of research and environmental monitoring will be linked to management. Implementing the water directive may also have a positive effect on water quality in Swedish coastal areas. It is therefore important to link marine management to the water framework directive as well. With this in mind, the distribution of

resources between fresh and salt water should be studied. The Commission on the Marine Environment also recommends that coastal fisheries, when based on an ecosystem approach, obviously should fall within the jurisdiction of the water directive.

Sweden's marine areas should be divided into regions in line with natural sea areas and these should be linked to the five proposed water districts. This regional demarcation will provide a clearer picture of implemented measures within each river basin.

Adaptive management of the marine environment should be supported by Sweden's marine establishments. These can contribute research and monitoring skills and make knowledge and background material available for coastal management plans. The country's marine establishments should be more involved than they are today in developing a more expedient system of environmental monitoring.

5. Information initiatives shall stimulate active participation and changes in attitude.

Monitoring the state of the environment generates information on the progress being made in conjunction with the national marine strategy. Environmental monitoring data is currently distributed in the form of information brochures published by Sweden's marine establishments. This is an important initiative and should be developed to include a deeper analysis of the anthropogenic impact on marine ecosystems. Certain environmental problems can only be solved by changing the attitudes of a broader public. The continual feedback of monitoring results creates knowledge about and interest in the state of the marine environment, both among the general public and among politicians. At the outset focusing on manageable problems and the success stories of the national marine strategy will also attribute to building trust.

Success stories on all levels should be highlighted and communicated to show that it is possible to achieve improvements in the marine environment. In partnership with the Swedish EPA, the country's marine establishments should further develop the annual popular science report on the state of the environment and the success stories of the national marine strategy.

5.2 More detailed interim targets and measures as a complement to the work being done to achieve the environmental quality objectives

The Environmental Objectives Council estimates that the three objectives that concern the marine environment will not be achieved by 2020 by employing the measures that currently are proposed. The Commission on the Marine Environment shares this assessment and also draws the conclusion that the environmental objectives will be impossible to achieve employing national measures alone. Vigorous political effort on an international level is needed to achieve the objectives adopted by the Swedish Riksdag. The Commission also draws the conclusion that in addition to ongoing national and international efforts to achieve the objectives, supplementary measures are needed if the quality objectives are to be achieved by 2020.

Shipping

Poorly constructed vessels in combination with insufficient maintenance heighten the risk of accidents. Accidents are often caused by a combination of factors, such as a substandard vessel being operated by a poorly trained crew. The proposal of the Commission on the Marine Environment aim to minimise the negative impact of shipping on marine and coastal environments. At the same time, shipping is an energy-efficient mode of transport, which is also cost-effective as there is little need for investment in its infrastructure. With a few local exceptions, congestion and noise from shipping cause little disturbance. In many cases, transporting hazardous goods by sea is beneficial from a safety point of view. However, serious problem with the increase in shipping is, the occurrence of substandard vessels.

The Marine Environment Commission proposes that the following additions are made to the environmental quality objective *A balanced marine environment, sustainable coastal areas and archipelagoes*.

- A. No sub-standard vessels shall operate in our surrounding seas.
- B. The most valuable areas shall be protected from negative impacts of shipping.
- C. Rescue contingency plans shall be guaranteed.

The Commission on the Marine Environment proposes the following supplementary measures:

1. The cargo-owner should take greater responsibility for the choice of transport.
2. Measures to facilitate quality shipping shall be taken.
3. All shipping traffic shall be diverted away from the most valuable areas.
4. Rescue contingency plans shall be strengthened regarding the rescue services' ability for carrying out emergency towing, emergency lightering and fire extinguishing at sea.

A. No sub-standard vessels shall operate in our surrounding seas.

One major cause of accidents and near-accidents, regardless of the type of vessel involved, is unreliable operators and poorly maintained vessels. Substandard shipping can be defined as shipping that does not comply with applicable regulations and agreements. Substandard shipping mostly occurs when rawmaterials are being transported, i.e. the goods need to be processed a great deal more before it reaches the end-consumer.

The following factors in the transport chain are important indicators as regards the quality of shipping:

- The flag state (the country where the ship is registered) A quality assessment of a country's shipping register/maritime administration can be carried out by studying the black/grey/white lists of shipping registers produced by the port state organisation, Paris MOU. Flag states that are high up on the white list benefit from being there because they are subject to fewer inspections.

- Classification societies: Apart from the shipping company itself, this is the only organisation that should have thorough knowledge of a ship's construction and condition. The role of the classification society is even more important for ships registered in countries that do not have their own maritime administration. In such countries the responsibility for maritime safety and the environment has been delegated to the society. There are about 60 classification societies in the world of which approximately ten are members of an international cooperation organisation called the International Association of Classification Societies, IACS (www.iacs.org). This organisation places fundamental quality requirements on its members.
- Shipping companies and vessels. The history of a ship and the company that operates it can be obtained from www.equis.org. The statistics and data available here are based on information from the port state control. There is also information on e.g. classification societies and third party liability insurers.

There are several quality indicators for shipping companies:

- The ISO 9000 (quality) and ISO 14000 (environment) voluntary certifications.
- Voluntary classifications, e.g. CAP (hull structure), RPS (redundant propulsion), NAUT (navigation).
- Voluntary measures such as low sulphur fuel and catalytic converters.
- Investment in further training of crews over and above regulatory requirements, such as Bridge Resource Management (BRM).

From the point of view of the cargo-owner, transport is a cost or an expense since it does not contribute to the final value of the processed product. Therefore, the price of the transport that is the single most important factor for the cargo-owner in his role as a customer. Since shipping has a considerable impact on the environment, the consumer and society at large have an interest in how shipping activities are conducted. Only the shipowner is currently responsible for the condition and running of the vessel. One incentive to promote quality shipping is therefore to bestow

an ethical responsibility on the cargo-owner/charterer for his choice of haulier and/or vessel.

1. The cargo-owner should take greater responsibility for his choice of transport.

The market for irresponsible shipping will decrease as cargo-owners start holding the shipping company responsible for how transportation is conducted.

Greater public awareness about the whole transport chain puts pressure on the cargo-owner/commodity producer to choose tonnage that fulfils rigorous environmental requirements. By highlighting the whole transport chain, the incentive to consider aspects other than merely the price of the transport become greater for those involved. The driving-force is that the charterer is aware of the fact that his choice of transport is both registered and published. It serves as an incentive to taking greater responsibility for sea-transportation in order not be associated with substandard shipping.

The undertaking of the cargo-owner should primarily be based on voluntary agreements, stimulated by information instruments. There are examples of other areas where this has been successful, including one from Denmark where the oil and shipping industries have agreed to only use double-hull tankers when transporting hazardous heavy oils.

Implementation should be based on collaborative agreements between the Swedish Shipowners' Association, the Confederation of Swedish Enterprise and the Swedish Maritime Administration with the following obligations:

- A declaration of intent from the charterer/cargo-owner to use tonnage that fulfils quality requirements over and above those that merely concern cost.
- A declaration of intent from the Swedish shipping industry to invest in the development of energy-efficient, green and commercially viable sea-transport solutions.
- The parties should also devise an aggressive research plan to develop shipping into an even more attractive alternative both for Swedish import/export and domestic transport.

A declaration of intent is required from central government to create favorable conditions for quality shipping in Sweden in

relation to other modes of transport and to shipping activities in other EU countries.

International requirements or regulations are often at a minimum which does not sufficiently promote development. Quality requirements need to be set higher and be based on indicators for shipping lines who invest in quality shipping as listed under A above; certification, classification, pollution abatement measures and investment in further training of their crews.

Highlighting the transport chain requires compiled information that is updated annually and easily available to the general public. And an information campaign is required if this information is to reach industry, the media, consumers and organisations. There is information on the transport chain but it must first be compiled and presented so that it is easily accessible. The important actors here are the Swedish EPA and the Swedish Maritime Administration, industry, consumer organisations and the media.

2. Measures to facilitate quality shipping shall be taken.

As knowledge increases, it is both natural and necessary to tighten the regulatory framework for shipping and environmental protection in general. One problem is, however, that more stringent regulations increase the pressure on quality shipping. At the same time, the gap between quality and substandard shipping will increase as the latter will probably not take action but rather find new ways of conducting its activities. Stricter controls of shipping are therefore necessary coupled with incentives for quality operators.

Shipping is an international industry and influence must therefore be exerted on the international process. A project to define "quality shipping" is underway within the IMO and it is crucial that Sweden takes a leading role in this to accelerate the process.

The aim is to provide pre-competitive conditions for quality shipping. The competent authorities can then concentrate their resources on shipping suspected of contravening regulations, such as the requirement to deposit waste at reception facilities in ports.

The Commission on the Marine Environment proposes that shipping lines/operators that fulfil established quality requirements be allowed scope for self-inspection within the framework of the port state control system. Since self-inspection can help save time, this would provide charterers with further incentive to use quality

tonnage. In addition to this, economic instruments (lower port and/or shipping lane tariffs) should be further developed in cases where specific environmental action is taken. Furthermore, Sweden should work internationally within the IMO to combat substandard shipping. A quality system for flag states is currently being designed within the IMO. Sweden should actively try to convince a coalition of interested countries within the IMO to take the lead and e.g. not permit substandard shipping to put into their ports.

There is generally high environmental awareness within the Swedish shipping industry. No other country in the world has such a high percentage of vessels equipped with emission-control technology and low-sulphur bunker oil. As regards the performance ratings of flag states by the European port state control organisation, Paris MOU, Swedish shipping is on the white list. They will therefore benefit from information being disseminated to consumers about the whole transport chain. Cargo-owners/commodity producers will first and foremost wish to distance themselves from substandard shipping. In the long run, the information compiled can also be used to strengthen their brands by being associated with quality transport.

The environmental benefit gained by introducing the above-mentioned measures is dependent on the environmental criteria applied to quality shipping. Based on the indicators we have listed for quality shipping (under A above), it is a matter of reducing the risk of accidents involving oil/chemical spills, less air pollution, better handling of ballast water to reduce the spread of non-native organisms and less risk of problems associated with hazardous antifouling paints on ships.

B. The most valuable areas shall be protected from the negative impacts of shipping.

One of the interim targets of the environmental quality objective *A balanced marine environment* is that illegal oil discharges shall be negligible by 2010. The risk of oil discharge in the event of accidents or mistakes will always remain and it is therefore important to protect the most ecologically valuable sites and to take the necessary action to guarantee a high level of rescue contingency.

Biological values are to a varying degree threatened by direct or indirect effects of shipping. Negative impacts of shipping are found

mostly along shipping lanes, where illegal discharges of oil are common, and in areas that are difficult to navigate where the risk of accidents is considerable. We do not have a complete picture of where the conflicts between nature conservation and shipping interests lie. There is however sufficient evidence to be able to identify sites that from an ecological point of view should be avoided.

3. All shipping traffic shall be diverted away from the most ecologically valuable areas.

All shipping shall be moved south and east of Hoburg Bank to reduce damage caused by commercial shipping accident to Natura 2000 sites and other valuable areas along the east coast of Gotland.

The environmental impact of an oil spill varies depending on where the accident occurs. For example, about 90 per cent of the approximately nine million wintering seabirds in the Baltic Sea can be found on less than five per cent of its surface area (see figure 5.1). As a result of shipping operating in areas of such considerable natural value, even small oil spills can have major, long-term effects on bird populations. If it occurs at an important wintering site, a major oil spill can wipe out large parts of the European populations of certain species.

