mmm.fi

# Management Plan for the Finnish Seal Populations in the Baltic Sea

4b 2007

# Management Plan for the Finnish Seal Populations in the Baltic Sea

Ministry of Agriculture and Forestry 4b/2007

Name of publication:
Management Plan for the Finnish Seal Populations in the Baltic Sea

Publisher:
Ministry of Agriculture and Forestry

Photographs:
Eero Helle, Kristian Hohkavaara,
Mervi Kunnasranta, Anita Storm,
Markku Saiha

ISBN 978-952-453-348-5
ISSN 1238-2531

Graphic design: Z Design Oy

Layout: Vammalan Kirjapaino Oy

Printer: Vammalan Kirjapaino Oy, 2007

# Summary

The Baltic grey and ringed seals are considered game species in Finland, and are thus under the responsibility of the Finnish Ministry of Agriculture and Forestry. At the regional level, the game management districts are responsible for seal management. The districts are the regional administrative units of the Finnish game administration, and at the same time the statutory organisation of hunting bodies. The Government of Åland has the responsibility for the management of seal populations in the autonomous Province of Åland.

In the last decades, the grey seal population has increased dramatically. The ringed seal population has also grown abundant, although the growth has not been as fast. Improvement in the reproductivity and the general health status of seal populations, and the resulting increased numbers, is a positive phenomenon. The utilisation of seals as a natural resource, and the development of diverse uses for seal products are increasing. The growing number of seals has called for a systematic management of their populations. Damage by seals to fishing gear and fish catch has increased dramatically, as have demands of regulating the populations. Attitudes towards seals have hardened as a result of financial losses sustained by fishermen. The grey seal, in particular, is regarded as a threat to the fishing industry in many places. As seals do not recognise national borders thus are shared among the Baltic Sea countries, the management of the seal populations is subjected to conflicting views and objectives at both a national and an international level.

The management plan for the seal populations in Finland was drawn up applying the Convention on the Conservation of European Wildlife and Natural Habitats, recommendations No 59 (1997) and No 74 (1999) of the Permanent Council, the principle of sustainable use advocated by the World Conservation Union (IUCN), and the obligations under the EU's Habitats Directive. This way, Finland's international obligations regarding the management of seal populations have been considered. As a part of the management plan process, a hearing of the opinions of local people, regional actors and national stakeholders was conducted.

The management plan consists of two parts. Part I establishes the background to the policy on seals practised by the Ministry of Agriculture and Forestry. It describes seal biology and the status of the populations based on the latest research in Finland, and compares the situation in Finland to international research findings. Part I also deals with national legislation, international obligations, international forms of cooperation, the economic damage caused by seals, the history of seal and man, earlier aims for the management of seal populations, population management accomplished so far, and research and threats to the development of seal populations. Part I presents a summary of the socio-economic data based on the public hearings. The socio-economic study has been published elsewhere.

The second part of the management plan presents the outlines of the seal management policy, which is based on seal biology and the socio-economic factors regarded as significant. By implementing this policy, Finland will continue with its systematic management of the seal populations and maintaining seals as a permanent component of the marine environment and its diverse community of living organisms. The central objective of the management and conservation of seal populations in Finland is to reach and maintain a favourable conservation status of both seal species. The biological requirements for each seal species make up the framework for the population management. As the well-being and viability of seal populations is ensured in the long term, socio-economic factors can be accounted for to a higher extent in the management process. The management policy of the grey seal population will stress its value as a valuable natural resource that can be utilised in a sustainable way. As for the ringed seal, the management plan focuses mainly on the conservation aspects of the population, largely due to uncertainties associated with the development of southern populations.

The management of the seal populations will be implemented through the joint impact of a variety of measures discussed here. Measures are proposed for regional population management, conservation of seals and conservation areas, seal hunting and hunting surveillance, utilisation of seals as a resource, prevention of damage and compensation, population monitoring and research, training, advice and guidance, information services, cooperation between different actors involved, updating the management plan and responsibilities for population management. The measures to be carried out will take into consideration economic, social and cultural requirements as well as special regional and local features. The implementation of the plan will be monitored and updated as necessary.

# Contents

# 1. INTRODUCTION

Populations of Baltic Sea seas are estimated to have been greater than they are today. According to a statistical model based on national bounty killings, 80,000-100,000 grey seals and 190,000-200,000 ringed seals occurred in the Baltic Sea at the beginning of the 20th century. Owing to uncertainties in the models, it is not possible to make completely reliable estimates of the actual sizes of the populations of the time, but the numbers of seals hunted each year alone suggest fairly large seal populations.

Both seal populations declined in the 1900s, and by the late 1970s the populations were estimated to 2,000-4,000 grey seals and around 5,000 ringed seals (Hårding & Härkönen 1999, Kokko et al. 1999). The main cause for the population decline was over hunting (Durant & Harwood 1986, Hårding & Härkönen 1999, Kokko et al. 1999). Later on, especially since the 1960s, the population decline has been caused by an impaired reproductive rate, which has been associated with elevated levels of environmental contaminants in the seals (Helle et al. 1976 a, b, Helle & Stenman 1990). The reproductive rate of ringed seals might also have suffered at times from lack of suitable ice cover in the southern distribution areas. Since the 1980s, however, the reproductivity of both species has improved and both populations are growing today.

The Baltic Sea grey seal population has grown dramatically in recent years and the annual rate of increase has averaged around 10%. The increase in Finland's south-western archipelago has occasionally been even much faster. While approximately 3,000 grey seals were counted in Finnish waters in 2000, the number of counted seals had risen to more than 10,000 by 2006. The same year, the whole Baltic Sea area was estimated to contain around 21,000 grey seals, of which some 50% occurred in Finnish territorial waters.

The increase has not been as rapid for the ringed seal population, which is estimated to grow at an annual rate of about 5% in the northern part of the Bothnian Bay, where around 75% of the entire Baltic ringed seal population occurs. Knowledge of recent trends in ringed seal populations in the Gulf of Finland and South-western Finland is currently lacking. The reason for the slower growth in the ringed seal population is assumed to be the prevalence of uterine occlusion, which leads to sterility. Today, roughly 20% of the adult females in the Bothnian Bay still suffer from uterine occlusions.

The increasing number of seals, especially in their main distribution area in the northern Baltic Sea (Finland, Sweden, Russia and Estonia), has called for a systematic management of their populations within this area. Damage by seals to fishing gear and fish catch as well as to aquaculture, has increased dramatically with the growing numbers of seals. This has also resulted in an increasing demand for regulating the seal populations. Both species of seal cause damage, but the grey seal causes a lot more. Attitudes towards seals have become less sympathetic especially as a result of the financial losses sustained by the fishermen. The grey seal is even regarded as a harmful species in many areas. It was largely the damage to the fishing industry that triggered the reintroduction of seal hunting in Finland in 1998, after a 16 year moratorium on seal hunting. In addition, representatives of the fishing industry in the Bothnian Bay have demanded a regulation of the regional ringed seal population. As the seals do not recognise national borders, the seal management also has to include an international perspective. It is thus a great challenge is to find jointly acceptable policies as the management of the Baltic seal populations is subjected to conflicting views and objectives at both a national and an international level.

In Finland the Baltic grey and ringed seals are game species, and the responsibility for managing their populations is that of the Finnish Ministry of Agriculture and Forestry. The ministry also supervises the game management districts, which are responsible for the regional population management on the mainland in Finland. In Åland, the Provincial Government of Åland is responsible for managing seals in its territory. The Finnish Game and Fisheries Research Institute has the main responsibility for monitoring the seal populations and for conducting biological research on seals. The Department of Fisheries and Game in the Ministry of Agriculture and Forestry negotiates matters concerning seal population management with the environmental authorities. Metsähallitus is responsible for the seal conservation areas, set up under the Finnish Nature Conservation Act.

The European Council's Habitats Directive is one of the EU's key legal instruments for nature conservation. Its general aim is to achieve and sustain a favourable conservation status for certain species and habitats. Baltic Sea seals are included in Annex II and Annex IV ('Animal and plant species of Community interest whose taking in the wild and exploitation may be subject to management measures') of the Habitats Directive. Although the Directive does not specifically require a management plan to be drawn up, such a plan demonstrates that the obligations of the directive are being met. This plan has been drawn up applying the recommendations and guidelines that take the local population into consideration, as is required by the Bern Convention. It also acknowledges the principles of sustainable use advocated by the World Conservation Union (IUCN) as well as the constraints set out in the Habitats Directive.

The Ministry of Agriculture and Forestry began drawing up a management plan for seal populations in 2004. The Finnish Game and Fisheries Research Institute was given the task of preparing a draft version of the plan. The draft was to be based on reliable data and knowledge regarding seal biology, and on public hearings representing a wide range of interest groups.

To provide a background for the management plan for seal populations a survey was undertaken to record the attitudes of local and national stakeholders towards the Baltic seals and the management of their populations. The target groups were those whose livelihoods and everyday life are affected by the seals in one way or another, as well as actors representing organisations and authorities involved in the conservation and use of nature and monitoring that use. During the process of drafting the plan, a number of public hearings were organised, one in Åland and 10 on the mainland of Finland. A total of 439 people attended these and gave their views on the management of seal populations. In addition, 393 actors representing different regional stakeholders received a questionnaire on the subject. A similar survey was also conducted on stakeholders at the national level. Details of this process and its main findings were published as a separate report in Finnish and Swedish in the Finnish Game and Fisheries Research Institute publications in the beginning of 2007 (Storm et al. 2007).

The management plan for seal populations was drawn up using the draft by a steering committee consisting of representatives from the Ministry of Agriculture and Forestry, the Ministry of the Environment, the Government of Åland, the Finnish Game and Fisheries Research Institute, the Finnish Hunters' Central Organisation, Metsähallitus, the Kvarken Council and the Association of Finnish Fishermen. A version of the plan dated 5 January 2007 was circulated widely for comment.

Sixty-one comments were received. They all mentioned the importance of drafting the management plan with reference to international obligations, national features and the views of local, regional and national stakeholders. The general opinion of part 1 of the management plan was that it constituted an excellent information package, and there were barely any comments made about it. There was also general approval of Part II, although there were also some comments made. On the one hand the desire was expressed to increase seal hunting, but there was a general desire to protect seals as well. The measures proposed to minimise damage caused by seals were considered inadequate, and it was thought important to encourage a culture of seal hunting. Furthermore, the importance of the entire Natura network (including seal conservation areas) for seals should be examined, and the proposal of establishing a seal information centre and the development of monitoring methods were supported. People were also in favour of the proposed increased cooperation and joint debates to ease conflicts and a permanent system of compensation for damage to the fishing industry. The general opinion was that measures to protect southern ringed seal populations were inadequate.

The Province of Åland has drawn up a separate seal management plan for the Åland Islands. This plan covers the territorial marine areas of mainland Finland.

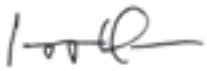
The management plan was finalised on the basis of the opinions received. The comments, suggestions and areas for clarification were taken into consideration in the plan when possible without jeopardising the objectives set in the plan and their implementation.

The management plan for seal populations in Finland has two parts. Part I establishes the background to the management of the seal populations and presents the status of the grey and Baltic ringed seal in national and international legislation. It examines the state of the Baltic Sea, seal biology and the development of the seal populations, and gives a general view of the relationship between man and seal throughout history. It also evaluates possible threats to the seal populations. In addition, it describes actions taken so far with regard to population management and gives an assessment of the favourable conservation status of the populations in Finland. The second part of the plan consists of the management plan itself and presents the outlines of the seal management policy, which is based on seal biology and the socio-economic factors regarded as significant. The main objective of the plan is to ensure that seals remain a permanent component of the marine environment and its diverse community, and that they remain a valuable natural resource which can be utilised in a sustainable way.

The management plan for seal populations contained in this document describes the measures which the Ministry of Agriculture and Forestry intends to implement to manage seal populations. The implementation of the plan will be monitored and, when necessary, the plan will be updated and improved.

Helsinki, 30 March 2007

Juha Korkeaoja
Minister of Agriculture and Forestry



Seppo Havu
Director-General

# PART 1: BACKGROUND TO THE MANAGEMENT AND CONSERVATION OF BALTIC SEA SEAL POPULATIONS IN FINLAND

# 2. LEGISLATION AND OTHER BACKGROUND FACTORS

## 2.1. International conventions and strategies

Several international conventions on wildlife conservation provide a framework for the content and implementation of Finnish national legislation within this field. Countries that have ratified the conventions are politically committed to their implementation.

The management of seal populations in the Baltic Sea is also of common interest to all nine countries surrounding the sea. These countries aim to create a common policy for the Baltic Sea area that is based on international conventions. The following international conventions apply to the management of the Baltic seal populations.

### 2.1.1. The Convention on Biological Diversity

The Convention was adopted at the UN Conference on Environment and Development (the Rio Earth Summit) in 1992. Today, 175 countries have ratified the Convention and in Finland it entered into force on 25 October 1994. Under the Convention, each signing country is responsible for maintaining diversity at gene, species and ecosystem levels, and the utilisation of natural resources must be based on the principle of sustainable use. Sustainable use is defined as the use of components of biodiversity in a way and at a rate that does not lead to the long-term decline of biological diversity.

The aims of the Convention and the measures implemented also guide the national management of seal populations, even though seals have not been mentioned in particular. The Convention relates to the Baltic seal populations in terms of maintaining biodiversity in the Baltic marine environment and in terms of the utilisation of natural resources in accordance with the principle of sustainable use. The responsibility for these measures is that of the competent authorities.

### 2.1.2. The Bern Convention

The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), which was drawn up in 1979 and which entered into force in 1982, concerns the protection of European wild flora and fauna and their natural habitats. The Convention has resulted in new legislation in the European Community (the Natura 2000 network and the Habitats and Birds Directives). The species protected under the Convention are divided into strictly protected (Appendix II) and protected species (Appendix III). The Baltic ringed seal (*Phoca hispida botnica*) and the grey seal (*Halichoerus grypus*) fall under Appendix III of the Bern Convention.

The following Articles of the Bern Convention relate to seals. According to Article 7.1, each contracting party shall take appropriate and necessary legislative and administrative measures to ensure the adequate conservation of seals. According to Article 7.2, any utilisation of seals shall be regulated to avoid threatening the populations. Furthermore, Article 7.3 lists the necessary measures: 1) closed seasons or other procedures regulating utilisation, 2) temporary or local prohibition of utilisation, as appropriate, in order to restore satisfactory population levels, 3) if needed, regulations on trading live or dead animals.

### 2.1.3. The Bonn Convention

The Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention) was drawn up in 1979 and ratified in 1983. It concerns populations of those migratory species of wild animal which regularly move between countries, and the conservation of their habitats. The Convention covers all strictly protected species listed in the Appendix, and all migratory species of wild animals. The Baltic seal populations are included in Appendix II of the Bonn Convention, which covers species (1) which have an unfavourable conservation status and for which international agreements are required to ensure their conservation, or (2) whose conservation status would benefit significantly from international cooperation based on international conventions. The Bonn Convention acts as a framework Convention to encourage countries to establish international agreements at different levels. No such agreement has as yet been drawn up regarding Baltic seals.

### 2.1.4. The Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention, HELCOM)

The Convention on the Protection of the Marine Environment of the Baltic Sea Area was signed in Helsinki in 1974 and entered into force in 1980. The Helsinki Commission (HELCOM), its governing body, covers all the countries surrounding the Baltic Sea. Its task is to monitor the status of the Baltic Sea and act as an advisory body for the Baltic Sea countries. In 1992, a new Convention on the conservation of marine life in the Baltic Sea was signed, which was more binding than the previous one. It entered into force in January 2000. The parties to the Convention include all the countries with a coastline on the Baltic Sea and the European Community.

In the new Convention, the Convention Area has been expanded to include not just territorial waters but also internal territorial waters as far as the shoreline (Article 1). This implies that regulation of pollution from land-based sources applies to the entire catchment area of the Baltic Sea (Article 6.1). In addition, the Convention has been extended to apply to the conservation of nature and its biodiversity (Article 15).

The Commission operates through recommendations which aim to influence the actions of the Contracting Parties. Its task includes a continuous surveillance of the implementation of the Convention, proposing new recommendations for measures aiming at reaching the HELCOM goals and, where appropriate, making changes either to the Convention itself or its appendices, as has occurred in recent years. The Commission proposes new recommendations, which can be ratified only through a consensus decision from all contracting parties. The consensus principle is considered a way of guaranteeing an effective implementation of the recommendations. An overview of the HELCOM activities is available at http://www.helcom.fi/.

The Convention on the Protection of the Marine Environment of the Baltic Sea Area is binding on its signatory, like other international conventions. HELCOM's recommendations, however, are not legally binding for national authorities, but they do have a political and a moral weight.

*Recommendation regarding seals*

HELCOM has drafted a number of recommendations for the management of seal populations in the Baltic Sea. The previous one dates from 1988 (Recommendation Concerning Protection of Seals in the Baltic Sea Area) and states that:

a) Contracting Parties shall through their national instruments ban hunting of grey seals, ringed seals and harbour seals in the Baltic Sea area. In order to safeguard the survival of these species, the ban shall be maintained until a natural health condition and a normal reproductive rate can be scientifically shown;

b) Contracting Parties shall make efforts to establish seal sanctuaries and, when appropriate, organise seal breeding in order to save the genetic individuality of the declining Baltic seal stocks.

In 1996, HELCOM decided on a derogation from this recommendation. According to it, derogations from the protection could be issued for hunting, either for scientific purposes to examine the effects of the elimination of seals damaging fishing gear, or, in exceptional circumstances, to eliminate individuals as a preventive measure.

Based on the decision 19/98, HELCOM launched a three year seal project to draw up a new seal recommendation as the existing one was not thought appropriate at a time of increasing damage to fishermen as a result of the growing grey seal populations. A new recommendation was proposed in autumn 2001. It was called "Conservation and management of seal populations in the Baltic Sea; ACTION PLAN for the implementation of the HELCOM project on seals". The proposed recommendation was not approved, however. During the period 2001-2005, several attempts were made to reach a consensus on a new recommendation on seals, at first lead by Finland and later on by Sweden. During a joint seal expert workshop of HELCOM, ICES and EU in Stockholm, Sweden, 6-8 September 2005, an agreement of a draft of a new Recommendation on Conservation of seals in the Baltic Sea area was reached. This recommendation was adopted on July 8th 2006 (http://www.helcom.fi/Recommendations/en_GB/rec27-28_2/). HELCOM's new recommendation permits the sustainable use of seals, within the framework of the Habitats Directive requirements to achieve and maintain a favourable conservation status.

According to the existing HELCOM recommendation:

1) the Contracting Parties should apply the General Management Principles and Management Units in the recommendation when drawing up a national management plan for seals
2) the Contracting Parties should take effective measures in order to prevent illegal killing, and to reduce

incidental bycatch to a minimum level
3) the Contracting Parties should establish a permanent seal expert group with the tasks of coordinating seal monitoring, defining target reference levels for the Baltic seal population and its health status, and assisting in harmonising National Management Plans.
4) the Contracting Parties should implement the following monitoring programmes:

– to collaborate within the HELCOM seal expert group to identify and establish a network of protected areas for important actual and potential seal habitats across the Baltic Sea area and attempt to harmonise the regulations and monitoring of these conservation areas
– to develop and to apply where possible (non-lethal) mitigation measures for seals, in order to reduce bycatch and damage to fishing gear, as well as to support and coordinate the development of efficient mitigation measures.

## 2.2. EU legislation

### 2.2.1. The Habitats Directive

The European Council's Habitats Directive is, along with the Birds Directive, the EU's key legal instrument on wildlife conservation. Its general aim is to achieve and maintain certain species and natural habitats at a favourable conservation status. Biodiversity is promoted through the conservation of natural habitats and of wild fauna and flora in the European territory of the Member States to which the EEC Treaty applies. Measures taken under the directive consider economic, social and cultural requirements and regional and local characteristics. These requirements also extend to a coherent network of special areas of conservation (Natura 2000), to ensure the maintenance of relevant habitats and habitats of species at a favourable conservation status, and, where appropriate, to restore habitats and species in their natural range.

The Habitats Directive is legally binding to EU Member States. National legislation must accord with the requirements under the Directive, and there can be no derogations from its obligations at the national level.

Article 1 of the Habitats Directive defines favourable conservation status as the sum of the influences acting on the species concerned that may affect the long-term distribution of its populations.

**According to the Habitats Directive conservation status of a <u>species</u> is taken as favourable when:**
1) population dynamics data on the species indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats
2) its natural range is neither being reduced nor is likely to be reduced for the foreseeable future
3) there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

**In the Habitats Directive conservation status of a natural <u>habitat</u> is taken as favourable when:**
1) the natural range and areas it covers within that range are stable or increasing
2) the specific structure and functions which are necessary for its long-term maintenance exist
3) the conservation status of its typical species is favourable.

As far as the conservation of natural habitats is concerned, the grey seal and the ringed seal are included in Annex II of the Directive: animal and plant species of Community interest whose conservation requires the designation of special areas of conservation. The areas of conservation for seals in Finland are thus based on the requirements of the EU Habitats Directive.

Regarding conservation of the species, the Baltic grey seal and ringed seal are included in Annex V of the Directive: animal and plant species of Community interest whose taking in the wild and exploitation may be subject to management measures. Under Article 14 of the Directive, Member States deem it necessary, they shall take measures to ensure that the taking in the wild of specimens of species of (wild) fauna and flora listed in Annex V as well as their exploitation are compatible with their being maintained at a favourable conservation status.. The provisions of Article 14 therefore do not prevent the exploitation of species. Under the Article a Member State may, if necessary, restrict exploitation of species as described in paragraph 2.

Paragraph 2 of Article 14 states that if such measures are deemed necessary, they must include continuation of the surveillance provided for in Article 11. Such measures may also include in particular:
– regulations regarding access to certain property
– temporary or local prohibition of the taking of specimens in the wild and exploitation of certain populations
– regulation of the periods and/or methods of taking specimens

– application, when specimens are taken, of hunting and fishing regulations which take into account the conservation of such populations
– establishment of a system of licences for taking specimens or of quotas
– regulation of the purchase, offering for sale, keeping for sale or transport for sale of specimens
– breeding in captivity of animal species as well as artificial propagation of plant species, under strictly controlled conditions, with a view to reducing the taking of specimens in the wild
– assessment of the effect of the measures adopted.

With regard to these points, the following mechanisms are implemented in Finland: continued surveillance of ringed and grey seal populations, a closed season, and a system of licences and quotas. In addition, the Finnish Hunting Act has provisions on certain prohibited hunting methods. The management plan supports in demonstrating that the obligations under the Directive are being met, although the Directive does not actually require management plans to be drawn up for individual species.

Furthermore, when utilisation within the meaning of Article 14 is not considered possible, the Habitats Directive nevertheless permits the elimination of specimens of a species in certain cases. Article 16 of the Directive provides for derogations from the provisions of Articles 12, 13, 14 and 15.

#### 2.2.2. Water Framework Directive

Fundamental to the protection of EU waters is the Water Framework Directive, which entered into force in 2000. Its aim is to protect and improve the status of aquatic ecosystems (including groundwater), promote the sustainable use of water resources, and reduce pollution and the effects of floods and droughts. One of the prerequisites for the Directive is the classification of the ecological status of waters and the planning of measures to improve the ecological status. The Directive also obliges Member States to draw up national programmes to monitor the ecological status, which should have been launched by 2006. The classification of the ecological status of waters applies to key taxa in the ecosystem. The classification is also supported by chemical and hydrological data.

#### 2.2.3. The Ban on driftnets

Driftnets are nets on or just beneath the surface of the water, kept upright in the sea by weights on their under parts. Generally the nets are left to float in the sea, but one end may be tied to a vessel pulling them along. In the Baltic Sea the normal driftnet catch is pelagic species such as salmon, trout and white fish. Globally the use of driftnets has caused numerous incidental catches of cetaceans, birds and seals. Due to this problem driftnets are being prohibited, also in the Baltic Sea area. The prohibition of driftnet fishing in the Baltic Sea area is mainly aiming at avoiding bycatch of the common porpoise (Phocoena phocoena), but the ban will also help reduce bycatch of seals. The EU Regulation which restricts driftnet fishing (812/2004) will enter into force in stages and driftnet fishing will have ceased entirely in the Baltic Sea by 2008. The Regulation's objectives have also been applied in Finnish law. Observers have been employed to monitor fishing by Finnish herring trawlers and other fishing vessels (>15 m).

## 2.3. EU strategies

#### 2.3.1. The EU's marine strategy

The preparation of a marine strategy to cover all the EU's marine areas was started in 2002. Its general aim is to reconcile the utilisation of the seas with the maintenance of a good environmental status of marine ecosystems. Targets are being set to achieve a good environmental status, and their implementation is being monitored using the same approach as in the Water Framework Directive. In order to achieve these targets, close attention is being paid to the role of regional agreements on marine conservation (e.g. HELCOM), regional differences and the commitment of countries outside the EU to the strategy.

In 2002, the European Commission presented a communication to the Council and the European Parliament entitled 'Towards a strategy to protect (and maintain) the marine environment'. The purpose of the strategy is to establish a general framework regarding how European marine areas can be protected and maintained. On 24 October 2005 the Commission made a proposal (COM [2005] 505 final) on the Marine Strategy Directive. The Directive's ultimate aim is to achieve a good environmental status for the marine areas by 2021. The proposal states that Member States should make a preliminary evaluation of the essential properties of the marine areas and an analysis of their current environmental status, with the focus on habitat types, biological factors, physical and chemical properties and hydro-

morphology. An analysis should also be conducted on the major pressures and effects on water properties and on the environmental status. This data would serve to determine the characteristics of a good environmental status for marine ecosystems, set environmental targets for marine areas and confirm indicators connected with them, and, finally, draft monitoring programmes for the biological data needed. This should serve as a basis for conducting a survey of fluctuations in the populations of species of marine mammals and their natural and current range and status, and for submitting a report on the main threats to these species and conservation and management actions taken so far.

#### 2.3.2. The EU's strategy on sustainable development

The Sixth Environmental Action Programme is a part of the strategy on sustainable development adopted by the European Council in 2001. It calls for coordinated examination of the economic, social and environmental impact of all policy, with this impact being taken fully into account in decision-making. Its themes during the time it is in effect are climate change, *nature and biodiversity*, environment and health, and *the use of natural resources* and waste. The Action Programme's objective is also to incorporate environmental questions in all areas of EC external relations. To achieve these aims, the Community intends to improve the way it applies its environmental legislation and to collaborate with markets and citizens.

The aim of the Decision on the Sixth Community Environmental Action Programme regarding the conservation of wildlife and biodiversity is conserving and restoring nature. In addition, the Decision aims to halt the loss of biodiversity in the EU and worldwide. To achieve these aims, the Programme contains certain types of action, including: implementation of environmental legislation, particularly on water and air protection, conservation and restoration of landscapes, protection and restoration of marine and coastal areas, extension of the Natura 2000 to the offshore sea area, combining wildlife and biological diversity with trade policy and development and support for research into nature conservation. The strategy relates to the Baltic Sea seals as far as it concerns protection and restoration of marine and coastal areas, the maintenance of biodiversity and the sustainable use of natural resources.

#### 2.3.3. The EU Biodiversity Strategy

The EU's Biodiversity Strategy was published in 1988 as an element of the Fifth EC Environmental Action Programme on the environment and sustainable development. The aim of the strategy is to predict, pre-empt and prevent the causes of significant reduction or loss of biodiversity. The strategy focuses on four main themes: 1) conservation and sustainable use of biological diversity (including *in situ* and *ex situ* conservation of ecosystems and species, the application of the precautionary principle with regard to alien species and genetically modified organisms, the development of economic incentives and the removal of incentives which have a negative impact), 2) sharing of benefits arising out of the utilisation of genetic resources, 3) research and monitoring and exchange of information, and 4) education, training and awareness.

The Biodiversity Strategy also calls for the drafting of biodiversity Action Plans containing concrete measures that have an impact on different areas of policy. An Action Plan to conserve natural resources was published in 2001. Its aim is to show how current Community legislation and other existing instruments (e.g. the Birds, Habitats and Water Framework Directives, the soil protection strategy and the Natura 2000 network) can be exploited as effectively as possible in the implementation of the Biodiversity Strategy. Action plans have also been prepared on agriculture, fishing and economic development cooperation.

## 2.4. Legislation on seals in Finland

In Finland, the management of seal populations is subject to the legislation of mainland Finland and the Province of Åland. Åland's autonomy gives it the right to legislate on many internal matters and make decisions about the province's budget. Åland acts as an independent country with its own statutes and administrative bodies in matters relating to seals, e.g. hunting licences, closed seasons, seal conservation areas and fishing.

#### 2.4.1 Hunting legislation

*Mainland Finland: Hunting Act (615/1993) and Hunting Decree (666/1993)*

In Finland, the administration of game species and nature conservation is shared between the Ministry of Agriculture and Forestry and the Ministry of the Environment. Under the Hunting Act, the grey seal and the Baltic ringed seal are game species (section 5), and the Ministry of Agriculture and Forestry is responsible for the management of their populations. Matters relating to the conservation of wildlife, the environment and

threatened species (e.g. the Saimaa ringed seal) and the Nature Conservation Act are the responsibility of the Ministry of the Environment's Administrative Unit.

Hunting means the capturing and killing of wild game animals as well as utilising the bag by the hunter (section 2 of the Hunting Act). According to section 20 of the Act, hunting must be practised in accordance with the principles of sustainable use and so that game populations are not endangered. Grey and Baltic ringed seal may be hunted under the Act during specific hunting seasons with a hunting licence. In mainland Finland, the present annual hunting season is between 16 April and 31 December for the grey seal and 1 September and 15 October and 16 April and 31 May for the Baltic ringed seal. Licences have been issued for grey seal hunting since 1998. No hunting licences have been issued for Baltic ringed seals since 1988. Since this time 5 – 7 ringed seals have been caught each year for research purposes, mainly to monitor the population's health status.

A hunting licence is required for seal hunting (section 10(2) of the Hunting Act). Each year the Ministry of Agriculture and Forestry determines the maximum quota of animals to be hunted each season in each game management district (1 August–31 July), and lays down rules and guidelines for hunting. The game management districts grant hunting licences to hunters regionally, based on the quotas set by the Ministry. A hunting licence can be granted only if the population of a game species is viable in the region and as long as hunting does not impair the maintenance of the species at a favourable conservation status. There may be fewer licences granted than all those applied for. These situations may occur if it is necessary for the regional management of the population, or for a balanced and practical organisation of hunting activities. One aim of seal hunting is to keep the damage caused by seals to the fishing industry to a minimum. When granting a hunting licence for seals, the regional authority must consider the distribution of damages in their area (section 2 of the Hunting Decree). A licence holder must notify the game management association of the bag obtained (section 9 of the Hunting Decree).

The seal hunt requires a grooved bullet with a weigh of at least 3.2 grams and the scoring energy when measured 100 metres from the muzzle must be at least 800 joules. A full jacket bullet may also be used for shooting seals (section 16 of the Hunting Decree). Use of a shotgun loaded with pellets is not permitted, though a bullet prepared for a shotgun may be used (section 18 of the Hunting Decree). A trap for the capture of live animals or other similar hunting device may be used in the capture of Baltic ringed seal and grey seal (section 11 of the Hunting Decree). In Finland hunting rights are linked to the ownership of land and water areas. Persons residing permanently in Finland who have paid a game management fee and hold a hunting licence have the right to hunt in public marine areas, and on islands and islets in areas belonging to the State whose possession has not been transferred to any other (and in the Exclusive Economic Zone of Finland) (section 7 of the Hunting Act). The police and game wardens referred to in section 63(4) of the Hunting Act are responsible for supervising compliance with this Act within their respective jurisdictions. The Finnish Border Guards and customs authorities conduct monitoring operations on the country's border and in areas of land and sea in Finnish territorial waters and in the Exclusive Economic Zone of Finland (section 88 of the Hunting Act).

According to section 35 of the Hunting Act, the chief officer of the Police District may in individual cases grant permission to transport an unloaded hunting weapon in a case on a motor sledge on ice at a certain time using a route notified in advance.

A grey or Baltic ringed seal found in fishing gear belongs to the owner of the gear (section 83 of the Hunting Act).

In special cases an animal such as a sick or injured grey or Baltic ringed seal can be killed pursuant to section 25 of the Police Act (439/1995) or section 14 of the Animal Protection Act (247/1996).

*Hunting legislation in the Province of Åland*

In the Province of Åland, the management of seal populations is the responsibility of the Government of Åland. Both seal species are considered game animals and are protected. The grey seal is protected under section 2 of the Decree of Åland on Wildlife Management (1998:113), and the ringed seal under section 15 of the Act of Åland on Wildlife Management (1998:82). The ringed seal is classed as a species in need of special protection. Such species or their natural habitats cannot be harmed or altered without the permission of the Provincial Government in such a way that their reproduction or existence is at risk.

Although both the ringed and grey seal are permanently protected, there are certain derogations allowed on

protection in Åland's Hunting Act (ÅFS 31/1985). A seal may be killed to prevent damage to fish farming if the animal is found inside the nets of the farm (ÅFS 31/1985). This also applies if the local hunting rights belong to someone else, or if hunting is banned in the area or if the seal is found during the closed season. Seals which are captured this way may be kept but cannot be sold.

The Government of Åland can also grant a licence under sections 28 and 29 of the Hunting Act (ÅFS 31/1985) to kill or hunt seals for scientific purposes or for some other acceptable reason. Furthermore, the Government may derogate from the regulations on protection (closed season) if the seal population has grown too large or if the species is proving problematic in terms of damage.

Since 2000, the Government has laid down guidelines every year for the grey seal hunt. These instructions specify volumes to be hunted, hunting seasons and how and where hunting may be practised. The Government has issued two different types of licence for hunting grey seal: one for registered professional fishermen and one for hunting associations in the Province of Åland. There is no proper hunting season for either species of seal, but the Government has issued licences to hunt grey seal on the basis of sections 28 and 29 of Åland's Hunting Act. From 2006–2007 the hunting season for grey seal was from 4 May to 31 January. The ringed seal is still protected but hunting licences can be issued to prevent damage to professional fishing.

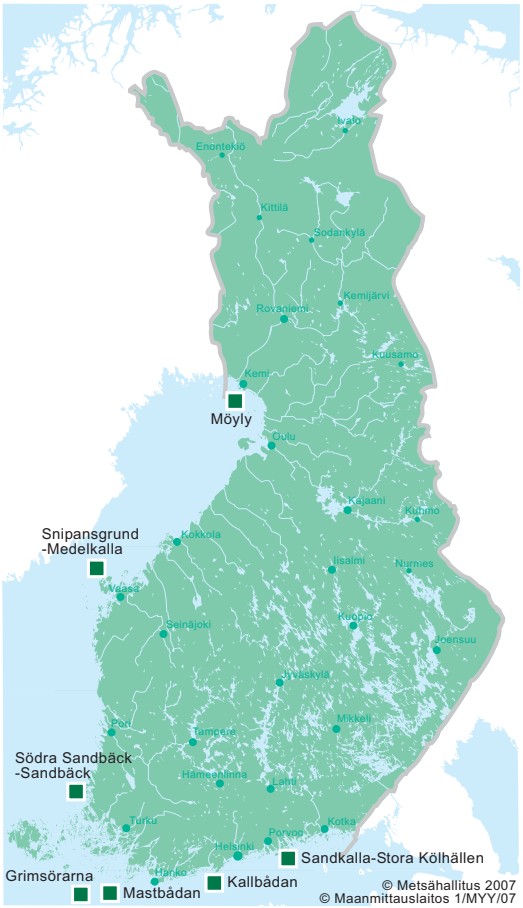
### 2.4.2. Seal conservation areas

*Seal conservation areas in mainland Finland*

The Government Decision on the adoption of Finland's proposal for the European Community's Natura 2000 network dated 20 August 1998 refers to six important distribution sites for grey seals where a ban on hunting was needed. A seventh seal conservation area, Södra Sandbäck, was included in the Natura 2000 network proposals, put forward by the Government of Åland. However, before the proposal on the seal conservation area was made, the area passed from the control of the Government of Åland to that of the Province of Western Finland, following some border agreements.

The seal conservation areas (Decree on Seal Conservation areas 736/2001) are intended for the protection of seals and to ensure that their living conditions are not disturbed. They are also intended to promote scientific research and the monitoring of seal populations as well as to preserve marine habitats. By Decree (736/2001), in 2001 seven seal conservation areas were established on state-owned marine areas as set down in the Nature Conservation Act (1096/1996). Their combined area measures more than 19,000 hectares. The conservation areas are important for the conservation of grey seals and their habitats. They are administered by Metsähallitus.

1) Sandkallan – Stora Kölhällen, covering approximately 7,570 hectares of state-owned territory in the City of Porvoo
2) Kallbådan, covering approximately 1,520 hectares of state-owned territory in the municipalities of Kirkkonummi and Inkoo
3) Mastbådan, covering approximately 900 hectares of state-owned territory in the municipality of Nauvo




*copyright Maanmittauslaitos 470/myy/07*

4) Grimsörarna, covering approximately 2,430 hectares of state-owned territory in the municipality of Korppoo
5) Södra Sandbäck, covering approximately 2,750 hectares of state-owned territory in the municipality of Kustavi
6) Snipansgrund - Medelkallan, covering approximately 3,260 hectares of state-owned territory in the municipality of Mustasaari
7) Möyly, covering approximately 760 hectares of state-owned territory in the City of Kemi.

The seal conservation areas stretch for at least one nautical mile (1,852 m) from the rock, islet or group of islets where the seals occur. In general, fishing is prohibited in these areas. However, professional trawl-fishing, thin-thread net fishing and using trap nets and traps whose mouths seals cannot pass through are permitted within the conservation areas at a minimum distance of 926 metres from the seal rock, islet or group of islets. Hunting is totally banned in the seal conservation areas. However, official navigation channels do go through these areas.

Official permits are issued on a case-by-case basis to visit the seal conservation areas for purposes of research, education, recreation, etc. In such cases organised trips to watch seals in their natural environment may be permitted. The Kallbådan conservation area has a special management and development plan in force for seal watching and for the use of the lighthouse. If necessary, such plans could be drawn up for other seal conservation areas and they could focus, in particular, on the potential of seal watching.

A resolution was appended to the Government Protocol in connection with Decree 736/2001, stating that the Ministry of the Environment, the Ministry of Agriculture and Forestry, and the Game and Fisheries Research Institute were to assess the impact of the seal conservation areas on professional fishing and wild salmon stocks, and investigate the closest possible distance one may get to grey seals, by the end of 2006. According to the resolution, the results of the survey would be used to alter the use of the seal conservation areas, if necessary. The actual survey work for the assessment was conducted by the Finnish Game and Fisheries Research Institute in the so-called PONSI project.

*Seal conservation area in Åland*

A seal conservation area was established in Åland under section 26 of the Hunting Act (ÅFS 31/85) in the municipality of Kökar. The Karlbybådarna seal conservation area covers the areas of Storlägnan, Nölingen and Stora Lägnan. A permit is needed from the Government of Åland to enter the conservation area, and trespassers may be fined. The ban extends to flights at an altitude of less than 500 metres.

### 2.4.3. Other conservation areas

In addition to the seal conservation areas, there are other conservation areas along the Finnish coast. The most important areas in terms of the protection of seals are the Bothnian Bay (Perämeri) National Park and part of the Archipelago National Park. Seal hunting in these areas is prohibited and there are also other kinds of restrictions. Some of the other conservation areas may be important both for seal conservation and the sustainable use of seal populations. Most of the state-owned and private nature conservation areas constitute a comprehensive Natura 2000 network along the coast (Appendix 1).

There are around 140 marine Natura 2000 sites, of which 66 are or may be important seal habitats. The Natura 2000 network consists of already established national parks, special conservation areas and nature conservation areas on private land, where activities are guided by regulations on protection laid down when the areas were established. There was no need for changes in their regulations when the Natura 2000 network was established.

At present, there are 12 Natura sites in the Natura 2000 network on mainland Finland that have the grey seal listed as present in those areas. The ringed seal is listed in five of these areas. In addition, in Åland there are 14 Natura sites with the grey seal listed as present in the area.

Regulations on protection for new sites and for extensions to existing sites are provided on a case-by-case basis. No decision to establish a nature conservation area on private land can be taken unless the Regional Environment Centre and landowner have agreed on the protection regulations for the site.

The marine Natura 2000 sites contain, in addition to the conservation areas, quite large areas of water for which the conservation status has been granted by virtue of the Water Act, Fishing Act, Land Extraction Act, Land Use and Building Act, or a separate agreement. In these cases, no kinds of hunting restriction are required. Pri-

vate landowners may, however, should they wish, apply to have a nature conservation or game conservation status granted for these areas, which means that hunting would be regulated.

*State conservation areas*

*The Finnish National Parks* are areas of the country which must be preserved as they are or in a natural state. They are intended as areas that are freely accessible to the public where people can view wildlife and nature. There are four national parks in the territorial waters of mainland Finland. The Perämeri National Park, located in the northernmost area of the Bothnian Bay in the outer archipelago of Kemi and Tornio, was established to protect the outer archipelago and marine wildlife and for environmental research and recreation. The park covers 157 km². 2.5 km² is land and comprises around 20 islands and islets/rocks. The Archipelago National Park (area 500 km²), between Åland and mainland Finland, was created to protect the nature and culture of the Archipelago area, to safeguard the traditional ways in which nature is used there, to maintain a vibrant archipelago community, and for environmental research and general recreation. The park mainly covers the outer archipelago and the 2,000 islands and islets/rocks to be found there. The Tammisaari National Park (area 52 km²), in western Uusimaa, was established to protect a representative part of the archipelago and marine wildlife in the Gulf of Finland and to promote environmental research and recreation. It extends from the open sea right up to the inner archipelago. It covers three of the four archipelago zones, the inner, outer and open sea zone, and has no areas on the mainland so that almost 90% of it is covered by water. The Eastern Gulf of Finland National Park (area 6.7 km²) consists of the outer archipelago of Finland's easternmost coastal area, though hardly any of the area of this park covers water. The park's hundred islands and islets/rocks are scattered over a wide area: an area of sea some 60 kilometres across, a long way from the mainland and any inhabited islands. These National Parks are part of the network of important areas of conservation in the Baltic Sea under the Convention on the Protection of the Marine Environment of the Baltic Sea Area.

In addition, there are several conservation areas in parts of the country *(including The Special Conservation Areas and the Metsähallitus Conservation Areas).* The nature of the areas and their aims for conservation vary a great deal. The seal conservation areas also belong to these areas.

*Private conservation areas*

The **nature conservation areas on private land** are established on application by a landowner by a decision of the relevant Environment Centre. Their area, nature and regulations on protection (closed season) may differ considerably. The areas are created for the purpose of a specific type of protection, so the landowner may also have different rights to use an area within the scope allowed by the purpose of conservation. The decision on protection stipulates precisely in what respect the area is protected. Areas may also be protected for a fixed term *(fixed-term nature conservation areas on private land).*

### 2.4.4. Compensation for damage caused by seals

Aid for improving the preconditions of the fishing industry can be granted out of the national budget. The aid, which is granted nationally, must be in accordance with the EC Treaty (Articles 92–93). National aid, which would favour individual entrepreneurship or industry and distort competition in the single market, is not allowed.

*Fisheries insurance*

Fishing gear used on the Finnish coast is exposed to exceptionally harsh environmental conditions for Europe. The fisheries insurance system is based on the Finnish Fisheries Insurance Act (331/1958). The Fisheries Insurance Association is paid an annual state subsidy of 40% of the damages the Association has paid to people and corporations in accordance with insurance policy agreements for fishing and other gear cited in the Act. The system has allowed professional fishermen to receive some compensation for the loss of or damage to fishing gear caused by seals.

*Compensation for damage to catch*

Under section 87 of the Hunting Act, compensation out of state budget funds may be granted for damage to catch caused by seals and sustained by professional fishermen. Under the Decree concerning compensation for loss or damage (445/2002), the Ministry of Agriculture and Forestry has paid professional fishermen compensation for damage caused by seals to the catch when using nets, lines and trap nets in Finnish territorial waters or within the Finnish fishing zone.

In 2002, the European Commission gave Finland permission to pay one-off compensation to professional fishermen for loss or damage caused by seals. The Commission required that the compensation only be paid

for damage caused in 2000 and 2001, because the condition for approving the aid is the exceptional situation due to the growth in seal populations. It was the Commission's view that if there were exceptional circumstances this warranted the one-off nature of granting aid. The system of compensation was approved by the European Commission, which stipulated that compensation for damage caused by seals would be paid for a maximum period of two years. It would only be paid if the loss caused by seals and sustained by the applicant for compensation was at least 20% of the average catch for 1997–1999. The claims for compensation in the period 2000–2001 show damages totalling 7.47 million euros. Under Government Decree 445/2002 a maximum of 1.7 million could be granted in compensation, only 23% of the approved damages to be paid.

According to Government Decree 388/2005, 1.5 million euros were paid out of state budget funds in supplementary compensation for losses of catch caused by the grey seal and the Baltic ringed seal in 2000 and 2001. Supplementary compensation was paid to professional fishermen who had been awarded compensation in 2003 on the basis of the Government Decree on Compensation for Damage caused by Seals (445/2002). The maximum amount for supplementary compensation was the difference between the estimated amount of the loss and the sum paid on by virtue of a decision by the local Employment and Economic Development Centre. If the appropriation available was not enough to pay supplementary compensation to cover that difference, the amount of damages claimed by all the recipients of compensation as a whole was reduced by an equal percentage. The Ministry of Agriculture and Forestry allocated the available appropriations for compensation of loss or damage to the relevant Employment and Economic Development Centre. Supplementary compensation was paid without any application out of funds allocated by the Ministry. The Decree was in force from 13 June until 31 December 2005.

*Assistance for purchasing of selective and seal-proof trap nets*

Owing to the increase in damage caused by seals, the Ministry of Agriculture and Forestry sought a derogation from the ban to grant assistance for purchasing fishing gear under EU Regulations. In 2002 the European Commission approved a one-off system of subsidies for purchasing seal-proof gear to come out of the structural funds for the development of fisheries. A condition for granting the subsidy was e.g. that the subsidised fishing gear would allow selective fishing of salmon.

By autumn 2004 fishermen were able to apply for a subsidy for purchasing selective, seal-proof trap nets. The details of how the subsidies would be granted and their overall level were decided on 24 January 2005 by the Department of Fisheries and Game in the Ministry of Agriculture and Forestry and the Fishery Units of Employment and Economic Development Centres. Overall the total subsidy awarded was in the region of 1.6 million euros. The Employment and Economic Development Centres had received 90 applications for financial support by the time the deadline had been reached. Subsidies were applied for a total of 250 trap nets, the cost of which was 2.5 million euros in all. Not all the purchases of trap nets for which subsidies were applied for have yet gone ahead. The Employment and Economic Development Centres will grant a subsidy for each applicant up to 70% for the first two trap nets and 50% for the rest for all applications meeting the terms and conditions of eligibility and application.

In June 2006 the Agriculture and Fisheries Council of the European Union decided to increase EU subsidies for the purchase of seal-proof gear. In the EU's new programming period, 2007-2013, the purchase of gear and development work to prevent damage can be subsidised by virtue of the new Regulation establishing a European Fisheries Fund.

### 2.4.5. The use of seal meat as food

EU Regulations 852/2004/EC, 853/2004/EC, 854/2004/EC and 2075/2005/EC all contain provisions on the use of seal meat as food. They relate to food energy, food control, and trichina tests on meat. There are also national regulations and provisions which apply here: the Finnish Food Act (23/2006), the Decree on Primary Production (134/2006) and the Decree on Meat Inspections (38/EEO/2006). In addition to these, there are requirements on the handling and processing of offal in laws relating to by-products.

The Food Act states that seals are wild game. On the whole, meat for general consumption, including wild game, must be inspected in Finland (section 11 of the Food Act). An exception to this is when it is for the hunter's own use (section 4) and the special cases referred to in section 11(1) and points 9, 10 and 14 in section 13(2). A hunter may sell wild game or supply it unchecked to a consumer directly only if it is for the latter's own use.

If seal meat is supplied for retail sale to a shop or restaurant, for example, or to an approved cutting or meat production plant for processing, the meat has to be inspected.

Inspections of seal meat may be carried out either in an approved slaughterhouse or a small place of slaughter approved for slaughtering wild game, in an approved game handling plant or in some other place as referred to in section 43 of the Food Act, approved by the official municipal veterinarian for the slaughtering of wild game and meat inspection.

In meat inspections, a seal carcass must be accompanied by its head and internal organs, even if these latter may have been separated from the carcass at the hunting site when the animal had its intestines removed and its blood let. The stomach and intestines can be left behind. The carcass must be accompanied by a document giving details of the hunting event and any suspected changes (134/2006, section 11(4) (3)).

If a hunting organisation has a member who is a 'trained' hunter, with training in health and hygiene as referred to in Annex III, Section IV, Chapter I of Regulation (EC) No 853/2004, he or she can conduct an inspection of the seal's carcass and internal organs at the hunting site. In such cases the internal organs can be left behind and just the carcass, head and diaphragm submitted for inspection. The trained hunter must submit a written report to the official veterinarian conducting the meat inspection.

Seal meat inspections always include trichina testing. For that purpose samples of the carcass need to be submitted for testing in an approved laboratory. If trichinosis is discovered the carcass will be rejected.

In meat inspections the seal's internal organs and the blubber and the fat in the hollow of the belly are always rejected because of their high contaminant levels.

No training in health and hygiene for hunters as described in Annex III, Section IV, Chapter I of Regulation (EC) No 853/2004 has been organised as yet. A training program has been discussed between the Finnish Food Safety Authority (Evira) and the Finnish Hunters' Central Organisation. Any training organised must have Elvira's approval.

## 2.5. National strategies

### 2.5.1. Finland's Programme for the Protection of the Baltic Sea

Finland's Programme for the Protection of the Baltic Sea is a programme based on a Government resolution adopted in 2002, which aims to influence on the state of the waters and the marine environment in the Gulf of Finland, the Archipelago Sea, the Åland Sea, the northern part of the main basin of the Baltic Sea, and the Gulf of Bothnia. In order to achieve a good ecological state of the Baltic Sea, action is to be taken in six main sectors. These are combating eutrophication, reducing risks caused by hazardous substances, reducing damage resulting from the use of the Baltic Sea, maintaining and increasing biodiversity, improving environmental awareness, research, and monitoring. The protection programme is intended to promote the achievement of a favourable conservation status of marine natural habitats and species. Planning the use of land and areas of water, developing the mapping of the marine environment and cooperation between actors and research institutes will increase knowledge and improve coordination. This will improve the approaches used to maintain the diversity of marine and coastal wildlife in the future. Knowledge about the hazardous substances, their emissions and occurrence, will be improved, which will support a systematic and prioritised approach to the action to reduce emissions. The programme mentions more than 30 means of achieving these aims. The decisions call for action both in Finland and its neighbouring regions within the next 10-15 years.

### 2.5.2. The Finnish Biodiversity Research Programme

The Finnish Biodiversity Research Programme (FIBRE) aims to promote cooperation between different administrative sectors in the implementation of the UN Convention on Biological Diversity. The previous action programme was in effect from 1997 to 2005. In 2006 the Finnish Government adopted a strategy on biological diversity and sustainable use for the period 2006-2016, which will guide the content of the new Biodiversity Research Programme. The maintenance of Finnish biodiversity relies on a sufficient number of nature conservation areas and the sustainable use and management of commercially utilised areas and natural resources, while taking into account of other social objectives. The aim is to protect and manage biological diversity so that Finland will not lose its natural species, gene resources or natural habitats. The programme also aims

to promote the sustainable use of natural resources and economic opportunities in the utilisation of biodiversity which may be important for entrepreneurship and employment.

## 2.6. Red List of threatened species

The Red List of threatened species relates to how likely it is that species or taxa will become extinct. According to the criteria proposed by the International Union for Conservation of Nature (IUCN), threatened species are classified as Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). Near threatened (NT) species are not endangered. Their status and population trends need to be monitored, however. According to the latest evaluation of threatened species in Finland, which is based on population estimates for 1998, the Baltic ringed seal and the grey seal are included in the NT category (Rassi et al. 2001).

A species' Red List classification may differ globally, nationally or regionally. Globally, the Baltic ringed seal and grey seal are classified as Vulnerable in the IUCN's list of threatened seal species (Reijnders et al. 1993, 1997). But in the Baltic Sea, IUCN (2004) classifies them as Vulnerable and Endangered respectively (based on information from 1996). Thus, the basis for the Red List status in the Baltic Sea was the seal population estimates in the Baltic Sea area with 5 000 grey seals and 3 400 Baltic ringed seals (Reijnders et al. 1997), differs clearly from the situation today.

# 3. THE STATE OF THE BALTIC SEA

The general development during recent decades within the Baltic Sea area has clearly affected the state of the Baltic Sea, by increased loading of nutrients and environmental contaminants (Pitkänen 2004). The contamination of the sea is a result of human coastal settlement and industry that has polluted the sea either directly or via rivers and the atmosphere. Ecosystem level changes, the impact of hazardous substances, the overuse of natural resources and eutrophication have all reduced the biodiversity in the Baltic Sea (PMN 1996, Bäck & Lindholm 1999).

## 3.1. Environmental contaminants

The Baltic Sea is polluted by intensive agriculture, industry, other types of commercial activity and the fact that the catchment area is densely populated (approximately 85 million people) (Pitkänen 2004). The sea is also a catchment area for slowly decomposing components, as it has unfavourable conditions for chemical decomposition: a cold climate and ice cover in the winter. In the Baltic Sea, hazardous substances are accumulating in organisms to a far higher extent than in the world's oceans. Tens of thousands of chemicals are used in the catchment area, but information on their concentrations in the environment and on their spatial and temporal distribution is available only for a few of the most potent organic contaminants. polychlorinated biphenyls (PCBs), 1,1,1-Trichlor-2,2-bis[p-chlorophenyl]ethane (DDT) and hexachlorocyclohexane [HCH]) and of some heavy metals. Furthermore, only limited information is available on those hazardous substances emerging from emissions, mainly dioxins and polyaromatic hydrocarbons (PAH compounds).

Organic environmental contaminants are synthetic substances which are produced for industrial or agricultural use or which are the by-products of industrial and/or combustion processes. Many organic contaminants are persistent (slow half-life in nature) and, because they are fat-soluble, they accumulate in living organisms, especially fat tissue. Trends in levels of organochlorine compounds and their derivative in the Baltic ecosystem have been monitored since the 1980s. Since the ban on PCBs and DDTs, DDT levels have clearly declined throughout the ecosystem (Bignert et al. 1998). Concentrations of HCH, hexachlorobenzene (HCB), chlorobornanes (toxaphene or camphechlor) and chlordanes have decreased in the Baltic Sea to levels similar to other marine ecosystems (Paasivirta et al. 1993, Vuorinen et al. 1997, Bignert et al. 1998), but the decreasing trend in PCB and dioxin levels have levelled of during the last 10 years. Concentrations are still elevated in, for example, birds' eggs, fish and seals (Bignert et al. 1998, Olsson et al. 2000, Nyman et al. 2002). Concentrations of dioxin-like PCBs in cods' livers have not been decreasing since the mid-1980s (Falandysz et al. 1994). The Baltic herring has been the main object for monitoring temporal trends of the contaminant levels in the Baltic ecosystem, as herrings play an important role as food for marine predators and humans. Since the 1990s, the decline in PCB concentrations has levelled off, or concentrations have even started to rise again (Finnish Institute of Marine Research 1999, Kiviranta 2003). In general, concentrations of these organochlorine compounds in the Baltic Sea are clearly higher than, for example, on the western costs of Sweden (HELCOM 1996) or in equivalent species in the Arctic region (AMAP 1998).

In recent years, dioxins have attracted growing attention. Dioxin compounds in the Baltic Sea are either airborne or arrive via the numerous rivers and the point source polluters. The most significant source of dioxins in the entire Baltic Sea is the contaminated sediment carried from the Kymijoki river into the Gulf of Finland (Verta et al. 1999 a, b, Isosaari et al. 2002), which accounts for more than 90% of the Gulf of Finland's dioxin load. Findings from long-term monitoring show that concentrations are declining, but recent findings also suggest that dioxin concentrations in fish have not decreased since the 1990s (Vuorinen et al. 1997, Korhonen et al. 2001, Kiviranta et al. 2003). Dioxins have been shown to be highly toxic for experimental animals, but only a few studies have reported on their effects on living organisms in the Baltic Sea.

Hormonally active harmful substances, including certain PCB compounds and tributyltin (TBT), have been shown to alter hormone function in fish and cause reproductive disruptions, which has resulted in skewed sex ratios (Nakari 2003). Moreover, many of the organochlorine compounds whose concentrations have not decreased in Baltic organisms for a long time have been shown to weaken animal's resistance to disease. Significant concentrations of natural and synthetic estrogens and chemicals, which have proven hormonally active, have been found in wastewater from areas of human settlement. Laboratory tests have also shown that natural plant sterols, which normally occur, for example, in wastewater in the pulp and paper industry, have sim-

ilar effects on fish. There is very little information on the distribution of these 'environmental hormones' in the Baltic Sea and their effects on the organisms. At present, a systematic arrangement for collecting information is being developed in the form of an international collaboration using testing and risk assessment methods.

Heavy metals, such as mercury, cadmium, copper, lead and nickel, find their way into the Baltic Sea from industry, from soil washout and from non-point source pollution (polluted runoff). These substances have accumulated in the bottom sediments in rivers, from where they can return to the food chain. For example, if the bottom of the river becomes oxygen-free, heavy metal compounds can change into a soluble form and get released into the water (Pitkänen 2004). Mercury concentrations in fish in the Baltic Sea are generally lower than in inland waters. There are exceptions in heavily polluted coastal areas where the chlor-alkali and wood processing industries contaminated the marine environment up until the end of the 1960s (Korhonen et al. 2001). Heavy metal levels have remained high since the 1980s, and no trends of reduced levels in the organisms have been shown (Jonsson et al. 1996, Fant et al. 2001, HELCOM 1996, 2002). Only lead concentrations in fish have decreased in general in the Baltic Sea ecosystem.

## 3.2. Eutrophication

The main problem in the Baltic Sea and its coastal waters is eutrophication. The sea's current nutrient load has been estimated to be four to eight times that of the pre-industrial age (Larsson et al. 1985). The cause of eutrophication is the high nutrient load from the catchment area compared to the sea's natural features (its shallowness, stratification and long water renewal time) (Pitkänen 2004). Most of the nutrient load ends up in the Baltic Sea via rivers (HELCOM 1998).

Nitrogen and phosphorous are minimi factors in plant nutrients, and they are also the main factors affecting eutrophication. In the Gulf of Finland, eutrophication in Finnish territorial waters has advanced the furthest, with a nutrient load two to three times that of the Baltic Sea as a whole (Pitkänen et al. 2001). Eutrophication affects the entire food chain. Its impact is evident in changes in the composition fish species and the numbers of fish, and in the increase in biomass, increased growth of certain species, and the profusion of small fish and offspring. The total fish catch in the Baltic Sea areas has increased tenfold in the last 50 years and has doubled in the last 20 years. On the other hand, many studies have shown that the effects of eutrophication are difficult to distinguish from other types of human impact.

## 3.3. Algal blooms

The intensity of algal blooms has clearly increased in the last 10 years (Kahru et al. 2000), mainly due to the increase in phosphorus concentrations and changes in the nitrogen-phosphorus ratio. Warm summers have also encouraged growth. Species of blue-green algae produce toxins that affect the liver and nervous system of mammals (Kononen 1992, Sivonen 1990, Kauppila et al. 1995). Toxin concentrations in algal blooms may be dangerously high, especially when masses of algae are washed up on the shore. In Finland domestic animals such as dogs and ducks have died of poisoning from blue-green algae (Pitkänen 2004). Algal toxins have also been proposed as a possible cause of death in birds. In 1992 and 2000, reports came in from the Gulf of Finland of the mass deaths of seabirds (Kauppi 1993, Pitkänen 2004). The reason for the deaths in 1992 was claimed to be algal toxins, although no poison as such was isolated (Kauppi 1993). Mass deaths of marine mammals due to algal blooms have been observed elsewhere in the world. Up until now, however, this has involved toxic poisoning from silica algae or dinoflagellates (Geraci et al. 1989, Scholin et al. 2000).

# 4. SEALS AND SEAL POPULATIONS

## 4.1. Seal species in the Baltic Sea

There are currently three species of seal in the Baltic Sea: the Baltic ringed seal (*Phoca hispida botnica*), the grey seal (*Halichoerus grypus*) and the common (harbour) seal (*Phoca vitulina*). The ringed seal and grey seal occur in Finnish territorial waters, while the harbour seal occurs on the eastern coasts of Denmark and on the coasts of Skåne, Gotland and Öland in Sweden (Helle & Stenman 1990). The grey seal and ringed seal are the most abundant Baltic seal species and most of them have settled in the north, in the territorial waters of Finland, Sweden, Russia and Estonia. The Baltic ringed seal is categorised as its own separate subspecies. The Baltic grey seal, on the other hand, has not officially been accorded a subspecies status, although it has been presented as its own subspecies in some contexts: *H. g. balticus* or *H. g. macrorhynchus* (e.g. Helle & Stenman 1990, Schwartz et al. 2003).

### 4.1.1. The ringed seal: distribution area, habitats, habits, annual cycle

In the global context, the ringed seal is the most abundant Arctic seal species of the northern hemisphere. Population estimates vary between 2.5 and 7 million (Reijnders et al. 1993). The ringed seal can be divided into at least five subspecies, and in the Baltic Sea catchment area two freshwater subspecies occur, in addition to the Baltic ringed seal: the Saimaa ringed seal (*P. h. saimensis*) and the Ladoga ringed seal (*P. h. ladogensis*). These partly genetically differentiated seal populations (Palo 2003) have evolved through the geographical isolation that has resulted from the post-glacial land upheaval during the last 10,000 years.

Figure 1. Distribution area of the grey and ringed seal (in grey) and main breeding areas (in dark grey) in the Baltic Sea.

The ringed seal is greatly dependent on ice and snow for reproduction and moulting. Together with the Baikal seal (*Phoca sibirica*), it is the only seal species in the northern hemisphere which can live in fast-ice areas. The ringed seal occurs in the northern parts of the Baltic Sea north of a line roughly between the Swedish archipelago and the Gulf of Riga. South of this line, only occasional migrating seals are encountered. The distribution of the ringed seal varies annually in the Baltic Sea according to the areas that are the most likely to freeze. The major part (75 %) of the Baltic ringed seal population occur in the Bothnian Bay, some 15% occur in the Gulf of Riga, and 5% or less occur in the eastern part of the Gulf of Finland (Figure 1). At present, also a few ringed seals occur in the Archipelago Sea (Helle 1980a, Helle & Stenman 1990, Härkönen et al. 1998, Miettinen et al. 2005, Stenman et al. 2005b).

The ringed seal is the smallest of the Baltic seal species. An adult measures 100–160 cm long and weighs 50–120 kg. Ringed seals reach maturity at the age of three to six years on average, females normally earlier than males. They can live up to 40 years or more (Helle 1980a, Helle & Stenman 1990). Adult males are characterised by a ring-like pattern in the fur. Mature females give birth to one pup a year over a three to five consecutive year period, after which they take a year off. Older ringed seals need to take years off more frequently. The breeding season for the Baltic ringed seal is February to April (Helle 1979a, Helle & Stenman 1990). Breathing holes and lairs enable ringed seals to live in fast-ice areas. Mature animals utilise the firmest ice areas for breeding. A pup is born in a lair, which the female has usually dug into snowdrifts on the pack ice. In areas with poor snow and ice conditions, as is the case often in the Archipelago Sea, the seals give birth on the shores of rocks, islets and islands (Miettinen et al. 2005). A pup weighs 4.5-6 kilos at birth (McLaren 1958) and is nursed for five to seven weeks. It grows by an average of 350 grams a day (Lydersen & Hammill 1993). A female will come into oestrus towards the end of the nursing period. The ringed seal female carries her young for 10–11 months, including a 3-3.5 month long phase of delayed implantation (Helle 1980a). In the Arctic Ocean, the ringed seal is the main prey of the polar bear (*Ursus maritimus*) and the arctic fox (*Alopex lagopus*) (Smith 1987). It has no natural predators in the Baltic Sea. Only large birds may cause danger to newborn pups on the open ice or on rocks and islets.

The Baltic ringed seal occurs in the northern most parts of the Baltic Sea, in areas with fast-ice.

Ringed seals spend most of their time in the water. They can dive for 25 minutes or longer, but normally they dive for just a few minutes, reaching a depth of 50 metres or more. Occasionally seals have dived down to 100 metres or more in the Baltic Sea (Härkönen et al. 2005), and in the Arctic Ocean to more than 500 metres (Born et al. 2004). During the moulting season, ringed seals haul-out on the ice, or in some cases on the shores. In the Baltic Sea, the moulting season lasts from April to May, when the last ice is melting in the Bothnian Bay. For the moulting process to be efficient the surface layer of the skin needs to be warm. This is best achieved in dry conditions. During the moulting season, ringed seals are fasting. Pups change their frizzy laguno hair to the short adult fur usually while still in their lairs. It is thus only animals that are more than a year old which moult on the ice.

Ringed seals generally live solitarily, and are not very social. They do not occur in large, compact herds as do grey seals. But in late spring, when most of the ice has melted, they sometimes haul-out in herds on the ice. Adult ringed seals typically exhibit site-fidelity (Härkönen et al. 2000), and long seasonal migrations are rarely encountered. Young animals can migrate further off, though not much is known about this. In the Arctic Ocean, young seals have been observed to migrate for hundreds or even thousands of kilometres (Smith 1987, Heide-Jørgensen et al. 1992, Kapel et al. 1998, Teilmann et al. 1999). In spring, Baltic ringed seals may move along with the ice floes, even long distances (Helle & Stenman 1990). Compared to the grey seal, the ringed seal is very timid and sensitive to disturbance. In the Archipelago Sea, for example, it is thought to establish its lair in the least disturbed areas of the sea (Miettinen et al. 2005).

### 4.1.2. The grey seal: distribution area, habitats, habits, annual cycle

The grey seal occurs only in the northern Atlantic ocean (divided into the West Atlantic and East Atlantic populations) and in the Baltic Sea. Although it has three geographically clearly separate populations, all grey seals are today regarded as one homogenous species. The world population of grey seals is estimated at a little fewer than 300,000 seals, with a distribution of roughly 50 % occurring on the western shores, and 50 % on the eastern shores of the Atlantic Ocean.

The current main distribution areas for the Baltic grey seal are the northern Baltic Sea basin, the Bothnian Sea and the Gulf of Finland. A small number of grey seals occur in the southernmost parts of the Gulf of Riga. The major part of the present Baltic grey seal population occurs north of the 58th latitude (Karlsson 2003) (Figure 1). The population in these northern sea areas has grown dramatically in recent years, but no equivalent development has been observed in the more southern parts of the Baltic Sea. The northern distribution is partly explained by the grey seal's preference to breed on suitable ice. Most grey seals occur in the northern part of the main basin of the Baltic Sea most of the year, but migrate in spring to breed on the drift ice in the northern Bothnian Sea, the Bothnian Bay and the eastern part of the Gulf of Finland (Helle & Stenman 1990).

The most common breeding habitat for the Baltic grey seal is ice. Grey seals do not build a lair. They give birth on the open ice, usually on the loose ice floes close to the pack ice (Helle & Stenman 1990). However, both Atlantic populations breed on land. The Baltic grey seal is not dependent on ice, and breeds on land on the west coast of Estonia, the Swedish coast and the outer islets and rocks of the Archipelago Sea, where ice is rare. Grey seals tend to breed in large herds on islets and rocks, while females usually breed solitarily on ice. Pups that are born on land are more vulnerable to stress and diseases. The weaning weight of pups born on land is lower and the mortality rate seems higher than of those born on ice (Jüssi 1999), and therefore breeding can be considered less successful on land than on ice.

The grey seal is the largest of the Baltic seals. Typically, there is a difference in size between the sexes (sexual dimorphism), where males are larger than females. Adult males can be 2.3 metres long and weigh almost 300 kg, while females average two metres in length and weigh closer to 200 kg. The sexual dimorphism in Baltic grey seals seems smaller, than with the East At-

lantic population (Karlsson 2003). Mature males are recognised by their long snout. The colour and pattern of the fur vary according to sex and age. Grey seals reach maturity at three to six years of age, females on average earlier than males. Adult females give birth to one pup every year for three to five consecutive years, after which they occasionally take a year off. Old animals need to take years off more frequently. Baltic grey seal pups are born in February-March, when the ice cover is the thickest in the Baltic Sea (Curry-Lindahl 1975). The female gives birth to a 90–105 cm long pup weighing around 10–12 kilos. Nursing lasts 17 days on the average, and the pup grows 1.5-2 kilos a day (Kovacs & Lavigne 1986, Jüssi 1999). Newborn pups have long, cream-white laguno hair, which they replace to a short and stiff fur at the age of 2-4 weeks. The female comes into oestrus towards the end of the nursing period. The grey seal female carries her young for 10–11 months, including a 3-3.5 month long phase of delayed implantation. The grey seal is typically polygamous and the male has a small number of females in his territory. The Baltic grey seal, however, does not have any real harems. Breeding on the open ice, and on ice which is breaking up, reduces the male grey seal's chances of having several mates. Grey seals breeding on land tend to have more females.

Grey seals are social animals and occur in herds, for at least a part of the year. In spring, they gather on distant rocks and islets and in winter on drift ice close to the open water. Especially when during their moult, grey seals gather in large herds, numbering more than a thousand in some cases, on rocks and islets in the outer archipelago. The moulting season in the Baltic Sea is generally in May-June. In winter and early spring, grey seals spend more time in the water. When foraging in the sea, they usually travel alone or in loose groups of just a few animals. The Baltic grey seal has been known to dive to a depth of more than 100 metres, but most dives last less than 10 minutes and reach an average depth of 25 metres (Sjöberg 1999, Sjöberg & Ball 2000).

Baltic grey seals travel long distances during their seasonal migrations (150 km or more) distances. Often the animals migrate between breeding sites and summer feeding areas. A typical seasonal migration route is between the Bothnian Bay and the Åland Sea. Grey seal behaviour has been studied along the eastern coasts of Sweden (Sjöberg et al. 1995, 2003, Sjöberg & Ball 2000, Karlsson 2003) and in the southern Baltic Sea (Dietz et al. 2003), mainly using satellite telemetry. In a study in Denmark individual grey seals were observed to make journeys of up to 850 km long in Swedish, German, Estonian and Latvian waters (Dietz et al. 2003). Similar lengthy journeys have also been observed in the northern region, where animals tagged in Northern Sweden travelled as far as to the Estonian coast. Both adults and young animals migrate over long distances (Sjöberg 1999), although this is probably more typical of young seals. Therefore the seals' home ranges cover a wide area, and individual animals might very easily travel throughout the entire Baltic Sea area. Although the grey seal can travel up to 100 km in 24 hours, most of the daily journeys made are less than 10 km in length (Dietz et al. 2003). Thus, in spite of the long seasonal migrations, grey seals show site-fidelity in moulting and feeding areas (Karlsson 2003). The seals usually use just a couple of rocks or islets to rest and haul-out in the proximity to their breeding and moulting areas outside the mating season (at a radius of approx. 50 km) (Sjöberg & Ball 2000).

The grey seal is distributed throughout the Baltic Sea area. It has adapted to live in ice conditions in the northern parts of the Sea, as well as in the archipelago further south.

## 4.2. Size of the seal populations

Estimates of the size of the Baltic seal populations at the beginning of the 20th century and up until the mid-1970s are mainly based on annual bounty or quota statistics. At present, the estimates for the seal population in Finland are based on aerial censuses, which have been carried out since the 1970s. Ringed seals are generally censused in April-May on the last ice, during their moulting season (Helle 1980b). Grey seals are counted during the moult in May-June, on rocks and islets in the outer archipelago. The number of estimated ringed seals based on random sampling (the census covers only a part of the ice covered area), while the grey seal census provides information on the minimum number of seals.

International censuses in the Baltic Sea are conducted in early summer over a two-week period at the end of May/start of June. At this time of year, the grey seals are most visible as they haul-out on rocks or islets or on the last ice floes. Keeping the census period so brief is a way to ensure that the risk of counting the same individuals more than once is minimised. The census number is clearly lower than the actual size of the population, as some of the seals are in the water even in the most optimal conditions, and thus do not get counted. In Finland, the census is mainly conducted by aerial photography, from which the exact number of seals can be obtained. In Sweden, Russia and Estonia, censuses are carried out from either boats or from land.