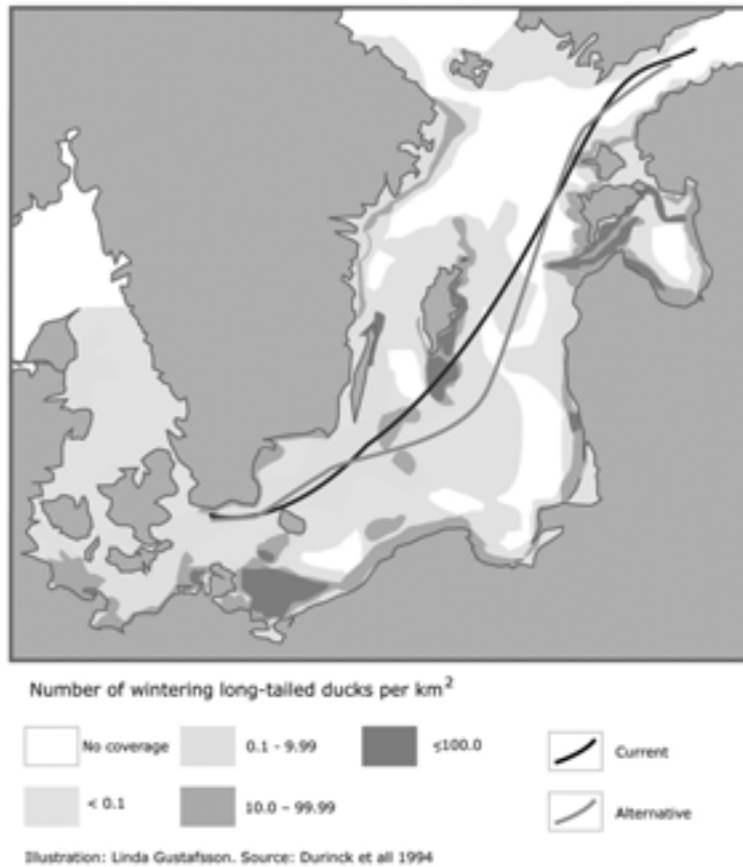


Figure 5.1 Distribution of wintering long-tailed ducks in the Baltic Sea along current and alternative shipping routes. Source: Durinck et al. 1994. Illustration: Linda Gustavsson.

HELCOM has drawn up recommendations to move heavy shipping traffic (vessels with a draught of over 12 metres) south of Hoburg Bank. Since most of the approximately 40,000 vessels that cross Hoburg Bank each year are made up of vessels with a draught of less than 12 metres, even these should use the alternative route.

C. Rescue contingency plans shall be guaranteed.

The increasing amount of oil being transported by tankers that can take over 100,000 tonnes and commercial shipping traffic containing thousands of tonnes of bunker oil demand that the capacity of the rescue services needs to be extended. An accident whereby tens of thousands of cubic metres of oil are discharged into the sea cannot solely be dealt with out at sea. International experience shows that such an accident has serious, long-term consequences for the living conditions of coastal populations and for the environment along large stretches of coastline.

4. Rescue contingency plans shall be strengthened regarding the rescue services ability for carrying out emergency towing, emergency lighterage and fire extinguishing at sea.

There are international examples illustrating that adequate resources to carry out emergency towing, emergency lighterage and fire extinguishing out to sea has prevented major oil spills. Studies carried out by the Helsinki Commission show that such resources are non-existent along large sections of the coastline of the Baltic Sea, not least in Sweden. The capacity to tackle serious accidents early enough should therefore be strengthened and resources jointly planned in different parts of the Baltic Sea.

The Swedish Coastguard has been charged by the Government with the task of performing a feasibility study regarding three major sea-going rescue vessels in order to improve Sweden's capacity in the face of increasing demand.

International cooperation agreements within the framework of the Helsinki Commission should form the basis of coordinated rescue resources in the Baltic Sea.

Fisheries

The Commission on the Marine Environment proposes an overall strategy for fisheries that enables the industry to be managed as part of the ecosystem and provides scope for the precautionary principle to be applied.

The fish in our seas are a public resource and the right to carry out professional fishing activities is granted by the government under certain conditions. Fish are in limited supply and losses incurred when handling them cannot be compensated for by

increased extraction. In the long term, we cannot accept that fish are caught and then thrown back overboard because of poor accuracy and selection capabilities of fishing gear. Short-term economic considerations must not receive priority over long-term objectives that will benefit the whole fishing industry, consumers and the continued survival of fish stocks.

It is the Commission on the Marine Environment's assessment that the *Balanced marine environment, sustainable coastal areas and archipelagoes* objective is unachievable unless powerful and immediate measures are implemented in fisheries. The proposals for revised interim targets and measures, which the Commission feels must be implemented on a national level, are presented below. Achieving the quality objective also necessitates the same extensive changes in fisheries management being implemented in countries that share the same fish stocks as us. In a dialogue with these countries, Sweden must strongly emphasise the need for similar measures. Regarding the Baltic Sea, there is scope provided for this in the proposed regional measures (Decouple the Baltic). For the Skagerrak, this discussion must take place separately.

The Commission on the Marine Environment proposes a revision of interim targets 4 and 5 of the environmental quality objective *A balanced marine environment, sustainable coastal areas and archipelagoes*.

- A. By 2010, the percentage of fish caught by fisheries shall not exceed what is needed to maintain the natural role of fish in the ecosystem. This also requires stocks to be replenished to levels well over biologically safe limits.
- B. Annual by-catches of marine mammals shall be less than 1 per cent of the population of each species respectively no later than 2010. The negative impact on populations or on the ecosystem as a result of by-catches of seabirds, unwanted fish species and young fish shall be no more than negligible.

The Commission on the Marine Environment proposes the following supplementary measures:

1. The prerequisites for enacting a fish protection law shall be examined.

2. The proportion of fish stocks caught shall be reduced and extraction levels shall be established on biological grounds.
3. Catch restrictions shall be established for all fished species and stocks.
4. The capacity of the fishing fleet shall be adapted to suit the available fish resources.
5. Selective and fishing methods and fishing gear shall be developed and employed.
6. Consultation groups for reducing by-catches shall be set up.
7. An institute of fishing technology shall be established.
8. Environmental Impact Assessments (EIAs) shall be introduced for exploratory fishing and when testing fishing methods and Best Available Technology (BAT) shall be applied.
9. Training initiatives for professional fishermen and research covering fish and fish ecology shall be implemented.
10. Scientific advice from ICES shall be strengthened and broadened.
11. An eco-labelling system for fish shall be developed and applied.

A. By 2010, the percentage of fish caught by fisheries shall not exceed what is needed to maintain the natural role of fish in the ecosystem. This also requires stocks to be replenished to levels well over biologically safe limits.

The Commission on the Marine Environment proposes that the current interim target number 5 under the *Balanced marine environment, sustainable coastal areas and archipelagoes* objective be reformulated to also take the important role of fish in the ecosystem into account.

Many fish stocks are currently outside biologically safe limits as a result of overexploitation. The situation is particularly serious for several demersal (bottom-dwelling) fish stocks such as cod, haddock and plaice. The increasing size of other stocks, such as the sprat in the Baltic Sea, is a result of the decline of predatory fish rather than of good management. Fish extraction that is not adapted to the long-term productive capacity of ecosystems threatens not only the stocks but also the fishing industry itself.

1. The prerequisites for enacting a fish protection law shall be examined.

The Commission on the Marine Environment proposes that a committee be appointed to put forward a proposal for regulating fisheries which clearly indicates that fish protection is part of nature conservation as a whole and that such considerations should be the primary basis of new regulations. The Fisheries Act is based on fishing rights. Under a fish protection act, the purpose of protection and conservation could be spelled out more clearly. Here, we can compare the wording in Section 1 of the Forest Act of 1979 (1979:429) which states that the forest is a national asset that is to be managed so that it can provide a sustainable yield at the same time as biodiversity is safeguarded. In its introduction, the Environmental Code also contains a similar paragraph.

New fisheries legislation can satisfy the need for environmental impact assessments to be performed on fishing methods. The principles of when such an assessment is required can be clarified, as can issues regarding how it should be financed. New legislation can also regulate how the BAT (Best Available Technology) shall be applied to the fisheries.

2. The proportion of fish stocks caught shall be reduced and extraction levels shall be established on biological grounds.

The most important measures for saving threatened fish stocks is to reduce the proportion of stocks that die as a result of being fished, so-called "fishing mortality". The quotas (TACs – total allowable catches) for numerous stocks have for many years been at levels that are higher than what can be tolerated by the biological conditions. Thereby an increasing proportion of the fish in a population have been caught, i.e. fishing mortality has gone up. As a result, around 60 per cent of the individuals in many populations currently die every year. If fishing mortality is dramatically reduced, stocks can be built up to levels at which the production of fish will be much greater than it is today. More fish can then be caught at this level despite the fact that the proportion of the stocks that die as a result of fisheries is maintained on a considerably lower level. To maintain long-term, sustainable fisheries, no more than about 30 per cent of the individuals in a population should be fished each year. (See Figure 5.2).

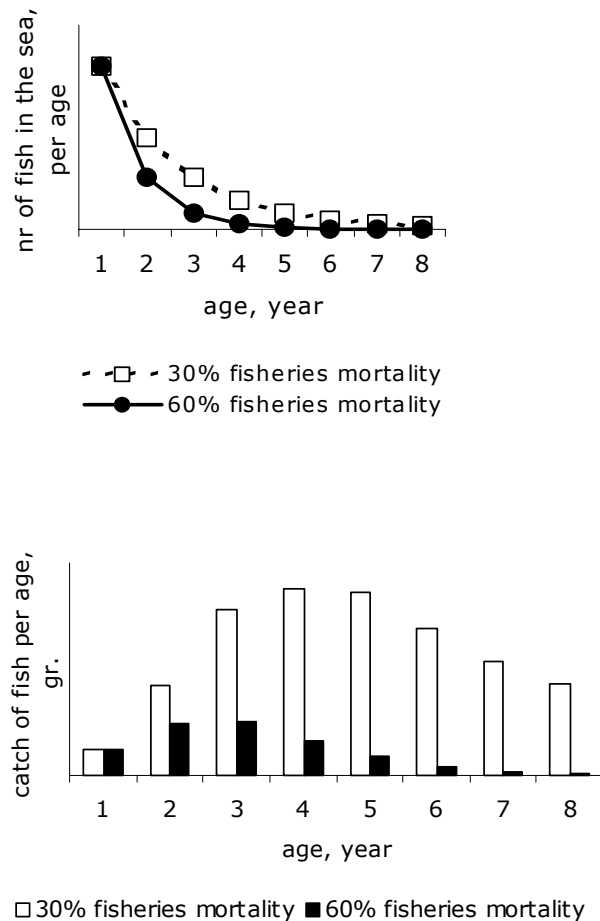


Figure 5.2. The model compares two scenarios: a low (30 %) and a high (60 %) fishing mortality. The size of the catch depends on the growth rate of individual fish as well as on the survival rate per age-group. The growth per age-group and the number of one-year-old fish are assumed to be the same regardless of how much they are fished. The total catch for all age-groups will be more than four times greater when fishing mortality is low (30 %) than when it is high (60 %). This is a general example, based on actual data. (Furthermore, it is worth mentioning that too high fish extraction, 60 %, also causes a lower spawning biomass and therefore poorer recruitment, i.e. fewer one-year-old fish.) Source: Johan Modin, Marine Biology Laboratory in Kristineberg.

Objectives which are concerned with the role of fish in the ecosystem may stipulate even larger fish stocks than those needed to safeguard productive capacity. Examples of such objectives are restoring the geographical distribution of species or a broader age composition. To safeguard productive capacity and the role of fish in the ecosystem, the Commission on the Marine Environment believes that the extraction of fish has to be founded entirely on the biological prerequisites for each fish population and not established with regard to the industry's demand for short-term profits.