An aerial survey is greatly dependent on weather conditions. It is not possible to count especially ringed seals every year, due to poor ice conditions. In addition, the proportion of seals counted out of the entire population is not known, and even during the best conditions many seals are out of sight (in the water or in lairs). It should be remembered, especially when counting ringed seals, that the margins of error are considerable with the present methods employed. Based on research undertaken in the Arctic Ocean, Finley (1979) has estimated that in optimum conditions censuses account, on average, for 70% of the entire population of ringed seals. The number of visible grey seals is probably in the same range in optimal conditions. Despite their limitations, aerial censuses give a reliable estimate of the long-term trends in population size.

## 4.3. Seal population trends and growth rate

Statistical models have made it possible to estimate the population sizes of both Baltic seal species during the beginning of the 20th century. It has been estimated that 80,000-100,000 grey seals and 190,000–200,000 ringed seals occurred in the Baltic Sea at this period. The statistical estimate is based on national bounty statistics, which always contains factors of uncertainty. It is thus impossible to make a fully reliable estimate of the actual sizes of populations in previous times. National high bounty statistics, however, suggest that populations were reasonably abundant at the start of the century. Populations clearly declined during the 20th century and around the late 70s/early 80s the grey seal stock was estimated to 2,000–4,000 seals and ringed seals to 5,000 individuals (Hårding & Härkönen 1999, Kokko et al. 1999). The main reason for the declining seal populations was over hunting (Durant & Harwood 1986, Hårding & Härkönen 1999, Kokko et al. 1999). Since the 1960s, the possible influence of their high contaminant load on the reproductive capacity of the females has been brought up as a cause for the declining seal stocks (Helle et al. 1976a, b, Helle & Stenman 1990). The reproductive success of the ringed seals may also have suffered at times from the lack of ice in its southern distribution areas. Both the ringed and grey seal populations have recovered and are growing (Figures 2 and 3), as their reproductive rate has improved since the 1980s. When the seal populations were at their peak at the beginning of the 20th century, both ringed and grey seals occurred more commonly in the Gulf of Finland and the Archipelago Sea, as compared to today Ringed seals occurred commonly in the Åland Sea as late as the 1960s and 1970s, as more than 700 seals were hunted in the waters around Åland from 1967 to 1975 (Åländsk utredningserie 1990:1), and bounties were paid on 138 ringed seals in 1969-1970.

### 4.3.1. Recent trends in the ringed seal population and its growth rate

According to the most recent population estimate from 1996, covering the entire Baltic Sea, the population consisted of roughly 5,600-6,000 individuals (Härkönen et al. 1998). At this time, some 4,000 ringed seals were counted on the ice in the Bothnian Bay. In the most recent census in spring 2002, some 4,500 were counted in the same area (Härkönen 2003, meeting of ICES work group). Ringed seals spend most of the year in water or on ice, in the off shore areas. Ringed seal numbers can-

not be divided by country, only by marine area. The only well documented marine area is the Bothnian Bay, where the majority of the Baltic ringed seal population occur (Figure 2). The second most important distribution area in the Baltic Sea is the Gulf of Riga, where the population size is estimated to roughly 1,000 (Härkönen et al. 1998). The ringed seal population in the Gulf of Finland is small, living mainly in Russian territorial waters. Fairly brief censuses conducted in 1996–98 and 2003 on Russian territorial waters have confirmed that the number of ringed seals in the Gulf of Finland is a few hundred (Härkönen et al. 1998, Stenman et al. 2005b). In the Archipelago Sea, the ringed seal population is small as well, probably numbering just around 150 seals (Miettinen et al. 2005).

The counted number of ringed seals has increased, but at more slowly rate than that of the grey seal. The main reason for the slow growth among ringed seals is the still occurring reproductive disturbance in mature females. According to estimates made in 1988–2002, the population in the Bothnian Bay has been growing with approximately 5% a year (Härkönen et al. 1998), which is about half of the growth rate in a healthy seal population. Only in the Bothnian Bay, has the population shown a clear growth. In the Gulf of Riga, the south-western archipelago and the Gulf of Finland no such increase has been documented, but data from these areas are inadequate or lacking. The seal populations in the Gulf of Finland and the south-western archipelago have probably not recovered from the collapse in the 1960s and 1970s (Tormosov et al. 1980a, b, Härkönen et al. 1998), and these populations are not growing as in the Bothnian Bay. Furthermore, approximately 150 ringed seals were reported dead for no known reason in the period 1991-1992, which is thought to have halved the population in the Gulf of Finland at the time (Härkönen 1998). On the other hand, it is difficult to observe the changes in the numbers very quickly because populations are small and as the used census methods are prone to error.

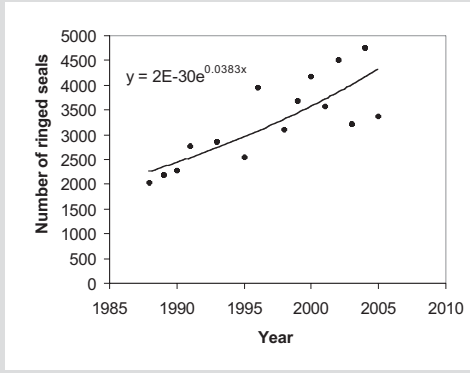



Figure 2. Annual estimates of the ringed seal population, based on aerial censuses in the Bothnian Bay (Data: Tero Härkönen, Swedish Museum of Natural History).

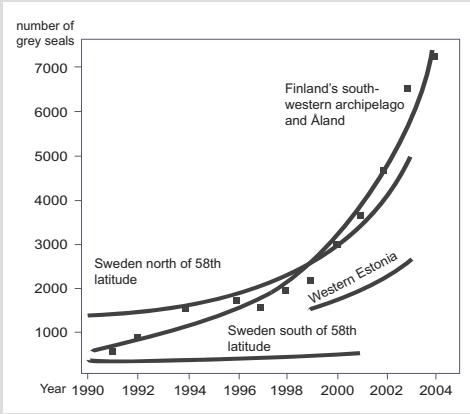



Figure 3. The number of grey seals counted in a census covering different areas of the Baltic Sea (Data: Finnish Game and Fisheries Research Institute, WWF and grey seal census parties from Sweden and Estonia)

### 4.3.2. Recent trends in the grey seal population and its growth rate

Recently, the so-called census population, i.e. population counted in censuses, of grey seals in the Baltic Sea has shown an upward trend (see Halkka et al. 2005, Stenman et al. 2005a). In 2000, approximately 3,000 grey seals were encountered in Finnish territorial waters, and in 2006 the number was 10,700 (Table 2). The very high growth rate observed in some areas seems unlikely compared to what is considered normal in a healthy seal population. On the other hand, the maximal growth rate for grey seals has been presented using biological data from grey seals in the Atlantic Ocean (see the Management Plan for the Grey Seal Population in Sweden). It is also possible that the efficacy of censuses has improved, although the survey methods were well established during the survey period. Another possibility is that the grey seal behaviour has changed, making them easier to find in censuses. From a management point of view, the growth rate in recent years can be estimated to roughly 10% in core areas of the

Table 2. Baltic Sea grey seal census 2000–2006

| Area / Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|
| Baltic Sea as a whole | 9735 | 10 300 | 13 100 | 15 950 | 17 640 | 18 300 | 21 000 |
| Finnish territorial waters | 3000 | 3600 | 5080 | 6285 | 8075 | 8700* | 10 700 |

* The figures include Märket, where some of the islands belong to Sweden

grey seal distribution. This is supported by the fact that the population's reproductive capacity is considered normal today (Helle et al. 2005).

In recent years, the grey seal population in Finnish territorial waters has grown most dramatically in the south-western archipelago (the Archipelago Sea, including Åland). In the aerial survey in 2004, more than 7,000 grey seals were counted, and in 2005, the figure was around 8,000. The surveyed population increased by an average of 23% a year during 1994–99. During 1999-2000, the increase was as much as 35% (Soikkeli & Stenman 1999). The most probable reason for this high population growth was an increase of grey seals migrating from Sweden and Estonia. An average annual growth rate of 7,5 % is reported in the Swedish grey seal population during 1990–2003 (Hårding et al. 2005).

The high growth level of the grey seal population has not been observed in other areas of the Baltic Sea. Grey seal counts have varied greatly between years in the Bothnian Sea. This is mainly due to differences in the ice situation between the years. In 2005, a year with poor ice conditions, more than 300 grey seals were counted in the Bothnian Bay. The grey seal population in the Gulf of Finland has remained fairly steady. In 2005, 300 animals were counted in the area.

## 4.4. Changes in distribution

The ringed seal arrived in the Baltic Sea basin about 11,500 years ago, at the end of the last Ice Age. The grey seal appeared in the region, two or three thousand years later. When the populations had reached their peak, the seals may well have spread throughout the whole Baltic Sea area. After the collapse of the populations in the 1900s, the main breeding areas have been concentrated to the northern Baltic Sea. This shift could be explained by a suitable climate and ice conditions in this area of the sea. Today, the Bothnian Bay, the Gulf of Riga and the eastern part of the Gulf of Finland make up the three core breeding areas for the ringed seal. In these areas, fast ice is formed even in very mild winters, and these stable ice conditions guarantee the most favourable breeding habitat for the ringed seal in the Baltic Sea. In addition, a small population occurs in the Archipelago Sea (Miettinen et al. 2005). Today, the main distribution area of the Baltic grey seal is the northern part of the Baltic Sea basin, the Bothnian Sea and the Gulf of Finland. As it is not a truly arctic species, the grey seal does not inhabit the fast ice, but use the ice edge for hauling out.

The distribution areas presented for the seals indicate the most optimal living environments for each species in the Baltic Sea. These areas have provided seals with the best conditions thus far, even though the hunting pressure has been most intensive in these very same areas. These core distribution areas seem to have remained throughout the 1900s according to the bounty statistics and other data.

## 4.5. Reproductive disorders and diseases

The collapse of seal populations up till the 1960–1970s was mainly caused by over hunting (Helle 1980a, Hårding & Härkönen 1999, Kokko et al. 1999). The slow population growth in the 1970s–1990s has been explained by an impaired reproductive capacity among the adult females (Helle et al 1976 a, b). The seal stock could also have been weakened as seals were suffered from a disease syndrome, which appears hyperadrenocortisism (impaired function of the adrenal gland) (Bergman & Olsson 1986, Bergman et al. 1992, Bergman et al. 2001). The syndrome also affected the liver, kidneys, reproductive organs, blood vessels, bones, skin, claws and intestines. These pathological changes indicate a hormonal imbalance. The disease syndrome and reduced reproductive capacity observed in Baltic seals, have been associated with their highly elevated contaminant burden (*inter alia* Bergman & Olsson 1986, Bergman et al, 1992, Bergman et al. 2001), but so far no causative relationship has been put forward to explain this connection.

*The grey seal*

The Baltic Sea disease syndrome was observed mainly in grey seals, and the majority of the population was thought to be suffering from this disease in the 1980s (Bergman & Olsson 1986). The dramatic decline of the contaminant load in fish (especially DDT, PCB and dioxins) in the 1970s (Bignert et al. 1998, Odsjö et al. 1996) has also reduced the seals' exposure to contaminants. Simultaneously with the decreasing contaminant levels in the grey seals, the occurrence of some pathological changes has also become less frequent in the seals. The frequency of disrupted reproductive organs has declined, in particular, and the proportion of pregnant females in the population has increased from 9 % to as much as 60 % in the most recent decades. According to Bergman (1999) most of the pathological changes are still observed in the grey seal population today. However, it should be stressed that the seals sampled for this study were mainly seals found dead on the shore or n fishing traps, and do not necessarily represent a random sample of the whole population with regard to diseases.

One dramatic change has been observed in the health status of the grey seal population. Since the 1980s, the occurrence of moderate and serious intestinal ulcers has increased from 10% to around 50% in young grey seals (under three years old) (Bäcklin & Bergman 2005). As these pathological changes are not just cases of slight damage, the results indicate that these individuals suffer from a reduced immunity. The primary cause of the wounds is infestations of the common hook worms to the intestinal wall. In a healthy animal, this process is not thought to lead to the pathological changes described above, although very little is known about the significance of the ulcers for the general well-being or as a cause of mortality.

The Finnish Game and Fisheries Research Institute continually monitors the health status of the seals. Most of the 59 grey seals (aged 1-33 years) collected during 1995-2000 were in a relatively good condition. Also in this sample, incidences of intestinal ulcers, excessive renal growth and kidney stones were randomly reported in both sexes (Helle & Nyman, personal communication). Findings based on the latest collection of random samples in 2001–2004 show that 81% of the mature grey seal females had given birth in the previous mating season in Finnish territorial waters, which can be considered a normal reproductive capacity (Helle et al. 2005).

The Baltic ringed seal suffers from uterine occlusions, a pathological disruption that leads to a life long sterility for the female.

*The ringed seal*

A decline in reproductive capacity in the Baltic ringed seal was observed in the mid-1970s, when the majority of females suffered from uterine occlusions (Helle 1980a). This pathological disorder probably leads to a lifelong sterility as the membrane of connective tissue blocking the uterine horn(s) is permanent. The occlusions develop in the middle of the uterine horn, where the embryo is attached by the placenta (Helle 1980a). Based on the pathological findings, the occlusions are thought to develop as a secondary infection in the uterus resulting from the death of the embryo/foetus. The dead foetus is not excreted through a miscarriage; but decomposed in uterine horn inside the occluded membrane. The uterine walls get thicker and the blood vessels are very much enlarged at the occluded site (Eeva Rudbäck, personal communication). The mechanism which causes uterine occlusion is not known. Occlusions have been observed in females of all ages, but they are most commonly found in old animals.

The frequency of occluded females reached its peak at the end of the 1970s (Helle 1981), when two thirds of the adult female ringed seals suffered from uterine occlusion. Since then, the situation has improved and the seals' contaminant load declined simultaneously. During recent years, uterine occlusions have occurred less frequently in young females. The occlusions found in elderly females have probably developed some years ago. In the most recent study, a fifth of the female ringed seals still suffered from sterility (Helle et al. 2005). As some adult females still suffer from uterine occlusion,

thereby affecting the population growth, the health state of the Baltic ringed seal population cannot considered normal today.

The Baltic ringed seal has also suffered from the above described syndrome, though clearly to a smaller extent than the grey seal (Bergman & Olsson 1986, Olsson et al. 1994). Ringed seals have primarily suffered from intestinal ulcers, arteriosclerosis, excessive growth of the renal cortex and renal glomerulopathy. Although the occurrence of most of the pathological changes described here has declined during the last 15 years, the incidence of intestinal ulcers has increased also in ringed seals (Bäcklin & Bergman 2005).

## 4.6. Environmental contaminant levels in seals

Since the early times of industrialisation, the Baltic Sea has been polluted with environmental contaminants. By the 1960s and 1970s, the Baltic Sea was seen to be one of the world's most contaminated seas. A clear evidence of this was the occurrence of high contaminant loads (heavy metals and organochlorines) in animals at the top of the food chains, such as birds of prey and seals (Jensen et al. 1969, Herva & Häsänen 1972, Helle et al. 1976a, b, Kari & Kauranen 1978, Helle 1981, Perttilä et al. 1986).

The extremely high PCB and DDT concentrations (over 100 mg/kg in seal oil) measured in Baltic organisms resulted in a ban on these substances in all Baltic Sea countries in the 1970s. Since that time, the DDT levels have shown a clear decline throughout the entire ecosystem (Bignert et al, 1998). Furthermore, concentrations of hexachlorocyclohexane (HCH), hexachlorobenzene (HCB), chlorobornanes (toxaphene or camphechlor) and chlordanes have decreased to levels similar to other marine ecosystems (Paasivirta et al. 1993, Vuorinen et al. 1997, Bignert et al 1998). However, PCB, DDT and dioxin concentrations are still high in Baltic seals (Nyman et al. 2002). Samples taken from adult seals in the Bothnian Bay for the period 1996-1998 showed average concentrations of PCB of 66 mg/kg in ringed seals and 38 mg/kg in grey seals. Average DDT concentrations were 28 mg/kg and 8 mg/kg respectively. These levels are 3-100 times higher than in the same species in less polluted areas (Nyman et al. 2002). The Baltic ringed seal, in particular, still suffers from a very great and directly toxic contaminant load (AMAP 1998).

In addition to the organic environmental contaminant load in the Baltic seals, small amounts of numerous other harmful compounds have also been discovered, e.g. polybrominated biphenyl (PBB), polychlorinated dibenzo-*p*-dioxins (PCDD), polychlorinated dibenzofurans (PCDF), polychlorinated diphenyl ethers (PCDE) and polybrominated diphenyl ethers (PBDE) (Andersson & Wartanian 1992, Bergek et al. 1992, Blomkvist et al. 1992, Koistinen et al. 1995, 1997). However, PCBs and DDTs clearly dominate the overall contaminant load in these seals, and these chemicals still constitute the biggest risk to the animals' well-being (Olsson et al. 1992, Nyman et al. 2005). Furthermore, new harmful substances are constantly being discovered and their properties or combined effects are still unknown. For example, previously unknown organochlorines, such as tris(4-chloriphenyl)-methane, have been found in seals (HELCOM 1996). In addition, the contaminated sediments at the sea floor in the Baltic Sea will remain a source of contaminants long into the future (Jonsson et al. 1996).

Heavy metal levels in Baltic seals and other organisms have remained high since the 1980s, and no indication of any reduction in these levels have been reported as yet (Jonsson et al. 1996, Fant et al. 2001).

## 4.7. Exposure to environmental contaminants and their effects on seals

The exposure of marine organisms to organic environmental contaminants and heavy metals is thought as one of the greatest threats to the marine environment. In many different contexts it has been stressed that certain organic environmental contaminants are the most harmful substances to marine mammals. However, only rarely studies have shown a direct, explanatory connection between the contaminant load and the physiological imbalance observed in marine mammals (Reijnders 1986, Brouwer et al. 1989, De Swart 1995, Ross 1995).

Hypotheses regarding the possible health effects of contaminants are, nevertheless, supported by a number of studies on experimental animals reporting detrimental health harmful effects of organochlorines on these animals. PCBs and dioxins, in particular, clearly reduce the reproductive capacity and increase the offspring mortality rate in minks (Jensen et al. 1977, Bäcklin 1996). Studies have shown that metabolites of organic

contaminants affect the adrenal cortex in experimental animals (Brandt et al. 1992). When collating up the existing information on the harmful effects of organic environmental contaminants on mammals, the connection between non-dioxin-like PCBs and the occurrence of diseases in the Baltic seals, especially in the grey seal, becomes apparent (Olsson et al. 1992, 1994, Wiberg et al. 2002).

*Exposure to environmental contaminants*

Contaminants are absorbed passively into the body, but require active metabolisation and elimination from the system. Metabolisation is a complicated process made up of several phases. Essential in the process are the biotransformation enzymes (cytochrome P450 or CYP enzymes), whose task is to make the degrading matter less toxic, even if sometimes the process may also produce new substances which are even more toxic (Letcher et al. 2000). The amount of CYP enzymes that metabolise contaminants and their metabolising intensity increase as exposure to contaminants grows. This way certain CYP enzymes have been used as bioindicators (biomarkers) in assessing the levels of exposure to contaminants.

The expression (amount of enzymes and their activity) of some CYP enzymes has served to show that Baltic seals are still highly exposed to dioxin-like substances (especially certain PCBs). However, even if the Baltic seals are highly exposed to dioxin-like compounds, studies have shown that they also seem to be able to metabolise these compounds effectively and thus eliminate them from their system (Nyman 2000). In the light of present knowledge, it seems that dioxin-like substances do not play a central role in the seal's reproductive disorders (HELCOM 1996).

Recent studies have reported that more DDT than PCBs accumulates in Baltic seals through their diet (Routti et al. 2005). This has been proposed to be a result of seals, like marine mammals in general, being less able to degrade DDT-like substances (Nyman 2000). Routti et al. (2005) noticed clearly higher dietary intake of PCB in Baltic ringed seals than grey seals, which is directly reflected in the much higher PCB load in the ringed seal. On the other hand, PCBs accumulate to a relatively lesser extent in ringed seals than in grey seals, due to the elevated enzyme activity in the ringed seal as described above. In general it can be concluded that DDT levels in Baltic seals reflect the dietary contaminant intake, while the PCB concentrations reflect the species specific ability to metabolise organic contaminants.

*Effect of contaminants*

Organochlorines may have a greater effect on marine mammals than on land mammals (Boon et al. 1992). It has been proposed that marine mammals are not as efficient at metabolising these contaminants as they lack certain CYP enzymes or their enzyme activity is poor (Nyman 2000). The lack of enzymes have been proposed to be a result of a lack of need for this mainly carnivorous group of animals develop enzymes through out the evolution, which have been developed to degrade phytotoxins in herbivorous animals (Gonzales & Nebert 1990). There is surprisingly little knowledge about the ability of marine mammals to metabolise and eliminate environmental contaminants, especially in view of the increasing number of reports highly contaminated marine mammal populations.

Assessments of the effects of hazardous substances on living organisms have primarily been conducted on experimental animals in laboratory conditions. No information is available on the impact of a large number of substances in use on the marine environment. Very little is also known on their actual impact at ecosystem and community level, and even less about the combined effects of different substances. It is thus a great challenge to assess the combined effect of the contaminant load in the Baltic seals.

How and at what stage contaminants affect an animal depends on its age, sex, species and general health status. For example, the contaminant levels in female seals do not increase in the same way as they do in males, because much of the contaminant load is transferred to their pups through the fatty milk (Addison & Brodie 1987, Brouwer et al. 1995).

Wild animals are exposed to a mixture of contaminants, in which the toxic properties of individual substances may have an additive or a reversed toxic effect on the animal. Only a very few experimental studies have assessed the combined effects of environmentally relevant contaminant mixtures. In addition, the organic environmental contaminants, in particular, have a very broad spectrum of toxic effects that often are species specific. Generally speaking, the animal's liver is most susceptible to the toxic effects, but functional disorders have also been reported in the immune, reproductive, nervous and hormone systems (Safe 1994, Giesy & Kannan 1998). Functional disorders can lead to cancer and other diseases as well as to pathological changes at different stages of the lifecycle. The body can respond to functional disorder up to a certain point, but when the

threshold of each compound has been passed, pathological changes become irreversible.

The effect of organochlorines on seals and their general health status has been evaluated recently. Captured harbour seals were fed fish from the Baltic Sea for two years. The results showed changes in their reproduction, immunity, and hormonal and vitamin A balances (Reijnders 1986, Brouwer et al. 1989, De Swart 1995, Ross 1995). The changes, however, proved reversible: the disorders disappeared when the fish was replaced with fish from the Atlantic Ocean.

The effect of organochlorines on the health state of the seal populations in the Bothnian Bay was conducted in 1995–98 (Nyman 2000). Changes were observed especially in the vitamin balance (low levels of vitamin A and high levels of vitamin E). The adverse vitamin levels showed a significant correlation with the individual PCB and DDT load. On the other hand, vitamin levels in mammals also reflect the dietary vitamin level. Further studies showed that their diet provides enough vitamins, but that some of the Baltic seals still suffer from vitamin deficiency (Routti et al. 2005). Thus, it has been concluded that Baltic seals may suffer from vitamin A deficiency and an increased need for vitamin E as a result of their high contaminant exposure (Nyman 2000). On the other hand blood screens from the Baltic seals have not shown any deviating values from those in healthy seals in zoos or living in clean waters, indicating that the Baltic seals do not suffer from any acute toxic disorders (Nyman et al. 2003). Baltic seals can, thus, evidently maintain a physiological balance despite their high toxic load, but the fear of the observed pathological changes becoming permanent is apparent, especially in the ringed seals (AMAP 1998).

A number of heavy metals affect the growth, reproduction and metabolism of living organisms. Studies have been conducted on mercury, cadmium and lead in the marine environment as these compounds are accumulated in the marine food webs, and as they have shown detrimental effects in humans and experimental animals (O´Shea 1999). Although exceptionally high concentrations of heavy metals has been found in the Baltic seals, no harmful effect caused by this load on these seals has been shown (Fant et al. 2001). Not much is known about the susceptibility of marine mammals to effects of heavy metals, but none of the disorders caused by heavy metal toxicity observed in land mammals have been discovered in marine mammals, despite very high concentrations. The high mercury load in the Saimaa ringed seal has, nevertheless, been statistically associated with a reduced reproduction capacity (Hyvärinen & Sipilä 1984, Hyvärinen et al. 1998). Marine mammals are thought to be able to adapt to high metal concentrations, as there are sometimes naturally high concentrations in the marine environment (Dietz et al. 1998). It has also been observed that marine mammals have a defence mechanism against metals: they use metallothionine or selenium to bind metals to permanent complexes which are harmless for the animal (O´Shea 1999).

## 4.8. The genetic structure of the seal populations

An abundance of genetic variability is considered to be a factor that boosts the viability of individuals and, hence, seal populations. Recent micro-satellite DNA studies have shown that the genetic variability of both the Baltic grey and ringed seal populations is large, and it has hardly narrowed during the era of isolation following the Ice Age (Karlsson 2003, Palo 2003, Schwarz et al. 2003).

Today, The Baltic ringed seal shows 98% of the variability of the main Arctic population, while the small Saimaa population shows only 30% of the original variability (Palo 2003). Abundant genetic variability indicates that the Baltic ringed seal population has been relatively large throughout the Baltic Sea's history, and that actual bottlenecks have not occurred in the population. It also seems probable that a genetic exchange between the Arctic and Baltic ringed seals has occurred since the Baltic Sea formed. The Baltic ringed seal barely differs genetically from the Arctic ringed seal, although they are regarded as separate subspecies (Palo et al. 2001). Neither is there any discernible genetic differentiation between the different breeding areas in the Baltic Sea (Bothnian Bay and Gulf of Finland) (Palo et al. 2001), which implies that there is genetic exchange between the breeding areas. The subpopulations in the Baltic Sea are not isolated from one another. The historical decline in the Baltic ringed seal population and its distribution into more or less separate breeding areas has not raised the population's inbreeding coefficient, and the whole population is still genetically diverse (Palo et al. 2001).

The West and East Atlantic grey seal populations seem to have become differentiated 1-2 million years ago. There are also clear genetic differences between the East Atlantic subpopulations (North Sea and Norwegian coast) (Boskovic et al. 1996). The Baltic grey seal popu-

lation seems to differ genetically from the East Atlantic populations (Karlsson 2003). On the other hand, young, tagged grey seals have been observed to travel long distances, and some individuals have travelled from the Baltic Sea to the East Atlantic (Jüssi 1999). Thus, genetic exchange between these populations may occur to some extent (Karlsson 2003). No genetic differentiation has been observed between the breeding areas in the Baltic Sea, so that the entire population belongs to the same gene pool. This is explained by the grey seal's tendency to migrate long distances (Karlsson 2003, Schwarz et al. 2003).

Both the Baltic grey and ringed seal seem to differ only slightly in genetic terms from the East Atlantic and Arctic Sea stock populations. Genetic distinctive marks are not, however, very prone to short-term changes (in seals <100–200 years) (J. Palo personal communication). For example, the collapse in Baltic seal populations in the 1900, strongly suggests that the Baltic ringed seal and grey seal are their own demographic units, which means that conservation and management measures needs to be implemented for them independently. It can be concluded that genetic threats are secondary to direct environmental threats in the near future (J. Palo personal communication)..

## 4.9. The seal's diet

The grey seal lives exclusively on fish, but the ringed seal feeds on both fish and some crustacean species (e.g. *Mesidotea entomon* and Mysids). Generally speaking, seals are opportunistic in their eating habits and feed on species which are the most abundant and the most readily available. Grey seals prey on more species than ringed seals (Söderberg 1975, Pöyhönen 2001, Hjerne et al. 2005, Stenman & Pöyhönen 2005). In the Baltic Sea, grey seals feed on at least 20 species of fish (Pöyhönen 2001, Lundström et al. 2005), while the ringed seal feeds on 12 fish species (Pöyhönen 2001). The grey seal diet usually focuses on a few fish species which are most abundantly available at any given time, while the ringed seal preys on several species at the same time. The ringed seal's typical prey species are small schooling fish or bottom feeding fish (averaging around 10 cm long). The grey seal's prey are larger (Söderberg 1975), although it also preys on small schooling and bottom feeding fish.

The Baltic herring is the most important prey species for both seals species of all ages (Söderberg 1975, Pöyhönen 2001, Lundström et al. 2005, Hjerne et al. 2005, Stenman & Pöyhönen 2005). This statement is also supported by the as yet unpublished results of analyses of the alimentary tracts of more than 700 seals collected by the Finnish Game and Fisheries Research Institute in the period 1986–2005 (O. Stenman, personal communication). Other especially important prey for the ringed seal is the three-spined stickleback and the smelt (Tormosov & Rezvov 1978, Pöyhönen 2001, Stenman & Pöyhönen 2005). The Baltic herring, smelt and eelpout have been reported to make up almost 75% of the diet of grey seal yearlings (Pöyhönen 2001). As the animals get older, the quantity of larger species like sprat and whitefish in the diet increases (Pöyhönen 2001, Lundström et al. 2005, Stenman & Pöyhönen 2005). Cod is one of the most important prey species for the grey seal in other seas. It not been reported from seals in the most recent Finnish study, which reflects poor status of the cod population in Finnish territorial waters today (Pöyhönen 2001).

Salmonids also make up a part of the seal diet, especially the grey seal (Söderberg 1975, Lundström et al. 2005, Hjerne et al. 2005, Stenman & Pöyhönen 2005). The most common salmonid species in the diet is the whitefish (O. Stenman, personal communication). Seals have been observed to cause damage especially to salmon traps, but no remains of salmonids have been found in the alimentary tracts of dead seal yearlings found in the salmon traps (Pöyhönen 2001, Stenman & Pöyhönen 2005). The explanation for this could be the time of year, the way the catch was handled, and/or the different feeding behaviour of young animals compared to adults.

A full-grown grey seal eats, on average, five to eight kilos of fish a day, and the Baltic ringed seal an average of 3.5 kilos a day (Söderberg 1975, Mohn & Bowen 1996). Seals' need for food depends on the season, and this varies greatly. Feeding is minimal in the spring during the breeding and moulting season. The feeding activity reaches its peak in the late summer and autumn, when the seals store subcutaneous fat (blubber) for the winter.

# 5. SEALS AND MAN

## 5.1. Seal hunting

Seal hunting has over the centuries been an important means of livelihood in the archipelago, and seal skin, meat and fat (blubber) have been exploited in many different ways (Edlund 2000). The most active seal hunting countries in the Baltic Sea area have been Finland, Sweden and Russia. However, at no stage has seal hunting been of a large commercial scale or oriented towards fur production, as has been the case in the world's oceans (Ylimaunu 2000). Seals have generally been regarded as pests, and the Kingdom of Sweden encouraged seal hunting in the 17th century (Ylimaunu 2000). The same attitude towards seals was evident also later as bounties were paid on seals in Finland in the 1900s up till the mid-1970s. Professional seal hunting ceased in Finland at the end of the 1950s (Bergman 1958), though in some coastal areas income from seals was still important for fishermen up until the 1970s.

The main hunting areas for the ringed seal in Finnish territorial waters have been the Gulf of Bothnia, especially the Bothnian Bay, and the eastern Gulf of Finland (Helle 1979b). Ringed seals were also hunted at one point in the western Gulf of Finland and the Archipelago Sea, but on a very small scale. In these areas, the population declined at an earlier stage due to an intensive hunting pressure (Bergman 1958). Grey seals have been hunted mainly in the Bothnian Sea, Kvarken area, the Archipelago Sea and the Gulf of Finland.

Seal hunting was the main occupation of fishermen in late winter, when there was hardly any fishing as such. Seals were mainly hunted along the coast on the newly frozen ice, and on long hunting trips to the iced-over sea. Harpoons were used as well as clubs, spears, traps and hooks, especially during the breeding season (Gottberg 1925, Nyström 2000, Ylimaunu 2000). Different types of nets were also used both as a passive trap and in the active hunt which required the presence of the hunter. To protect fishing gear from seal attacks, special seal traps, trap nets and cages were developed (Nyström 2000, Ylimaunu 2000). There was also a small-scale attempt to eliminate seals by poisoning them (Ylimaunu 2000). Furthermore, seals were often trapped in fish traps, trap nets and nets as bycatch. Guns have been used in the seal hunt since the 1700s, although proper, effective use of them only started in the early 20th century, when it became the main method of hunting seals (Gottberg 1925). Later on, the use of motor boats and ice breakers to assist hunting further increased the seal catch (Helle & Stenman 1990).

In Finland, bounties were paid on seals from the early 1900s until the mid-1970s. Earlier bag statistics are mainly based on bounty reports (Gottberg 1909–1946, Bergman 1956, 1958, Helle 1979b). Later statistics are based on bag reports. In the early 1900s in particular, the volume of seals caught in the Baltic Sea is in fact estimated to have been 20–30 % greater than that in the official statistics (Ylimaunu 2000). Unfavourable weather conditions, political instability and wars occasionally made it harder to hunt up until the 1940s, and this is reflected in the bag statistics (Figure 4). During the war years, some of the hunted seals were also not reported to the state. The post-war statistics are not directly comparable to the earlier ones either, as the area in which Finns could hunt in the eastern Gulf of Finland diminished as a result of the territories ceded to the Soviet Union (Bergman 1956).

In Finland, bounties were paid for 126,000 seals during the period 1909–1918 (Gottberg 1925), and for around 70,000 during 1926–35 (Bergman 1958). Ringed seals accounted for two thirds of the total seal catch in the beginning of the 1900s (Gottberg 1925). Bounties, the use of modern weapons and the increasing value of seal blubber intensified the hunting pressure. The ice cover has had an enormous influence on the success of seal hunting. During years when there has been little ice cover, seals have congregated in smaller areas, and have been easier to hunt. This is clearly reflected in the bag statistics, particularly in the 1930s, when winters were mild and there was little ice around (Bergman 1956, 1958, Helle 1979b, Hårding & Härkönen 1999). Hunting reduced seal populations dramatically during a short period. From 1956 to 1975 approximately 40,000 seals were hunted in Finnish territorial waters. Ringed seals accounted for around 28,000 of these (Helle 1979b). The decline in seal populations began to be clearly evident in seal bags during the 1960s, although the bounties were doubled in 1964. This change resulted in an increased bag, but the change was only temporal (Helle & Stenman 1990). The bounties on the ringed seal returned to its previous level in 1971, and in 1975 bounties on seals were abolished.

In 1980, the ringed seal was protected during the summer in Finland, and in spring 1982 ringed seals were only allowed to hunt on the spring ice. In spite of this, the population continued to decline. In the period

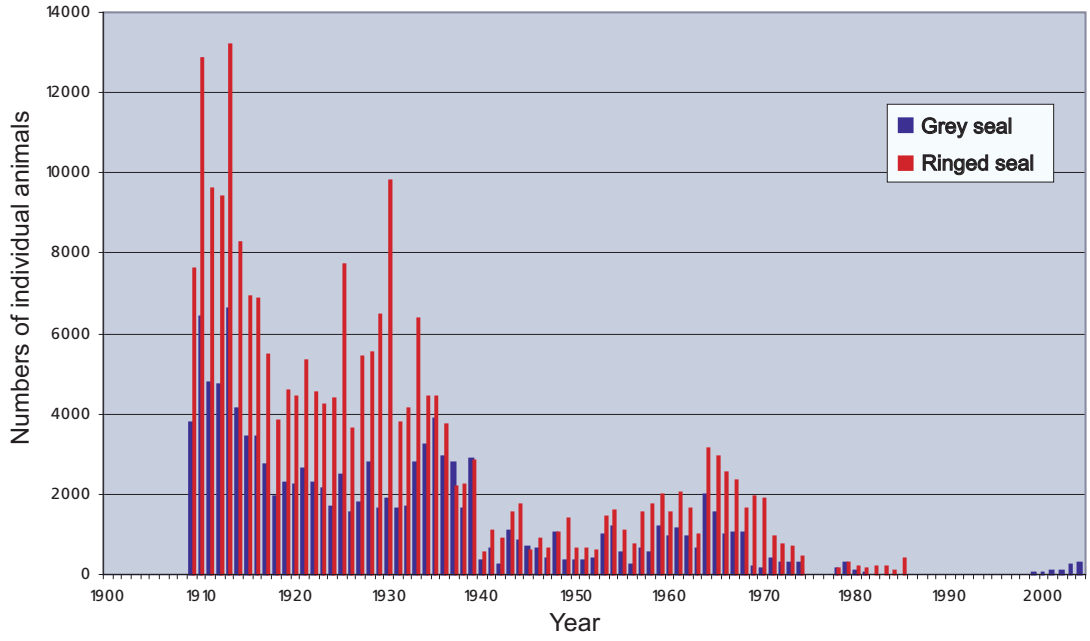



Figure 4. The seal bags in Finnish territorial waters.