Regarding fish stocks that are managed nationally, Sweden can determine the extraction levels. For other stocks, however, measures can only be implemented within the framework of the European common fisheries policy. The fish in the Baltic Sea (including the Kattegat) should be dealt with within the framework of the pilot project proposed in Chapter 4.2. Several fish stocks in the Skagerrak, such as cod, plaice and haddock, must be replenished and their sustainable use guaranteed. Parallel to national measures, Sweden must apply heavy political pressure within the EU in this respect.

Applying the precautionary principle, according to the Commission, implies an immediate ban on fishing for all stocks that are considered to be outside biologically safe limits in order to eliminate the risk of collapse. A replenishment plan should be established with clear goals for how quickly and to what level stocks should be replenished and all fishing (including by-catch) must be incorporated into the plan.

To achieve sustainable use of replenished fish stocks, management plans extending over a number of years and containing long-term goals both for the size of stocks and fishery mortality are needed. These goals shall be well in excess of "safe biological limits" and be based firstly on the role of fish in the ecosystem and secondly on the size of stocks needed for optimum production.

3. Catch restrictions shall be established for all fished species and stocks.

Currently, the fisheries use several stocks, the catches of which are not regulated, mainly due to a lack of knowledge. In order to reduce the risk of stocks being overexploited, all fished stocks must be regulated. If there is a lack of knowledge, preliminary

definitions of safe biological limits should be used until a population estimate is carried out and a management plan established.

Sweden must make a concerted effort to ensure that all commercially used species are regulated, both within the framework of the proposed pilot project for the Baltic Sea and within the EU policies. Regarding stocks that are managed nationally but are not currently regulated, the National Board of Fisheries should establish TACs and begin collecting the relevant data.

4. The capacity of the fishing fleet shall be adapted to suit the available fish resources.

The Commission on the Marine Environment feels that the size of the fishing fleet must be radically reduced, both in the EU, within the framework of the proposed pilot project for the Baltic Sea, as well as nationally.

Scrapping premiums are the best means by which the fleet capacity can most efficiently be reduced. How much money may be paid for individual vessels is regulated by the EU regulation regarding Community structural assistance to the fisheries sector (EC 2792/1999). Generally speaking, less money is paid per tonne, the older and larger the vessel is.

The current level of scrapping premiums has not provided a sufficiently strong incentive to reduce the capacity of the Swedish fleet throughout the sector. This applies in particular to larger pelagic tonnage. There is scope within the EU for supplementing the scrapping assistance with special premiums to the fishermen. Financial assistance may be provided to co-finance national early retirement schemes for fishermen. Funds can also be made available to compensate individual fishermen who have worked onboard vessels that are being scrapped. These options should be used to a greater extent.

The new EU regulation (Council Regulation 2371/2002 EC) provides plenty of scope for each Member State to divide its fleet into segments and establish conditions for entry into or withdrawal from the fleet. On 30 January 2003, the Government submitted a bill amending the Fisheries Act of 1993 (1993:787) and the Act pertaining to the EU regulations on the common fisheries policy of 1994 (1994:1709). These amendments, which came into force on 1 July 2003, enable fisheries to be regulated not only for reasons of

fish conservation but also based on how the fisheries operate. For regional policy reasons, scope is also provided for directing fisheries towards certain areas and distributing them among different categories of fishermen, e.g. by allocating the quotas on a central level to different groups of fishermen.

A political objective regarding fisheries is to create jobs in the coastal region. Angling is seen by several groups as a direct competitor to coastal fisheries and other professional fishing. At the same time, there is an alternative way of using the fish resources professionally based on leisure fishing, namely fishing tourism. This industry can greatly help to provide employment in coastal municipalities. Fishing tourism should be put on the same footing as the rest of the fisheries industry regarding both obligations and rights.

B. Annual by-catches of marine mammals shall be less than 1 per cent of the population of each species respectively no later than 2010. The negative impact on populations or on the ecosystem as a result of by-catches of seabirds, unwanted fish species and young fish shall be no more than negligible.

Interim target 4 of the *Balance marine environment, sustainable coastal areas and archipelagoes* objective states that by-catches of seabirds and unwanted fish species shall have been minimised to levels that do not have a negative impact on populations. The Commission on the Marine Environment proposes that also by-catches of young fish shall be included in this interim target and that the role of the different organisms in ecosystems should be taken into consideration.

Fishing has an environmental impact not only on fish stocks, as we have previously outlined, but also on other components in the ecosystem, e.g. as the result of by-catches or mechanical impact on seabed environments. This impact can be mitigated in different ways, for example by adapting fishing methods and fishing gear and by looking at where and when fishing activities are carried out.

5. Selective and humane fishing methods and fishing gear shall be developed and employed.

Humane fisheries use passive fishing gear that catches the fish alive. Some passive gear can however lead to more by-catches of e.g. birds and mammals. Gear that catches the fish alive (e.g. fish traps, cages, hoop nets and creels) can reduce fishery mortality since it can often be fitted with a species selection device. Selection can be made both in terms of species and size with a high degree of accuracy and a good survival rate. Investment in the development of these types of fishing gear is poor and according to the Commission on the Marine Environment should be increased considerably.

For nets, greater selection involves increasing the mesh opening so that fewer quantities of young fish will be caught. Juveniles make up a major proportion of stocks that are severely exploited. An increase in the mesh opening when fishing for severely exploited stocks must be accompanied by a reduction in TACs to begin with in order to prevent fishery mortality from increasing and the measure having the opposite effect to the one intended. This fundamental aspect of an increase in the mesh opening has not yet been taken into account in the current management measures for cod, primarily in the Baltic Sea.

The development of more selective and more humane fishing methods and gear will not only reduce fishery mortality, which is the result of catching the wrong size of fish, but also reduce by-catches of species other than the one intended and cause less damage to the marine environment.

Fisheries technology is undergoing rapid development, but Swedish research in the field is lagging behind. Professional fishermen are experimenting with selection and some scientific trials are being carried out, but without continuity, sufficient resources or long-term goals. Selection methods must be developed in partnership with the fisheries industry. At the same time, scientific methods are needed in order to perform quantitative evaluations of the properties of new or modified fishing gear and the vast majority of these need to be carried out as research projects.

6. Consultation groups for reducing by-catches shall be established.

The Commission on the Marine Environment proposes that working groups comprising professional fishermen and researchers be formed to find solutions to the by-catch problem. These groups should work interactively with common analysis and proposals for solutions, evaluation of the proposals and further modification.

Examples of possible cooperation groups are: marine mammals and birds in net-fishing, juvenile fish in small hoop nets, sharks and rays in seabed trawling, juvenile whitefish and scaly fish in vendace trawling.

The institute of fishing technology proposed below is a natural starting-point for the cooperation groups. A similar system of cooperation groups is also applicable in other fields, for example to tackle the problem of mechanical damage to sensitive seabeds.

7. An institute of fishing technology shall be established.

The Commission on the Marine Environment proposes the establishment of an institute of fishing technology responsible for the development of selective and humane fishing gear and methods, primarily focusing on passive fishing methods. It is crucial that the fisheries industry participate in these activities so as to make full use of the fishermen's knowledge in developing suitable gear.

The institute of fishing technology will increase collaboration among authorities, researchers and industry in the development of methodology that makes it easier for the fisheries to adapt to the environmental objectives. Work should therefore be prioritised in relation to the environmental objectives, up-to-date research results concerning the environmental impact of fishing and the needs of fisheries management.

The Swedish Institute of Agricultural and Environmental Engineering (JTI) is an institute of industrial research that conducts research, development and information activities in the areas of agricultural and environmental technology. JTI is partly funded by the agricultural industry and by FORMAS (Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning) and can act as a model when establishing the institute of fishing technology.

The institute can be independent, belong to another technical university or be a department at the National Board of Fisheries.

Regardless of its organisational form, the Commission on the Marine Environment proposes that the institute be strategically located, for example in or around Lysekil, where the National Board of Fisheries Marine Laboratory, the Royal Swedish Academy of Sciences and the University of Gothenburg are all situated. Even the training for professional fishermen proposed below should be located at or near the institute. All this would facilitate communication and cooperation between the authorities, researchers and the industry.

8. Environmental Impact Assessments (EIAs) shall be introduced for exploratory fishing and when testing fishing methods and Best Available Technology (BAT) shall be applied.

Professional fishing should be put on par with all other industries regarding environmental consideration. This implies, for example, the application of Best Available Technology (BAT) to prevent damage to the environment. This refers to both the technology used and the way in which vessels or fishing gear are constructed, maintained, operated and decommissioned. In those cases where there are different items of fishing gear or methods of catching the fish in question, the method that involves the least damage to the fish population and to other components in the ecosystem shall be used. This means, for example, that the trawling of Norway lobster should cease in those areas where it is possible to fish using cages. This also means that trawling for cod will be replaced by fishing with passive gear (nets).

Environmental Impact Assessments for fishing gear and fishing methods are an important component in evaluating their impact. Evaluation results should be applied to existing gear and methods as well as new technology prior to it being brought into service. The Commission on the Marine Environment proposes that more detailed regulations on how authorised gear of a certain type is to be constructed be adopted within the framework of the current regulatory system. One prerequisite is that the definitions tally with European technical provisions regarding minimum mesh openings, etc. Where necessary, however, the definitions can be more restrictive and detailed without contravening EU regulations. The list of gear definitions can then be incorporated into the National Board of Fisheries regulatory framework and specified for each sea area respectively. If any interested party wishes to have an approved item of gear modified, this modification should be

assessed jointly by the National Board of Fisheries and the Swedish EPA, after an EIA has been performed.

Fishing rights are regulated in the Fisheries Act of 1993 (1993:787) and subsequent amendments. The act includes fisheries regulations. Under these, the Government or the authority appointed by the Government may issue regulations for fish conservation, banning or restricting fisheries in some respects, and regarding the consideration the fisheries must take in the interests of nature conservation. Under the Government Ordinance on Fisheries, Aquaculture and the Fishing Industry from 1994 (1994:1716), the National Board of Fisheries may decide that an analysis shall be performed of the environmental impact of a particular fishing method. Furthermore, the National Board of Fisheries may also decide that the costs of such an analysis shall be met by the party wishing to use a new method. These are examples of how consideration is shown for nature conservation interests when regulating the fisheries. There is no direct link to other fishing regulations. The National Board of Fisheries has only used its authorised powers on a small number of occasions. No requirement for an environmental impact assessment was specified in these cases.

Regulating fishing gear in such detail obviously limits technical development. This is the aim of the proposal, since the unchecked efficiency improvements in fisheries have contributed to the current overcapacity of the fleet and excessive fishing pressure. It is however important that environmental impact assessments can be performed relatively quickly so that they don't unnecessarily prolong the introduction of environmentally friendly or ergonomically beneficial fishing gear.

9. Training initiatives for professional fishermen and research covering fish and fish ecology shall be implemented.

There is a palpable need for greater resources for both professional training and research studies within fisheries and fishery biology. This is causing a lack of communication among fishermen, researchers and managers. A study of the training requirement within fisheries carried out in 2000, indicates that new knowledge is needed, not only concerning the interaction between various parties but also regarding detailed knowledge in the different fields. The study proposed that formal training requirements be specified to obtain a professional fishing licence, something which the

Commission on the Marine Environment also supports. Discussions on the establishment of a training and development centre are ongoing with upper-secondary and higher education authorities. The Commission on the Marine Environment feels that the above-mentioned training is a matter of national importance and should therefore be allocated national resources. Furthermore, training facilities should be located close to the proposed institute of fishing technology to facilitate exchange of knowledge and communication between researchers and fishermen.