Table 3. Grey seal hunting in the Baltic Sea 1998–2006. (Sources: O. Karlsson, personal communication, Finnish Game and Fisheries Research Institute, Finnish Hunters' Central Organisation, Ministry of Agriculture and Forestry, Provincial Government of Åland)

| **Year** | **Sweden** | | **Mainland Finland** | | **Åland** | |
|---|---|---|---|---|---|---|
| | Quota | Catch | Maximum permitted number (1.8.–31.7) | Catch | Quota | Catch |
| 1998 | 0 | 0 | 30 | 16 | ? | ? |
| 1999 | 0 | 0 | 100 | 62 | ? | ? |
| 2000 | 0 | 0 | 100 | 60 | 84 | 30 |
| 2001 | 150 | 57 | 180 | 92 | 89 | 54 |
| 2002 | 150 | 79 | 230 | 134 | 203 | 95 |
| 2003 | 170 | 79 | 395 | 233 | 203 | 82 |
| 2004 | 170 | 81 | 490 | 293 | 293 | 150 |
| 2005 | 170 | 83 | 635 | 334 | 250 | 118 |
| 2006 | 180 | 107 | 675 | | 390 | |

1975–1985 a total of 1,800 ringed seals were hunted (Durant & Harwood 1986). Åland protected all seals in 1985, though in fact no hunting licences had been issued since 1982. The ringed seal was also entirely protected in Finland in spring 1988, because the population had been declining continuously despite the low hunting pressure. Seal hunting was prohibited in 1980 in the Soviet Union, and in 1986 in Sweden. The protection of the grey seal was introduced gradually in Finland. In the period 1975–77, the grey seal was protected during the breeding season (10 March–31 May). Otherwise people were free to hunt grey seals until the end of 1981. Because of the decline in the seal population, the grey seal was protected in 1982 by not endorsing a hunting season for the species (Helle & Stenman 1990).

Due to damage to the fisheries, grey seal hunting was opened again in mainland Finland in 1998 and in Åland in 1999. The Ministry of Agriculture and Forestry endorsed a hunting season on 16 March–31 May and 1 September–15 October up till the end of the 1999/2000 hunting season. Hunting of grey seals was opened also during the summer in 2000, with an amendment to the Hunting Decree (479/2000). The most recent amendment to the Hunting Decree entered into force on 1 October 2003, according to which the grey seal hunting was permitted in mainland Finland between 16 April and 31 December. This change to the hunting season also permits hunting in the autumn and early winter, during the active fishing season when damage by seals occurs. The number of hunting licences in Finland has risen each year, but numbers in Sweden have remained roughly at the same level each year (Table 3). Increasing the time of the hunting season also provided hunters with a chance of making better use of their hunting licences than before. No hunting licences have been issued for ringed seal.

Only about 50% of the issued hunting licences are used. The number could be even lower than this, depending on weather conditions. In recent years, the ice cover has been so poor that it has been very difficult to use the issued quotas in the southern areas of Finnish territorial waters. Another problem is that hunting licences are allocated personally instead of to a seal hunting party, where hunting would be a lot more efficient and all interested hunters would have the chance to take part in the hunt.

Seals cause substancial damage to the fisheries.

## 5.2 Seals and the fishing industry

The relationship between seals and the fishing industry is dual. Seals cause problems for fishing and fish farming because they compete for the same resource, eat and harm fish, break gear and nets on fish farms, and chase fish away. On the other hand, seals gain from fishing by making it easier for them to obtain food, but it also causes mortality among the seals in terms of bycatch.

### 5.2.1 Damage to catch and gear

Seals have caused damage to fishing gear since man first began to fish, especially to gillnets, trap nets and long lines. Bounties used to be paid on seals for the very reason that they caused damage to the fisheries. Later on, when seal populations were low, damage to catch and fishing gear by seals hardly occurred in the Baltic Sea. Simultaneously with the growing seal populations since the 1990s, the amount of damage has increased dramatically. As the seal populations continue to grow, the amount of damage is expected to increase further. Both species of seal cause damage, but the grey seal causes more (Westerberg et al. 2000, Kreivi et al. 2002, Lunneryd et al. 2003, Kauppinen et al 2005). The ringed seal's share of the damage is hard to estimate, because the consumed fish are smaller and they are generally eaten whole. Furthermore, the signs on damaged catch or fishing gear caused by the seals do not reveal which species has been at work.

The most common type of damage caused by seals is loss of catch (eaten and damaged fish) and broken fishing gear (Kreivi et al. 2002, Lunneryd et al. 2003, Kauppinen et al. 2005, Suuronen et al. 2006). Damage to catch by seals in Finland has been assessed since the mid-1990s on the basis of data from records on catch from the professional fishing industry. Decisions 798/1997 and 259/1998 of the Ministry of Agriculture and Forestry on the application of the Finnish Act Implementing the Common Fisheries Policy of the European Community (1139/94) obliges all professional fishermen to provide records on the catch. At the end of 2005, 2,223 persons were registered as professional fishermen. Out of them, 752 derived at least 30% of their income from fishing, 208 15-29 % and 1,263 less than 15 % (Source: Finnish Game and Fisheries Research Institute 2006: Professional Fishing at Sea). Professional fishermen record their catch in logbooks, either from individual fishing trips or monthly, depending on the size of the vessel they use and the species being fished. Since 1999, the logbooks have also included an enquiry about the number of fish rejected, e.g. those eaten by the seals.

Professional fishermen record their catch data by a statistical grid of squares issued by ICES (55 km x 55 km) (Figure 5). This record also includes the damage caused by seals. The information in the logbooks has served to estimate the minimum value of damage to catch compared to the actual damage. The challenge is how to estimate the real catch loss in a reliable way. Reported estimates of damage to catch are generally based on the remains of damaged fish found by fishermen in their gear. However, it is not always possible to clearly see and identify the remains of a damaged fish in the gear. A seal may eat the whole trapped fish and it might also chase some of the fish away. Fish may also escape from the gear through holes made by seals (Kreivi et al. 2002, Kauppinen et al. 2005). Damage to prey also tends to get unnoticed the smaller the fish species is. Accordingly, it is more difficult to assess damage to catches of whitefish, for example, than salmon. Swedish research shows that the total damage to catch can be up to 40% greater than what has been reported in the logbooks (Fjälling 2005).

On the basis of data on damage in the period 1997–1999, damage to professional fishing by seals in Finland was estimated to roughly 1.68 million euros. Since then, the grey seal population has more than doubled. In the period 2000–2001, professional fishermen were compensated for 3.2 million euros for the damage they had sustained, although the claims sent in suggest that the overall damage amounted to 7.47 million euros. In

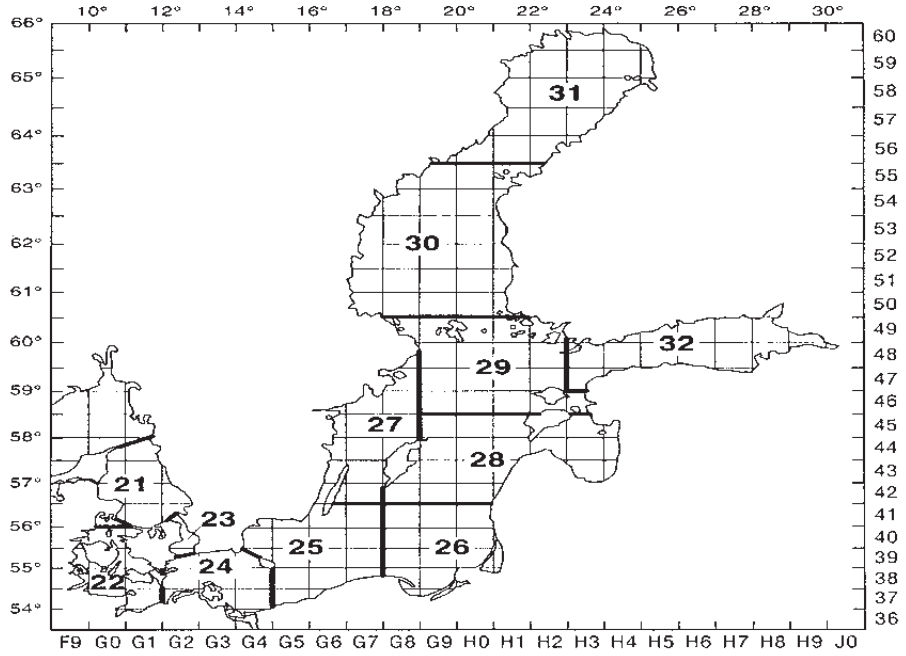



Figure 5. Grid system used to produce statistics on catch by the fishing industry (the 'ICES areas').

Table 4. Catch damaged by seals reported by Finnish professional fishermen (all fish species) 2000–2005 by ICES area (tonnes). (Source: Finnish Game and Fisheries Research Institute)

| Area of the sea | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|
| Southern Baltic Sea (25–28) | 2 | 3 | 2 | 2 | 2 | 5 |
| Archipelago Sea and Åland Sea (29) | 25 | 40 | 34 | 29 | 30 | 48 |
| Bothnian Sea (30) | 25 | 63 | 41 | 98 | 66 | 53 |
| Bothnian Bay (31) | 10 | 13 | 16 | 24 | 17 | 19 |
| Gult of Finland (32) | 21 | 25 | 22 | 26 | 30 | 21 |
| Total | 82 | 143 | 115 | 178 | 145 | 147 |

Sweden, the total damage to the fishing industry is estimated at 5 million euros a year.

The damage caused by seals varies greatly in terms of when and where it occurs and the type of fishing method used (Kreivi et al. 2002, Kauppinen et al. 2005). The quantity of fish damaged by seals is the greatest in the Bothnian Sea (Table 4). Most of the damages concerns whitefish and salmon catches. Seals cause proportionately more damage to pike-perch in the Archipelago Sea than in other areas of the Baltic Sea. The damaged pike-perch catch accounted for 1.1-3.8% of the total annual catch in the period 2000-2005. On the other hand, damaged salmon in the Archipelago Sea accounted for 3.7-36.8% of the catch during the same period. The catch data reveal that damage to salmon was the greatest in the Archipelago/Åland Sea area and in the Gulf of Finland. Seals in the Bothnian Sea mostly damage the whitefish catch.

When analysing the temporal development of damage caused by seals, it is important to consider local changes and trends in fishing activity and forms of fishing. In certain areas, fishing has recently either ceased partially or totally.

In terms of catch volume, the seals cause the most damage to professional salmon fishing (Figure 6). The numbers of salmon damaged by seals have increased in both the Archipelago Sea and the Bothnian Sea, though the salmon catch has increased faster than the quantity of damage. The salmon and whitefish catch in the Bothnian Bay and the Kvarken has halved since 1996. The low levels of damage in the Bothnian Bay and the Kvarken are thus explained by the reduced numbers of fishermen there, local fishing restrictions and the type of fishing gear used. The damage in the Gulf of Finland as a share of the total catch has increased the most during this period. The fact that the share of salmon damaged by seals declined in 2005 in the area may be due to the introduction of push-up trap nets. Damage to catch caused by seals to fishermen from mainland Finland has been greater in coastal areas (13-15 %) than in off shore areas (1-2 %). Fishing in offshore areas in

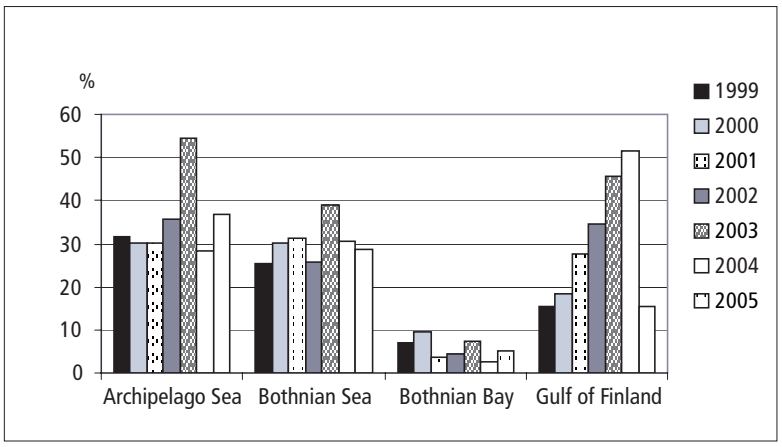



Figure 6. Volumes of salmon damaged by seals as a percentage of the total catch in 1999–2005 (Source: Finnish Game and Fisheries Research Institute)

this context includes all forms of trawling, drift net and drift line fishing, and all forms of fishing in ICES areas 22-28. Coastal fishing is everything else, i.e. mainly fishing with trap nets or anchored nets. The fact that coastal fishermen sustain more damage by seals could be explained by the fishing methods employed, because seals are specialised at hunting their prey close to passive gear such as trap nets and gillnets. In general, the damage caused by seals was clearly greater and increased more in the Åland Sea between 1999 and 2002 (18 - > 34 %) than in mainland Finland (7 - > 9 %).

Damage caused by seals takes place mainly in the summer season when the fishing effort also reaches its peak. A similar seasonal variation has been observed in Sweden, where the amount of damage is clearly linked to the fishing intensity (Westerberg et al. 2000).

Many professional fishermen consider seals to be the biggest single threat to their livelihood (Salmi et al. 2004). The seriousness of the situation is thought to be due, not only to the growing numbers of seals, but also partly to their changed behaviour. Many fishermen claim that seals no longer see man as a threat as they have barely been hunted during the most recent decades.

The uneven spread of seals in the Baltic Sea has resulted in greatly varying levels of damage in different areas, and furthermore in varying views on how the seal populations should be managed. The focus of their distribution is in the central and northern Baltic areas where they have increased dramatically in numbers. This is also where the most damage takes place. Damage by seals is much less significant in Russia, on the Swedish coast south of Öland, on the eastern shores of the Baltic Sea south of the Gulf of Riga (Latvia and Lithuania), and on the southern coast of the Baltic Sea in Poland and Germany. Permanent grey seal populations are hardly ever found in the southern Baltic Sea, except to a small extent in Denmark.

### 5.2.2. Damage to fish farming

In 2004, a total of 12.8 million kilos of fish were farmed for consumption. 86% of the whole country's farmed fish for human consumption were farmed in the sea, where fish farming almost exclusively takes place in cages or nets. In recent years fish farming has suffered from damage caused by seals. Seals, especially the grey seal, eat and damage the fish in the cages and sometimes tear holes in the nets. In the worst case scenario the entire stock of fish may escape. Seals also cause fish

The relationship between the seals and the fisheries has become more intence as seal stocks are growing, and thereby causing increasing damage to the fisheries.

farmers to incur indirect costs and sustain losses in the form of the increased costs of keeping watch and repairs. It is hard to assess how much the ringed seal accounts for the seal damage to fish farms as there are normally no signs on the damaged fish or nets which could suggest which species has been at work.

The amount of damage by seals sustained by fish farmers has been estimated by means of surveys (Backman 1999, Salminen 2002, Moilanen et al. 2005). Fish farmers estimate that the amount of damage done has clearly increased in recent years (Salminen 2002). A survey conducted by the Finnish Fish Farmers Association for producers in mainland Finland suggests that seal damage also increased in 2006, particularly in the Gulf of Finland. The survey also revealed that fish farmers have made high investments to protect their farms from seals. Major fish farming regions like the Archipelago Sea and Åland suffer the most from damage caused by seals. Damage to fish farms has also occurred in other areas in recent years, e.g. the Gulf of Finland, where there had been barely any damage before. Most seal damage to fish farms occurs in autumn and spring, when the seals move from offshore areas to coastal wa-

ters. Moreover, a good deal of the damage that has occurred earlier is only noticed in the autumn when the nets are being emptied (Salminen 2002).

According to a survey carried out in 2000–2001, the amount of damage to farmed fish amounted to 0.7 million euros per annum (Salmi 2002). In a survey in 2003, seals were thought to have caused approximately 1 million euros in losses to fish farms in Finland. Around 97% of this was damaged fish (Moilanen et al. 2005).

In 2004, 125 fish farms were active in mainland Finland. Seals caused damage to 64 (51.2%) of these. The same year, 12 companies were engaged in farming fish for consumption in Åland, with a total of 37 farms between them. Of these, 10 companies reported damage by seals on their farms. The damage was generally done to several plants owned by the same entrepreneur. Throughout the whole marine area, the damage to fish farming caused by seals was estimated to a total of 234,000 kilos of fish. Damage caused by seals was overall the greatest in Åland and the Archipelago Sea. In different parts of the sea seal-damaged fish accounted for 1.7% to 2.5% of all fish produced for consumption. Throughout the whole marine area, the value of the damage to fish and farm nets caused by seals amounted to 647,000 euros. Losses mainly consisted of damage to fish, while the proportion of damage to nets was relatively small (around 7,000 euros). Damage to fish and nets caused by seals in 2004 amounted in value to about a third less than in 2003 (Savolainen, Moilanen and Ahvonen, unpublished material).

### 5.2.3. The impact of seals on fish stocks

There is very little published information on the impact of seals on fish stocks in the Baltic Sea. Hjerne et al. (2005) have estimated the amount of fish caught by grey seals among the different fish species. Of these by far the most significant is Baltic herring, but whitefish, flounder and salmon are also important in the diet of the grey seal. According to tentative estimates, Baltic grey seals eat the same amount of some species (in terms of biomass) as is caught by fishing. This suggests a substantial competition between seals and the professional fisheries. On the other hand, it has also been proposed that seals may be a benefit to fishing in that they reduce the number of species of little commercial value and which compete in financial terms with the more important species. Furthermore, seals normally eat a lot of smaller fish, which can result in an increase in the size of fish which are more favourable for the fisheries (Westerberg et al. 2000).

### 5.2.4. Seals as bycatch in fishing nets

One of the most significant mortality factors for seals in the Baltic Sea is that they drown in fishing gear (Helle & Stenman 1990). Drowning in fishing gear is the most important cause of death among young seals. Pups which are just starting to lead an independent life are especially prone to get trapped in fishing gear. There are no reliable up-to-date estimates of the number of by-caught seals in Finland by, but it has been estimated that in the period 1986–1990 some 100 grey seals and 30-50 ringed seals were by caught in Finnish marine waters. According to these estimates roughly 20% of the annual production of grey seal pups and 5% of that for ringed seal pups die in fishing gear every year (Helle & Stenman 1990). The most recent estimate for bycatch is for the period 1997–1999, when it was estimated that each year some 70 ringed seals and over 200 grey seals ended up as bycatch in Finnish territorial waters (Finnish Game and Fisheries Research Institute, unpublished material). With the increase in seal populations the incidence of seal bycatch is likely to increase. In Sweden, the number of by-caught seal has increased, even though in relation to the current numbers of seals the proportion of animals that ends up as bycatch have probably declined (Lunneryd & Königson 2005).

At the most recent meeting of Baltic Sea seal researchers, estimates of bycatch in the Baltic Sea countries were presented. In a Swedish study based on interviews with professional fishermen, bycatch is estimated at 360–575 grey seals (143 recorded instances) and 34–74 ringed seals (10 recorded instances) a year. The volume of actual bycatch, however, was thought to be a lot higher (Lunneryd & Königson 2005). It is one of Sweden's environmental targets that no more than 1% of the population should end up as bycatch (Lunneryd, personal communication). In Latvia, 200–400 seals are estimated to end up as bycatch each year, the majority of which are young grey seals (Urtans et al. 2005). In Poland, 59 seals have been reported as bycatch, most in nets (Kuklik et al. 2005). There are no estimates on bycatch for Lithuania, Estonia or Russia.

Seals mainly get caught in salmon and Baltic herring trap nets, salmon, turbot and cod gillnets, and drift nets (Helle & Stenman 1990, Lunneryd & Westerberg 1999, Lunneryd & Königson 2005). Swedish studies show that Baltic herring gillnets and salmon drift nets are a greater danger to seals than nets anchored to the sea bottom (Management Plan for the Grey Seal Population in Sweden).

## 5.3. Utilisation of seals as products and for consumption

The hunting has been reintroduced as a result of the increasing grey seal population. This has re-awakened the seal hunting tradition and culture. At the same time, the utilisation of the hunted animals has been developed in accordance with today's needs. Today, hunters mainly make use of what they catch, or the seals are used locally. Grey seal products are made into end products on a small scale and at the local level. Skins are turned into furs in a few companies and the skin is used for clothes and bags. One company in Kalajoki also produces tinned seal meat. In some restaurants mainly on the coast, seal meat is prepared and served, mainly as a speciality of the house, e.g. as a starter.

Although PCBs and DDTs, as well as various heavy metals, are found in the meat and internal organs of both seal species, the meat is fit for human consumption (Nyman et al. 2002). Current international recommendations state that approximately 500 grams of Baltic grey seal meat and around 200 grams of ringed seal meat can be consumed per week, with regard to maximum amounts of organic substances and heavy metals. On the other hand, mercury levels in the liver and kidneys of both seal species are clearly above all recommended levels for human consumption, so they cannot be recommended for eating at all.

*Diseases spread by seals*

oonoses are diseases which can be transmitted from animals to humans and vice versa. Humans can catch such a disease directly from an animal or through food derived from an animal. Zoonoses occur in domestic and wild animals and pets. In Finland, the Finnish Food Safety Authority (Evira) is responsible for monitoring diseases in seals and other wildlife. There is also a new Finnish Zoonosis Centre, which coordinates the monitoring and prevention of zoonoses. The centre is to start up in 2007, as a cooperation body of Evira and the Finnish National Public Health Institute. The Centre undertakes the work of the permanent zoonosis working group set up by the Ministry of Agriculture and Forestry. The working group produced a national strategy for combating zoonoses (MMM 2004b).

Trichinellae, or trichinae (*Trichinella spiralis and other species*), are parasitic worms which cause the disease trichinellosis (trichinosis). Trichinae can be caught by carnivores, including humans. Seals, too, have been found to be susceptible to trichinosis (Kapel et al. 2003), even though there have been no discoveries of seal meat containing trichinae in the Baltic Sea. The larvae can live cocooned in the muscle tissue for years. The disease's symptoms are usually swelling, fever and muscle ache, but it may also be fatal. There is no known drug to combat trichinosis. It can be avoided if meat is cooked for at least 20 minutes at +78°C, in which case the larvae will die.

The disease most likely to be transmitted from seals to humans is "seal finger", which is caused by a bacterium of the mycoplasma family lacking cell walls (Bakers et al. 1998). Seal hunters have also for a long time known the disease as "blubber oil poisoning" or "seal hand". The disease is transmitted easily to the hand from the seal's bite or when skinning a seal with bare hands. After 1–15 days of the infection, the patient exhibits a very painful swelling in the finger joints. Left untreated, the disease can lead to permanent stiffening of the joint in question. The cause is a bacterium and the disease can be treated with antibiotics (tetracycline). Good hygiene and wearing protective gloves when handling seals prevents the transmission of the disease in most cases.

Seals are hosts to many fish parasites. In the Atlantic Ocean, grey seals are hosts to the cod worm (*Pseudoterranova decipiens*) which, in abundance, causes economic damage to the fishing industry. These parasites can occur in fish flesh to such an extent that the fish cannot be sold for aesthetic reasons. Cod worms have not as yet been encountered in significant numbers in the Baltic Sea, so equivalent parasitic diseases transmitted by seals is not foreseen in the Northern parts of the Baltic Sea. The closest cod worm observations have been in Gotland (Lunneryd, personal communication).

## 5.4. Other uses for seals

Efforts have been made to develop the economic utilisation of seals, in addition to that associated with hunting. Seal watching as a tourist attraction is a new phenomenon in the Baltic Sea compared with the rest of the world (Ylimaunu 2000). The use of seals in eco tourism exists only on a rather small scale in Finland. Organisers of trips are either entrepreneurs in yachting tourism or professional fishermen who arrange seal watching trips as a subsidiary trade and as a complement to local tourist services.

Seal watching mainly focuses on the grey seal, which is easier to reach than the ringed seal, as it is a herding

animal that tends to haul-out on rocks and islets. Seal watching as a form of nature and adventure travel is mainly practiced in Åland. On the Finnish mainland, seal watching is only organised occasionally. Seal watching trips are available as day excursions in boats or as longer boat trips in the Gulf of Finland, the Archipelago Sea, the Kvarken area and the Bothnian Bay.

The main problem with seal watching tourism is thought to be the lack of suitable rocks or islets that can be utilised (not a seal conservation area) to watch and photograph the seals hauling out (Storm et al. 2007). The most well known seal rocks and islets are included in the network of seal conservation areas, which are so called "no go" areas.

Hunting trips for ringed seal ('seal safaris') were organised for a short time in Kalajoki in the 1970s. Today, there is no seal hunting tourism industry in Finland.

## 5.5. Local attitudes towards seals

The views of local people and stakeholders regarding the seals and their management were surveyed when the management plan for the seal populations was being prepared. Written surveys on both species were sent to local stakeholders within each coastal game management district. Local people were also able to present their views at local public hearings. The views of national stakeholders were also surveyed. A separate report has been published on the attitudes of stakeholder groups and local residents towards seals and the management of their populations (Storm et al. 2007).

### 5.5.1. Local attitudes towards the ringed seal

Regionally, Baltic ringed seals are thought to have increased especially in the Bothnian Bay, but in the Gulf of Finland and the Archipelago Sea they are regarded to be few in number, and even rare. Local people still see the ringed seal very much as an animal to be protected, although there are also calls for hunting them, especially in the Bothnian Bay. Unlike the grey seal, the ringed seal is hardly ever thought of as a harmful species. The ringed seal is regarded as a component of the biodiversity of the Baltic Sea, as an important indicator species and also as a possible future game species. However, the ringed seals are assumed to cause damage to gillnet fishing in certain areas, even if the damage is on a much smaller scale than that of the grey seal. On the other hand, in the Bothnian Bay area, ringed seals are thought to cause even more damage than grey seals locally. On the other hand, some think that damage by ringed seals does not occur.

The conflicts concerning the ringed seal are felt to be mainly a question between fishermen and the conservationists/conservation authorities. The feeling is also that conservation aims and targets conflict with those for hunting. In addition, the media is thought to stir up the controversy. Some replies suggested that the conflict is not a local but a national issue. The ringed seal is not utilised commercially and its further utilisation was considered difficult, if not impossible. There seems to be possibilities for small-scale ringed seal watching tourism, but voices are also raised to leave the seals alone.

People believe it very important to develop seal-proof fishing gear and a permanent system of compensation for damage. The state and/or the EU should fund this. The losses suffered by the fishing industry and fish farming are reduced in the most profitable and effective way by hunting and by eliminating 'troublemakers', which are seals specialised in feeding in fishing gear. On the other hand, some think that the current very low level of damage by ringed seals should be accepted. In some of the regional replies the reintroduction of the hunting culture and hunting of ringed seals are considered important. But there is also the view that hunting should not extend to ringed seals. It is, nevertheless, considered necessary to document the special features of the old ringed seal hunting culture.

The regional division of the management of seals through the game management districts is considered good in some replies, and bad in terms of an administrative division in others. The failure is mainly explained from the point of view of hunting. If ringed seal were hunted, the game management districts are not suitable for issuing hunting licences. People also think that the ringed seal should be the responsibility of the Ministry of the Environment and that there should be separate conservation plans for the ringed seal populations in the Archipelago Sea and the Gulf of Finland. Yet, some replies state that a favourable conservation status has already been achieved and that there is no need for additional conservation measures. Instead, they suggest systematic harvesting of the population using different methods.

Research and population monitoring are regarded as important. The essential development needs include estimates of the actual population, a more detailed ex-

amination of the ringed seal's diet, more impartial information on the ringed seal, and cooperation between various stakeholders. The potential for utilising seals and its possible development is thought as important, as is the monitoring of the ringed seal population's health state, the reproductive capacity, the behaviour of individuals and the environmental contaminant burden. In addition, international cooperation with Estonia, Russia and Sweden is a desirable goal. The work of the authorities is considered to be heading in the right direction, although it is also thought to be progressing too cautiously – decisions need to be taken more quickly.

5.5.2. Local attitudes towards the grey seal

Regionally, the grey seal population is commonly thought to have grown dramatically in recent times in all Finnish territorial waters. The majority of the regional respondents think the present grey seal population is too big and that the animal is a harmful animal. The seals' behaviour is also thought to have changed due to the light hunting pressure, resulting in individuals being less afraid of humans and colonising the inner archipelago. On the other hand, some replies insist that the grey seal is a component of the biodiversity and an important indicator species for the Baltic Sea ecosystem. Seal conservation areas are considered important in some answers and some suggest protecting core breeding areas. But there are also calls for a less dense network of seal conservation areas and reducing the legal constrains on protection, or even reversing them altogether. Fishermen, in particular, feel that grey seal protection has generally gone too far, although many yachtsmen and summer residents would like to see grey seals a lot more often than they do at present. The damage caused by the grey seal to fishing and the protection of the species as well as the experience of seeing a seal it are felt to be a matter of conflict. The development of tourism around the grey seal was expressed as difficult.

The grey seal is believed to cause substantial damage to fishing and fish farming and to adversely affect fish stocks. In the Bothnian Bay and the Kvarken the ringed seal is also thought to cause damage to fishing and to fish stocks. Grey seals are believed to prevent fishing with gillnets almost entirely in many areas as well as damage fishing with trap nets. Seals are thought to influence how waters with fish in them are exploited, the location of fishing activity and fishing industry strategies. In the respondents' opinion grey seals disperse shoals of fish and chase fish away from fishing sites to new areas such as waters by the coastline. Near shore areas are privately owned and fishermen do not often have access to these fishing grounds. The fishermen are of the opinion that the increased seal population has an impact on the entire production chain. The status, in particular, of fish caught in Finnish waters in fish processing and trading is felt to be under threat owing to increased damage and the fact that fishing with nets has ceased entirely in some areas.

Reasons given for the current conflict between the grey seal and the fishing include the seal population growth, change in the behaviour of the grey seal, low profitability of professional fishing, change in fishing methods, low hunting pressure, uneven distribution of grey seals because of changing weather conditions, changes in the commercial fish populations, and the small number of fishermen. All of these factors accumulate to a problematic situation for the fishing industry. The grey seal was also blamed for the general difficulties of the fishing industry. Regional replies emphasised the importance of a permanent system of compensation for damage and improved, seal-proof gear to solve the problems of the fishing industry. The costs of buying seal-proof fishing gear is much higher than for normal trap nets, and the one-off subsidy by the state has only partly made up the differential. It was seen as a problem that the subsidy was not at the time readily available. There was a call for financial support by the Finnish Government and/or the EU for this purpose.

The replies suggested that efficient hunting was one of the main tools to reduce damage by seals. Hunting would be a viable way of achieving a smaller grey seal population. People were keen to lengthen the hunting season and abolish many of the restrictions on hunting. Almost half of the respondents were in favour of hunting without a licence. People also wanted to see bigger seal licence quotas. The grey seal was also considered a valuable natural resource and a source of valuable commodities (e.g. meat, skin and blubber oil). It is also believed that its status as a game species and the development of its use and processing are ways to raise the value of seals and play down their image as a harmful species. There needs to me more effective training of hunters and the principles of sustainable hunting should be stressed. There is a call to revive the hunting culture and train new hunters. In some replies, the way the game districts areas are divided was perceived to be good in administrative terms, though sometimes the view was that the division did not work. This failure is mainly explained from the point of view of hunting. The

administrative division is unsuitable for hunting seal because the present administrative districts are too small. Not everyone, however, agrees with the hunting of seal or believes all the reports of damage by the grey seal are true. It is also believed that a large number of seals are lost as a result of human activity (bycatch, illegal killing).

Regional responses express the opinion that the work of the authorities is heading in the right direction in general, although there was some criticism, too. Important areas of development were thought to be the assessment of the actual population, examination of the grey seal's diet, environmental contaminants and effects of these contaminants. In addition, there was a desire for more impartial information on the seal populations and more cooperation between the various stakeholders at both national and international level.

# 6. MANAGEMENT OF THE POPULATION SO FAR

## 6.1. National legislation

Legislation on seals has changed numerous times over the last hundred years (Table 5). In early times, legislation focused on the seal as harmful animals, later on it has focused on protection, and recently on the reintroduction of hunting, on damage caused by seals and on compensations.

## 6.2. Collecting information

The Finnish Game and Fisheries Research Institute is responsible for monitoring seal populations and for conducting research on the Baltic seals in Finland. The Institute cooperates closely with Finnish and foreign universities, other research institutes and various organisations. A significant contribution to the collection of information on the seal population status and potential conservation methods has been made by the Baltic seal work group set up by WWF Finland. This group, set up in 1986, established a population monitoring method, which is still in use (e.g. aerial censuses of grey seal populations).

*Seal counts*

Grey seal populations were first estimated at the beginning of the 1970s, and the aerial census has been used as the main method from the 1990s on in Finland. Today, the main contribution to grey seal population monitoring is the annual aerial censuses, which are conducted by the Finnish Game and Fisheries Research Institute during an internationally agreed period for counting Baltic grey seals in late May/early June, in the mainland Finland and the Åland region. Since the end of the 1980s, WWF Finland has also conducted grey seal counts every year during the same period.

The aerial census for the ringed seal population in the Bothnian Bay was introduced in Finland in the mid-1970s (Helle 1980b), and since the mid-1980s Swedish researchers have conducted a count almost every year (Härkönen et al. 1998). Aerial censuses for ringed seals are conducted using a sampling method on the ice in April. Ringed seal censuses in the Gulf of Riga (in 1995, 1996, 2003 and 2006) have been conducted in cooperation with Swedish and Finnish researchers. Ringed seals have been counted in the Russian territorial waters in the Gulf of Finland in cooperation with Finland. WWF Finland has studied the status of the ringed seal population in Finland's south-western archipelago during the 2000s.

*Monitoring seal movements and distribution*

The movements and habitat use of seals have been studied in international projects. In one project, Pups were tagged to examine the dispersal of grey seals after weaning. During the period 1986–1993 around 2,000 grey seal pups had their flippers tagged in Finnish and Estonian territorial waters. The results of this project have supported the view that the grey seal moves over a very wide area (Helle & Stenman 1990).

Satellite telemetry was used to study the ringed seal's habitats, daily activity and migration patterns in the period 1994–1999. The behaviour of 19 adult ringed seals on the Estonian coast, in the Gulf of Bothnia and in the Gulf of Finland was studied in a joint project between Sweden, Russia and Estonia. The findings suggest that adult ringed seals have strong site fidelity, and move less actively than grey seals (Härkönen et al., unpublished).

*Studies of the environmental contaminant load on seals and their health status*

Since the 1980s, research on the Baltic seals has focused on their reproductive capacity, contaminant load, diet and population structure. The Finnish Game and Fisheries Research Institute collected samples from 700 seals found dead or hunted during 1986-2005. The collected material has provided information on their diet as well as on the population structure as well as on their general health status Additional data is collected every year from all hunted grey seals, as because the hunters obliged to send in samples of each hunted grey seal. In addition, since 1987 the Institute has sampled an average of five to seven Baltic ringed seals each year for research purposes, mainly with the aim to monitor the seals' health status. The main focus is on monitoring the frequency of uterine occlusions in the adult female ringed seals.