Apart from the Department of Aquaculture at the Swedish University of Agricultural Sciences in Umeå, Sweden has no research training in the fields of fishery biology, fish biology or fish ecology. University research on the subject of fish and fisheries has so far depended completely on the interests of individual researchers.

Research on fish and fisheries must be firmly rooted in ecological theory and methodology, which can only be achieved if it is conducted in a broad research environment, e.g. at the country's various marine research establishments (in Umeå, Stockholm and Gothenburg). The Commission on the Marine Environment proposes that permanent research schools of "Fish Ecology and Fisheries Biology" be created at these establishments. To prevent these research schools from only concentrating on the problems of the fisheries industry, they are to be incorporated into the existing ecological departments but should be established as separate research subjects.

The research schools at the various universities are to work together and even be integrated into the activities conducted at the institute of fishing technology. The research schools should also be linked together by a common advisory group, comprising stakeholders and research beneficiaries, with the task of identifying important fishing and research issues. Both the research schools and the institute of fishing technology should consciously identify social science issues that are relevant to the various parts of the fisheries and its "greening" in addition to issues of a natural science or technological nature.

10. Scientific advice from ICES shall be strengthened and broadened.

The International Council for the Exploration of the Sea (ICES) is an intergovernmental cooperative body for marine research and has functioned as an advisory body primarily regarding fisheries issues in the North Atlantic region, at the request of the EU and HELCOM. In the last decade, ICES has broadened its remit to include marine ecosystem issues and issues relating to the environmental impact of fisheries. The Member States, including Sweden, have traditionally provided ICES with high expertise regarding quintessential fishery management issues. When it comes to new fields such as environmental and ecosystem issues, ICES does not, however, have the same tradition and weight. The best researchers in these fields are to be found at the universities, which have no connection to ICES: At the same time, there is no alternative to ICES for the major commissioning bodies, especially not for the EU Commission.

National efforts to develop the necessary background information, both traditional fish biology data and qualitative and quantitative information on the impact of fisheries on the rest of the ecosystem, must be strengthened. Sweden's prospects for active participation will be strengthened by the efforts made at the research schools and the institute of fishing technology. Marine ecologists from the universities are also needed, however, and their participation must be encouraged and funded.

Adding representatives from the Ministry of Agriculture/National Board of Fisheries and the Ministry of the Environment/Swedish EPA should also be considered to increase Swedish representation on ICES councils.

11. An eco-labelling system for fish shall be developed and applied.

Consumers demand information on how and where various products are manufactured and whether this has been done in an environmentally friendly way. This is especially true of food products and hence also of fish and fish products. Currently there is a requirement that all fish must be marked with their country of origin. On the initiative of the National Board of Fisheries, the fisheries industry has recently started a project to review the scope for eco-labelling fish, in partnership with the KRAV eco-label association.

A certification or eco-labelling of fish and fish products would enable fishermen who fish using more environmental friendly methods (e.g. use humane fishing methods, avoid threatened stocks and reduce their use of chemicals) to be better paid for their fish. Certification schemes would hence act as an important driving force towards more environmentally friendly fishing and therefore be a significant supplement to greener fishing methods.

An efficient eco-labelling system requires relevant information on stocks, fishing methods and how the fisheries are run (e.g. whether regulations and quotas are respected, etc.) Several of the proposals put forward by the Commission on the Marine Environment should facilitate eco-labelling.

Toxic substances

A large amount of harmful chemical substances are spread in the environment during the manufacture and use of products and goods. There are also different forms of direct discharges of harmful chemicals. In addition, substances are also formed during different processes, such as combustion. Some of these substances only degrade slowly and remain in the environment for a long time. Examples of such substances include dioxins, PCB, DDT and brominated flame retardants. These toxic substances can be found in fish, meat, dairy produce and in mother's milk.

Chemical substances can be harmful in several different ways (see also Section 2.4 *Toxic substances*). When substances have been proven to lead to actual damage to human health or the environment, they are said to be toxic substances or toxins. They may be carcinogenic, mutagenic or disturb to reproduction. Substances that are hazardous for flora or fauna in the environment are called ecotoxic. The assessment of a substance's toxicity is normally based on data on actual damage (in laboratory studies). A substance's inherent properties, persistence and bioaccumulability are however different from its toxic/hazardous properties since persistence and bioaccumulability are not properties that are intrinsically harmful for health or the environment. But the fact that a substance is persistent and bioaccumulating may lead to both prolonged and high exposure. This increases the risk of damage which does not always manifest itself when the substance is being tested for toxicity.

The problem with the use of persistent, bioaccumulating and toxic substances that are e.g. carcinogenic, mutagenic and toxic to reproduction is that the effects of emissions – both direct and diffuse from products etc. – are or can be delayed. What is emitted today may lead to effects that only manifest themselves one or two decades later. It can also take a long time before measures employed to prevent emissions have any effect, especially if levels of the substances have been built up over a long period of time. Even if we succeed in preventing the emission of a persistent chemical, the quantities of the substance that have already reached e.g. the marine environment may remain there for a long time.

The threat posed by the harmful effects of chemical substances means that preventive measures have to be carried out and longer time perspectives have to be employed than what is the norm in today's society. A starting-point must therefore be Sweden's environmental quality objective *A non-toxic environment*, which also applies to the Baltic Sea and North Sea. The objective states that within one generation (i.e. by about 2020), the environment is to be free from substances and metals that have been created or extracted by society and that can threaten human health or biodiversity. The environmental quality objective also states that concentrations of naturally occurring substances in the environment shall be close to background levels and that concentrations of non-native substances in the environment shall be close to zero. There are also six interim targets formulated under the *Non-toxic environment* quality objective. One of these concerns especially hazardous chemicals. The specific aim of this target is to phase out:

- substances that cause cancer, affect genetic make-up and disturb reproduction,
- organic substances that are persistent and bioaccumulating, and
- the heavy metals mercury, cadmium and lead.

Such substances should e.g. not be used in new products or in production processes unless the company can prove that health and the environment will not be damaged. Existing products that contain the above-mentioned types of substances shall be taken care of in such a way as to prevent the substances from leaking out into the environment. The interim target refers to substances that humans have produced or extracted from the natural environment

and material that gives rise to substances with the above-mentioned properties, including those formed accidentally.

The Commission on the Marine Environment proposes that the following more precise details be added to the *Non-toxic environment* quality objective.

- A. All fish caught in Swedish seas shall be suitable for human consumption.
- B. The impact of toxic substances on the marine ecosystem shall be negligible.

The Commission on the Marine Environment proposes the following supplementary measures:

1. Sources of toxic substances which currently lead to the imposition of dietary restrictions should be identified and rectified as far as possible.
2. The output and formation of toxic substances originating from combustion shall decrease to non-hazardous levels.
3. Environmental monitoring shall be strengthened and be able to predict risks before damage occurs.
4. Environmental monitoring activities shall be linked to the need for measures.
5. The capacity of municipal wastewater treatment plants to treat new substances shall be guaranteed.
6. An information requirement for chemical substances in products shall be introduced.

A. All fish caught in Swedish seas shall be suitable for human consumption.

Powerful measures must be implemented to prevent and in the long term reduce concentrations of hazardous substances such as PCB and dioxins to a level where dietary restrictions on fatty fish can be lifted. Health risks associated with PCB, DDT, dioxins and mercury have resulted in fatty fish species from inland lakes, the Baltic Sea and the Bothnian Bay being subject to dietary restrictions. According to the National Food Administration, particularly sensitive groups, such as breast-feeding mothers, pregnant women, women of child-bearing age and girls, shall limit their consumption of these species. Studies indicate that Swedes ingest fewer dioxins and less PCB and DDT via their food than

previously. Despite this, every tenth Swede ingests more dioxins and PCB than is considered acceptable. Risk assessment of certain toxic substances has become stricter over the years. Extensive efforts are being made in Sweden and internationally to reduce emissions of dioxins during combustion, to identify and rectify sources of PCB and limit the use of mercury. Despite this, there is still a lack of knowledge as to the health and environmental effects of many chemical substances.

The water and hence the fish in the Baltic Sea and the North Sea is/are affected by emissions in Sweden and other countries. One example is that more than 85 per cent of the world's total PCB use can be traced to a geographical area between 30 and 60 degrees latitude in the Northern Hemisphere, i.e. the entire industrialised world. The potential of these substances to be dispersed over large geographical areas is described in detail in studies on their occurrence in arctic and sub-arctic regions.

Even though direct emissions in Sweden are limited, there are still major emission sources in northern Europe and the former Soviet Union. Harmful substances, large amounts of which have accumulated in the soil and sediment, are a significant source of toxins like PCB. A cost-effective way of reducing levels of PCB, dioxins and furans in fish in the Baltic and North Sea may therefore be to initiate measures outside Sweden's borders as well. Previous load reductions measured, for example in the Baltic, indicate that further restricting emissions from remaining sources can have a rapid effect. It would also be worthwhile extending the measures to include more substances than up to now. For example, attention should be paid in particular to carcinogens, mutagens and substances that disturb reproduction and persistent and bioaccumulating substances.

1. Sources of toxic substances which currently lead to the imposition of dietary restrictions should be identified and rectified as far as possible.

Levels of e.g. PCB, dioxins and furans have not decreased quickly enough over the last ten years for us to expect them to be reduced further in the near future. This is very worrying. The Commission on the Marine Environment therefore proposes measures that will help reduce levels of these substances in fish.

The sources that potentially contribute to the load in the Baltic Sea should receive priority, primarily because this is where levels

are highest and because levels decrease much more slowly in the Baltic due to its limited water exchange. Both international and national measures are needed to tackle this problem.

We propose that an action group, with representatives from all the Baltic Sea states and the EU, be established as a result of various EU bodies and HELCOM working together. The Commission on the Marine Environment feels that Sweden should take a leading role in this initiative. The groups should begin by surveying the sources and assessing the size of emissions. Considerable importance should here be attached to actively including countries whose production, consumption and emission estimates are uncertain. The groups shall assess what further measures are necessary to reduce emissions of PCB, dioxins and furans to levels that alleviate the environmental load primarily on the Baltic but also on the North Sea. The group should also assess what other harmful substances should be given priority in the work to reduce emissions. As part of its remit, the group should allocate priority to limiting emissions, the disposal and safe deposition of waste from sources including the following:

- Landfills, contaminated soil and sediment, etc.
- Jointing compounds and other building materials.
- Combustion processes containing above all halogens and heavy metals.
- Industrial processes containing e.g. halogens, harmful organic substances and heavy metals (mercury, lead, cadmium etc.).
- Products/processes containing PCB and old PCB repositories.

The action group must also endeavour to build up knowledge in the participating countries concerning:

- The relationship between various emissions and the levels of each substance in the Baltic and the North Sea.
- Accuracy of current emission estimates and the shortcomings in future national and international estimates.
- Strengths and weaknesses in existing and future load estimates and models for the Baltic and North Sea.
- Transport mechanisms for long-distance dispersion.
- Degradation and re-circulation mechanisms in the aquatic environment.

A strategy for rectifying the most important national sources should be formulated. This can be done by coordinating the existing anthologies of contaminated sites. Only those sources where improvement measures are of key importance for total national emission levels should receive priority. The aim shall be to reduce Sweden's total discharges to the Baltic and North Sea.

At present, there is no overall national strategy aimed at reducing the total Swedish load of PCB, dioxins and furans, as well as certain other particularly important substances. The sources are currently being surveyed and the size of the emissions assessed by the Swedish EPA at the request of the Government. When this survey is complete, measures should be focused on emissions that impact the Baltic Sea. These measures should include emission abatement, and the management and safe disposal of waste from:

- Landfills, contaminated soil and sediment, etc.
- Jointing compounds and other building materials.
- Combustion processes containing halogens.
- Industrial processes containing halogens and organic material.