*Conflict between seals and the fishing industry*

With the growing seal populations a need for studying the conflict between the protection of seals and the fishing industry has become apparent. The increase in seal populations has made it necessary to develop seal-proof fishing gear. Since the 1980s, gear which is resistant to seal damage has been developed in Sweden. Finland has also developed and tested seal-resistant fishing gear and methods suited to local Finnish conditions. Measures to reduce damage to catch and gear have been targeted to salmon trap net fishing, in particular

Table 5. Finnish legislation on seals 1908–2006

| Year | Legislation |
|---|---|
| **1908–18** | Bounty (5 marks) paid for each seal hunted |
| **1923** | Seals classified as a harmful species to be killed without restriction. Only in nature conservation areas is the hunting of seals prohibited.. |
| **1924–43** | Bounty system (50 marks) reintroduced.. |
| **1944–62** | Bounty was raised to 200 marks. |
| **1962** | New Hunting Act enters into force. Seals have an open hunting season, and all hunters have the right to hunt seals in the coastal and off shore areas. Permission needed of holder of hunting permission or of landowner when hunting with traps or other fixed gear. |
| **1963** | Bounty changed to 20 marks with the change in value of the Finnish mark. |
| **1965** | Bounty of 20 marks paid in Åland. |
| **1975** | Seal pups protected in mainland Finland 10 March – 31 May. In Åland hunting season changes (1 June – 31 November), and bounties abolished. |
| **1976** | Bounties abolished on mainland Finland.. |
| **1977** | Grey seal protected entirely in Åland. |
| **1978** | Grey seal protected 15 March – 31 August on mainland Finland. |
| **1980** | In mainland Finland, hunting season for the grey seal during 1 September –14 March and for the Baltic ringed seal 1 September – 14 June. In Åland, the grey seal is protected during 1 June – 31 August and 1 September – 30 November. |
| **1981** | In Åland, hunting season for grey seals during 1 September – 31 December, unless closed seasons announced. In Åland, the grey seal is protected during 1 June – 31 December. . |
| **1982** | In mainland Finland, grey seal is protected entirely and the hunting season for the ringed seal is shortened (20 March – 10 June). No hunting season laid down for the grey seal in Åland. |
| **1985** | In Åland, the grey seal is fully protected until further notice. |
| **1988** | Hunting season for the grey seal in the Gulf of Finland during 1 April – 25 April, and in the Bothnian Bay 1 April – 25 May. Game management districts grant hunting licences as set down by the Ministry of Agriculture and Forestry. |
| **1993** | New hunting Act permits hunting of ringed seal only with a licence from the game management district, in accordance with a maximum number set by the Ministry of Agriculture and Forestry. |
| **1998** | In mainland Finland, Hunting Decree lays down hunting seasons for both seal species (16 April – 31 May and 1 September – 15 October). Hunting of grey seals was reintroduced through allocation of hunting quotas. |
| **1998** | Seal sanctuary established in Åland. |
| **2000** | Hunting Decree abolishes the closed season for the grey seal in the summer (1 June – 31 August). |
| **2001** | Seven seal conservation areas established in mainland Finland. |
| **2002** | In mainland Finland, it is agreed that compensation should be paid for damage to fish catch by seals for two years. Grey seal hunting was reintroduced in Åland by annual decisions of the Government of Åland. |
| **2003** | Hunting Decree lays down closed season for ringed seal (16 October – 15 April and 1 June – 31 August) and for grey seal (1 January – 15 April). |
| **2004** | One-off Government subsidy for buying selective, seal-proof trap nets. |
| **2006** | Opportunity to apply for aid from the European Fisheries Fund for buying seal-proof gear in the period 2007-2013 (Council Regulation establishing a European Fisheries Fund). |

(Lehtonen & Suuronen 2004, Kauppinen et al. 2005, Suuronen et al. 2006). The aim has been to block the access to the rear of the trap net by making the rear out of Dynema, and by connecting a roof mesh of Dynema netting to the rear, and further by replacing the wire threads with a mechanical grille. Studies have also looked at the behaviour of seals and fish in fishing gear and, for example, the feasibility of seal scaring devices. An attempt has been made to prevent seals from drowning in trap nets by using not only bars but also a smaller knot distance on the wing of the netting (100 mm).

The floating trap net, developed in Sweden, or the so-called push-up trap net, has also been introduced in Finland. The push-up trap net works on the principle where the whole hooped rear of the trap net lifts on floats filled with compressed air while the catch is being emptied. The materials are seal-proof and the structure of the rear is designed so that the actual fish chamber cannot be entered from the outside, other than by opening the check hatch. The seal-proof feature of the push-up trap nets has been achieved not just with resistant materials but also in the way they are constructed. The rear is in two parts, the larger meshed outer netting keeping the seals at a distance from the small meshed section used for fishing. The seals cannot therefore tear fish in the chamber, which is the problem with the conventional solution even when the trap net is made of resistant materials. Thanks to the two-part structure, the fish that enter the trap net probably do not get as stressed as in trap nets with single walls and the catch stays in good condition. Push-up trap nets are the best suited fishing gear for coastal fishing. They meet the requirements by fishermen and are also satisfactory in terms of selectivity and seal protection. Boats that currently are in use to check the traps have enough capacity to carry the loads because the push-up system works by compressed air and, unlike a Dynema trap net, does not need to hold up the gear from the boat.

Seal-proof trap nets are more expensive than the traditional type but they definitely last longer. They would seem to be somewhat less effective at catching fish than the traditional types, but their advantage is their resistance to seals and their selectivity. Regarding materials, Dynema is about four times the price of nylon and polyethylene. Dynema netting is manufactured by companies (e.g. Carlsen Net, Utzon, Van Belen and Hampidian) which have to buy the raw thread from just one producer (Dupont in Holland), which has patented the product. The patent rights do not expire until 2010, after which the cost of Dynema is predicted to fall almost to that of nylon.

Seal-proof trap nets have been developed as a measure to mitigate the conflict between seals and the fisheries.

However, a lot of problems still remain in the protection of fishing gear from seals and more development is needed. Professional fishermen say that the problem with using seal-proof floating trap nets is the immediate surroundings of the gear, where seals may have learned to catch and/or damage fish before they get inside the traps. These losses to catch caused by seals and the effect of scaring fish away are very hard to assess, however. The proportion of scarred fish (old wounds) points to this kind of damage which, according to statements by fishermen, have been found in some areas to account for 10-15 % of the catch, but this is extremely difficult to assess for sure.

The most difficult thing is to protect gillnets from seal damage (e.g. those normally used in fishing for perch, whitefish and pike-perch). No suitable mechanism has been found to protect gillnets from seals as yet. One solution might be to replace the net fishing method with some other catching method. At present, a new type of protective trap net is being developed by a Swedish trap net producer in collaboration with fishermen, which can be used to catch fish with scales (e.g. the pike-perch). Furthermore, pike-perch fishing using a type of seine designed for use in lakes was tentatively trialled in the autumn of 2005 in the Archipelago Sea.

At the adoption of the Decree on Seal Conservation areas (736/2001), a resolution was appended to the Government Protocol. In accordance with the resolution, the Finnish Game and Fisheries Research Institute has investigated the impact of seal conservation areas on professional fishing. The results show no significant difference between areas close to the conservation areas and the general trend in terms of fishing units, days spent fishing or volumes of catch. The amount of catch damaged by seals has increased in the whole marine

area. In the Gulf of Finland, the Bothnian Bay and partly in the Archipelago Sea, the amount of damage to catch was proportionally greater in ICES squares connected to seal conservation areas than in similar areas elsewhere. Seal conservation areas had had a direct impact on the activities of just a few professional fishermen, but more than half of those interviewed thought that the establishment of the conservation areas has caused a rise in the number of seals and thus had adversely affected the conditions for professional fishing in general.

## 6.3. Nordic and other international cooperation

As seals are distributed large areas crossing national borders international cooperation is of key importance in the management of these populations. Every year, Finland, Sweden, Estonia and Russia have common meetings at which the results of each county's population census are collated and an estimate is made of the size of the Baltic grey seal population. At these meetings the participants decide the following year's census date and discuss the latest seal research issues and current projects.

Finland and Sweden have conducted seal censuses in cooperation for a long time: Swedish researchers conduct aerial censuses of ringed seals in the Bothnian Bay and Finnish researchers visit Swedish territorial waters when conducting grey seal counts. Similarly, cooperation on censuses takes place every year with Estonian and Russian seal researchers. In addition, researchers and officials in seal administration have met in international seminars and meetings where participants from all the Baltic Sea countries disseminate information on the status of their seal populations, development and research.

Those engaged in seal research in the Baltic Sea and its surrounding area (Saimaa and Ladoga) have met every 5-10 years since 1974 to present new findings and to discuss the management of seal populations and matters relating to seal biology. The 'Symposium on the Biology and Management of Seals in the Baltic Sea Area' is an important forum where seal researchers, officials and students from the Baltic Sea countries meet regularly.

ICES (The International Council for the Exploration of the Sea) is the oldest international organisation for marine research. It has 19 member countries: all the EU Member States along the Atlantic coast, the Baltic Sea countries, Canada and the United States. The Council sets out to coordinate and promote scientific marine research in the North Atlantic Ocean (Baltic and North Seas included). The independent network relies on an exchange of information and a supply of scientific information to political decision-makers and international bodies to serve as a basis for decisions taken. ICES plans and coordinates marine research with the help of seven science committees, more than 100 expert groups, symposia and Annual Science Conferences. At present, ICES has an international worldwide group of experts specialised in marine mammal ecology (the Working Group on Marine Mammal Ecology). Finland and other Baltic Sea countries are represented in this Group, whose task is to make known the results of scientific research and advise international agencies on marine mammals. ICES acts as an organisation of experts for institutions such as HELCOM.

The work group set up under the Convention on the Protection of the Marine Environment of the Baltic Sea Area (HELCOM) has been negotiating common policies in the Baltic Sea for the management of seals (see 2.1.4.) for a long time now. A former recommendation on seals was made in 1988. In 2005 and 2006 a new recommendation was drafted, which came into force on 8 July 2006. According to the new recommendation, a permanent international working group consisting of seal experts was established to start work in autumn 2006. Its main tasks include coordinating of the monitoring of Baltic seal populations, evaluating the population structure, size, range, reproductive capacity and health status, and harmonising national management plans and the network of conservation areas. The group reports back to HELCOM annually.

## 6.4. Regional actions taken

An Interreg III A project in the Kvarken (Kvarken Mitt Skandia) was launched in 2000, with the purpose of creating wide-ranging regional cooperation among different stakeholders. The project had three objectives: to develop a common view in the Kvarken area of the grey seal as a natural resource, to minimise the conflict between fishing and seals, and to raise the profile of the seal's value as a renewable natural resource. The project resulted in an action plan for the Kvarken Sea area. At the same time, training programmes for seal hunters were constructed separately for Sweden and Finland based on their respective hunting legislations. During the project training in seal hunting has been conducted, and the feasibility of using push up trap nets has been tried out in the Kvarken area. In addition, the project

aimed to develop the use of different parts of the seal for products, and to develop a network of cooperation for seal products. The project established a forum where people could discuss problems and opportunities for improvements with all the relevant regional stakeholders.

From 2004 to 2006 there was a project entitled *Seals our mutual resourc*e, which was a continuation to the Grey seal in the Kvarken region project between Finland, Sweden and Norway. The objective was to promote the ecological management of seal populations in the Kvarken area with a view to benefit the coastal residents. The project aimed to create favourable conditions for the sustainable use of a valuable renewable resource while ensuring that the species was maintained at a favourable conservation status. The establishment of a seal centre was also proposed, with aim to act as a forum for the ecologically sustainable management of seal populations and to enhance cooperation between organisations and authorities.

The Provincial Government of Åland drew up a Programme of Measures in 2005 to prevent and reduce damage caused by seals to fishing. The Programme also contains proposals for the utilisation of seals, such as seal watching or as making use of the meat and skin. A plan I also being drawn up to promote the development of new gear (e.g. acoustic harassment devices) and fishing methods to reduce seal damage. The Provincial Government has also organised events for hunters to highlight the traditional and cultural significance of seal hunting and discuss hunting methods recommended today.

In 2004, the Association of the Sea Fishermen of Southern Finland launched a project called 'RISA – the grey seal: once a nuisance, now a resource'. It involved trialling a Swedish seal-proof trap net and organising training on hunting seals, utilising the hunted animal and seal tourism in southern Finland (www.merikala.fi). A project in the Archipelago Sea in 2000-2006 called 'SAMPI' also examined the suitability of seal-resistant push up nets for catching fish with scales and the requirements for catching whitefish with trap nets.

## 6.5. The history of the protection of seals in Finland

In Finland, bounties were paid on seals from the beginning of the 20th century up to the end of 1975. Although studies were reporting the alarming decline in seal populations as far back as the late 1950s (e.g. Bergman 1956, 1958), research and conservation work on seals did not start until the 1970s. The first main field of action was to investigate their environmental contaminant load, reproductive disturbances and population sizes (e.g. Herva & Häsänen 1972, Helle et al. 1976a, b, Kari & Kauranen 1978, Helle 1980). The damage caused by just a few seals to fishing was also found to be slight (Stenman 1979), which contributed to the positive climate which reigned regarding their protection. The first official meeting on the protection of Baltic seals was held in Sweden in 1974. A seal conservation area was established in Finland under Decree (339/1970) in 1970, when the Kantskogsbrotten-Bergstadsbrotten area in Kyrkslätt was protected. These were the only areas of rocks and islets between Hanko and Porvoo known at the time where grey seals regularly hauled out.

Active seal conservation was initiated in the 1980s, during a time when the public awareness of and the concern for the status of the Baltic seal populations was increasing. In 1986 WWF funds from Finland and Sweden were used to initiate a joint project to improve the protection of the Baltic seals. At this time the WWF's Working Group for the Protection of Baltic Seals was set up to plan and carry out research on the protection of seals in Finland. The Group included experts in the fields of administration, protection/conservation and research. The group worked mainly with grey seal counts, the collection and study of seals found dead, and tagging of live seals (Helle & Stenman 1990). Different ways of protecting seals were looked for. One option considered was a seal care centre, which was planned mainly for looking after young seals found in poor condition or undernourished, and then returning them back to nature. This plan received attention especially during in the winters in 1989-90 with poor ice conditions (Stenman 1992).

The protection of grey seal rocks and islets was seen as one of the most important practical conservation measures. In 1989, the Finnish Game and Fisheries Research Institute submitted a proposal to the Ministry of Agriculture and Forestry to establish three seal conservation areas (Sandkallan, Grimsörarna and Södra Sandbäck) and to the Provincial Government of Åland to establish three conservation areas there as well (Karlbybådan, Sankan and Märkallarna). The aim of these proposals was to guarantee the seals a peaceful area from the busy yachting traffic from May to September. As a result of the proposal, the Government of Åland set up a working group, which later submitted its own proposal for a conservation area.

In 1990, the Working Group for the Protection of Baltic Seals met to discuss a proposal to make seal conservation in Finland more effective. The conservation programme was submitted to various authorities and was published as a report in Finnish and Swedish with the title 'More effective Baltic seal protection in Finland'. The programme contained a proposal to establish seal conservation areas, but it also expressed views on unintentional mortality, treatment of seal diseases and monitoring of seal populations. The proposals did not, however, produce any immediate result. A seal sanctuary was established in Åland in 1998. As for mainland Finland, a new proposal by the Ministry of the Environment was drafted in 2000. When Finland joined the European Union, Finland was obligated to establish conservation areas for seals under the Habitats Directive, and seven official seal conservation areas were set up in 2001.

The protection of seals made gradual progress in Finland, including several different changes regarding the shortening of the hunting season. Åland did not issue any hunting licences after 1982 and protected all seals in 1985. Since 1982, no hunting season was declared for seals in mainland Finland, and the grey seal was officially protected in spring 1988. Owing to the damage caused to fishing, grey seal hunting was reintroduced again in mainland Finland in 1998 and in Åland a year later. The ringed seal has in practice been protected since 1988, and the Ministry has not issued any hunting licences for ringed seal since that date.

The debate on seal hunting has been influenced by the HELCOM recommendations. In 1988, HELCOM adopted the recommendation that any sort of killing of seals should end and it could only be allowed to start again when seal reproduction and their health state in general had returned to normal. In 1996, HELCOM decided on a derogation from the existing recommendation on hunting, and in 2006 the recommendation was reviewed as the seal populations had increased. The new seal recommendation allows a sustainable use of seals, on the condition, however, that that use meets the conditions to achieve and maintain a favourable conservation status under the EU Habitats Directive.

# 7. POSSIBLE THREATS TO SEAL POPULATIONS

## 7.1. Diseases, illnesses and parasites

Mass mortalities of marine mammals have been reported around the world in the last few decades (Härkönen et al. 2005). The most recent reports in the vicinity of the Baltic Sea have been the mass mortalities of seals from phocine distemper virus (PDV) in the Kattegat-Skagerrak area in 1988-89 and in 2002. In 1988 an epidemic killed 55–60% of common seals and reduced the population of 9,000 to around 3,500. According to current views, the virus was carried down from the Arctic Ocean by migrating harp seals to the Danish Straits. The recovery of the population was, however, a swift process. By autumn 2000, this common seal population was already larger (roughly 16,000) than before the deaths in 1988–89. A new epidemic on the west coast of Sweden in summer 2002 caused a similar drop in the population as occurred 14 years earlier (Jensen et al. 2002). This time the epidemic is thought to have been due to viruses carried by grey seals.

Both times the PDV epidemic broke out in a harbour seal population which was growing at a record speed. Studies show that the numbers of seals lounging on one islet does not influence the rate of mortality – densely packed herds of seals hauling out became ill regardless of the size of the herd. Thus, the main factor was the density of the colonies. On both occasions, the epidemic did not spread to the main basin of the Baltic Sea, which may have been due to the few and small harbour seal colonies on the eastern coast of Sweden.

In most cases, morbilli virus, which causes the mortalities in seals, has been transmitted to marine mammals from terrestrial mammals. In the Baltic Sea, an unexplained mass mortality of ringed seals was observed in the eastern part of the Gulf of Finland in the winter of 1991/92 (HELCOM 1996).

When parasites such as hookworms, roundworms, tapeworms, lungworms and protozoans occur in abundance they can weaken seals' general condition and increase their mortality rate through under nourishment or secondary infections. Worms that affect the lungs and heart have been observed to cause death, for example, in young harbour seals in the Wadden Sea (Breuer et al. 1988). Heartworms are common parasites in Baltic ringed seals under the age of three, and have even been the cause of death in some individuals (Westerling et al. 2005). No heartworms have discovered in Baltic grey seals.

Hookworms are very common in both ringed and grey seals in the Baltic Sea. They may cause intestinal ulcers and, in the worst cases, death in grey seals, when the wounds penetrate the intestinal wall (Bergman 1999, Bäcklin and Bergman 2005). The incidence of intestinal ulcers is thought to have increased dramatically in recent years, especially in young seals (Bäcklin and Bergman 2005), and thus they may pose a new threat to the health of seals. Bacterial infections can also be the cause of death in seals.

*Summary: Viral epidemics seem to be the greatest single risk factor for the seas. A serious epidemic will weaken the seal's immunity and, as a result, secondary infections become common. Parasites also cause impaired immunity and exposure to secondary infections, although they do not spread as quickly as viral infections.*

## 7.2 Climate change

The earth's climate is now changing and average temperatures are rising faster than ever before. Climate change is expected to speed up and cause major ecological, social and economic changes, some of which have already begun. The Arctic climate, in particular, is now warming up fast, and the changes are expected to become more dramatic. The consequences will affect the entire planet (ACIA 2004).

Climate change is also regarded as one of the most serious global threats to marine mammals. In particular, it is expected to have a major impact on the breeding and foraging of many mammal species, which are dependent on ice and snow (Tynan & Demaster 1997, Stirling et al. 1999, Kelly 2001, Clarke & Harris 2003, Ferguson et al. 2005). Over the last 30 years or so, the snow cover has declined each year by around 10% in the northern hemisphere (Brown & Braaten 1998), the ice cover has become thinner and the ice winter has shortened. Climate change and the resulting milder winters may also have an impact on the Baltic winter. It has been estimated that in a hundred years from now, the annual average ice cover in the Baltic Sea may in the worst case scenario be as much as 80% less than now (Meier et al. 2004).

Climate change is thought to have an especially serious effect on the ringed seal (Kelly 2001, Meier et al. 2004,

Ferguson et al. 2005), which is greatly dependent on ice and snow as a breeding habitat. The average reduction in snow cover is the most crucial during the late winter, when ringed seals give birth and nurse their offspring in lairs. The average temperature in late winter in Finland is now about two degrees warmer than in the mid-19th century (Tuomenvirta 2004). Climate change, therefore, is likely to restrict the ringed seals' natural distribution area in the future. In its southern distribution areas, the ringed seals suffer at times from poor ice conditions today. Reduced ice cover is thus thought to be the greatest threat to the southern breeding areas in the future (Gulf of Finland, Archipelago Sea and Gulf of Riga). It is assumed, however, that the innermost areas of the Bothnian Bay and the Gulf of Finland will continue to freeze in the future, even if the climate were to warm up quite dramatically (Meier et al. 2004).

The reduced ice and snow cover affect especially the pups' ability to survive (Ferguson et al. 2005). In addition to reducing areas with ice cover, the breeding environment is also affected as the snow melts too early or when there is no snow at all. In such a case the pups are without the protection of their lair. Lairs protect the pups of around five kilos against cold and predators. Pupping on rocks, islets or the open ice may involve problems of thermoregulation and nursing for the pup, resulting in pups being underweight and thereby increasing the mortality rate (Kelly 2001, Smith & Harwood 2001). Having no lair may increase the risk of predators and getting caught in nets earlier in the spring. A reduced or no ice cover in the Arctic Ocean has been connected to a greater predation on pups (Lydersen & Smith 1989, Smith & Lydersen 1991). Pups born on the open ice or on the rock and islets may thus be exposed to new types of pressure from predators in the Baltic Sea (e.g. small predators, crows, seagulls and white-tailed eagle).

The indirect consequences of the global warming are also relevant for the grey seal, as they use the drift ice as a breeding habitat in the Baltic Sea. However, grey seals are will probably not suffer from the effects of climate change in terms of breeding habitat as they also breed on islets and rocks in the Baltic Sea area (Meier et al. 2004). The grey seal weighs 10–12 kilos at birth and is not as exposed to the cold or to predators to the same extent as the ringed seal. The grey seal population has previously adapted well to winters with a poor ice condition by pupping in large herds on rocks and islets in the outer archipelago. Studies have reported that the average weight of pups born on land at weaning, and their survival rate is lower than pups born on ice. Pups born on land also carry a greater risk of dying of disease, as these seals stay close together and the land is not as sterile as the ice (Jüssi 1999).

*Summary: Climate change is a threat to the ringed seal and it may also affect conditions for grey seals breeding. The reduced ice and snow cover resulting from climate change may increase the mortality rate of Baltic seal pups. Climate change is expected to affect the breeding areas of ringed seals, in particular, as the ice cover gets thinner and the period of fast ice shortens.*

## 7.3. Environmental contaminants, blue-green algae and eutrophication

The deterioration of the state of the Baltic Sea has a complex effect on the seals. The increased levels of environmental contaminants and the environmental chemicalisation pose a threat to the well-being of the seals and their reproductive capacity. The seals are at the top of the Baltic food chain, and have thus been exposed to extremely high levels of environmental contaminants. Although some contaminant levels have declined dramatically throughout the Baltic ecosystem, the seals still suffer from 3-100 times higher contaminant levels than seal populations in less polluted regions. The ringed seal, in particular, continues to suffer from a very high and direct toxic contaminant load.

Very little is known about the harmful effects of environmental contaminants on marine mammals. Only few studies have shown a relationship between the observed physiological imbalance or pathological changes in marine mammals and their contaminant burden. On the other hand, laboratory studies have reported a variety of harmful effects of organic environmental contaminants on experimental animals. Today, especially the non-dioxin-like PCBs are thought to play a central role in the development of diseases in the Baltic seals, especially in the grey seal (Olsson et al. 1992, 1994, Wiberg et al. 2002). Too little is still known about the effects of the organochlorines occurring in the Baltic ecosystem on the Baltic ringed seal to be able to assess their impact on their health state.

Although heavy metal levels have remained high in Baltic seals since the 1980s, they do not seem to have any direct impact on the seals' health status, as seals probably have the ability to adapt to high concentrations of heavy metals.

Toxic algal blooms may affect seals mainly via their diet (Scholin et al. 2000). The possible effect of algal toxins on seals is not known at present. On the other hand, the occurrence of sudden mass mortalities of the different species caused by algal toxins in the Baltic Sea has become more common, which implies that algal blooms also could be a possible threat to the seals.

The changes caused by eutrophication in the Baltic Sea do not affect the well-being of the seals directly. However, eutrophication has an indirect influence via changes in their living environment and in terms of possible shifts in the prey species. Another consequence of eutrophication is the spreading dead seabeds, which will affect the whole Baltic Sea ecosystem.

*Summary: The Baltic Sea's high levels of environmental contaminants, especially organic environmental contaminants, pose a major threat to seals, although it has not been possible to show any clear connection between contaminant levels observed and disturbances and pathological changes in the seals. Algal blooms are also a possible direct threat to seals. Environmental contaminants, algal blooms and eutrophication, together cause changes in fish stocks and the seals' living environment.*

## 7.4. Oil and chemical spills

Oil spills are considered one of the most serious threats to life in the Baltic Sea. Oil spills include not only oil accidents but also oil spills from ships, harbours/ports and the mainland. These spills may affect the Baltic Sea even more than single large scale accidents.

At the end of the 20th century, oil was being transported in the Gulf of Finland mainly for use in Finland at approximately 15 million tonnes a year (Pitkänen 2004). In recent years, Russian oil traffic and other cargo consignments have rocketed (Hänninen 2005), and 15% of the world's maritime traffic is in the Baltic Sea. With new dock areas being opened on the Russian shores in the near future, maritime traffic is predicted to double in the Gulf of Finland by 2010–2015. Tanker traffic per annum is even expected to triple over the coming decade. The estimated yearly growth in Finland is 2%, in the Baltic countries 4% and in Russia 7% (VTT, 2002a). On the other hand, the monitoring of shipping and preparations in the event of accidents are continuously being developed both nationally and internationally.

The risk of accidents from tankers carrying chemicals is considered smaller than the risk of oil spills. In the future, therefore, greater focus should be on the prevention of oil spills. The greatest threats of oil and chemical spills are seen in 1) fiercer competition in the transport sector, 2) the decline in Russia's ability to prevent environmental disasters and 3) the rapid growth in shipping.

Oil is toxic and dissolves slowly, and its effect in the environment is complex. Oil spills can change local flora and fauna for a long time, affect the structure of the food chain and upset the ecosystem balance. The possible effects of oil and chemical spills on seals have mainly been investigated in studies in Alaska after the *Exxon Valdez* disaster. In these studies it was noticed that adult seals do not suffer directly from the adverse effects of oil as much as, for example, seabirds. On the other hand, the contamination of the living environment and the drastic changes in the ecosystem and food resources has an indirect impact on seals (Loughlin 1994). The risk of exposure to oil for seals living in the Baltic Sea is clearly the greatest in the Gulf of Finland, simply because of the size of maritime traffic their (especially consignments of oil). Oil shipping routes there pass through ringed seal pupping areas as well as close to rocks and islets where seals haul-out.

*Summary: Oil and chemical spills pose a threat to the life in the Baltic Sea, and the risk of an accident increases as maritime traffic grows at the fast rate it does. In addition, oil emissions from ships, harbours and the mainland are thought to affect the Baltic Sea even more than single accidents. Estimates suggest that the risk of a chemical spill is not as serious as the risk of an oil spill. Seals do not suffer directly from the adverse effects of oil as much as, for example, seabirds, but the indirect effects may be significant on a local level.*

## 7.5. Predators

There are no large terrestrial predators that threaten seals in the Baltic Sea. Seal pups, especially ringed seal pups, may, nevertheless, become the prey of birds (e.g. large seagulls, crows and the white-tailed eagle), especially in winters with poor snow and ice conditions.

*Summary: Predators do not pose a great risk to Baltic seal populations. They may be significant, however, in mild winters, especially for young seals.*

## 7.6. Hunting

Today hunting is conducted according to the principles of sustainable use, which in accordance with the present hunting legislation. This approach prevents the seal populations from becoming endangered in the future. Sustainable use in hunting relies on the authorities responsible for the management of populations having sufficient and reliable ecological data in order to do their job. Seal hunting in Finland is based on ethical principles, animal well fare aspects, and on utilising the hunted animal.

Summary: The seal hunting conducted today under the current legislation does not threaten Baltic seal populations.

## 7.7. Illegal killing

Illegal killing of seals does occur in Finland, but the extent of this activity it is not known. The present growth rate of the seal populations and the small number of seals found shot suggest that the level of illegal killing does not constitute any significant threat to seal populations. Neither is large scale illegal killing of seals profitable as there is no market for the hunted animals. Illegal killing is also reduced by the fact that grey seal hunting has become legalised and licences have been more readily available.

*Summary: Although the extent of illegal killing is unknown it is not thought a threat to either species.*

## 7.8. Fishing

Fishing can have an effect on Baltic seal populations both indirectly by affecting the food reserves, and directly through bycatch. The decline in some commercial fish stocks due to over fishing has affected seal populations in some marine areas around the world (Reijnders et al. 1993, 1997). More than 90% of the fish caught by Baltic fishermen is Baltic herring, sprat and cod. At present cod stocks are low, Baltic herring is abundant and sprat very abundant. Baltic herring and sprat are important sources of food for the Baltic seals (Pöyhönen 2001, Stenman & Pöyhönen 2005, Lundström et al. 2006). Although seals and fishermen compete to some extent for the same fish, present professional and recreational fishing and the quantities caught are not on a scale that would appear to threaten the seals' food supplies. Seals have also been found to eat the species of fish which are the most readily available at any one time (Pöyhönen 2001, Stenman & Pöyhönen 2005). This improves their adaptability to any changes in the fish stocks.

Getting caught in fishing gear poses a real threat to many marine mammal species worldwide. With the increase in seal populations, seal bycatch is in absolute terms also likely to have increased. Nevertheless, the share of bycatch may have declined as a result of changes to fishing methods and improved fishing gear (Lunneryd & Königson 2005). The most dangerous forms of fishing for seals (fishing with gillnets and unprotected trap nets) are less common today, and they have been replaced with seal-proof gear. In most cases seal-proof trap nets prevent seals from getting caught in the fish chamber, where they drown. However, young seals have been observed to drown in seal-proof floating trap nets, as these manage to squeeze in between the bars of the fish chamber (Suuronen et al. 2006). The role of bycatch in the total threat to seal populations is hard to assess at present, as there are no reliable estimates of bycatch. The existing estimates may be clearly less than actual numbers in many areas (Lunneryd & Königson 2005).

*Summary: Fishing in its present form is no obvious threat to the food supplies of the Baltic seals. Seal mortality in the form of bycatch and its role in the total threat to seal populations are hard to assess, owing to lack of reliable data.*

## 7.9. Disturbances caused by maritime traffic and other use of the marine environment

*Maritime traffic*

The most significant maritime traffic factor for seals is the winter navigation. Since the 1980s, the largest harbours in the Bothnian Bay have been kept open for traffic through the winter. The Baltic Sea is probably the only marine area where seals give birth and nurse their young on ice in areas with heavy maritime winter traffic. As the offshore fast ice moves to some extent even in mid winter, ships cannot use the same open channels continually. Instead, they have to break ice to make new channels to keep on the track. Normally, ships pass through more or less the same areas, however, and ice between the lanes is left undisturbed by shipping. Ships also try, where possible, to circumnavigate the most firmly iced up areas, which are generally the ringed seal's favoured breeding areas.

Vessels passing through the ice may destroy ringed seal lairs and kill seal pups which lie directly in their path or close to it. This happens only very sporadically, however, and is probably of no significance for seal populations. Furthermore, ringed seal females probably avoid settling down right next to shipping lanes. But there have been some cases where a female grey seal has come up onto the ice to give birth on a lane opened by ships. Winter navigation has encouraged the spread of the grey seal to give birth regularly in the Bothnian Bay where the ice cover is firmest. The natural pupping environment for the grey seal is the drift ice zone between the fast ice and the open water. Winter navigation has created artificial drift ice conditions by cutting ice fields into areas of firm and solid ice.

When the sea is free of ice maritime traffic's main impact on the Baltic Sea is the result of establishing and maintaining shipping lanes, and the traffic itself. The network of lanes maintained by the Finnish Maritime Administration is around 16,000 km in length, half of which are sections of sea lanes. The main focus in the work on sea lanes is the maintenance of the lanes and improved standards. The dredging and channelling of the lanes has the greatest impact on the environment. As a result of this work, the waters become muddy and nutrients are released, and they can also change the currents, water depth, seabed fauna, and production of algae and on the levels of environmental contaminants. Dredging can also have an impact on the fish stocks. For example, spawning sites can be destroyed or damaged, or there may be changes to the production of young fish.

Maritime traffic affects the environment through emissions into the air and sea. The emissions include oil, wastewater from toilets and washing, solid waste, ballast water, chemicals and the toxic undercoats of paint on ships. The volume of water emissions has declined in the last few years and the impurities that got into the water earlier are now properly collected. There are no emissions restrictions on washing water (grey water), though some attempts are is now being made to also collect these in ports for treatment in sewage plants. The major mechanical effects of maritime traffic are the waves, streams, suction and pressure caused by vessels. Increased traffic causes more noise, emissions, swell and slipstream effects, which may have an impact on life forms in the area. Furthermore, the more traffic there is the greater is the risk of an accident.

*Use of sea sand and gravel*

For decades, sea sand and gravel has been dug up and used for land fill at construction sites in ports and other coastal areas. The main problems are thought to be the risk of erosion on shores where sand has been taken and the damage caused to fishing. The long-term environmental impact of removing sea sand results in changes to currents and sedimentation and possibly also locally to oxygen depletion. These changes affect the seabed fauna, fish stocks and fishing, and seabed vegetation and erosion. Most often the changes caused by removal of material are reversible, but the quality of the seabed alters permanently.

*Wind power stations*

In the last few years wind power stations have been located to coastal areas, and there are plans to locate them in the sea as well. There is no comprehensive information available in Finland on the effects of wind power stations and associated structures on the marine environment. A number of studies have been conducted on the effects of the power stations on marine wildlife in Sweden (www.environ.se). The effects are various and may be due to any of the following: noise, vibration, electromagnetism, magnetic fields, cables, sedimentation, changes to light, shadowing, reflection, emissions, and construction and repair work.

A magnetic field forms around the cables linking the wind power stations to the main supply, and this may cause local disturbances to the magnetic field. Many species of fish, bird and even animal plankton use this magnetic field to navigate by, but the possible effects of wind power stations on the navigation of these species are unknown. The cables also produce an electric field, whose effects on marine mammals are also not known. Increased sedimentation, light changes and shadows caused by wind power stations have been shown to affect the immediate environment, fish in particular, but the possible effects of these on seals have not been examined.

The direct impact of wind power stations on seals has been studied in the southern Baltic Sea on grey seals (Sundberg & Söderman 1999). The seals adapted to the constructions and the operation of the power plants. In general, seals seem to adapt well to new constructions in the sea, for example, harbour seals use the new artificial islands under the Oresund Bridge. But grey seals were clearly disturbed when wind power stations were

being built and by the increased level of human activity in their living environment.

*Summary: The use and maintenance of traffic lanes in the Bothnian Bay and the Gulf of Finland in the winter can damage seal lairs on the ice, but do not pose any obvious direct threat to seal populations. In some areas maritime traffic and the use of the marine environment in general, such as dredging, the utilisation of sea sand and gravel, land defence in coastal areas and wind power stations can indirectly affect seal populations, e.g. through changes in fish stocks.*

## 7.10. Disturbances caused by yachting and other recreational activities

The Baltic Sea's archipelagos and coastal areas are used for many kinds of recreation. Although the permanent settlement of the archipelago has decreased in the last few years and professional fishing has declined, there has been a dramatic rise in recreational activity during the same time period. Outdoor activities, hiking and rambling, boating, recreational fishing, motor sledging, ecotourism and cottage life are becoming more and more common as ways of using coastal areas for recreation. This contributes to the increase in the contamination of marine wildlife and causes disturbances. Efforts have been made to minimise the negative impacts on the use of land and water areas in decision-making. Emissions from boats have declined owing to the refurbishing of boats and yachts and septic tank requirements. Special plans have been drawn up for the location of cottages and other forms of recreational activity so as to restrict pressures on the environment to a limited area. Various conservation areas have also been established to protect marine wildlife.

A direct problem for seals resulting from recreational activity is mainly that they are disturbed to a greater extent. Human disturbance causes most harm during the breeding season. For example, motor sledging over a wide area can cause disturbance to seals giving birth on ice. This is especially evident for ringed seals, which establish their lairs on areas of fast ice, ideal for motor sledges. Recreational activity can also disturb seals during their moulting season or when they are hauling-out. Yachting, which has increased greatly, takes a lot more people travelling right out in the outer archipelago, where seals moult and haul-out. However, most of the main moulting and hauling-out areas are protected as conservation areas. Contact between man and seal in the archipelago increases with the growing seal populations and expanding recreational activities. Based on present knowledge, it is difficult to assess the significance of human disturbance on seals and the adaptability of the seals to the changing environment. Today human recreation does not have a significant impact on the Baltic seal populations in general, though the disturbance may be significant locally.

Recreational disturbance has been assessed by studying the closest possible distance one can get near to seals, i.e. the distance at which they move from the land or ice into the water as some source of disturbance, normally a boat, draws near. This movement into the water does not always mean they are actually taking flight, and often seals calmly move off somewhere where they feel safer and watch to see what happens. With reference to the measurement of disturbance factors in the PONSI project, the closest possible distance one can get near to seals is much less (median of 300m) than the present outer limit of the seal conservation areas (1,852m). In most of the cases studied, the seals moved off the rocks and islets into the water at distances of 500 metres or less from a boat. In all the cases studied in seal conservation areas, the closest possible distance to seals was also within the outer limit of the no go area (Kallbådan: 500m, other conservation areas: 926m). Furthermore, cases studied in other areas give similar results regarding possible human proximity.

*Summary: Recreational activity is not a significant threat to the Baltic seals, but it may cause disturbance locally and have an effect on where seals settle and may change the quality of their habitats.*

# 8. AN EVALUATION OF THREATS AND OF THE FAVOURABLE CONSERVATION STATUS OF THE SEAL POPULATIONS

## 8.1. Evaluation of threats and the potential for reducing them

Baltic Sea seal populations are faced with various types of threat (e.g. disease, illness, parasites, environmental contaminants, oil and chemical spills and climate change), for which there are no direct management tools (Appendix 2). Many of these are also indirect threats to seals, causing changes to fish stocks and/or the living environment. There are also threats mainly to the habitats of seals and/or their prey species (eutrophication and algal blooms). Direct legislation to achieve and/or maintain a favourable conservation status for seals as regards these two groups of threats cannot succeed alone. Seals need to be protected also via the several international conventions ratified by Finland and through national action programmes and other decisions.

Through international cooperation the planning of the use and management of the Baltic coastline is aimed at maintaining and improving the status of the Baltic Sea's marine wildlife. These aims are implemented through the EU's Water Framework Directive (2000/60) and Council Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment. The UN Framework Convention on Climate Change (UNFCCC) aims to stabilise concentrations of greenhouse gases in the atmosphere at a level which does not jeopardise its state or functioning. The Kyoto Protocol, which entered into force in February 2005, lays down targets for reducing and limiting emissions in individual industrialised countries and countries where the economy is in a state of transition.

The threat of an oil or chemical spill in the Baltic Sea as a result of increasing maritime traffic is a very real one. To reduce the risk of a spill, safety at sea has been stepped up in a number of ways: good marking of sea lanes, a fixed and comprehensive radar network, and local piloting. The latest requirement is a double hull for tankers, which will minimise the impact of spills.

According to the International Maritime Organisation's Convention MARPOL 73/78, the Baltic Sea is classified as a 'special area'. Special areas have to be protected and oil emissions are forbidden there. In 2004, the IMO approved an application by the Baltic Sea countries (except Russia) to raise the status of the sea to that of a Particularly Sensitive Sea Area (PSSA). Action has also been taken to improve navigational safety and be better prepared for the prevention of oil disasters. HELCOM has posted a risk assessment service for oil spills on the internet (MARIS, Maritime Accident Response Information System), where visitors may monitor navigation, the risk of spills and the prevention of oil disasters all over the Baltic Sea (www.helcom.fi). MARPOL 73/78 also regulates how oil waste from vessels should be handled, as do HELCOM recommendations and the EU Directive concerning ship-generated waste.

At the national level, the Baltic Sea is protected under Finland's Programme for the Protection of the Baltic Sea, which aims, *inter alia*, to reduce the loads of nutrients and organic substances into the sea and emissions of hazardous and harmful substances.

There are conflicts of interest between humans and seals (Appendix 2). They include hunting, professional fishing, maritime traffic and other use of the marine environment. All these can be influenced by legislation and measures. The Finnish seal conservation areas, which have been established based on the requirements of the EU Habitats Directive, have been established to prevent seals from being disturbed and to safeguard their habitats. The existing seal conservation areas were set up mainly to protect grey seals.

## 8.2. Evaluation of the favourable conservation status of the seal populations

The EU Habitats Directive's general aim is *to achieve and maintain certain species and natural habitats at a favourable conservation status.* As far as conservation of natural habitats is concerned, the grey seal and the ringed seal are included in Annex II of the Directive: animal and plant species of Community interest whose conservation requires the designation of special areas of conservation.

Regarding conservation of the species, the Baltic grey seal and ringed seal are included in Annex V of the Directive: animal and plant species of Community interest whose taking in the wild and exploitation may be subject to management measures. According to the Habitats Directive conservation status of a species is taken

as favourable when *it can maintain itself on a long-term basis in its natural habitat and its natural range is not being reduced. Furthermore, its habitat must be protected sufficiently to maintain the population on a long-term basis.*

*Maintenance of seals in their natural habitats*

Ringed seal

The counted population of Baltic ringed seals is around 6,000, which probably means a total number of around 8,000 – 9,000 individuals. Approximately 40% of these live in or near Finnish territorial waters. Information on the reproductive capacity of the ringed seal is available only for the Bothnian Bay population, where the proportion of females unable to reproduce has been roughly 20% in the last few decades. However, the proportion of normally reproducing females has increased continuously since the 1970s, and today uterine occlusions are encountered primarily among the oldest females. The population is thus recovering from uterine occlusion. The annual rate of growth of the ringed seal population has been 5 - 6% during the last decade. A comparison of the reproductivity between ringed seals in the Bothnian Bay and in the Arctic Ocean shows that the impaired reproductivity in the Baltic Sea has no greater impact than the hunting has in the Arctic Ocean. *The constantly improving reproductivity of the ringed seal in the Bothnian Bay is sufficient to ensure the maintenance of the population on a long-term basis, though in southern areas (Gulf of Finland, South-western Finland) population trends are uncertain*.

Grey seal

The counted population of the Baltic grey seal is around 18,300 (2005), but the actual population is probably well over 20,000. In Finland, the count is over 10,000. The reproductive capacity of the grey seal is considered normal, and the total Baltic population is growing at a rate corresponding to grey seal populations in other marine areas. In Finland's main distribution area, the south-western parts of Finland, the growth rate has been even faster. *The reproductivity of the grey seal will ensure the maintenance of the population on a long-term basis*.

*Maintenance of the seal's natural range and sufficiency of habitat*

Ringed seal

The ringed seal's natural range or distribution area in the Baltic Sea can be regarded as the areas of sea most likely to freeze each year, as the animal is strongly dependent on ice and snow as a breeding and moulting habitat. Today, ringed seals occurs in this very region: most (75%) of the population live in the Bothnian Bay, some 15% in the Gulf of Riga and 5% or fewer in the eastern part of the Gulf of Finland. A few hundred ringed seals are also encountered in South-western Finland. Of the threats to the Baltic seal habitats mentioned in Chapter 7, the main one for the ringed seal is climate change, as mild winters may in the long term diminish that their natural range. *On the basis of current knowledge, it is assumed that the ringed seal's natural range will be maintained. However, the effects of global warming on the ringed seals distribution should be monitored.*

The ringed seal's winter habitat is on the fast ice in areas where the ice is compressed against other areas of ice or the shore, building up snow piles that are suitable for building a lair. In summer, the ringed seal lives mostly in the water, and only occasionally hauls-out on rocks or islets. *There are abundant suitable habitats for the ringed seal and they are sufficiently available in both winter and summer*.

Grey seal

At present the main distribution areas for the grey seal are in the northern part of the main basin of the Baltic Sea, in the Bothnian Sea and in the Gulf of Finland. The distribution is in general further south than that of the ringed seal. The distribution of the grey seals varies according to season, and is also dependent on the ice conditions. Most of the grey seal population spends the summer in the northern part of the main basin of the Baltic Sea and on its fringes, but moves north and east searching for drift ice suitable for breeding. The Baltic grey seal is, however, not dependent on ice for breeding, and gives birth on land during mild winters. *On the basis of current knowledge, the grey seal's natural range will be maintained.*

In winter, the grey seal's ideal habitat is drift ice, which is found between the solid ice and the open water. Winter navigation creates a new 'drift ice environment' for grey seals, as ice breakers keep shipping lanes open in areas otherwise unsuitable for settlement. During ice-free winters, the grey seal lives in the water and on outer rocks and islets. *There are abundant suitable habitats for the grey seal and they are sufficiently available in both winter and summer*.

The importance of conservation areas for Baltic seals

The grey seal and ringed seal are included in Annex II of the Habitats Directive as animal species whose con-

servation requires the designation of special areas of conservation. The actual seal conservation areas, together with other areas of conservation, form a network of areas that covers large marine areas along the Finnish coastline, including most areas favoured by the seals (Appendix 1).

The existing seal conservation areas on Finnish territorial waters serve mainly as breeding, moulting and hauling-out areas for the grey seal. Other conservation areas are also important for seals as a result of the restrictions which apply there (e.g. on fishing, hunting, landing on shore, trespassing, etc.). These restrictions ensure that suitable moulting and hauling-out areas remain calm and peaceful. The closed hunting seasons ensure that the seals can breed undisturbed. Large conservation areas, such as national parks, benefit grey seals in particular as moulting and hauling out areas. The ringed seal benefits mostly from the Archipelago Sea National Park in South-western Finland, where most of the local ringed seal population occur. The distribution of seals in conservation areas in the archipelagos should be mapped to provide a better basis for evaluating the importance of the areas for the protection of the seals.

*Summary*

*It can be stated that the grey and ringed seal populations throughout the Baltic Sea and in Finnish territorial waters are posed to different types of threats. The most serious ones are climate change and environmental contamination. Despite these threats, the conservation status of the grey seal is believed to be favourable as defined under the EU Habitats Directive. The health state of the grey seals is considered normal at present, and the population has clearly grown in Finnish territorial waters. According to current knowledge, the grey seal can maintain itself on a long-term basis in its natural habitat in the Baltic Sea, and its natural range will remain. Furthermore, its habitats are sufficient to ensure the maintenance of the population on a long-term basis.*

*The favourable conservation status of the ringed seal in Finnish territorial waters is difficult to assess due to uncertainties regarding the size, structure and health status of the populations in the southern most territorial waters (eastern Gulf of Finland and South-western Finland). Sufficient information is available on the ringed seal population size and health state only in the Bothnian Bay area. There, the population has clearly increased and it is assumed to maintain itself in its natural habitat, and also to maintain its natural range on a long-term basis. However, the population growth in this area is slowed down by reproductive disorders still occurring in the females. Studies conducted on the southern subpopulations suggest that these are not growing as fast as in the Bothnian Bay. A closer examination of the status of the southern subpopulations and a possible differentiation between the various subpopulations would make it possible to assess the favourable conservation status of the ringed seal population in Finland according the requirements in the EU Habitats Directive.*

# PART 2: OBJECTIVES AND MEASURES FOR THE MANAGEMENT OF THE SEAL POPULATIONS

## 9. OUTLINES OF THE SEAL POPULATION MANAGEMENT POLICIES

### 9.1. Points of departure and criteria for the seal population management

In the last decade, the grey seal population has increased dramatically. The ringed seal population has also grown abundant over the last 10 years, even if not as rapidly as the grey seal population. The seals' improved reproductivity and health status, and their increased numbers as a result, are a positive phenomenon which contributes to the diversity of the marine ecosystem. The eutrophication and contamination of the Baltic Sea are still extensive, but the improved status of seal populations suggests that at least levels of some organochlorines have declined in the Baltic ecosystem.

The use of seals as a natural resource and the diverse use of seal products are slowly increasing, which is an important factor in maintaining the local traditions along the coast. With the growing seal populations the amount of damage to fish catch and fishing gear caused by seals has increased greatly, resulting in a clear demand to control the seal populations and their growth. Attitudes towards seals have hardened, mainly due to the financial losses sustained by fishermen, and the grey seal, in particular, is in many areas considered a threat to the fishing industry. The increase in seal populations has put forward a demand to lay down a comprehensive and harmonised policy for the systematic management of these seal populations.

Seals do not stay within national territorial waters, so their management also needs to take account of the international perspective. The challenge is to find jointly acceptable policies, as there are sometimes very conflicting views regarding the management of the seal populations in the Baltic Sea at both a national and an international level. The management of Baltic seal populations has been discussed for a long time in international fora, and an attempt has been made to draw up common policies among the Baltic Sea countries. Views concerning the total protection of seal populations and, on the other hand, on the principles of sustainable use of seal populations, have been the subject of debate. HELCOM's new recommendation on seals adopted in July 2006 permits the sustainable use of seals, albeit on the condition that it meets the specific conditions of the EU Habitats Directive to achieve and maintain a favourable conservation status.

The biological requirements of the seal species, and their reference values, form the frame for a systematic population management. In populations where the well-being and viability of the seals is ensured in the long term, the management can take account more of the socio-economic impact of developing the coexistence between seal and man. The central socio-economic factors involved can be gained by hearing the public. As a part of preparing this management plan, the Finnish Game and Fisheries Research Institute studied the attitudes of local and national stakeholders to seals and their management through public hearings (Storm et al. 2007). The target groups selected were mainly those whose livelihoods and everyday life is affected by seals in one way or another, as well as actors representing organisations and authorities involved in the conservation and use of natural resources, or monitoring that use. The views on seals collected to draft the management plan focused on the problems of coexistence and of people's worries on various aspects.

The best way to achieve an acceptance of the management plan from the society is to obtain a broad approval of it at all levels, including the local level. Current legislation, however, sets clearly defined limits to how the expectations and demands of citizens can be taken into account in population management. The achievement and maintenance of a favourable conservation status for seals under EU legislation and the biological requirements of the species set the frames for the conservation, management and control of the seal populations.

As the seal populations are growing and dispersing, also the living environments of humans and seals meet more often. Sea population growth creates new challenges for managing the coexistence of human and seals, as the conflict increases and as the views of how to manage the seals diverge. The purpose of this seal management plan is to maintain seals as a permanent component of marine wildlife and its diverse commu-

nity of living organisms, reconcile the problems of coexistence between man and seal, and enable the utilisation of seals in a sustainable way as a valuable natural resource, in such a way that no single group of citizens have to suffers undue damage or is unfairly disadvantaged. The management measures are implemented through an ecosystem approach, which aims at finding a balance between the use of natural resources and the limits of the ecosystem. The general approach is to treat all utilising sectors as a whole, and not by sector. In addition, the aim is not to focus management measures to individual species alone but to extend the framework to encompass the entire marine environment.

## 9.2. Management objectives for the seal populations

The management plan sets out the outlines of policies along which Finland will continue the management and maintenance of seal populations in mainland Finland as a permanent component of Finnish marine wildlife. Regarding Åland, the Provincial Government has drawn up its own separate management plan for seal populations. The aim of drawing up the plan has been to find commonly agreed policies on a national level out of the differing views on seal population management. The policies drawn up emphasise the role of the grey seal as a natural resource that can be utilised in a sustainable way. As for the ringed seal, the plan focuses more on policies of conservation, especially because of the uncertainties associated with southern populations.

The management plan describes and explains the population management objectives, which can be divided into five main objectives:

1) To maintain Finnish seal populations viable
2) To manage seal populations so that they can be used in a diverse and sustainable way
3) To minimise damage to the fishing industry as a result of viable seal populations
4) To increase awareness among the general public of the seal and its value as an important natural resource
5) To develop tools of improving coexistence between man and seal and to ease conflicting views among the various stakeholders.

*Management objectives for the grey seal population*

The Finnish grey seal meets the EU criteria for a favourable conservation status. Its reproduction capacity can be considered normal at present, and the population has clearly been growing. The growth trend seems to continue in Finnish territorial waters. Current knowledge suggests that the grey seal is also able to maintain itself in its natural habitat in the Baltic Sea on a long-term basis and that its natural distribution is not being reduced in the long term. In addition, its habitats are sufficient to ensure that the population can be maintained on a long-term basis.

The increased numbers of grey seals have resulted in damage and catch losses in the fishing industry and fish farming. The fact that the grey seal is a game species as well as an animal to be protected, plus the fact that is causes damage to fishing and fish farming, has led to strong conflicts of opinion on how to manage the seal populations between various stakeholders. Although the marine ecosystem could maintain an even larger grey seal population, the population management objectives focuses today, on the social-economic carrying capacity of the local society with the aim of maintaining the damage caused by seals at an endurable level. Preventing and minimising damage to the fisheries are important measures in the management of the grey seal population.

The present management objectives for the grey seal population are based on long-term, comprehensive monitoring of the seals in the Baltic Sea. This monitoring will continue to provide information on trends and possible changes in the population dynamics. The objectives also take account of management measures implemented by neighbouring countries as well as any effects on the seal population these have had.

**Objectives:**
**The objective is to enable the coexistence between seal and man in such a way that the grey seal is seen as a valuable natural resource that can be utilised in a diverse and sustainable way.**

**The management of the grey seal population will take account of the regional and local fishing and fish farming industry, through closer cooperation and by exchanging information between the various stakeholders to prevent and compensate for damage caused by seals.**

*Population management objectives for the ringed seal*

The ringed seal population is viable in the Bothnian Bay and the Kvarken area. However, in its southern distribution areas in Finland, the south-western archipelago and the Gulf of Finland, the general lack of information

makes it difficult to estimate the size, structure and health state of these subpopulations. Consequently, it is not possible to assess the favourable conservation status of the ringed seal population with any satisfactory degree of precision at the national level. Enough extensive research data is available only for the seals on the Bothnian Bay area, to estimate the size and health of the ringed seal population. In this area, the population has increased clearly and it can be stated that the Bothnian Bay seal population can maintain itself viable in the long term, that it has sufficient habitats, and that its natural range is not being reduced. In the Bothnian Bay, the population growth is still being slowed down by reproductive disorders to a certain extent. Research data suggests that the southern populations are not increasing in the same way as they are in the Bothnian Bay.

The present management objectives for the ringed seal population are based on long-term monitoring in the Bothnian Bay. This monitoring will continue to provide information on trends and possible changes in the population dynamics. The objectives also take account of management measures implemented by neighbouring countries as well as any effects on the seal population these have had.

**Objectives:**
**The preconditions for a viable ringed seal population are ensured in all management areas.**

**The development of the ringed seal population and the occurrence of uterine occlusion will be monitored in each management area.**

**The status of the ringed seal population and its current reproductive rates will be examined, especially in the southern management areas.**

**The management of the ringed seal population will take account of the regional and local fishing and fish farming industry, through closer cooperation and by exchanging information between the various stakeholders to prevent and compensate for damage caused by seals.**

**The elimination of damage causing individual seals will be allowed as to prevent damages.**

# 10. REGIONAL MANAGEMENT OF SEAL POPULATIONS

The seal populations in Finland are growing, but there are regional differences in the growth trend between the species. The regional management of seal populations takes account of regional and local differences in the population dynamics. Based on the local situation an evaluation is made of how to influence the population and its development. The aim is to maintain viable regional seal populations. As a general principle, small populations that are not growing are not to be reduced by hunting. In case of major damages in such a population, problematic individuals can be eliminated with caution. In growing populations, problematic individuals can be eliminated. In a rapidly growing population, the growth can be controlled. A naturally fluctuating and viable population can be hunted based on the principle of sustainable use without endangering its viability.

The living conditions of seals and the views on seals by the fishing industry vary by region. Fishing and fish farming are important industries in all Finnish territorial waters and coastal areas, and seals, especially the grey seal, may cause significant damage to these. Many professional fishermen and fish farmers have jointly called for restrictions to the growth in the grey seal population through hunting and by eliminating problematic individuals.

Efforts have been made in the Bothnian Bay and Kvarken area to change the negative attitudes of fishermen and other local actors as seals being only a damage causing species. The aim has been to raise the profile of the seal's value as a valuable natural resource and as a game species. Although the opinions expressed publicly at regional hearings focused mostly on seals as trouble makers, opposing views were also put forward. These related to the notions that grey seal observations in the archipelago was a great nature experience and that the increasing grey seal numbers indicate a cleaner sea.

The ringed seal has not caused damage to the fishing industry to the same extent as the more abundant grey seal. Nevertheless, damage has also been caused by ringed seals, especially in the Bothnian Bay, where they are more abundant. Representatives of the fishing industry in this region have insisted that the growth of the ringed seal population should be regulated by reintroducing the seal hunt. Yet others see a need to refrain from hunting the ringed seal at all, until there is sufficient knowledge on the actual status of the ringed seal population on a national level.

## 10.1. New management areas

he core distribution area for the grey seal population is in South-western Finland, and for the ringed seal population, in the Bothnian Bay. Both species, however, also occur in the other sea areas. The management of the seal populations takes account of local conditions, trades and livelihoods. Accordingly, more specific management of seal populations needs to be drawn up for each separate management area. These areas are based largely on the present distribution of seals. On the other hand, it is not appropriate to divide the national seal management into too small units that need to be dealt with separately.

Based on the situation today, Finnish territorial waters can be divided into three management areas, in which the current seal situation and thus also the objectives and measures are slightly different. The management areas comprise three large zones: the Bothnian Bay/ Kvarken, South-western Finland, and the Gulf of Finland (Figure 7).

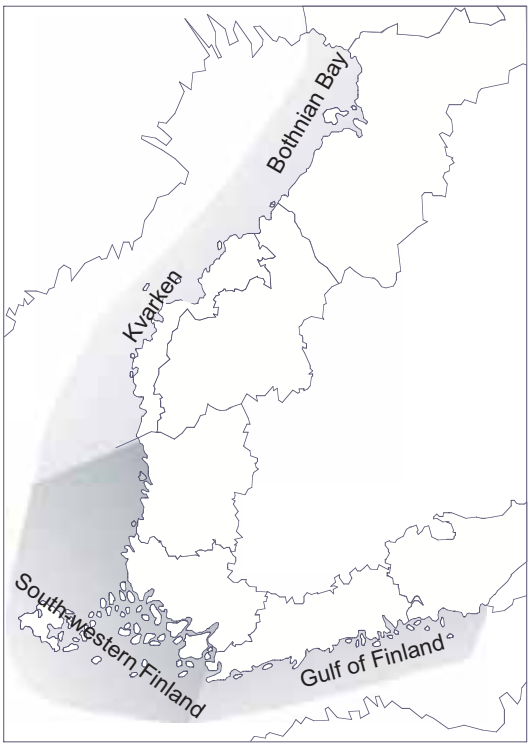



Figure 7. New management areas for the Finnish seal populations.

**Measure:**
**The seal management in Finland will be divided into the management areas of the Bothnian Bay/ Kvarken, South-western Finland, and the Gulf of Finland.**

## 10.2. Regional target populations

The need to establish regional target populations for seals was expressed both at the public hearings and in the written questionnaires used for preparing the management plan. However, it is not considered appropriate to define regional target populations as such, but regional targets should be set in accordance with maintaining the viability of seal populations, with the extent of damage occurring and with the opinions of local people. One specific constraint on seal population growth is that seals may not cause undue damage to the local fishing industry. The intention is for the regional game management organisation to make an assessment of the regional seal situation in collaboration with other regional stakeholder groups.

At present grey seals in the Bothnian Bay/Kvarken and South-western Finland management areas occur abundantly and regularly. The amount and gravity of the damage done to fishing in these areas, the general trend in damage and the failure to prevent the damage so far constitute a clear threat to fishing as a trade in the future. It can thus be stated that the target populations have been reached in these management areas, which will enable a systematic regulation of these grey seal subpopulations.

**Measures:**
**The development of the grey and ringed seal populations and their impact will be monitored to assess regional target populations.**

## 10.3. Regional management areas and objectives for the grey seal population

**Area 1: Bothnian Bay/Kvarken**
The Bothnian Bay/Kvarken management area (the districts of the game management districts of Lapland, Oulu, Ostrobothnia and Swedish-speaking Ostrobothnia) is a core area of distribution for the grey seal, and the southern most ice covered areas serve as important pupping sites. Estimates of the grey seal population in this management area vary annually, and are greatly dependent on the ice situation during the census. In years with little ice cover, fewer grey seals are probably counted in this management area than the actual number. Grey seals move northwards as the ice melts in spring. When all the ice is gone, some of the seals migrate back south and may even swim as far as to the outer rocks of the Archipelago Sea. The viable grey seal population in these management areas, as a part of the core distribution area of the Baltic grey seal population, has grown very rapidly in recent years.

**Objectives and measures:**
**The objective in this management area is to maintain the grey seal population at a level where the damage it causes remains at a reasonable level without endangering the population's viability.**

**Tools and processes will be developed to steer the hunting activity towards the damage caused by grey seals, and the measures will be implemented in accordance with the principles of sustainable use so that the viability of the grey seal population is not endangered.**

**Monitoring grey seals, increasing the amount of up-to-date information available, and the prevention of and compensation for damage caused by seals will be important measures in the management of the area's grey seal population. In addition, there will be closer cooperation and more exchange of information among the various stakeholders.**

**Area 2: South-western Finland**
The management area of South-western Finland (the districts of the game management districts of Satakunda and South-western Finland) constitute at present Finland's core area for the distribution of the grey seal population. The area is important for breeding and for moulting in particular, when they can be seen on the outer rocks and islets in herds of up to a thousand. They mainly give birth on the ice in the Bothnian Sea, but also on the outer rocks and islands of the Archipelago Sea. The Archipelago Sea area also contains the only known land breeding area in Finnish territorial waters. In the last few years, the local grey seal population has grown much faster than in the other management areas on an average, due partly to the natural reproduction and partly to new grey seals immigrating from other areas.

**Objectives and measures:**
**The objective in this management area is to main-**

**tain the grey seal population at a level where the damage it causes remains at a reasonable level without endangering the population's viability.**

**Tools and processes will be developed to steer the hunting activity towards the damage caused by grey seals, and the measures will be implemented in accordance with the principles of sustainable use so that the viability of the grey seal population is not endangered.**

**Monitoring the grey seal population, increasing the amount of up-to-date information available, and the prevention of and compensation for damage caused by seals will be important measures in the management of the area's grey seal population. In addition, there will be closer cooperation and more exchange of information among the various stakeholders.**

**Population management in the management area of Finland will take account of the management measures implemented by the Provincial Government of Åland.**

**Area 3: Gulf of Finland**
The management area of the Gulf of Finland (the districts of the game management districts of Nyland and Kymmene) provides the grey seal with a suitable habitat, but the population censuses suggest that the population has remained rather small, and has not grown as much as in other areas.

**Objectives and measures:**
**The objective in this management area is a controlled increase in the grey seal population, while ensuring that the damage the grey seals cause remains at a reasonable level and that the population's viability is not endangered.**

**The reasons for the relatively slow development of the grey seal population in this management area will be examined.**

**Monitoring the grey seal population, increasing the amount of up-to-date information available, and the prevention of and compensation for damage caused by seals will be important measures in the management of the area's grey seal population. In addition, there will be closer cooperation and more exchange of information among the various stakeholders..**

## 10.4. Regional management areas and objectives for the ringed seal population

**Area 1: Bothnian Bay/Kvarken**
The Bothnian Bay/Kvarken population management area (the districts of the game management districts of Lapland, Oulu, Ostrobothnia and Swedish-speaking Ostrobothnia) is at present the core area of distribution for the ringed seal. The severe winters in the Bothnian Bay ensure good ice conditions for breeding and moulting. The ringed seal population in the northern part of this management area is today growing at around half of a normal rate (about 5% a year), probably because of the occurrence of uterine occlusion there. The current frequency of occlusions (just over 20% of the adult female seals) and its declining trend, indicate that the occlusions no longer are fatal for the population's future. On the other hand, it has been shown that the mortality rate among pups in the Bothnian Bay is much lower than among oceanic populations (where approximately 40% are killed by polar bears) as the seals have virtually no predators in the Baltic Sea.

**Objectives and measures:**
**The objective in this management area is to increase the ringed seal population, while ensuring that the damage they cause remains at a reasonable level and that the population's viability is not endangered.**

**The ringed seal population dynamics and the frequencies of uterine occlusion will be monitored.**

**Increasing the distribution of up-to-date information on the ringed seal, and preventing and compensating for damage caused by seals will be important measures in the management of the regional ringed seal population. In addition, closer cooperation and more exchange of information among the various stakeholders will be encouraged.**

**Methods will be developed to eliminate individual animals causing damage to the fisheries.**

**Areas 2 and 3: South-western Finland and the Gulf of Finland**
According to the present knowledge, the number of ringed seals is relatively small in management areas of South-western Finland (the districts of the game management districts of Satakunda and South-Western Fin-

land) and the Gulf of Finland (the territories of the game management districts of Nyland and Kymmene). The lack of information on the health status and the population structure and their trends in these areas makes it very difficult to assess the situation of these seal population with all associated uncertainties. Owing to the small numbers of ringed seals, the damage they cause to fishing and fish farming is assumed not to be significant for the present.

**Objectives and measures:**
**The objective in these two management areas is to promote the strengthening of the ringed seal populations. The management of these populations should focus especially on research and monitoring activities. Information on the status of the population will be attained by cost-effective research and intensified monitoring. These results will serve as a basis for selecting appropriate regional management measures and targeting them effectively in the future.**

**The populations in South-western Finland and the Gulf of Finland management areas will be monitored more carefully and possible isolations of the populations will be investigated.**

**The health status and possible reproductive disturbances in ringed seals will be examined. Further, the health monitoring of the population will be intensified as a part of the ongoing monitoring of the state of the Baltic Sea.**

**Monitoring the ringed seal population, increasing the distribution of up-to-date information on ringed seals, and preventing and compensating for damage caused by seals will be important measures in the management of the regional ringed seal population. In addition, closer cooperation and more exchange of information among the various stakeholders will be encouraged.**

**Population management in the management area of South-western Finland is to take account of the seal management measures implemented by the Provincial Government of Åland.**

# 11. THE CONSERVATION OF SEAL POPULATIONS AND SEAL CONSERVATION AREAS

Baltic Sea seal populations are posed by various types of threats (Chapter 7). The most significant ones are climate change and environmental contaminants (Appendix 2). It is not possible to determine direct management measures within the scope of this management plan to protect the seals against some of the previously described threats (e.g. disease, illness, parasites, environmental contaminants, oil and chemical spills and climate change). The best way to protect seals against these threats is by means of the international conventions ratified by Finland, national action programmes and other decisions.

The current seal conservation areas have been established for the protection of seals and to ensure that their living conditions are not disturbed. They are also intended to promote scientific research and the monitoring of seal populations as well as to preserve marine habitats. It is mainly the grey seal that is encountered in the conservation areas. Scientific information is lacking on the importance of these areas for protecting the grey seal population and for its development. The areas offer seals an undisturbed living environment, especially during their moulting season. Other nature conservation areas may be important for seals through the restrictions applied there (e.g. on fishing, hunting and landing on shore). Seals are most sensitive to disturbance during their breeding season in January-April. In general, both the ringed and the grey seal give birth on the ice in off shore areas, where the large areas along the ice edge and between the shipping lanes provide suitable breeding habitats. The use and maintenance of traffic lanes in the Bothnian Bay and the Gulf of Finland in winter may damage some ringed seal lairs on the ice, but it does not pose any real and direct threat to seal populations. In years with poor ice conditions, seals give birth on the shores of islets and rocks. In addition, the reproduction has been protected by means of closed seasons on seal hunting during their breeding season.

**Objectives and measures:**
**The objective is to maintain both seal populations viable, while taking account of the increased damage to the fisheries due to the growing seal populations.**

**Efforts will be made to influence the planned use and management of the Baltic coastal areas internationally in order to improve the status of its marine environment as a hole, and thereby ensure that the seals will remain a component of the Baltic Sea ecosystem.**

**Solutions in the development of fishing gear will be encouraged in order to reduce seal bycatch.**

**If the seal population is reduced in a way that endangers its viability, the cause(s) for this will be examined, and the necessary action will be taken to protect the population in order to eliminate that/those cause(s). This will require an active monitoring of any changes in the seal populations and a prediction of possible threats to them (e.g. loss of suitable habitats or disease epidemics).**

**With regard to the current development of the seal populations there is no need for biological reasons to establish new or extend existing conservation areas for either seal species in order to safeguard the future existence of the populations.**

**The biological role of the existing conservation areas in the Natura network (including the seal conservation areas) as areas for hauling-out and moulting will be examined. As for the grey seal, the location of the conservation areas will be evaluated in relation to the species' main habitats. The annual census data will be used to evaluate the proportion of grey seal occurring in the conservation areas.**

**The need for protection measures for the ringed seal can be decided only based on results from further research on the size, reproductivity and mortality of the population.**

# 12. SEAL HUNTING

Seal hunting is permitted under the Habitats Directive and the Finnish Hunting Act. Grey seals and Baltic ringed seals may be hunted under the act with a licence during their hunting season. Hunting licences for seals are granted by the game management district by virtue of regulations issued by the Ministry of Agriculture and Forestry. Seals must be hunted in an ecologically sustainable manner, without endangering their favourable conservation status. Ecological sustainability is ensured by means of calculations of the population size, reproductivity and mortality. Under section 41 of the Hunting Act (615/1993), the Ministry of Agriculture and Forestry may also issue derogations from the protection during the closed season. In exceptional circumstances licences may be issued for scientific research, game management, prevention of damage and animal diseases, or some other acceptable purpose.

Seal hunting on ice is dependent on the spring ice cover and weather conditions. Grey seals mainly occur on the edge of the ice cover, and may move very quickly from one place to another as winds move the ice. As to be able to implement the principles for granting and allocating hunting licences, it should be possible to grant licenses also to off sore areas outside the game management districts (fishing area) and within the whole management area to which the game management district issuing the licence belongs.

## 12.1. Grey seal hunting

The grey seal was protected up until 1997. In 1998, hunting was allowed with a hunting licence with subject to restrictions. The current hunting season for the grey seal in mainland Finland is 16 April - 31 December. The resumed hunting activity has led to a revival of the seal hunting culture in coastal areas. At present, a licence for hunting grey seal is applied for in writing from the game management district to which most of the intended hunting grounds belong, which means that the area is restricted by the conditions mentioned in the licence. Seal hunters have suggested the possibility of hunting in a larger area: in the off shore area off the territory of the game management district (fishing area) and within the whole management areas. The call has been motivated with the movement of the grey seals as winds carry the edge of the ice along. The number of seals actually hunted has been around 50% of the total quota. Depending on weather conditions, the bag has even been lower than 50%. To improve the utilisation of seal hunting licences, wishes have been expressed to lengthen the hunting season, to switch from a system of personal licences to regional quotas, and to allow the hunting of seals in some conservation and restricted areas as well. It has also been suggested that suitable areas of water and land for seal hunting during the ice-free season should be put forward within the very large and comprehensive network of conservation areas. Establishing grey seal hunting areas would improve an ethically and ecologically sustainable hunting by reducing the number of wounded animals and by improving opportunities for capturing the hunted seal.

There are around 140 marine Natura 2000 areas along the Finnish coast, of which 66 have or may have seal habitats. The Natura network consists of already established national parks, special conservation areas and nature conservation areas on private land, where the hunting activities are guided by regulations laid down when the areas were established. No amendments to these regulations will be needed on account of the decision on the Natura 2000 network.

Regulations on protective measures are drawn on a case-by-case basis for new conservation areas and when extending existing areas. No decision to establish a nature conservation area on private land can be taken before the Regional Environment Centre and landowner have agreed on the protection regulations for the area.

The marine Natura 2000 sites contain both terrestrial conservation areas, and additionally considerable marine areas. These marine conservation areas have been established based on the Finnish Water Act, Fishing Act, Land Extraction Act, the Land Use and Building Act, or a separate agreement. In these cases no hunting restrictions are required.

**Measures:**
**The Ministry of Agriculture and Forestry will continue to guide the game management districts in hunting licence procedures in order to ensure the maintenance of a favourable conservation status for the grey seal population.**

**The population growth will in the first place be controlled according to the management areas by license issued hunting. Hunting will mainly be focused on areas with a strong population and where damage by grey seals is evident. The number of licences issued will remain regulated in areas where the population has not significantly increased in recent years.**

The ringed seal hunt requires a long hunting experience and good knowledge about varying ice conditions.

The grey seal is hunted primarily on the spring ice.