2. The output and formation of toxic substances originating from combustion shall decrease to non-hazardous levels.

As part of the work to lower concentrations of toxic substances in fish from the Baltic and North Sea, an action programme to reduce the formation and emission of toxic substances and other harmful substances during combustion is required. This work should be based on the *Non-toxic environment* quality objective and its interim targets. Basically this means that producers need to take on an extended responsibility through voluntary and legally binding undertakings. The proposed action aims to reduce the contributions from combustion to the occurrence of harmful chemical substances in the sea by implementing national measures.

Optimised combustion and refined flue-gas treatment technology have reduced the total emissions of regulated toxic substances. This applies primarily to PAH and dioxins. In all likelihood, implemented measures have also led to a reduction in other potentially toxic substances that can be formed during the combustion process but which have not been subject to measurement and control. Society faces a situation where the number of incineration plants will increase markedly in the non-too-distant future, caused by the introduction of new regulations

banning organic waste in landfills. Decommissioning nuclear power may also lead to an increase in the combustion of fossil fuels and renewable hydrocarbons (woodchips, wood, etc.)

The action programme should include several components:

Waste

The requirements on intermediate waste storage facilities and landfills must be more stringent than they are today in order to combat uncontrolled fires. In addition, it should be mandatory to establish action programmes for major landfill sites. Both small and large landfills can be expected to cause problems if fires occur. Better supervision of landfills is required. The large number of exemptions from the landfill ban that are currently granted should be revoked. According to Swedish calculations, emissions of chlorinated dioxins from uncontrolled combustion in landfills are as large as from all other combustion sources put together.

Combustion

Emission requirements on existing major biofuel plants must be as stringent as those on other combustion plants regarding metals and organic substances. Requirements regarding the disposal, separation and combustion of all types of products, as well as ash and slag at biofuel combustion plants and other large-scale combustion plants should also be tightened. The combustion of unseparated waste should not be permitted. The supervision of waste incineration plants should be tightened. Industrial organisations should encourage all combustion plants (including biofuel plants) to be environmentally certified.

Targeted measures to facilitate the conversion of private households with old heating systems to new non-combustion-based alternatives (district, geo-thermal heating, solar energy and windpower) should be implemented.

Control programmes

A screening survey should be performed which evaluates chemical control programmes of flue-gas emissions and leakage from ash and slag dumps at the largest plants. These programmes should also be compared to biological impact control programmes. The results may provide the basis for assessing how large a source of both "known" and unknown potentially toxic substances a particular

plant is. The Swedish EPA, in partnership with the National Energy Administration and the National Chemicals Inspectorate, should be given the task of initiating a research programme aimed at developing chemical control programmes for both soil and water.

In addition, isokinetic (flow-proportional) sampling of combustion gases in all major combustion plants (including biofuel plants) is needed in order to obtain a clearer total estimate of the emissions. This can be aided by chemical markers for the occurrence of various types of undesirable combustion products, which would reduce costs. It is proposed that the National Energy Administration be given the task of initiating a programme to develop "on-line" methods of measuring chemical markers.

Information

Individual households can be of relatively major significance for the occurrence of toxic substances in connection with combustion. By increasing the amount of information on the drawbacks of small-scale unchecked combustion, the relatively large emissions from these sources can be reduced.

B. The impact of toxic substances on the marine ecosystem shall be negligible.

A holistic, comprehensive approach is needed to reduce the impact of toxic substances on marine ecosystems. This should be based on the *Non-toxic environment* quality objective and its appurtenant interim targets.

A survey of residual products from our consumption should be performed and patterns of our production and use of chemical products need to be further studied with the aim of proposing concrete measures.

More environmental monitoring and a more holistic approach in general are needed instead of merely focusing on individual substances. For example, action plans and environmental monitoring should be performed to a greater extent regarding major groups of chemicals which have similar inherent properties (CMR and PB substances, i.e. carcinogens, mutagens or substances toxic to reproduction, and persistent and bioaccumulating substances).

There is a considerable lack of knowledge as regards the impact of chemical substances on marine ecosystems. It is therefore extremely important for us to increase our knowledge in this regard and this necessitates a comprehensive environmental monitoring programme. Knowledge is also needed as to which substances reach the sea from watercourses and in wastewater via our treatment plants. Above all, we need knowledge that provides us with the possibility to act before problems arise.

Until now, monitoring has mainly concentrated on a small number of substances (the traditional organic toxins and a few heavy metals) and often in limited areas. The large-scale handling of toxic and ecotoxic substances in our modern-day society means, however, that our current environmental monitoring activities are totally insufficient. Very little is known about the pollution caused by present-day chemical use. For example, we currently do not know whether such pollution will force us to issue more dietary restrictions in the future or what the large-scale impacts might be on the ecosystem.

3. Environmental monitoring shall be strengthened and be able to predict risks before damage occurs.

Environmental monitoring must follow up the effects of implemented measures in the environment to a greater extent. This would lead to unexpected increases in and the negative impact of known and unknown toxic substances being discovered at an earlier stage. The *Non-toxic environment* objective and its interim targets should again be the basis of how priorities are allocated. One reason for why a chemical substance becomes an environmental problem is that it degrades slowly in the environment and/or bioaccumulates. For this reason, poorly managed landfills, the unchecked combustion of refuse and demolition material, modified chemical or physical conditions in sediment can all suddenly release stable substances that have previously remained bound in the sediment.

Many years' environmental monitoring has provided information on the concentrations and impact of some of the substances that have already reached the marine environment via treatment plants, air precipitation or some other dispersion route. The knowledge gained from studies of archetypal toxic substances can be used in surveys of new, previously unknown ones. An important starting-point for future efforts is therefore to broaden

the perspective and place emphasis on new substances, especially those that are persistent and bioaccumulating. The monitoring of chemical substances and their impact is currently coordinated through the International Council for the Exploration of the Sea (ICES). Over a considerable length of time, ICES has built up a solid database and has coordinated reporting, analysis and regular assessments on the state of the environment.

Swedish monitoring of toxic substances is unique since the time series are very long. Samples taken in the environment are characterised by a relatively large natural variation from one year to the next. Long time series of measurements are therefore necessary in order to be able to interpret changes in the load of different chemicals to the marine environment correctly. Environmental monitoring activities have the world's oldest bank of systematically collected and well-defined samples at their disposal, which allows for the retrospective analysis of newly discovered toxic substances from the end of the 1960s and onwards. Developing Swedish environmental monitoring and coordinating it effectively with international activities has the potential to build up a pro-active form of environmental monitoring.

4. Environmental monitoring activities shall be linked to the need for measures.

Pending new EU chemicals legislation, measures must be taken based on the information we have today. Environmental monitoring in Sweden has provided essential information on how we must prioritise measures to protect the marine environment. Monitoring also indicates the effects implemented measures have on the environment and is an important part of the follow-up of the environmental quality objectives. Despite this, there are shortcomings, especially since environmental monitoring targets a fraction of the chemical substances that can be found in the environment. A strategy is needed for how we should proceed from the tangible control of just a few substances to the more varied control of hundreds or maybe even thousands of substances that are feared to be harmful. This strategy needs to include an analysis of how we should select and manage to control all these chemicals in a suitable and viable manner and how information should be disseminated to authorities and decision-makers.

Furthermore, the levels in the environment at which we can expect these substances to make an impact are generally unclear.

Analysing the results of effect monitoring is complicated and it is therefore important to improve existing methods and to develop new methods of biological effect monitoring.

The aim of environmental monitoring is to help us ascertain what measures we need to prioritise based on today's extensive use of chemicals.

For a small number of substances that have known toxic effects and constitute a serious threat to the environment, there are international agreements on monitoring and reporting to intergovernmental organisations such as the regional marine conventions (HELCOM, OSPAR). The aim here is to determine the extent of change in the environment in quantitative terms in order, for example, to follow up political pledges on halving emissions within certain time periods. The OSPAR Convention also covers radioactive substances. In order for Sweden to comply with these agreements, it is essential that the existing national environmental monitoring programme for radioactive substances and expertise in the research areas of radio-ecology and radiation biology be developed.

Environmental monitoring

The Swedish EPA should be charged with the task of improving the existing environmental monitoring of chemicals and toxic substances using a number of measures.

- In partnership with relevant authorities, the Swedish EPA should be instructed to design a national strategy for rendering environmental monitoring more long-term and cost-effective.
- Current environmental monitoring programmes should be broadened and developed. Substances that are currently screened and that are shown to occur in the environment at levels over known effect limits must be included in current monitoring programmes. Increased screening is also needed to cover more substances that are potentially toxic. This screening should be based on existing lists of priority substances. Monitoring should also have greater geographical coverage to provide a more comprehensive picture of the state of the marine environment.
- For monitoring to be preventive, tighter requirements are needed on tried and tested analysis methodology with detection levels that are sufficiently under the effect levels for

substances that do not naturally occur in the environment. In addition to the biological effect monitoring of organisms in our seas, so-called “bioassays” should be used in aquatic organisms to look for toxic substances by dividing selected samples chemically and testing their toxicity.

It is important to enhance methods of studying and increasing knowledge about the spread and occurrence of potential toxins. Along with information from the product register, other databases and model calculations, this knowledge forms the basis of risk analysis and priority allocation. Collecting more samples in the existing environmental sample bank enables retrospective studies to be performed of newly discovered problem chemicals. This will constitute important reference material and facilitate the interpretation of extended screening activities. The recently developed monitoring programme for radioactive substances further helps to provide a more comprehensive picture of the state of the environment.

Action plans

The National Chemicals Inspectorate should be charged with the task of developing action plans to limit the risks of identified substances that cause problems for the marine environment. To assign priority to these substances, a systematic approach is employed where the substance is identified, effect levels are estimated, the most significant sources are identified and relevant water areas are screened. The task should be delimited so that within 3–5 years there will be a basis for risk limitation measures.

5. The capacity of municipal wastewater treatment plants to treat new substances shall be guaranteed.

The Swedish EPA should be charged with the task of examining how our municipal treatment plants can be adapted to better suit today’s “chemical” society. The Swedish EPA should elucidate the origins of both known toxins and other harmful substances (pharmaceuticals, goods, products, flows), what happens to chemical substances in the treatment plants (separation via particles, metabolism, etc.) and to what extent and in what form they reach our watercourses. The Swedish EPA should consider how the flow of toxic substances from treatment plants can be abated, e.g. by separating various in-flows, creating barriers and

employing technology to destroy harmful substances. This task should be performed in close partnership with relevant authorities, the water and wastewater industry and researchers. The measures will also create the right conditions for the transfer of technology and knowledge to other countries.

Recipient control outside treatment plants must include toxic substances to a greater extent than at present, which means that the monitoring of discharges to water and to the marine environment must be stepped up. Monitoring shall also include screening for both known and potential toxins regarding both levels in and effects on biota (see the section on screening below).

Municipal treatment plants have the technology for dealing with organic material and are specially adapted to fix phosphorus and nitrogen. However, they do not have the technology to separate toxic substances from household wastewater, stormwater or wastewater from connected industrial plants. Measures have been implemented to reduce flows of toxic substances to treatment plants. The primary aim of these measures has been to reduce and eliminate toxic substances that would otherwise find their way into treatment plant sludge. Relatively little effort has been put into reducing toxic substances that pass through treatment plants despite studies indicating that a substantial proportion of the toxic substances in wastewater are flushed out of the plants and find their way into watercourses and the sea.