**The possibilities and practical considerations for improving the current hunting licence system will be explored and, if necessary, the system will be developed on the basis of the findings so that grey seal hunting can be practised in the entire management area to which the game management district belongs.**

**To improve the utilisation of seal hunting licenses by management area, increasing hunting possibilities will be explore by permitting hunting in established nature conservation areas and in areas to be established, other than the specific seal conservation areas. In addition, the importance of these areas for seal hunting will be examined, and this aspect will also be considered in the regulations on protection in that area.**

**As it is not necessary to establish new seal conservation areas or extend them for biological reasons, seal hunting should not be prohibited or restricted when new marine conservation areas are established or existing ones are extended by the nature conservation Act.**

**Derogations from the closed seasons issued by the Ministry of Agriculture and Forestry will mainly be used to protect important objects, such as trap nets, nets and fish farms, from damage. With this in mind, methods will also be developed to capture live seals.**

**Grey seal hunting needs to be planned and carried out in such a way that the animal is killed with a sufficient degree of certainty and so that it does not suffer needlessly, and so that the hunted animal is recovered and utilised. The best way of accomplishing this is to shoot the grey seal from a solid base (land or ice) on a solid base or in shallow water. The positive status of the seal as a game species which can be utilised in a sustainable way as a valuable natural resource will be stressed when developing the seal hunting culture.**

## 12.2. Ringed seal hunting

The current hunting season for the ringed seal in mainland Finland is 1 September - 15 October and 16 April - 31 May. No hunting licences have been issued for the ringed seal since 1993. Calls to reintroduce the ringed seal hunt have also grown louder because of the damage caused to the fishing industry, and of the desire to revive the old ringed seal hunting traditions. At public hearings people hoped that hunting and/or derogations would be restored, especially in the Bothnian Bay, where there is evidence of damage by the ringed seal. The occurrence of uterine occlusion in ringed seals in the Bothnian Bay (roughly 20%) is slowing down the local population growth, which is partly the basis for not issuing hunting licenses so far. The small seal populations in the management areas of South-western Finland and the Gulf of Finland have caused minimal damage to fishing and fish farms, and only few calls for hunting have been presented in these areas.

**Measures:**
**The Ministry of Agriculture and Forestry will continue to guide the game management districts in hunting licence procedures in order to ensure the development of a favourable conservation status for the ringed seal population.**

**Hunting licences for the ringed seal will not be issued in the management areas of South-western Finland and the Gulf of Finland, due to the uncer-**

**tainties regarding the status and growth of these populations.**

**Possibilities to reintroduce ringed seal hunting in the Bothnian Bay to minimise damage to the fishing industry will be examined by issuing derogations. A hunting licence system governed by the game management districts will not be used in the Bothnian Bay/Kvarken management area at this stage.**

**Ringed seal hunting needs to be planned and carried out in such a way that the animal is killed with a sufficient degree of certainty and so that it does not suffer needlessly, and so that the hunted animal is recovered and utilised. The best way of accomplishing this is to shoot the grey seal from a solid base (land or ice) on a solid base or in shallow water. The positive status of the seal as a game species which can be utilised in a sustainable way as a valuable natural resource will be stressed when developing the seal hunting culture.**

## 12.3. Surveillance of seal hunting

Under section 88 of the Hunting Act, the police, the Coast Guards, customs authorities and game wardens appointed by the Game Management Associations supervise the compliance with the laws and regulations on hunting in their respective jurisdictions. In state-owned areas, the surveillance is carried out by designated officials. A landowner or a holder of the hunting rights is entitled to supervise the compliance with the Hunting Act in their own areas. Under section 63 of the Act, the surveillance of the hunting is a task of the game management associations.

The surveillance of hunting is a demanding and difficult task, because hunting generally is conducted in the outer archipelago and off shore areas, in difficult conditions. With the increase in hunting quotas and numbers of seal hunters, however, effective and functioning surveillance is becoming more important than ever.

**Measures:**
**The cooperation between the police, the Coast Guard, customs authorities, officials employed by Metsähallitus and the hunting organisation will be developed for the surveillance of seal hunting.**

**Concrete proposals for measures will be drawn up to make the surveillance of hunting more efficient.**

# 13. UTILISATION OF SEALS

The growing seal populations have created new opportunities for their economic utilisation. The promotion of different forms of utilisation of the seal as a resource (eco and adventure tourism, hunting tourism, design, product development and marketing of seal products) plays an important role in finding a form of coexistence between seal and man. The long-term aim should be to understand that seals are a valuable component of the marine ecosystem as well as a natural resource that can be utilised in a diverse way. Reaching this aim will depend on cooperation between many different parties to find and implement economically productive and ecologically and ethically sustainable ways to utilise these animals.

## 13.1. Seals as a part of the ecotourism

Adventure and ecotourism relating directly or indirectly to seals has been developed to some extent in recent years along the coast of Finland. Grey seals herds hauling-out on rocks have been the centre of attraction on organised seal-watching trips, especially in the Gulf of Finland and the south-western archipelago. The use of ringed seals as a tourist attraction is, however, rarely successful because of its shyness and its less social habits. At public hearings, ecotourism was pointed out as a secondary occupation for fishermen, especially by the environmental conservation agencies. However, many professional fishermen do not see it as a realistic way of earning a living. Utilisation of seals in ecotourism involves a lot of practical problems, such as the fishing boats being unsuitable for transporting tourists, the high cost of insurance, seasonal variations and weather conditions, and the uncertainty of whether seals will be sighted. Restricted access to the seal conservation areas also make it difficult to approach, observe and photograph seals on the seal trips.

**Measures:**
**The development of adventure and ecotourism relating to seals will be promoted and supported. Seal tourism will be developed in such a way that it is both ecologically and socially sustainable.**

**The possibilities of amending the regulations in the seal conservation areas will be investigated, with the aim of increasing the possibility to utilise these areas for seal-watching in the development of the tourism industry.**

## 13.2. Other ways of utilising seals as a resource

The reintroduction of seal hunting, as a result of the growing grey seal population, has made it possible to revive the seal hunting traditions and culture in Finnish coastal regions. At the same time, the utilisation of the hunted animals has been developed in a way that it better fits present needs. The grey seal products are today being developed (fur, meat, blubber and bone products) and marketed on a small local scale. According to present knowledge, seal meat from the Baltic seals has been found to be suitable for human consumption. According to current international recommendations, roughly 500 grams of meat from the Baltic grey seal and around 200 grams from the ringed seal can be consumed weekly. However, liver, kidney and blubber from both species are not suitable for human consumption due to their highly elevated contaminants concentrations.

**Measure:**
**The utilisation of seals as a natural resource will be supported and developed, however without creating a conflict with reaching the favourable development of the populations.**

**Possibilities to use seal products for human consumption will be explored. The frequency of trichinae in Baltic seal populations will be examined.**

# 14. PREVENTION OF AND COMPENSATION FOR DAMAGE CAUSED BY SEALS

## 14.1. Prevention

Seals cause damage to the fishing industry. The most common forms of damage include fish losses (eaten, damaged, escaped) and broken gear, nets, etc. Seals are also responsible for indirect costs and losses in the form of protection and repairs. The high abundance of seals has led to a situation where fishing has been restricted or where it has ceased altogether in some areas. Seals are also thought to scare away fish by their presence close to fishing gear. The growing seal populations and the dramatic increase in damage have brought about a social conflict in which representatives from the fishing industry experience that seals cause undue damage and disruption to their business.

Methods to prevent damage and alternative fishing practices are few in actual fact, but there have been some developments over the last few years. There are no fully operational or comprehensive solutions at present, however. The most viable prevention methods include seal-proof floating trap nets, which are far more expensive than the traditional ones. According to present knowledge, it is extremely difficult or even impossible to protect some fishing methods from seals, such as net fishing.

The grey seal hunt was reintroduced as the health state of the seals have improved and because of the increasing damage caused to the fishing industry. The hunt has been used mainly as a means to reduce the damage caused by grey seals. Hunting does not only serve to eliminate animals directly but also to scare seals, which will then become more cautious and be less inclined to approach fishing gear and fish farms. However, many professional fishermen and fish farmers do not consider hunting in its current form as sufficient enough. To prevent damage, it has been proposed that fishermen should have the right to shoot a seal found in their gear, in a fish farm net or near to these.

**Measures:**
**The development and introduction of alternative fishing methods and practices will be stressed and supported to prevent damage by seals.**

**Damage to fishing and fish farming caused by seals will be reduced by applying technical solutions to fishing gear and fish farming.**

**Problematic individuals will be eliminated mainly by means of derogations issued from the Ministry of Agriculture and Forestry. In addition, possibilities of developing seal traps to capture live animals will be examined.**

**Concrete proposals for measures to use derogations will be drawn up.**

**The fish damage caused by grey and ringed seals, and their shares, will be examined in different marine areas.**

**In the new program period 2007-2013, the acquisition of fishermen's gear and seal-proof components and units used in fish farms and development work relating to damage prevention will be financed within the framework of the Finnish Operational Programme co-financed by the European Fisheries Fund (Promotion of the marketing and structural policy of the fisheries). There will be closer cooperation with Sweden in order to step up the development work.**

## 14.2. Compensation

There is no permanent system of compensation or aid in Finland for seal damage to the fishing industry or for its prevention. Before Finland joined the EU, there was no system of compensation for damage caused by seals, but after the accession Finland proposed a permanent system for this. The European Commission rejected the proposal, however, and instead gave Finland permission to pay compensation to professional fishermen for damage to catch caused by seals on a one-off basis only in 2000 and 2001. So far the appropriations allocated have been inadequate to cover the damage sustained and the costs of protection work. Compensation paid covered about 43% of the approved damages. One-off support has been used for buying selective and seal-proof trap nets. At the public hearings, it became evident that all key parties involved considered it necessary to establish a permanent system of compensation. Compensation for seal damage and financial aid for seal-proof fishing gear were thought to be an important way to ease the difficulties of professional fishermen who sustain damage by seals, as well as to calm down the social conflict associated with the seals.

Under the new Regulation on the European Fisheries Fund (No 1198/2006), aid is available for the purchase of fishing gear and development work to prevent damage. At Finland's request, the regulation permits the granting of aid to buy seal-proof trap nets and development work to prevent damage on a broader basis than in the previous period. For example, under the new rules fish chambers in large trap nets can without limitations be exchanged freely for seal-proof units. One condition of investment aid under the Regulation is also that all the appropriate measures are taken to avoid damage to seals in the fishing gear.

When the draft Regulation on the Fisheries Fund was being discussed, Finland also insisted that there be a solution regarding compensation for damage to catch by seals, cormorants, etc. Finland was backed by Sweden, Estonia and Latvia. In talks, the Commission committed by a written statement to exploring the possibility of putting forward a proposal for Community measures to compensate for loss of income and damage to fishing gear caused by wild predators (e.g. the grey seal) protected under Community regulations.

**Measures:**
**The aim is to pay compensation to fishermen and fish farmers for damage caused by seals within the frameworks and approved budgets of the Finnish Government.**

**Matters relating to seal damage will be raised for discussion at EU level when debating the new guidelines on state aid for the fisheries sector, and new regulations on maximum amounts for de minimis aid in the fishing industry. This way an attempt will be made to ensure there is a consistent and liberal policy in the regulations on aid to EU fisheries with regard to animals that cause damage.**

# 15. SEAL POPULATION MONITORING AND RESEARCH

## 15.1. Monitoring population growth and reproductive capacity

Seal population management needs precise and reliable data on population growth and development. Achieving precise and reliable data is difficult as the behaviour of the seals and varying weather conditions make it hard to count seals. Thus, information on changes in population trends only becomes certain after several years of censuses. To obtain reliable data it is also relevant to monitor directly the main factor affecting the population growth, the birth rate, where one essential element is the reproductive capacity (including reproductive disturbances).

Seals are counted by aerial censuses. Ringed seals are counted at least every two to three years by line-counting in April-May. The aim is to conduct censuses in all the important areas (Bothnian Bay, Gulf of Riga, the eastern part of the Gulf of Finland and the south-western archipelago) in years with favourable ice conditions. International coordination is required to conduct a comprehensive count. All available counting methods are used to monitor the southern ringed seal populations in order to conduct a census in the most efficient way. Grey seals are counted using aerial photography as part of an international census operation every year in May-June. This allows most of the grey seal population to be reached during their moult on the outer islets and rocks in the archipelago. In some years, censuses are also conducted on the ice in the Bothnian Bay. The goal is to harmonise calculation methods internationally so that the results from different countries can be compared and compiled in a reliable way. At the public hearings and in the written surveys, it was frequently expressed that seal counts should be improve in Finland, especially those for the ringed seal population in the Bothnian Bay. At present, the ringed seal censuses in the Bothnian Bay are conducted by Swedish researchers.

At the public hearings it was also desired that concrete data would be available on the actual size of the seal populations, i.e. the precise number of animals. Nevertheless, opinions vary on the necessity of this information. If such detailed data is seen as vital, obtaining it will require the introduction of new census methods to be used simultaneously. Conducting such a census is a very complicated process and the costs involved are enormous. Additional information may not significantly alter the way population management is carried out.

The reproductive capacity of the ringed seal has been monitored in the Bothnian Bay since the mid-1970s, and the trends of development have been followed continually. This monitoring is of special importance as the trends of reproductive capacity have not been systematically monitored elsewhere in the Baltic Sea. For the purpose of monitoring, an average of 5-10 females is caught each year to be examined. Samples are also collected from mature female ringed seals found dead, in fishing gear or for other reasons. If ringed seal hunting is reintroduced, the reproductive capacity will also be examined in the bodies of hunted animals. Grey seal hunting licences contain a statement obliging the holder to submit samples to the Finnish Game and Fisheries Research Institute. Ongoing monitoring of the grey seal's reproductive capacity is conducted on samples obtained from the hunted animals, which are a very representative sample of the grey seal population.

**Measures:**
**Monitoring the size of the Baltic seal populations will be developed on the basis of internationally agreed and standardised aerial census methods. Counts will be conducted more efficiently in Finland, especially with regard to the ringed seal. Monitoring the grey seal population in the Gulf of Finland will be stepped up so that the causes of the relatively slow growth in the population can be examined more closely. All possible counting methods will be used to monitor the ringed seal populations in the southern management areas. Monitoring will be coordinated and synchronised internationally. Monitoring will be developed to give a better picture of regional and local features and of population fluctuations.**

**Monitoring of the reproductive capacity of both the ringed and the grey seal will continue. The occurrence of uterine occlusion in the ringed seal population, and the reproductive success in regional populations, will be examined. The reproduction success of grey seals giving birth on land will also be studied.**

## 15.2. Monitoring the general health state of the seal populations and their mortality rates

In several international fora, it has been stressed that in addition to the monitoring data collected on population growth and reproductive capacity, other information on the Baltic seals is needed as a base for the seal management. It has been suggested that the scope of regular monitoring should be extended to monitoring the general health state, the environmental contaminant load and Bycatch, and the significance of these for the population as a whole. This information would increase our knowledge of the status of the Baltic seal populations, while making it possible to react swiftly to changes in the population dynamics.

The aim is to introduce the health monitoring of the Baltic seal populations within the context of HELCOM. The monitoring will be conducted according to the 'harmonised health monitoring scheme', which incorporates both pathological and physiological parameters. The pathological parameters used are intestinal ulcers, arteriosclerosis, adrenocortical hyperplasia, renal failure, skull lesions, osteoporosis and skin disorders. The occurrence of these pathological changes and various pathogens (viruses, bacteria, etc.) should be investigated at least in animals caught for monitoring their reproductive capacity. The addition of possible physiological parameters into the monitoring scheme will be considered by HELCOM during 2007.

The elevated environmental contaminant load in the Baltic seals has been proposed as one of the main threats to maintaining the populations at a favourable conservation status. Accordingly, it is vital to monitor the occurrence of contaminants which are known to be harmful or which may be new hazardous substances. The monitoring of the contaminant load is especially important for the grey seal, as its meat is being used more and more for human consumption. Even if assessments on contaminant levels are not carried out every year, it is of great importance to collect and to store the samples properly for present and future research. Contaminant monitoring in seals will use samples from seals which have been hunted or shot for research purposes. Samples are taken from at least the blubber, liver, muscle tissue, kidneys and blood, and are stored in a tissue bank.

Today, information on ringed and grey seals by caught by fishing nets is hardly available in Finland. The occurrence of bycatch should be examined by following up the number of seals lost in fishing gear. This information is of special importance as international conventions require an evaluation of the total mortality of seals (including bycatch) for assessing the sustainability of hunting the species in question.

**Measures:**
**Monitoring the health status of the seal populations will be launched following international monitoring schemes, and the monitoring of parasites in seals will continue.**

**The monitoring of the contaminant burden in the Baltic seal populations will be launched following international monitoring schemes.**

**Monitoring guidelines on causes of death will be drawn up to monitor seal mortality rates. The topics covered will be: seal bycatch, pup mortality, illegal killing, the structure and location of the seal bag in the different management areas. The monitoring of bycatch will be carried out according to international recommendations (HELCOM, ASCOBANS, CMS, ICES, IWC, NAMMCO) using, for example, the practice of own reporting.**

**Section 83 of the Hunting Act should be amended so that the owner of hunting gear is under an obligation to report on seals caught in fishing gear.**

## 15.3. Research needs

The need for new and diverse information on the Baltic seals has been put forward in international fora concerning particularly their ecology and the effects of contaminants on their health. It would also be of great value to seal management to obtain information on regional and local distributions of seals are during seasons other than in spring when the census is conducted. Today, knowledge on the seasonal migration and distribution patterns in scarce. This information would serve as a base for assessing the possible isolation of different subpopulations and the damage to fishing caused by seals and its prevention. Recently there has been some debate on possible changes in the behaviour of grey seals and their distribution also to coastal areas.

Satellite tracking could be used as a method for investigating migration and distribution patterns. The seal's diets should also be studied using new research methods to evaluate the impact of the seal populations on the Baltic fish stocks. These studies would also produce more information on the position of seals in the Baltic Sea food chain.

Environmental contaminants affecting the hormone function (endocrine disrupters) are being discovered more and more often in the marine ecosystem, and very little is known about their properties or mechanisms of action. They may have an impact on the health of seals and, especially, their reproduction. The consequences of this would be reflected as a reduced reproduction capacity in the seal populations. To understand the effects of the endocrine disrupters, it is essential to know how these substances are metabolised and dissolved. Further, we need information on how these compounds together with others affect the hormone system. Levels of several environmental endocrine disrupters may rise dramatically, especially in areas around ports as a consequence of dredging. Research should focus especially on males, because many endocrine disrupters have an effect similar to that of female hormones. In addition, the increasing trend of 'new' compounds (brominates and chlorinated biphenyl ethers and polybrominated compounds) in sediments and organisms in the Baltic Sea pose a possible threat also to the seals. It would be of importance to assess their levels and possible effect on the seals

In general, knowledge on the basic physiology of seals is still rather poor. Reliable physiological data is essential as a reference for the development and use of biomarkers. Physiological data should be collected from healthy Baltic seals in connection with other research, to build up a robust data bank of physiological parameters. There is also a need to develop standardised research and monitoring methods that have been adapted to field conditions in the marine environment. Today, information is lacking on how susceptible the Baltic seals are to disease (e.g. distemper) and to the exposure and effects of algal toxins. The occurrence and effects of algal toxins should be studied in seals found dead during the algal blooms.

The recent increase in the Baltic seal populations has caused problems for the fishing industry and fish farming. This has resulted in seriously conflicting views between stakeholders on the management of the seal populations. A common understanding and cooperation are needed to resolve the disputes and to develop the coexistence between man and seal. This will require a will to find compromises from each side.

**Measures:**
**The seasonal movement and distribution of seals should be examined using satellite tracking.**

**The seal diet and the effect of seal populations on the Baltic fish stocks should be examined using a battery of different research methods. In particular, the impact of seals on wild salmon stocks in the Bothnian Bay should be examined.**

**The occurrence of 'new' environmental contaminants affecting the hormonal function should be examined in the Baltic seals, and tools should be developed to assess the risk they pose to the seals.**

**The establishment of a tissue bank for the Baltic seal should be discussed.**

**Socio-economic research on the utilisation, management and conservation of the seal populations should be initiated.**

# 16. TRAINING, ADVICE AND INFORMATION

## 16.1. Seal information centre

Substantial information is available on various aspects relating to seals. The problem, however, is the sheer diversity of this information. Many professional and stakeholder groups as well as NGOs produce information and opinions on seal populations, their management and the damage they cause, and communicate these through the media. This makes it hard to separate neutral information based on facts from that which is loaded and biased. Furthermore, the way the media reports on seals is often aggravating and problem-oriented. When the management plan was being drawn up, the need for reliable and fact based information and advice was brought forward as a tool to mitigate the social conflict between the fishing industry and the seals. An increased awareness among the general public would support in changing the view from being seen as a pest to being appreciated as a valuable natural resource. A high number of Baltic ringed and grey seals occur in Finnish territorial waters or very close to them, which gives Finland a major responsibility to provide information also internationally. The popularisation of the research findings is also an important component of spreading information. The information has to be neutral, up-to-date and based on facts. The Finnish Game and Fisheries Research Institution has a central role in distributing research information.

An establishment of a seal information centre has been proposed. The centre would be responsible for coordinating information and education on seals (ringed and grey seal) locally, nationally and internationally. Its main task would be to act as a neutral source of information and as a forum where different views on seals could be brought forward. Its target group would be all those interested in seals and the Baltic Sea environment. A similar type of centre has already been set up for large carnivores (Petola Visitor Centre www.suurpedot.fi). The activities of the seal information centre would be followed up by a steering group made up of representatives of local stakeholders, the Ministry of Agriculture and Forestry, Metsähallitus, Hunters' Central Organisation, Finnish Game and Fisheries Research Institute, Finnish Fishermen's Association, Ministry of the Environment, Finnish Association for Nature Conservation and WWF Finland. The parties responsible for collecting and distributing information on seals would predict and determine the public's need for information, and increase knowledge and awareness on seals within their own fields of expertise through information and training.

**Measures:**
**More information on seals will be made available both nationally and internationally.**

**The possibility to establish a seal information centre will be explored. A project plan will be drawn up to evaluate the feasibility of the centre, including necessary costs and operational considerations. The seal information centre forms a neutral, up-to-date and objective awareness-raising unit and supplier of information, and a discussion forum on different views with regard to seals. The purpose will be to provide different stakeholders with the opportunity of presenting their own expertise on seals to a wider public.**

**The possibilities for Nordic cooperation in information and communication will be examined.**

## 16.2. Training and advice

The organisation of hunting and game management bodies in Finland (Chapter 18) arranges training, advisory and information services relating to game species. The training and advice are mainly for hunters, but information on game species is also provided to the public at large via the media. The organisation covers the whole country. The organisation also arranges training for seal hunters along the coast, which includes species recognition, handling of dead animals, and hunting and animal protection legislation. Other key tasks include assisting the Finnish Game and Fisheries Research Institute in collecting samples, in training, and in maintaining the networks of cooperation.

The organisation of hunting and game management bodies in Finland plays an important role in providing information on food hygiene with respect to seal meat. According to EU Regulations on food hygiene (852/2004, 853/2004 and 854/2004), training in health and hygiene must be given to hunters who bring wild game onto the market for human consumption. Training should be given to at least one person in a hunting party, who could examine wild game provisionally on site immediately after the seal has been shot. This examination is a supportive measure for the final veterinary inspection.

**Measures:**
**The organisation of hunting and game management bodies in Finland contributes to the provision of information and training relating to seal management. The work has to be neutral and the information provided must be up-to-date. The organisation provides training and guidance, and takes determined action to improve the tolerance towards seals. Other actors may participate in the training and guidance work.**

**The training of seal hunters will be supported and developed. The training should address specific issues relating to species identification, shooting and recovery of the hunted animal. Training and information will be organised regionally as events concerning, in particular, species identification, hunting methods that comply with animal protection and hunting legislation, food hygiene and handling and efficient utilisation of the hunted animal.**

**Information on diseases transmitted by seals will be distributed and, research on these diseases will be initiated if needed.**

# 17. COOPERATION BETWEEN DIFFERENT ACTORS

## 17.1. Regional cooperation

At the national level, the Ministry of Agriculture and Forestry has the main responsibility for the management of the Finnish seal populations. In the Province of Åland, it is the responsibility of the Government of Åland. At the regional level the responsibility rests with the game management districts, which are supervised by the Ministry, but coordinated by the Hunters' Central Organisation. Seals are, nevertheless, a national natural resource shared by all, and many other stakeholders are also interested to express their views on matters relating to seals and their management.

In order to develop cooperation between the different stakeholders and to establish a regional policy on population management, broadly-based participation is needed. Regional or local advisory boards or working groups would offer a suitable forum for this. Similar working groups and advisory boards have been set up for large carnivores, for example, in North Karelia, Kainuu, Central Finland and North Savo, where the various stakeholders are represented. Such fora should extend to all stakeholders in the area where seals occur. The stakeholders include representatives of fishermen, fish farmers, hunters, game management, nature conservation and the authorities. Discussion fora dealing with seal issues could have an important role in the interaction between different actors, and in the development of cooperation. With their help it would be possible to form a common regional view, and to promote information exchange, cooperation and dialogue between the various stakeholders.

**Measures:**
**There will be more cooperation between stakeholders within all three seal population management areas and between them.**

**Where necessary, discussion fora will be set up to maintain interaction and dialogue between the different groups, to develop a regional view on the management of seal populations, and to increase the distribution of information regionally. The long-term aim for the regional game administration is to be able to influence and determine seal management targets in its own area, having heard the regional cooperation partners. However, as a completely independent regional management scheme is not possible at present, the seal management will be coordinated at a national level.**

**The occurrence and gravity of conflict will be identified in the different management areas, and solutions and applications will be proposed depending on the nature of the conflict.**

## 17.2. National cooperation

The responsibility for the management of the seal populations in the territorial waters of mainland Finland is that of the Ministry of Agriculture and Forestry. The Ministry of the Environment also has an official role to play as it determines the Red List of threatened species and, therefore, has significant impact as regards the protection of seals in Finland. The Finnish Game and Fisheries Research Institute has the main responsibility for the seal research and monitoring. In addition, many national authorities, organisations and associations are showing a growing interest in expressing their views on the control, conservation, management, and development of seal populations and on damage caused by seals.

**Measure:**
**There will be closer administrative cooperation and cooperation on research at the national level among the stakeholders in mainland Finland and in the Province of Åland. The need to establish a national advisory board or working group to maintain interaction and dialogue on seals at the national level will be examined.**

## 17.3. International cooperation

Finland is committed to several international nature conservation conventions (Bern Convention, Bonn Convention, Convention on Biological Diversity, Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention, HELCOM [Helsinki Commission]) and the EU's marine strategy, the strategy on sustainable development and the Biodiversity Strategy in Finland. As one of the countries having ratified the conventions, Finland is politically committed to promoting their implementation, and thus they must be taken into account in the management of seal populations as well. The importance of international cooperation in the management of the seal populations and in research is increasing continuously.

In Sweden, a management plan for the grey seal has been drawn up, and one for the ringed seal is being prepared. Estonia has produced a conservation programme for seals in the Baltic Sea.

**Measures:**
**The aim is to influence international conventions and EU legislation and their interpretation in such a way that national features will be reflected in the decision-making, and so that the principle of sustainable use remains the basis for utilising natural resources.**

**Finland will continue and intensify the communication with bodies responsible for the management of the seal populations in the Baltic Sea countries. Cooperation will continue especially with Sweden, Russia and Estonia concerning monitoring the size of seal populations and granting hunting quotas.**

**Finland will be active in the work of HELCOM and in the work of the HELCOM SEAL group established with reference to the new seal recommendation.**

# 18. RESPONSIBILITIES FOR POPULATION MANAGEMENT

The main tasks of seal management in Finland can be divided among the different official actors as below.

| ACTOR | | RESPONSIBILITY |
|---|---|---|
| Ministry of Agriculture and Forestry | | Main responsibility for management and conservation of seal populations, delegation of tasks, overall control and functioning as the licence authority. International affairs. Updating of the management plan. |
| Finnish Game and Fisheries Research Institute | | Main responsibility for monitoring the population, research, communication of findings, expert services. |
| Organisation of hunting and game management bodies | Hunters' Central Organisation | Information services, training, advice, statistics, expert services, coordination. |
| | Game management districts | Regional information services, training, advice, authority for issuing licences, regional responsibility for population management. |
| | Game Management Associations | Local information services, training, advice, and hunting surveillance. |
| Ministry of the Environment | | Conservation areas established under the Nature Conservation Act. Updating of the classification of endangered species. |
| Police | | Hunting surveillance. |
| Metsähallitus | | Administration and management of state conservation areas. Hunting surveillance. |
| Border Guards | | Hunting surveillance |
| Finnish Food Safety Authority Evira | | Monitoring, research and information services relating to diseases transmitted to humans by seals. Meat inspection and guidance, training and advice on meat inspection. |

# 19. EVALUATION OF THE IMPLEMENTATION OF THE MANAGEMENT PLAN AND UPDATING THE PLAN

Current knowledge on the status of the Finnish seal populations and the findings from the seal research has been compiled in this management plan. Seal populations will be managed in the future in accordance with the policies set out in the plan. The fundamental policy is that the favourable development of the seal populations will continue, new information will be obtained from research to serve as a basis for planning and decision-making, and the seal populations will cause undue damage for anyone.

Besides the measures set out in the population management plan, several national agreements and programmes, as well as national measures in other countries on the Baltic Sea, will have an indirect impact on the Baltic seals and their living conditions.

The steering committee appointed to prepare the draft for the management plan for the Finnish seal populations in the Baltic Sea may continue its work as a small working committee of officials (Ministry of Agriculture and Forestry, Ministry of the Environment, Finnish Game and Fisheries Research Institute, Metsähallitus, game management district of Swedish-speaking Ostrobothnia). Its task will be to evaluate the implementation of the management plan for the seal populations in the Baltic Sea. Each body responsible for implementing the plan will report back to the Ministry of Agriculture and Forestry each year on the accomplishments. The working committee will evaluate the implementation of the management plan no later than five years after the plan is adopted, and every five years after that.

**Measure:**
**The implementation of the management plan will be followed up, and it will be updated every five years.**

# REFERENCES


ACIA. 2004. Impacts of a warming Arctic: Arctic Climate Impact Assessment. ACIA overview report (Executive Summary). 24 s.

AMAP. 1998. AMAP Assessment Report: Arctic Pollution Issues. Arctic Monitoring and Assessment Program (AMAP), Norway.

Addison, R. & Brodie, P.F. 1987. Transfer of organochlorine residues from blubber through the circulatory system to milk in the lactating grey seals (*Halichoerus grypus*). Can. J. Fish. Aquat. Sci. 44: 782–786.

Andersson, Ö. & Wartanian, A. 1992. Levels of polychlorinated camphenes (Toxaphene), chlordane compounds and polybrominated diphenyl ethers in seals from Swedish waters. Ambio 21: 550–552.

Arbetsgruppen för skydd av Östersjöns sälar 1990. Förbättring av skyddet av Östersjöns sälar i Finland. Maailman luonnonsäätiön WWF Suomen rahaston raportteja 4, 10s.

Baker, A.S., Ruoff, K.L. & Madoff, S. 1998: Isolation of *Mycoplasma* species from a patient with seal finger. Clinical Infectious Diseases 27: 1168–1170.

Bergman, A. 1999. Health condition of the Baltic grey seal (*Halichoerus grypus*) during two decades. APMIS 107: 270–282.

Bergman, A. & Olsson, M. 1986. Pathology of the Baltic grey seal and ringed seal females with special reference to adrenocortical hyperplasia: Is environmental pollution the cause of a widely distributed disease syndrome? Fin. Game Res. 44: 47–62.

Bergman, A., Olsson, M. & Reiland, R. 1992. Skull-bone lesions in the Baltic grey seal (*Halichoerus grypus*). Ambio 21: 517–519.

Bergman, A., Bergstrand, A. & Bignert, A. 2001. Renal lesions in Baltic grey seals (*Halichoerus grypus*) and ringed seals (*Phoca hispida botnica*). Ambio 30: 397–409.

Bergman, G. 1956. Rannikoittemme hyljekannasta. Luonnon Tutkija 60: 81–90

Bergman, G. 1958. Suomen hyljekannoista. Suomen Riista 12: 110–124.

Bignert, A., Olsson, M., Persson, W., Jensen, S., Zakrisson, S., Litzén, K., Eriksson, U., Häggberg, L. & Alsberg, T. 1998. Temporal trends of organochlorines in Northern Europe, 1967-1995. Relation to global fractionation, leakage from sediments and international measures. Environ. Pollut. 99: 177–198.

Bergek, S., Bergqvist, P-A., Hjelt, M., Olsson, M., Rappe, C., Roos, A. & Zook, D 1992. Concentrations of PCDDs and PCDFs in seals from Swedish waters. Ambio 21: 553–556.

Blomkvist, G., Roos, A., Jensen, S., Bignert, A. & Olsson, M. 1992. Concentrations of SDDT and PCB in seals from Swedish and Scottish waters. Ambio 21: 539–545.

Boon, J.P., van Arnhem, E., Jansen, S., Kannan, N., Petrick, G., Schulz, D., Duinker, J.C., Reijnders, P.J.H. & Goksyør, A. 1992. The toxicokinetics of PCBs in marine mammals with special reference to possible interactions of individual congeners with the cytochrome P450-dependent monooxygenase system – an overview. Teoksessa: Walker C.H. & Livingstone, D. (toim), Persistent Pollutants in Marine Ecosystems, Pergamon Press, Oxford, s. 119–159.

Boskovic, R., Kovacs, K.M., Hammill, M.O. &. White, B.N. 1996. Geographic distribution of mitochondrial DNA haplotypes in grey seals (*Halichoerus grypus*). Can. J. Zool. 74: 1787–1796.

Brandt, I., Jönsson, C.J. & Lund, B.O. 1992. Comparative studies on adrenocorticolytic DDT-metabolites. Ambio 21: 602–605.

Breuer, E.M., Hofmeister, R.H. & Hörchner, F. 1988. Pathologic-anatomic, histologic and parasitologic findings in harbor seals. Angew. Zool. 2: 139–145.

Brown, R.D. & Braaten, R.O. 1998. Spatial and temporal variability of Canadian monthly snow depths, 1946-1995. Atmosphere-Ocean 36: 37–54.

Brouwer, A., Reijnders, P.J.H & Koeman, J.H. 1989. Polychlorinated biphenyl (PCB)-contaminated fish induces vitamin A and thyroid hormone deficiency in the common seal *Phoca vitulina*. Aquat. Toxicol. 15: 99–106.

Brouwer, A., Ahlborg U.G., Van den Berg M., Birnbaum L.S., Boersma E.R., Bosveld B., Dension M.S., Earl Gray L., Hagmar L., Holene E., Huisman M., Jacobson S.W., Koopman-Esseboom C., Koppe J.G., Kulig B.M., Morse D.C., Muckle G., Peterson R.E., Sauer P.J.J., Seegal R.F., Smits-Van Prooije A.E., Touwen B.C.L., Weisglas-Kuperus N. & Winneke G. 1995. Functional aspects of developmental toxicity pf polyhalogenated aromatic hydrocarbons in experimental animals and human infants. Eur J Pharmacol, Environ Toxicol Pharmacol Section 293: 1–40.

Bäck, S. & Lindholm, T. 1999. Vesi- ja rantaluonnon monimuotoisuuden säilyttäminen. Selvitys vesiensuojelun tavoiteohjelmaa vuotta 2005 varten. Suomen ympäristö. 364, 78 s.

Bäcklin, B-M. 1996. Studies on reproduction on female mink (*Mustela vision*) exposed to polychlorinated biphenyls. PhD thesis, Swedish university of Agricultural Sciences.

Bäcklin, B-M & Bergman, A. 2005. Increased prevalence of intestinal ulcers in Baltic grey seals. International conference on Baltic seals, 15–18 February Helsinki, Finland.

Clarke, A. & Harris, C.M. 2003. Polar marine ecosystems: major threats and future change. Environmental Conservation 30 (1): 1–25.

Curry-Lindahl, K. 1975. Ecology and conservation of grey seal, *Halichoerus grypus*, common seal, *Pusa hispida*, in the Baltic Sea. Rapp. P-v. Reun. Cons. int. Explor. Mer. 169: 527–532.

De Swart, R.L. 1995. Impaired immunity in seals exposed to bioaccumulated contaminants. PhD Thesis, Erasmus University of Rotterdam.

Dietz, R., Norgaard, J. & Hansen, C.J. 1998. Have Arctic marine mammals adapted to high cadmium levels? Mar. Pollut. Bull. 36: 490–492.

Dietz, R., Teilmann, J., Henriksen, O.D. & Laidre, K. 2003. Movements of seals from Rødsand seal sanctuary monitored by satellite telemetry. Relative importance of the Nysted Offshore wind farm area to the seals. National Environmental Research Institute, NERI technical Report No 429. http://faglige rapporter.dmu.dk.

Durant, S. & Harwood, J. 1986. The effects of hunting on ringed seals (*Phoca hispida*) in the Baltic. ICES committee meeting 10, 15 s.