Wastewater contains substances such as pharmaceutical and hygiene product residue. Knowledge as to what happens in treatment plants to these substances and other known and potential toxins is very inadequate. Some may, for example, be converted into harmless substances, others to even more hazardous ones, during the treatment process. There are several reports showing that the active substance in contraceptive pills, ethinyl estradiol, in addition to natural oestrogen, is responsible for a large share of the oestrogenic effect observed in the environment, e.g. that male fish exhibit more female-like tendencies outside treatment plants. Another example of how the environment is affected is the extensive use of antibiotics that have caused resistance in bacteria in treatment plants and in wastewater recipients. There is hence a great need to reduce the amount of substances and potential toxins from municipal treatment plants.

6. The capacity of municipal wastewater treatment plants to treat new substances shall be guaranteed.

A special investigator should be called upon to propose how we can satisfy the requirements of various target groups for information on chemical substances in products. The proposal should be used as a Swedish contribution to EU efforts, i.e. the starting-point should be on developing a system that could be applied in the entire EU. It is proposed that the investigator highlight the different approaches, bearing in mind the number of product-types, and the fact that products contain chemical substances of varying toxicity. Furthermore, the investigator should highlight which chemical substances shall be covered by the information requirements and how these should be introduced. The investigator should also elucidate how information is to be disseminated to relevant target groups via various manufacturing and supplier chains. The task should be performed in close collaboration with relevant authorities and the business sector. It is important that practical solutions are developed and that industry's experience of such solutions is utilised effectively.

A large amount of marine pollution originates from chemical products and goods used in society. There is an information requirement imposed on products and goods that harm our environment. Information is needed to be able to implement measures when handling these products with the aim of preventing hazardous substances from reaching the sea. Equipped with more information, consumers are in a better position to "opt out" of chemical products and goods that may damage our environment. Concerning chemical products, common EU regulations have been in place for some time governing the type of information that must be supplied and what form this should take for products that may constitute a health-hazard. Equivalent requirements have now been in place for about a year regarding products that may constitute an environmental hazard. There are, however, no corresponding regulations for goods, despite the fact that there are about 35 million tonnes of hazardous chemical substances found in goods in our society.

It is yet uncertain, but all evidence suggests that an information requirement for chemical substances in goods will not be part of the new EU chemicals legislation that is currently being prepared. One reason for this is that there are no good examples of how an information system for goods might be constructed. Here, Sweden

has the chance to take the lead in international chemical work and develop such a system.

Eutrophication

When an ecosystem gradually changes as a result of anthropogenic impact (e.g. eutrophication, increased toxin levels, climate change and overfishing), a point is normally reached at which it suddenly alters dramatically. The ecosystem is then said to “flip” (see Section 2.1). Changes in the species composition of floral and zooplankton, probably as the result of high nutrient discharge and a changing fish fauna, indicate that the Baltic Proper is undergoing a dramatic shift in the ecosystem’s structure and function, a so-called “ecosystem flip”. Restoring a flipped ecosystem to a previous state of equilibrium presupposes awareness of the nature of the problem and necessitates a long-term programme of measures. In addition, experiences from freshwater systems indicates that we may need to “rewind” the change process much further back than the load level at which the “flip” occurred, in order to bring about a change in the opposite direction. Efforts to restore the system can therefore seem to be fruitless for a long time since there are no or very few visible signs of recovery taking place.

The Commission on the Marine Environment has ascertained that achievement of the environmental quality objective *Zero eutrophication* will necessitate a reduction in nitrogen emissions to the level they were in the 1940s. The Commission estimates that the 1940s level was about 40,000 tonnes per year south of Åland.

The Commission proposes that the following supplementary measures be attached to the *Zero eutrophication* objective.

1. The cultivation of follow-up crops (catch crops) shall be set at a permanent level of 100,000 hectares.
2. The area of arable land tilled in the spring instead of in the autumn shall be set at a permanent level of 100,000 hectares.
3. The supply of nitrogen during cultivation must not exceed the crops’ need.
4. The autumnal spreading of liquid fertiliser from animals on autumn-sown seed shall be reduced.
5. Permanent fallow land shall be introduced.
6. 12,000 hectares of wetlands shall be constructed.

7. Environmental training courses shall be compulsory for farmers.
8. A survey of the geographical distribution of farm animals shall be conducted.
9. Nitrogen treatment shall be intensified in some treatment plants.
10. The degree of purification in private wastewater treatment facilities shall be improved.

The overall aim is to restore a natural supply of nutrients to the sea and a first step is to achieve the generation targets (to be achieved within one generation) for nitrogen and phosphorus as adopted by the Government. The assessment of the Commission on the Marine Environment is that the target for phosphorus will be achieved, but achievement of the nitrogen target requires vigorous additional measures. According to the Commission, it is not at all certain that achieving the 1940s level will be enough, bearing in mind that even this level implies double the amount of anthropogenic nitrogen being discharged into the sea compared to the level in the 1860s (see table 5.1). An evaluation and follow-up are therefore urgently required to ascertain the need for further measures in order to achieve the *Zero eutrophication* objective.

To achieve the generation target for nitrogen, measures that will bring about a further reduction of 13,000 tonnes are required over and above those that have already been decided. How this is to be done, with a view to reducing nitrogen emissions to the 1940s level, i.e. 40,000 tonnes a year south of Åland, is described below. If the measures are implemented, it is estimated that, along with the measures to reduce nitrogen oxide and ammonia emissions, the load will decrease by about 17,000 tonnes by 2010 and by about 23,000 tonnes by 2020 (see table 5.1). This means that, according to estimates, it will be possible to meet both the 2010 interim target and the 2020 generation target (see table 5.1).

Table 5.1. Estimated anthropogenic supply of nitrogen at different points in time since the 1860s for the whole of Sweden and south of the Åland Sea and the effect of proposed measures. Interim targets and generation targets in brackets. Source: Commission on the Marine Environment

Nitrogen	<i>The 1860s.</i>	<i>The 1940s.</i>	<i>1970s-80s "the peak"</i>	<i>2000⁴</i>	<i>2010</i>	<i>2020</i>
	<i>thousand tonnes/year</i>	<i>thousand tonnes/year</i>	<i>thousand tonnes/year</i>	<i>thousand tonnes/year</i>	<i>thousand tonnes/year</i>	<i>thousand tonnes/year</i>
N from agriculture	17	30	50	39	33	31
Wastewater	0	13 ¹	21 ²	17	11	10
Atm. Dep. Lakes ³	3	4	12	11	8	7
Private waste- water fac.	4	1	2,5	2,5	1,5	1,5
Industry	0	2	3	4,5	3	2,5
Other	2	3	7	5	5	4
Total – whole Sweden	26	53	95,5	79	61,5	56
Total – south of Åland Sea	⁵	40	⁵	60	43 (47) ⁶	37 (40) ⁶

¹ 16 thousand tonnes/year in total, 50 per cent directly to the sea, 50 per cent inland, 40 per cent retention.

² 26 thousand tonnes/year in total, 50 per cent directly to the sea, 50 per cent inland, 40 per cent retention.

³ Net supply to the sea of nitrogen deposited on the surface.

⁴ Data from the TRK project.

⁵ Not calculated.

⁶ Interim targets and generation targets in brackets.

Over and above the measures aimed at agriculture, arable land is continuously decreasing. Since the 1940s, about one million hectares of land have been afforested, built on or asphalted. This development is continuing and it is estimated that it will have reduced nitrogen emissions by 2,500 tonnes/year by 2020.

The *Zero eutrophication* quality objective also covers nitrogen oxide emission reductions. These are not, however, discussed here. Air quality improvement measures are dealt with nationally within the framework of the *Clean air* and *Natural acidification only* quality objectives and internationally under the EU Clean Air for

Europe Programme and within the UN-ECE Convention on Long-Range Transboundary Air Pollution (LRTAP).

The Commission on the Marine Environment proposes the following measures:

1. The cultivation of follow-up crops (catch crops) shall be set at a permanent level of 100,000 hectares.

Catch crops are a type of grass which absorb the nitrogen that is naturally released from the ground's large stores of the substance during the autumn. As a result, the nitrogen content of the land decreases prior to the winter and hence there is less nitrogen leakage. The area of catch crops cultivated in Sweden has increased rapidly since 2001 as a result of the EU environmental compensation programme. The actual area cultivated this year is just under 180,000 hectares and reductions in nitrogen discharge have been three to four times greater than expected. For this successful cultivation of catch crops and reduced discharges to continue, it is crucial that the compensation programme in the EU common agricultural policy is maintained for the forthcoming programme period. In a new survey, catch crops along with spring tillage (see below) have been shown to reduce nitrogen discharges by about 2,000 tonnes a year.

2. The area of arable land tilled in the spring instead of in the autumn shall be set at a permanent level of 100,000 hectares.

Arable land shall as far as possible be tilled late in the autumn or in the spring in order to reduce nitrogen releases from the ground's large natural stores. The area of land tilled in the spring in Sweden has increased rapidly since 2001 as a result of the EU environmental compensation programme. The actual area tilled in the spring in 2003 is just over 90,000 hectares and reductions in nitrogen discharges will therefore be nearly twice as large as expected. For this successful spring tillage to continue, it is crucial that the compensation programme in the EU common agricultural policy is maintained for the forthcoming programme period.

3. The supply of nitrogen during cultivation must not exceed the crops' needs.

Some farmers use less fertiliser than government guidelines stipulate and some use more. Farmers are being advised not to fertilise crops more than is necessary but if this initiative is unsuccessful, some form of nitrogen supply control may need to be introduced covering all forms of supply. This measure can potentially reduce nitrogen discharge by about 2,500 tonnes a year.

4. The autumnal spreading of liquid fertiliser from animals on autumn-sown seed shall be reduced.

By 2008, the area of autumn-sown seed that is fertilised with farmyard manure in the autumn shall have decreased by 75 per cent. If this target is not met, regulations should be introduced to regulate the spreading of farmyard manure. This measure can potentially reduce nitrogen discharges by about 1,300 tonnes a year.

5. Permanent fallow land shall be introduced.

Model estimations show that permanent fallow land in accordance with the MTR (Mid-term Review of the EU common agricultural policy) can lead to a decrease in leakage compared to the current mixture of land lain fallow for one or several years. The provisions for when fallow land shall occur in the crop rotation cycle are being amended to create permanent instead of temporary fallow land with recurring breaks. This measure can potentially reduce nitrogen discharge by about 1,500 tonnes a year.

6. 12,000 hectares of wetlands shall be constructed.

In southern Sweden where the need for wetlands as nitrogen traps is greatest, about 1 hectare of wetland is required per 100 hectares of arable land to reach the target of 12,000 hectares by 2010. Up to now, 2,500 to 3,000 hectares have been constructed since 1995, reducing nitrogen discharge by 300-400 tonnes per year. To reach the target, a general increase is needed in the construction pace. More specifically, wetland construction shall be linked to the river basin management plans described in the water framework directive, in which a condition shall be established for each river basin. The location of wetlands can therefore be decided locally. A general expansion in wetland construction can be achieved by

increasing the current budget for project assistance and through an information campaign aimed at landowners. This information campaign should be implemented by the Swedish Board of Agriculture in partnership with the national *Greppa Näringen* (“*Grab the Nutrients*”) environmental objectives campaign and the county administrative boards. It is not however the total area of wetlands that is the aim, but rather an improvement of their function. Better function, using less area can be achieved as a result of strategic location, i.e. analysis of where in the country and in the natural landscape the wetlands are to be located. Wetlands should be designed so as to accomplish optimum nitrogen removal. At the request of the Government, the Swedish Board of Agriculture is currently looking into quality criteria for wetlands in order to create better conditions for construction. This measure can potentially reduce nitrogen discharge by about 2,400 tonnes a year.

7. Environmental training courses shall be compulsory for farmers.

The biggest obstacle for improvement measures is a lack of knowledge. This is true both on the system level and on the individual level, i.e. the person who is “to do the job” knows too little. In a new survey, 65 per cent of farmers said that it was a lack of knowledge as to which measures are efficient that was the biggest obstacle in their attempts to solve the problem with leaching nutrient. This clearly shows that there is insufficient information transfer to farmers when it comes to environmentally sound cultivation methods.

To begin with, it shall be compulsory for farmers with more than 50 hectares of arable land and more than 25 animals (and who have not previously attended any form of environmental education) to participate in a course or counselling. Education and counselling are currently being carried out as part of the *Greppa Näringen* campaign in the six coastal counties of southern Sweden.

In addition, the farming industry and the Swedish Board of Agriculture shall jointly investigate the potential of further compulsory training in the subject of nutrient loss. This investigation should make use of and consider the various educational initiatives that are currently ongoing as part of the farming industry’s environment and quality programme. Training and counselling in these subjects should be intensified and be much more systematic and persistent than previously to achieve change, and to reach more farmers. It is difficult to quantify the value of

training since it is not a question of a single measure but of several measures of varying intensity. In practice, greater knowledge will lead to action being taken against both nitrogen discharge as well as phosphorus and ammonia losses.

8. A survey of the geographical distribution of farm animals shall be conducted.

It has been claimed for a long time that major environmental benefit can be derived from geographically more coherent crop and animal production. The potential of this proposal, to reduce the waterborne nitrogen discharge to various Swedish sea areas and its impact on the agricultural industry, has not been properly elucidated. The effects of a modified distribution of farm animals, bearing in mind the varying sensitivity of different Swedish coastal areas to nitrogen discharge, should therefore be investigated.

It must be pointed out, however, that such a modification would imply large-scale structural changes to agriculture. It is hence a very costly measure to implement and Sweden already has Europe's strictest regulations concerning the maximum number of animals allowed per hectare of land.

Such a measure can be implemented both regarding organic and conventional forms of production and both should therefore be included in the survey. Using the HBV-NP model (transport, retention and source apportionment of nitrogen loading), model estimations of potential reductions in nitrogen discharge to the sea can be performed. To do this, however, the HBV-NP model needs to be improved regarding how to deal with the organic farming system, which is also important since the percentage of organic farming in the country is increasing.

9. Nitrogen treatment shall be intensified in some treatment plants.

There is considerable scope for further reducing the discharge of nitrogen from treatment plants by optimising existing technology or by using new technology. Several years' experience from the Himmerfjärdsverket treatment plant, which receives wastewater from the south-west areas of Greater Stockholm, shows that 85-90 per cent nitrogen reduction can be achieved in so-called "fluidisation beds".

Under the EU wastewater directive (Article 5.4, 91/271/EEC), the general requirement for nitrogen treatment need not be applied

if it can be shown that the minimum percentage of reduction of the overall load entering urban waste water treatment plants (>2,000 person equivalents, pe) is at least 75 per cent for total nitrogen. This target could be reached for the whole of Sweden if treatment plants with >10,000 pe from Norrtälje Municipality and to the south achieve 85 per cent reduction and if retention may also be included in the calculation. This would mean the measures could be focused on treatment plants that discharge to nitrogen-sensitive coastal and sea areas. If retention may not be included, further measures will probably be necessary, e.g. some nitrogen reduction in smaller-scale treatment plants (<10,000 pe) and/or in treatment plants north of Norrtälje, in order to fulfil the requirements of the directive. In the latter case, treatment plants that discharge into the South Bothnian Sea or into areas where increased nitrogen treatment is believed to lead to better water quality should receive priority, since this may to a certain extent reduce the load on the Baltic Proper. Using new technology, net discharges to the sea could be reduced by about 6,000 tonnes of nitrogen a year.

Since dramatically reduced nitrogen discharge to certain recipients may lead to the increased occurrence of nitrogen-fixing cyanobacteria ("blue-green algae"), the conditions in individual coastal and inland recipients should also be assessed. Such an assessment is obviously part of an adaptive management system and is of general interest as far as achievement of the *Zero eutrophication* quality objective is concerned.

10. The degree of purification in private wastewater treatment facilities shall be improved.

Private wastewater treatment facilities contribute to eutrophication. The majority of Sweden's one million or so private wastewater treatment facilities can be found in sparsely populated areas and the archipelagoes. There is a general need for measures since treatment facilities in sparsely populated areas are responsible for considerable discharges of phosphorus to lakes, rivers and streams. Discharges from private facilities can also be expected to be a growing problem in certain areas, since people have recently begun to convert holiday homes into permanent dwellings, especially close to metropolitan areas. These buildings often have substandard wastewater treatment facilities, not intended for use all year round.

Most private wastewater facilities only have sludge separation capabilities. All waterborne wastewater facilities need therefore to be upgraded and fitted with both phosphorus and nitrogen treatment devices.

Finland has recently adopted an ordinance on the treatment of household wastewater outside the water authorities' wastewater grid, which will come into force on 1 January 2004. This estimates that the phosphorus load from about 1 million people using private wastewater treatment facilities is 1.5 times as big as from the four million people who are connected to the municipal wastewater treatment plants. Swedish estimates are unreliable but in the county of Blekinge, for example, phosphorus discharges from private households in 1992 were 2.5 times those from the municipal treatment plants. According to current calculations, which are unreliable and need to be evaluated, private wastewater treatment facilities are responsible for a substantial share of the phosphorus discharge to the sea. Even if the discharge were to be smaller, there is still reason to reduce discharges from private facilities, especially in areas close to rivers/streams or near the coast. New technical solutions show that it is possible to reduce phosphorus by 90 per cent. New technology for private wastewater facilities also leads to more effective nitrogen reduction and a 40-percent reduction should be possible in the long term.

The Commission on the Marine Environment proposes that new general requirements on the treatment of wastewater from private facilities, similar to those in Finland, be introduced and adjusted to Swedish legislation. The environmental load of organic material (BOD₇) caused by wastewater shall be reduced by at least 90 per cent, for total phosphorus by at least 85 per cent and for nitrogen by at least 40 per cent, compared to the load from untreated wastewater.

6 The research requirement

A major lack of implementation rather than a lack of knowledge is the principle cause of shortcomings in the way the sea is currently managed, but this does not preclude the fact that there are important gaps in our knowledge that need to be filled. There is plenty of ongoing research that will be useful for a future management system. The Swedish EPA has, for example, invested in two extensive research programmes on the marine environment, one focused on biodiversity and the other on the effects of introducing species (also in freshwater). The priority allocated by the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas) to marine environment research in 2003 will also generate deepened understanding to the benefit of future marine management. Similarly, an ongoing research initiative on ecology, biodiversity and sustainable use is being funded by Formas, the Scientific Council and the Swedish Species Information Centre. A further important initiative is the research programme aimed at developing an eco-friendly antifouling paint for ships run by the Foundation for Strategic Environmental Research (MISTRA) and the SUCOZOMA programme which integrates socio-economic aspects with natural science within the framework of coastal zone management. To supplement these and similar initiatives, the Commission on the Marine Environment wishes to highlight some areas where it either considers there to be a total lack of significant research or where ongoing and planned research needs to be strengthened. The list should not be seen as complete, but more as examples of what research needs to focus on to support the measures proposed by the Commission.

6.1 In general

Cross-sectoral and interdisciplinary research is needed to provide a better basis for decision-makers. There is a lack of research that combines natural sciences with social sciences in order to handle complex environmental problems and argues in favour of biological values being prioritised. Since several types of anthropogenic impact collaborate over time and space when environmental problems occur, research that is only based on recently collected data or focuses on just one area is insufficient. Retrospective and/or interdisciplinary studies can help clarify the causes of today's detrimental state of the environment and also elucidate what measures need to be prioritised to achieve the environmental objectives. Principles and methods of an efficient, adaptive form of management need to be developed and new knowledge uncovered as to how a zoning of coastal areas is to be carried out.

6.2 Shipping, etc.

The problem of noise and other disturbances from ships and small boats has been broached as part of the work on environmental objectives but the effects of noise on marine organisms are as yet basically unknown. Sound propagates more easily in water than in air and all fish apart from sharks can hear.

There is a certain amount of research on the effects of noise on porpoises and seals, but other areas are characterized by knowledge voids.

Our understanding regarding the extent of environmental damage caused by the construction of marinas and other human activity (dredging, hard seabeds destroyed by trawling) is also severely lacking, as well as our understanding of overgrowth caused by thread algae and sublittoral soft seabeds affected by hydrogen sulphide. We know very little about the significance of such impact on the structure and function of ecosystems and the area is poorly researched. Both qualitative and quantitative examination of such issues is needed and should be integrated into a GIS-based planning instrument. The material can also act as basis for the management of coastal waters within the framework of the EU water directive.

6.3 Fish

Knowledge as to the complex system of fish, the effects of ambient environment and their exploitation by fisheries is incomplete. The large fish species (cod, flatfish, sharks and rays) are, key species in marine ecosystems. The starting-point when the precautionary principle is applied must be that, at their present level, fisheries cause considerable ecological and environmental disturbance. Better knowledge as to, e.g., the role of different fish species in the various components of ecosystems and as to the interaction between fish species and other species in food webs is crucial to good management. A great deal of new knowledge is required in this respect. In addition, the ecological and socio-economic effects of a zoning system, including areas where a total fishing ban is in place, should be analysed.

The prerequisites of fish research

It is important that some of our universities support research of fish stocks as a part of marine ecosystems. Both in Sweden and abroad, it has often been a problem that only laboratories belonging to the government agency responsible for fish stock management have had the resources to conduct research on these stocks, which has stifled scientific discourse. There is basically no advanced education in fishery biology at Swedish universities. In addition, research on angling and fishing for household requirements has not received priority, which can be explained by the strong link between the National Board of Fisheries and the professional fisheries.

Fish stocks

Knowledge of the actual fishing mortality rate, i.e. total extraction of fish including dumping and illegal fisheries, is insufficient. The lack of a reporting obligation for leisure fishermen, private water owners and fishing tourism companies also means that there are plenty of hidden statistics regarding total catch figures. Our knowledge as to the environmental effects of trawling on productive seabeds, demersal fauna and other stationary fish stocks is equally poor. Surveys on the effects of various types of site protec-

tion are essential. A first step might be to evaluate the effects of the trawling ban in the Öresund Sound.

Biological knowledge about coastal fish stocks and numerous species that are not currently regulated by quotas is also insufficient. More in-depth surveys of the population structure (genetic and ecological) of commercial species are important so that we can improve future management and especially so that we can assess the value of protected sites and examine the scope of local fish resource management. Releasing reared salmon and eel affects the population structure. Knowledge of eel reproduction is still limited and new discoveries indicate that releases of imported elver (glass eels) to strengthen populations may be unsuitable.

We know little about the long-term genetic effects of large-scale fisheries. Limiting fishing to the largest individuals may impair growth in a population as a result of targeted selection of those rudiments that promote slow growth. Such a trend may need to be checked by the introduction of maximum sizes to go with existing minimum catch sizes. Research is needed to ascertain these and other long-term effects that can impact fish stocks, including changes in salinity in coastal waters caused by climate change.

Technical development

Research and development is needed in a partnership between professional fishermen, engineers and researchers to develop fishing gear that is selective and prevents by-catches of small fish, marine birds, mammals and other species. Sophisticated technology for passive fishing gear probably needs to be developed to deal with mammals and birds in particular. The aim of such gear is both to save the animals and prevent catch losses as a result of e.g. seals and cormorants raiding the nets. Some development has already occurred, e.g. the design of a seal-proof salmon trap, but there is still a lot to be done.