Falandysz, J., Kannan, K., Tanabe, S. & Tatsukawa, R. 1994. Concentrations, clearance rates and toxic potential of non-ortho coplanar PCBs in cod liver oil from the southern Baltic Sea from 1971 to 1989. Marine Pollution Bulletin 28: 259–262.

Fant, M.L., Nyman, M., Helle, E. & Rudbäck, E. 2001. Mercury, cadmium lead and selenium in ringed seals (*Phoca hispida*) from the Baltic Sea and from Svalbard. Environ. Pollut. 111: 493–501.

Ferguson, S.H., Striling, I. & McLoughlin, P. 2005. Climate change and ringed seal (*Phoca hispida*) recruitment in western Hudson Bay. Marine Mammal Science 21 (1): 121–135.

Finley, K.J. 1979. Haul-out behavior and densities of ringed seals (*Phoca hipida*) in the Barrow Strait area, N.W.T. Canadian Journal of Zooogy. 57:1985–1997.

Fjälling, A. 2005. The estimation of hidden seal-inflicted losses in the Baltic Sea set-trap salmon fisheries. ICES Journal of Marine Science 62: 1630–1635.

Geraci, J., Anderson, D., Timperi, R., Staubin, D., Early, G., Prescott, J. & Mayo, C. 1989. Humpback whales (*Megaptera novaeangliae*) fatally poisoned by dinoflagellate toxin. Can. J. Fish. Aquat. Sci. 46: 1895–1898.

Giesy, J.P. & Kannan, K., 1998. Dioxin-like and non-dioxin like toxic effects of polychlorinated biphenyls (PCBs): implications for risk assessment. Crit. Rev. Toxicol. 28: 511–569.

Gonzales, F. J. & Nebert, D. W. 1990. Evolution of the P450 gene superfamily. Trends in Genetics 6: 182–186.

Gottberg, G. 1925. Tilastoa hylkeensaaliista vv. 1909-1918. Maataloushallituksen tiedonantoja 167: 23–29.

Halkka, A., Helle, E., Helander, B., Jussi, I., Karlsson, O., Soikkeli, M., Stenman, M. & Verevkin, M. 2005. Numbers of grey seals counted in the Baltic Sea, 2000–2004. International conference on Baltic seals, 15–18 February Helsinki, Finland.

Heide-Jørgensen, M.P., Stewart, B.S. & Leatherwood, S. 1992. Satellite tracking of ringed seals *Phoca hispida* off northwest Greenland. Ecography 15:56–61.

HELCOM 1996. Third Periodic Assessment of the State of the Marine Environment of the Baltic Sea, 1984–1993; Background Document. Baltic Sea Environ. 64 B, 252 s.

Helle, E. 1979a. Growth and size of the ringed seal *Phoca* (*Pusa*) *hispida* Schreber in the Bothnian Bay, Baltic. Z. Säugetierkunde 44: 208–220.

Helle, E. 1979b. Structure and numbers of seal populations in the northern Baltic Sea: a study based on Finnish bounty statistics, 1956–75. Aquilo Ser. Zool. 19: 65–71.

Helle, E. 1980a Reproduction, size and structure of the Baltic ringed seal population of the Bothnian Bay. PhD thesis, University of Oulu.

Helle, E. 1980b. Aerial census of ringed seals *Pusa hispida* basking on the ice of the Bothnian Bay, Baltic. Holoarctic Ecology 3: 183–189.

Helle, E. 1981. Reproductive trends and occurrence of organochlorines and heavy metals in the Baltic seal populations. International Council for the Exploration of the Sea (CM papers and reports) E: 37.

Helle, E. & Stenman, O. 1990. Itämeren hyljekannat 1986-1990. Maailman Luonnon Säätiön Suomen Rahaston raportteja 1, 76 s.

Helle, E. & Stenman, O. 1990. Sälstammarna i Östersjön 1986-1990. Maailman Luonnon Säätiön Suomen Rahaston raportteja 3, 76 s.

Helle, E., Olsson, M. & Jenssen, S. 1976a. DDT and PCB levels and reproduction in ringed seal from the Bothnian Bay. Ambio 5: 188–189.

Helle, E., Olsson, M. & Jenssen, S. 1976b. PCB levels correlated with pathological changes in seal uteri. Ambio 5: 261–263.

Helle, E., Nyman, M & Stenman, O. 2005. Reproductive capacity of grey and ringed seal females in Finland. International conference on Baltic seals, 15–18 February Helsinki, Finland.

Herva, E. & Häsänen, E. 1972. Mercury in seals of the Gulf of Bothnia. (in Finnish). Suomen Eläinlääkärilehti 78: 445–448.

Hjerne, O., Lundström, K. & Karlsson, O. 2005 Effects of grey seal (*Halichoerus grypus*) predation on Baltic Sea fish stocks and fisheries. CES CM 2005 / R: 19 poster.

Hårding, K.C. & Härkönen, T. 1999. Development in the Baltic grey seal (*Halichoerus grypus*) and ringed seal (*Phoca hispida*) populations during the 20th century. Ambio 28 (7): 619–627.

Hårding, K.C., Härkönen, T., Helander, B. & Karlsson, O. 2005. Population assessment and risk analysis of Baltic grey seals. NAMMCO Scientific puplications, painossa.

Hänninen, S. 2005. Itämeri ei kestä suurta öljyvahinkoa. Vesitalous 2: 10–13.

Härkönen, T., Stenman, O. Jüssi, M. Jüssi, I. Sagitov, R. & Verevkin, M. 1998. Population size and distribution of the Baltic ringed seal (*Phoca hispida botnica*). Teoksessa M.P. Heige-Jorgessen & C. Lydersen (toim.) Ringed seals in the North Atlantic s. 67–180.

Hyvärinen, H. & Sipilä, T. 1984. Heavy metals and high pup mortality in the Saimaa ringed seal population in Eastern Finland. Marine Pollution Bulletin 15: 335–337.

Hyvärinen, H., Sipilä, T.Kunnasranta, M. & Koskela, J.T. 1998. Mercury pollution and the Saimaa ringed seal. Marine Pollution Bulletin 36: 76–81.

Itämeren hylkeiden suojelutyöryhmä 1990. Itämeren hylkeiden suojelun tehostaminen Suomessa. Maailman Luonnon Säätiön Suomen Rahaston raportteja 2, 10 s.

Jensen, S., Johnels, A.G. Olsson, M. & Otterlind, G. 1969. DDT and PCB in marine mammals from Swedish waters. Nature 224: 247–250.

Jensen, S., Kihlström, J. E., Olsson, M., Lundberg, C. & Örberg, J. 1977. Effects of PCB and DDT on Mink (*Mustela vison*) during the reproduction season. Ambio 6: 239.

Jensen, T., van den Bildt, M., Dietz, H., Andersen, T., Hammer, A., Kuiken, T. & Osterhaus, A. 2002. Another phocine distemper outbreak in Europe. Science 297: 209.

Jonsson, P., Grimvall, A., Cederlöf, M., & Hildén, M. 1996. Pollution threats to the Gulf of Bothnia. Ambio Special Report 8: 22–27.

Jüssi, M. 1999. Breeding habitat preference and reproduction success of Baltic grey seal (*Halichoerus grypus*). Master thesis, University of Tartu.

Kahru, M., Leppänen, J.-M., Rud, O. & Savchuk, O.P. 2000. Cyanobacteria blooms in the Gulf of Finland triggered by saltwater inflow into the Baltic Sea. Mar. Ecol. Prog. Ser. 207: 13–18.

Kapel, F.O., Christiansen, J., Heide-Jorgensen, M-P., Härkönen, T, Born, E.W., Knutsen, L-O., Riget, F. & Teilmann, J. 1998. Netting and conventional tagging used to study movements of ringed seal (*Phoca hispida*) in Greenland. Teoksessa M.P. Heige-Jorgessen & C. Lydersen (toim.) Ringed seals in the North Atlantic s. 211–228.

Kapel,C.M.O., Measures, L., Moller, L.N., Forbes, L. & Cajadhar, A. 2003. Experimental trichinella infection in seals. International Journal of Parasitology 33: 1463–1470.

Kari, T. & Kauranen, P. 1978. Mercury and selenium contents of seals from fresh and brackish waters in Finland. Bull. Environ. Contam. Toxicol. 19: 273–280.

Karlsson, O. 2003. Population structure, movements and site fidelity of grey seals in the Baltic Sea. Ph.D thesis, University of Stockholm.

Kauppi, L. (toim.) 1993. Itäisen Suomenlahden lintukuolemat keväällä 1992. Vesi- ja ympäristöhallituksen julkaisuja 142, 46 s.

Kauppila, P., Hällfors, G., Kangas, P., Kokkonen, P. & Basova, S. 1995. Late summer phytoplankton species composition and biomasses in the eastern Gulf of Finland. Ophelia 42: 179–191.

Kauppinen, T., Siira, A. & Suuronen, P. 2005. Temporal and regional patterns in seal-induced catch and gear damage in the coastal trap-net fishery in the northern Baltic Sea: effect of netting material on damage. Fisheries Research. 73: 99–109.

Kelly, B. P. 2001. Climate change and ice breeding pinnipeds. Teoksessa: G.-R. Walther, Burga, C. A. & Edwards, P. J. (toim.) "Fingerprints" of climate change: adapted behaviour and shifting species' ranges: 43-55. Kluwer Academic Plenum Publishers, New York and London.

Kiviranta, H., Vartiainen, T., Parmanne, R., Hallikainen, A. & Koistinen, J. 2003. PCDD/Fs and PCBs in Baltic herring during 1990s. Chemosphere 38: 311–323.

Koistinen, J., Paasivirta, J., Suonperä, M. & Hyvärinen, H. 1995. Contamination of pike and sediment from the Kymijoki river by PCDEs, PCDDs, and PCDFs: Contents and patterns compared to pike and sediment from the Bothnian Bay and seals from Lake Saimaa. Environ. Sci. Technol. 29: 2541–2547.

Koistinen, J., Stenman, O., Haahti, H., Suonperä, M. & Paasivirta, J. 1997. Polychlorinated diphenyl ethers, dibenzo-p-dioxins, dibenzofurans and biphenyls in seals and sediment from the Gulf of Finland. Chemosphere. 35: 1249–1269.

Kokko,H, E Helle, J Lindström, E Ranta, T Sipilä, F Courchamp, 1999, Backcasting population sizes of ringed and grey seals in the Baltic and Lake Saimaa during the 20th century: Annales Zoologici Fennici, v. 36, p. 65–73.

Kononen, K. 1992. Dynamics of the toxic cyanobacterial blooms in the Baltic Sea. Finnish Marine research 261, 36 s.

Korhonen, M., Verta, M. & Backström, V. 2001. Harmful substances. Teoksessa: Kauppila, P. & Bäck. S. (toim.). The state of Finnish coastal waters in the 1990s. The Finnish Environment 472, s. 94–104.

Kovacs, K.M. & Lavigne, D.M. 1986. Growth of grey seal (*Halichoerus grypus*) neonates - differential maternal investment in the sexes. Can. J. Zool. 64: 1937–1943.

Larsson, U., Elmgren, R. & Wulff, F. 1985. Eutrophication of the Baltic Sea - Causes on consequences. Ambio 14: 9–14.

Letcher, R. J., Nordstrom, R., Muir, D., Sandau, C., Koczansky, K., Michaud, R., De Guise, S. & Béland, P. 2000. Methylsulfone polychlorinated biphenyls and 2,2-bis(chlorophenyl)-1,1-dichloroethylene metabolites in beluga whale (*Delphinapterus leucas*) from the St Lawrence River estuary and wetern Hudson Bay, Canada. Environ. Toxicol Chem. 19: 1378–1388.

Loughlin, T. R. (toim.) 1994. Marine mammals and the Exxon Valdez. Academic press, San Diego, USA. 395 s.

Lundström, K., Hjerne, O., Alexandersson, K. & Karlsson, O. 2005. Diet of grey seals (*Halichoerus grypus*) in the Baltic Sea assessed from hard-part prey remains. International conference on Baltic seals, 15–18 February Helsinki, Finland.

Lunneryd, S.G. & Königson, S. 2005. By-catch of seals in Swedish commercial fisheries. International conference on Baltic seals, 15–18 February Helsinki, Finland.

Lunneryd, S.G. & Westerberg, H. 1999. By-catch of grey seal (*Halichoerus grypus*) in Swedish waters. International conference on Baltic seals, 18–21 November Pärnu, Estonia.

Lunneryd, S.G., Fjälling, A. & Westerberg, H. 2003. A large-mesh salmon trap: a way of mitigating seal impact on a coastal fishery. ICES. J. Mar.Sci. 60: 1194–1199.

Lydersen, C. & Smith, T.G. 1989. Avian predation on ringed seal, *Phoca hispida*, pups. Polar Biology 9: 489–490.

Lydersen, C & Hammill, M.O. 1993. Activity, milk intake and energy consumption in free-living ringed seal (*Phoca hispida*) pups. J. Comp. Physiol. B. 163: 433–438.

Mc Laren, I.A. 1958. The biology of the ringed seal (*Phoca hispida* Schreber) in the eastern Canadian arctic. Fisheries Research Board of Canada. Ms. Rep. (Biology) 653. 146 s.

Meier, M., Döscher, R. & Halkka, A. 2004. Simulated distributions of Baltic Sea-ice in warming climate and consequences for the winter habitat of the Baltic ringed seal. Ambio 33: 249–256.

Merentutkimuslaitos 1999. Kemikaalit ja kertymät. Ympäristömyrkyt Suomen merialueiden silakassa. Ympäristö 7: 23–24.

Miettinen, M, Halkka, A., Högmander, J., Keränen, S., Mäkinen, A., Nordström, M., Nummelin, J. & Soikkeli, M. 2005. The ringed seal in the Archipelago Sea, SW Finland: population size and surveys techniques. International conference on Baltic seals, 15–18 February Helsinki, Finland.

Mohn, R. & Bowen, W.D. 1996. Grey seal predation on the eastern Scotian Shelf: modeling the impact on the Atlantic cod. Can. J. Fish. Aquat. Sci. 53: 2722–2738.

Moilanen, P, Savolainen, R & Ahvonen, A. 2005. The losses in the Finnish aquaculture caused by seals in 2003. International conference on Baltic seals, 15–18 February Helsinki, Finland.

Nakari, T. 2003. Kunnallisten jätevesien hormonaalinen aktiivisuus. Suomen ympäristö 626, 20 s.

Naturvårdsverket: Nationell förvaltningsplan för gråsälbeståndet i Östersjön (2001)

Nyman, M. 2000. Biomarkers for exposure and for the effects of contamination with polychlorinated aromatic hydrocarbons in Baltic ringed and grey seals. PhD Thesis, University of Helsinki and University of Oulu, Finland.

Nyman, M., Koistinen, J., Fant, M.L., Vartiainen, T & Helle, E. 2002. Current levels of DDT, PCB and trace elements in the Baltic ringed seals (*Phoca hispida baltica*) and grey seals (*Halichoerus grypus*). Environmental Pollution 119: 399–412.

Nyman, M., Bergknut, M., Fant, M.L., Raunio, H., Jestoi, M., Bengs, C., Murk, A., Koistinen, J., Bäckman, C., Pelkonen, O., Tysklind, M., Hirvi, T. & Helle, E. 2003. Contaminant exposure and effects in Baltic ringed and grey seals as assesses by biomarkers. Marine Environmental research 55: 73–99.

Nyman, M., Routti, H., Koistinen, J., Bäckman, C. & Helle, E. 2005. POP load and vitamins as potential biomarkers in the Baltic seals. International conference on Baltic seals, 15–18 February Helsinki, Finland.

Nyström, L. 2000. Alg, pytare och skridstång. Svenska litteratursällskapet in Finland, Helsinki. 274 s.

Olsson, M, Andersson, Ö., Bergman, Å., Blomkvist, G., Frank, A. & Rappe, C. 1992. Contaminants and disease in seals from Swedish waters. Ambio 21: 561–562.

Olsson, M., Karlsson, B. & Ahnland, E. 1994. Diseases and environmental contaminants in seals from the Baltic and the Swedish west coast. Sci. Tot. Environ. 154: 217–227.

Olsson, M., Bignert, A., Eckhéll, J. & Jonsson, P. 2000. Comparison of temporal trends (1940s-1990s) of DDT and PCB in Baltic sediment and biota in relation to eutrophication. Ambio 29 (4-5): 195–201.

O'Shea, T. 1999. Environmen

tal contaminants and marine mammals. Teoksessa: Biology of Marine Mammals. Reynolds III JE and Rommel SA (toim.) s. 485–536.

Paasivirta, J., Rantio, T., Koistinen, J. & Vuorinen, P. 1993. Studies on toxaphene in the environment. II. PCCs in Baltic and Arctic Sea and lake fish. Chemosphere 27: 2011–2015.

Palo, J. 2003. Genetic diversity and phylogeography of landlocked seals. PhD Thesis, University of Helsinki.

Palo, J., Hyvärinen, H., Helle, E., Mäkinen, H.S. & Väinölä, R. 2001. Microsatellite variation in ringed seals (*Phoca hispida*): genetic structure and history of the Baltic Sea population. Heredity 86: 609–617.

Perttilä, M, Stenman, O., Pyysalo, H. & Wickström, K. 1986. Heavy metals and organochlorine compounds in seals in the Gulf of Finland. Mar. Environ. Res. 18: 1962–1966.

Pitkänen, H. 2004. Rannikko- ja avomerialueiden tila vuosituhannen vaihteessa. Suomen ympäristö 669, 104s.

Pitkänen, H., Lehtoranta, J. & Räike, A. 2001. Internal nutrient fluxes counteract decreases in external load: The case of the estuarial Gulf of Finland. Ambio 30: 195-201.

PMN 1996. Phytobenthic biodiversity in the northern Baltic Sea. Background, methods, and suggestions for future actions. Nordic Council of Ministers. Tema Nord 559, 91 s.

Pöyhönen, O. 2001. Nuorten hylkeiden ravinto Suomenlahdella, Lounaissaaristossa sekä Merenkurkussa ja Perämerellä. Ms-thesis, University of Helsinki.

Rassi, P., Alanen, A., Kanerva, T. & Mannerkoski, I. (toim.) 2001: Suomen lajien uhanalaisuus 2000. Ympäristöministeriö & Suomen ympäristökeskus, Helsinki.

Reijnders, P. 1986. Reproductive failure in common seals feeding on fish from polluted coastal waters. Nature: 324: 456–457.

Reijnders, P., Brasseur, S., van der Toor, J., van der Wolf, P., Boyd., I., Harwood, J., Lavigne, D. & Lowry, L. 1993. Status survey and conservation action plan – seals, fur seals, sea lions, and walrus. IUCN. 88.s

Reijnders, P.J.H., Verriopoulos, G. & Brasseur, S.M.J.M. (toim.). 1997. Status of pinnipeds relevant to European Union. IBN Scientific Contributions 8, 195 s.

RKTL. 2006. Ammattikalastus merellä 2005. 58 s.

Routti, H., Nyman, M., Bäckman, C., Koistinen, J. & Helle, E. 2005. Accumulation of dietary organochlorines and vitamins in Baltic seals. Marine Environmental Research 60: 267–287.

Ross P. 1995. Seals, pollution and disease: environmental contaminant induced immunosuppression. PhD Thesis, University of Utrecht.

Safe S. 1994. Polychlorinated biphenyls (PCBs) and polybrominated biphenyls (PBBs): Biochemistry, toxicology, and mechanisms of action. CRC Crit. Rev. Toxicol. 13: 319–393.

Salmi, P., Seppänen, E. & Ahvonen, A.. 2004. Ammattikalastajien näkemyksiä hylkeidensuojelualueista. Riistaraportteja 337.

Scholin, C., Gulland, F., Doucette, G., Benson, S., Busman, M., Chavez, F., Cordaro, J., DeLong, R., De Vogelaere, A., Harvey, J., Haulena, M., ym. 2000. Mortality of sea lions along the central Californian coast linked to a toxic diatom bloom. Nature 403: 80–84.

Schwarz, J., Harde, K., von Nordheim, H. & Dinter, W. (toim.). 2003. Wiederansiedlung der Ostseekegelrobbe (*Halichoerus grypus balticus*) an der deutchen Ostseekuste. Bundesamt fur naturschutz, 206 s.

Sivonen, K. 1990.Toxic cyanobacteria in Finnish fresh waters and the Baltic Sea. PhD Thesis, University of Helsinki.

Sjöberg, M. 1999. Behaviour and movements of the Baltic grey seal. PhD Thesis, Swedish University of Agricultural Sciences.

Sjöberg, M., Fedak, M.A. & McConnell, B.J. 1995. Movements and diurnal behaviour patterns in a Baltic grey seal (*Halichoerus grypus*). Polar Biology 15: 593–595.

Sjöberg, M. & Ball, J.P. 2000. Grey seal, *Halichoerus grypus*, habitat selection around haulout sites in the Baltic Sea: bathymetry or central-place foraging, Can. J. Zool. 78: 1661–1667.

Smith, T. 1987. The ringed seal, *Phoca hispida*, of the Canadian western Arctic. Can.Bull.Fish.Aquat.Sci. 216, 81 s.

Smith, T. G. & Harwood, L.A. 2001. Observations of neonate ringed seals, *Phoca hispida*, after early break-up of the sea ice in Prince Albert Sound, Northwest Territories, Canada, spring 1998. Polar Biology 24: 215–219.

Smith, T.G. & Lydersen, C. 1991. Availability of suitable land-fast ice and predation as factors limiting ringed seal populations, *Phoca hispida*, in Svalbard. Polar Res. 10: 585–594.

Soikkeli, M. & Stenman, O. 1999. Grey seal numbers in Finland in the 1990's. International conference on Baltic seals, 18–21 November Pärnu, Estonia.

Stenman, O. 1979. Hylkeiden aiheuttamat vahingot lohenkalastukselle Suomessa vuosina 1974–76.Suomen Kalastuslehti 6: 128–132.

Stenman, O. 1992. Ajatus hyljehoitolasta kypsyy. Metsästys ja Kalastus 4: 64–65.

Stenman, O. & Pöyhönen, O.. 2005. Food remains in the alimentary tracts of the Baltic grey and ringed seal. International conference on Baltic seals, 15–18 February Helsinki, Finland.

Stenman, O., Halkka, A., Helle, E., Keränen, S., Nummelin, J., Soikkeli, M., Stjernberg, T. & Tanskanen, A. 2005a. Numbers and occurrence of grey seals in Finnish sea area in the years 1970–2004. International conference on Baltic seals, 15–18 February Helsinki, Finland.

Stenman, O., Verevkin, M, Dimitrieva, L. & Sagitov, R. 2005b. Numbers and occurrence of ringed seals in the Gulf of Finland in the years 1997–2004. International conference on Baltic seals, 15–18 February Helsinki, Finland.

Storm, A., Routti, H., Nyman, M., Kunnasranta, M & Helle, E. 2007. Hyljepuhetta – Alueelliset ja kansalliset näkökulmat ja odotukset merihyljekantojen hoidossa. Kala- ja riistaraportteja, painossa

Sundberg, J. & Söderman, M. 1999. Wind power and Grey Seals: An impact assessment of potential effects by sea-based wind power plants on a local seal population. Anceps Ekologidata. Department of animal ecology. Uppsala University.

Suuronen, P., Siira, A., Kauppinen, T., Riikonen, R., Lehtonen, E. & Harjunpää, H.. 2006. Reduction of seal-induced catch and gear damage by modification of trap-net design: design principles for a seal-safe trap-net. Fisheries Research 79: 129–138.

Söderberg, S. 1975. Feeding habits and commercial damage of seals in the Baltic. Proceedings from the Symposium on the Seal in the Baltic, 4-6 June 1974, Lidingö, Sweden: 66–78.

Teilmann, J., Born, E.W. & Acquarone, M. 1999. Behaviour of ringed seals tagged with satellite transmitters in the North Water polynya during fast-ice formation. Can. J. Zool. 77: 1934–1946.

Tormosov, D.D. & Filatov, I.J. 1978. Information on distribution, number and feeding habits of ringed and grey seal in the Gulfs of Finland and Riga in the Baltic Sea. – proceedings from the Symposium on the Conservation of Baltic Seals, April 26-28, 1977, Haikko, Finland. Finnish Game Research 37: 14–17.

Tormosov,DD, A G Esipenko, V P Shopov, 1980a. On the distribution and abundance of seals in Riga and Finland Bays in the summer-autumn period.: III Symp.Cons.Baltic Seals, Konstancin 1980.

Tormosov,DD, E G Sazhinov, I E Filatov, 1980b. Spring survey of ringed seal and grey seal in the USSR Baltic waters, 1979.: III Symp.Cons.Baltic Seals, Konstancin 1980, p. 8.

Tuomenvirta H. 2004. Reliable estimation of climatic variations in Finland. PhD-thesis, University of Helsinki.

Tynan, C. T. & DeMaster, D.P. 1997. Observations and predictions of arctic climatic change: potential effects on marine mammals. Arctic 50: 308–322.

Urtans, E., Liskins, N. & Pilats, V. 2005. Seal monitoring in Latvia 1999-2004. International conference on Baltic seals, 15–18 February Helsinki, Finland.

Verta, M., Ahtiainen, J., Hämäläinen, H., Jussila, H., Kiviranta, H., Korhonen, M., Kukkonen, J., Lehtoranta, J., Lyytikäinen, M., Malve, O., Mikkelson, P., Moisio, V., Niemi, A., Paasivirta, J., Palm, H., Rantalainen, A.-L., Salo, S., Vartiainen, T. & Vuori, K.-M. 1999a. Organoklooriyhdisteet ja raskasmetallit Kymijoen sedimentissä; esiintyminen, kulkeutuminen, vaikutukset ja terveysriskit. Suomen ympäristö 334.

Verta, M., Korhonen, M., Lehtoranta, J., Salo, S., Vartiainen, T., Kiviranta, H., Kukkonen, J., Hämäläinen, H., Mikkelson, P. & Palm, H. 1999b. Ecotoxicological and health effects caused by PCP's, PCDE's, PCDD's and PCDF's in river Kymijoki sediments, South-Eastern Finland. Organohalogen Compounds 43:239–242.

Vuorinen, P, Paasivirta, J., Keinänen, M., Koistinen, I., Rantio, T., Hyötyläinen, T. & Welling, L. 1997. The M74 syndrome of Baltic salmon (*Salmo Salar*) and organochlorine concentrations in the muscle of female salmon. Chemosphere 34: 1151–1166.

Westerberg, H., Fjälling, A & Martinsson, A. 2000. Sälskador i det svenska fisket. Beskrivning och kostnadsberäkning baserad på loggbokstatistik och journalföring 1996-1997. Fiskeriverket Rapport 3, 40 s.

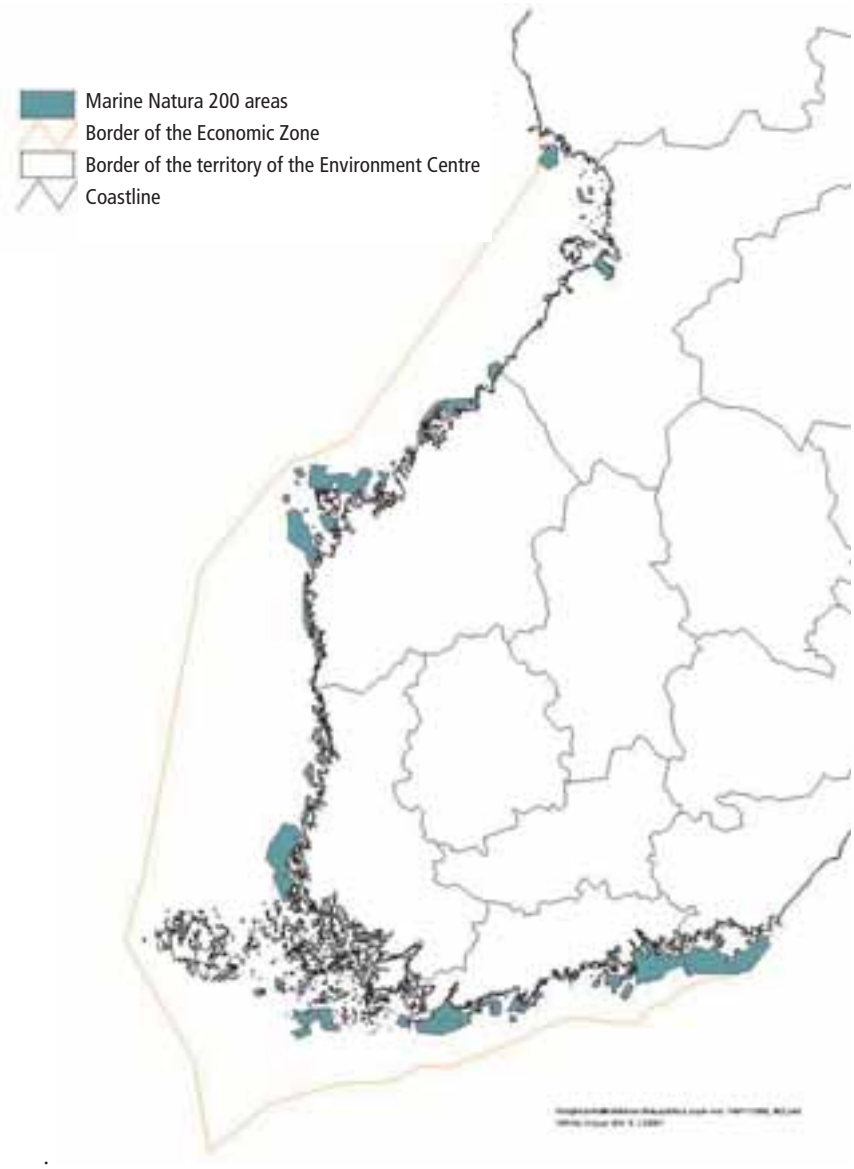
Westerling, B., Stenman, O. & Rudbäck, E.. 2005. Pathology of seals from the Finnish coastal waters, Lake Saimaa and Lake Ladoga in the years 1982-2004. International conference on Baltic seals, 15–18 February Helsinki, Finland.

Wiberg, K., Bergman, A. Olsson, M., Roos, A., Blomkvist, G. & Haglund, P. 2002. Concentrations and enantiomer fractions of organochlorine compounds in Baltic species hit by reproductive impaerialment. Environ. Toxicol Chem. 21 (12): 2542–2551.

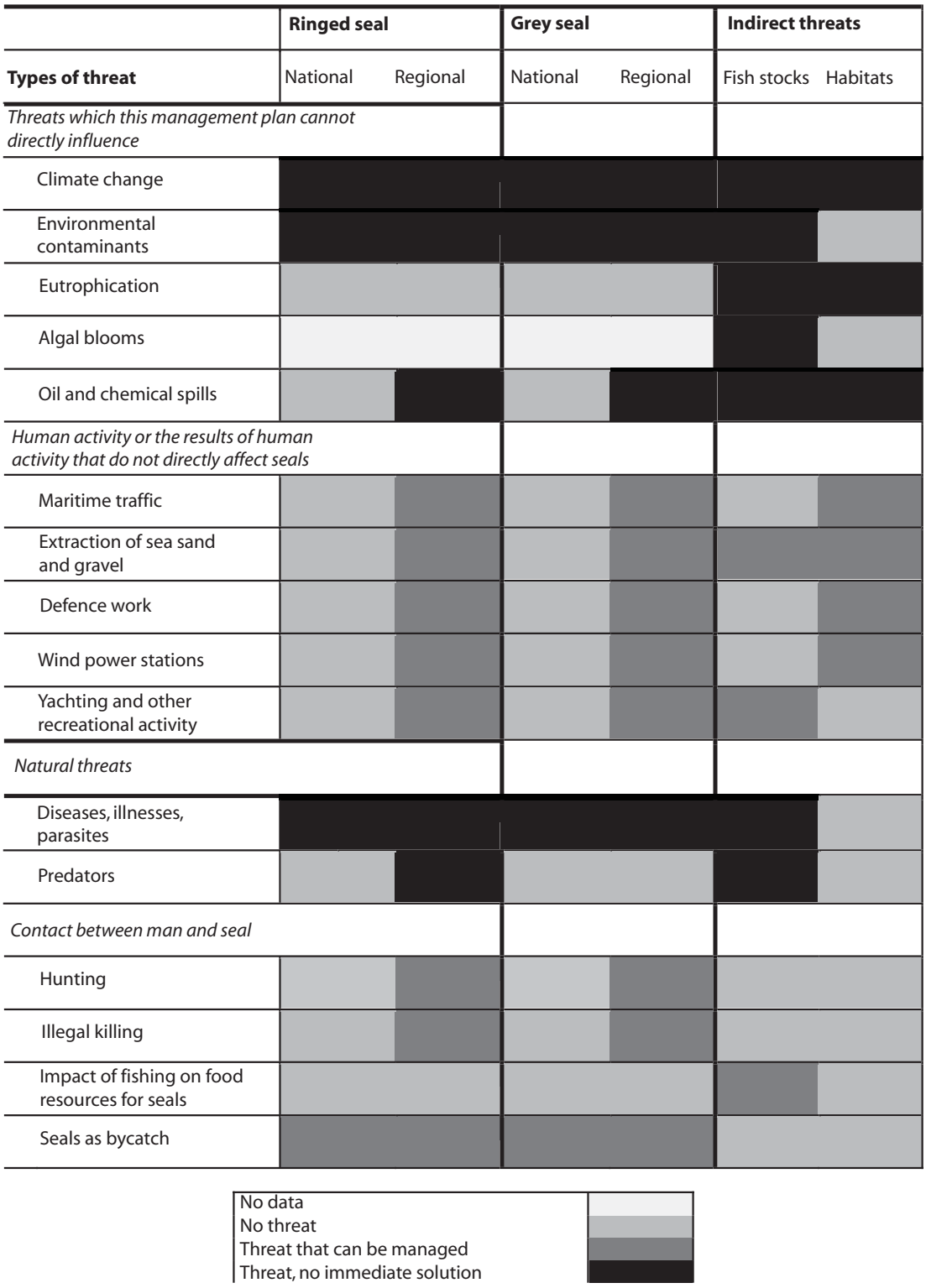
Ylimaunu, J. 2000. Itämeren hylkeenpyyntikulttuurit ja ihminen-hylje-suhde. Suomen Kirjallisuuden Seura, Helsinki.

Åländsk utredningsserie 1990:1 Förslag till sälskyddsområden 1990, Mariehamn 1990, ISSN 0357–735X

Appendix 1. The conservation areas on the Finnish coast which constitute a comprehensive NATURA 2000 network of 140 marine conservation areas, of which 66 areas are or may be important seal habitats.



Appendix 2. Summary of possible threats to Baltic seals and potential direct and indirect impacts.



# Publications of Ministry of Agriculture and Forestry

mmm.fi

3/2007 Maatalouspolitiikan vaihtoehdot
ISBN 978-952-453-316-4

4/2007 Itämeren hyljekantojen hoitosuunnitelma
ISBN 978-952-453-329-4

4a/2007 Förvaltningsplan för Östersjöns sälstammar
ISBN 978-952-453-337-9

5/2007 Kansallinen metsäohjelma 2010 – Seurantaraportti 2005–2006
ISBN 978-952-453-330-0

5a/2007 Finlands nationella skogsprogram 2010 – Uppföljningsrapport 2005–2006
ISBN 978-952-453-331-7
Vain verkkojulkaisu

5b/2007 Finland´s National Forest Programme 2010 – Follow-up report 2005–2006
ISBN 978-952-453-332-4
Vain verkkojulkaisu

6/2007 Eläimistä saatavia elintarvikkeita koskevan lainsäädännön sekä sen toimeenpanon ja soveltamisen vaikutukset pienten ja keskisuurten elintarvikeyritysten toimintaan
ISBN 978-952-453-335-5

7/2007 Suomen metsät 2007
Kestävän metsätalouden kriteereihin ja indikaattoreihin perustuen
ISBN 978-952-453-339-3

8/2007 Manner-Suomen maaseudun kehittämisohjelma 2007–2013
ISBN 978-952-453-342-3

9/2007 Suomen metsäpeurakannan hoitosuunnitelma
ISBN 978-952-453-343-0

10/2007 Suomen peltopyykannan hoitosuunnitelma
ISBN 978-952-453-344-7

11/2007 State of Finland´s Forests 2007
Based on the Criteria and Indicators of Sustainable Forest Management
ISBN 978-952-453-347-8

ISBN 978-952-453-348-5
ISSN 1238-2531

www.mmm.fi
P.O. 30, 00023 GOVERNMENT