6.4 Toxic substances

There is still a considerable lack of understanding about chemical substances, their inherent properties and their impact on health and the environment. Risk assessment of individual substances has

made sluggish progress and led to very few decisions being taken on restrictions or bans on harmful chemicals. A new chemicals strategy is therefore under development within the EU:

Regarding the lack of understanding, it is for example a question of our ignorance regarding the health and environmental effects of chemicals, particularly the effects that take a long time to surface. Deeper understanding is needed, for example, as to the relationship between pollutants and human health. It is also worth mentioning here that there is even a lack of fundamental information as to inherent toxicological and ecotoxicological properties of most substances.

A particular slant on the chemicals problem is the diffuse and extremely large-scale spread of chemicals in products. This is both a major problem and a difficult one to solve. The trend has gone from a small number of individual toxic substances whose emission sources could be distinguished to one where an incredibly wide spectrum of chemical substances are in use. Even at low concentrations, each and every one of these substances may cause an unspecified impacts that are difficult or quite simply impossible to link to any specific exposure. The large amounts of chemical substances in society that all too often end up in the sea, the lack of knowledge as to their toxicological and ecotoxicological effects, the large-scale diffuse spread in combination with the difficulty in understanding complex biological relationships all mean that there are many gaps in our knowledge that need to be filled. These gaps pertain both to aspects which the research community or the authorities should bear responsibility for and those that companies should be responsible for developing knowledge about.

How do we progress from the specific control of a handful of substances to a more diversified control of thousands of chemicals that we fear may be harmful? How can society manage to control all these thousands of substances when we either know nothing at all or have very limited knowledge about the potential health and environmental hazards which the vast majority of them pose.

The precautionary principle must be the touchstone of chemical safety. Chemicals policy must be built on scientific fact but at the same time include values and ethics, such as the precautionary principle and the substitution principle. Society should have a sufficient basis for banning or limiting a chemical substance, but at the same time simplifications must be accepted to enable any progress at all to be made in the area of chemical safety. A general

approach involving the phasing-out of persistent and bioaccumulating substances is necessary. It is unreasonable to demand “to see dead bodies” before measures are taken to combat chemical substances that are suspected of causing long-term effects. Adopting a policy of “wait and see” also constitutes taking a decision.

There is a considerable lack of information as to what chemicals are incorporated in products or are formed during combustion, where chemicals that are transported over long distances come from and regarding the potential effects of these substances on marine ecosystems. Furthermore, knowledge is also incomplete regarding chemical leakage in connection with the storage and final disposal of ashes and slag from various types of combustion processes. Information is also lacking regarding the leakage of toxins from contaminated land and sediment areas.

In order to be able to implement measures to reduce levels of PCB and dioxins in fatty fish from the Baltic Sea and in the long term lift dietary restrictions, comprehensive as to the sources of these toxins is required. Fundamental information is lacking as to which sources contribute most PCB and dioxins and as to how fast these substances are broken down and circulate in the ecosystem. More waste incineration as a result of increased consumption in the Baltic States, Russia and Poland may also lead to changes in the relative size of emission sources. Sprat-fishing in the Baltic has increased and as a probable result, the indirect consumption of fatty fish from the Baltic has also gone up in the form of poultry feed. We lack information as to how dioxins from fishmeal are passed on via poultry to humans.

A research programme should be initiated to develop chemical control programmes for soil and water. New information is also needed to develop treatment technology that can cope with toxic substances at wastewater treatment plants.

6.5 Eutrophication

Eutrophication in the sea is affected by land use and nature's delaying mechanisms, leaching from arable land and climate change. There is a considerable lack of understanding regarding several of these mechanisms. Changes in cultivation methods in land-based industries are poorly documented which makes it difficult to make forecasts and follow up the effects of measures. Better

statistics on land-based industries are needed, as are more measurements of the effects in rivers and streams. A more spatial resolution is required in both cases.

We still know far too little about the mechanisms that regulate the turnover of nutrients in the sea to be able to draw accurate conclusions about the causes of transient trends over decades. Analyses do show, however, that trends in the surface layer do not necessarily reflect the water body's entire nutrient content, and that large-scale and rapid changes in the nutrient content of deep water occur when oxygen levels change.

The quantitative significance of denitrification (return of nitrogen to the atmosphere) needs to be estimated and the processes that affect denitrification must be examined in detail.

We also need to know more about how nutrients are transported from the coast to deep-sea areas and the transition they undergo, as well as on deep-water and surface-water exchange. In many coastal areas, it is not local discharges that determine the water quality but the conditions further out to sea. The extent of the impact depends on a number of factors such as water exchange and where the water originates.

A research programme on phosphorus

Phosphorus calculations indicate that Sweden currently has lower discharges than in the 1940s, and that the discharge target has already been reached. Swedish wastewater treatment plants already have such effective phosphorus reduction capabilities that there is little incentive to reduce it further. A lack of knowledge on the biogeochemical composition of phosphorus in soil and water makes it difficult to propose discharge-reduction measures and to estimate the potential effects of these. Better knowledge on the factors that influence phosphorus losses from and retention in soil and is therefore necessary to be able to calculate background leakage and the contributions of different sources to the transport of phosphorus to the sea.

Particular attention should be paid in the future to reducing nitrogen leachate and increased nitrogen treatment in wastewater treatment plants. Better nitrogen treatment may lead to a phosphorus surplus in lakes and increase the occurrence of nitrogen-fixing cyanobacteria.

Regulated drainage

Regulated drainage means that the outflow of drainage water from ditched fields is prevented during the winter in order to create anaerobic conditions and hence increase denitrification. It is estimated that the method could be used on about 100,000 hectares of arable land in Sweden. International research shows that the method is very effective but the relatively few trials performed in Sweden provide no unequivocal evidence as to whether the method can be used in Swedish conditions. A research project coordinated by the Swedish Board of Agriculture should therefore be initiated to elucidate all the aspects of regulated draining and its potential.

Investment in developing green cultivation methods

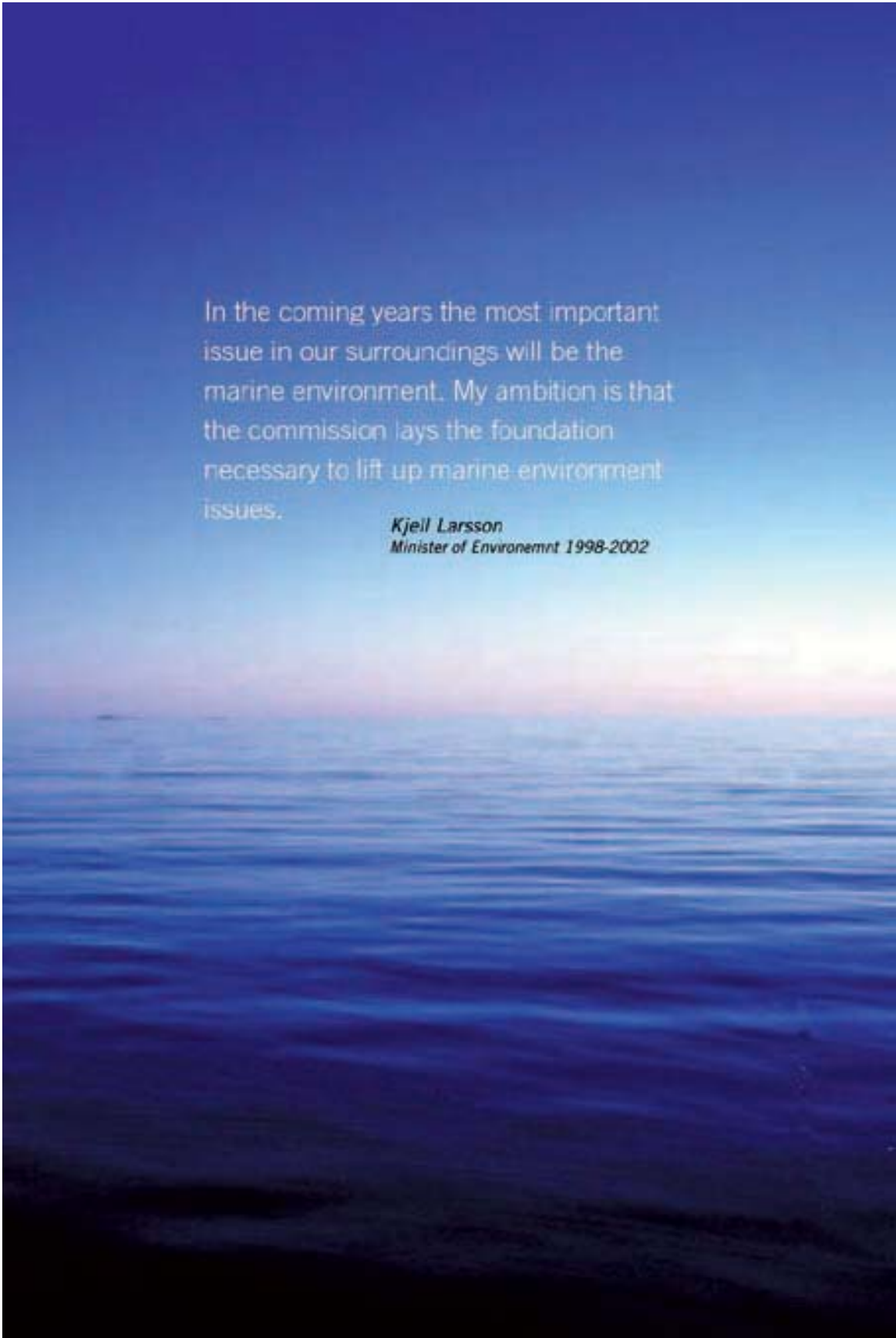
Large question-marks still remain in certain areas, not least regarding phosphorus losses and how to manage the large natural stores of nitrogen in the soil so that they are not released. Environmental advisors who counsel and train farmers must be furnished with new knowledge. It is, for example, a matter of providing a basis for recommendations on cultivation methods that reduce nutrient leakage. This requires intensified investment in research into new green cultivation methods.

The impact of eutrophication on the ecosystem

Future research should also focus on the ecosystem effects of eutrophication linked to fish and fisheries. Eutrophication has impaired the potential for a number of fish species (e.g. plaice and cod) to reproduce and breed, while other species (e.g. sprat) have benefited. There is currently insufficient understanding as to how large a reduction this causes in the recruitment of coastal fish stocks. We also lack understanding about the potentially positive effects of eutrophication on the size of certain fish stocks. This population growth may depend on the increased production of fish feed such as zooplankton, and in certain areas, of demersial species (where dead seabeds don't hamper production).

Modified volumes and composition of floral and zooplankton blooms can also be expected to have an impact on fish fauna, as do the effects of high organic load on deeper seabeds. At present

environmental monitoring of the dynamics of fish and plankton communities is somewhat sketchy due to a lack of resources. Much of the research performed is restricted both in time and space. Our monitoring of coastal plankton and demersal flora and fauna is also insufficient, especially bearing in mind the tighter requirements incorporated in the water directive. The implementation of the water directive will also involve a greater requirement for understanding on the water composition of coastal zones and hence on prohibited transports of nutrients and contaminants. Such understanding is important since human activity can be expected to have a much greater impact than that which current studies assume.



In the coming years the most important issue in our surroundings will be the marine environment. My ambition is that the commission lays the foundation necessary to lift up marine environment issues.

Kjeil Larsson
Minister of Environment 1998-2002