

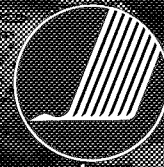
Nordic wetland conservation

TemaNord Environment



CONVENTION ON WETLANDS

(Ramsar, Iran, 1971)



Front cover: The boreal coniferous forest zone in the Nordic countries contains numerous small and large lakes that are characterised by having little access to nutrients and hence comparatively low production of plant material. The animal life in such localities usually consists of characteristic species, and rare ones seldom occur. The photograph shows how white water-lilies *Nymphaea alba* can dominate such lakes.

PHOTO: JON ARNE SÆTER

Nordic wetland conservation

Nordic wetland conservation

Publishing costs defrayed by the Ramsar Convention Bureau

Nordic wetland conservation

TemaNord 2004: 506

© Nordic Council of Ministers, Copenhagen 2004

ISBN 92-893-0987-3

Cover design and layout: Guri Jermstad, Trondheim, Norway

Copies: 400

Print: AKA-Print a/s, Århus 2004

Paper: Environment-friendly paper approved by Nordic Environmental Labelling

Distribution: This publication may be purchased from any of the agents listed on the last page

Printed in Denmark



Concept and editor-in-chief: Jon Suul, Directorate for Nature Management, Trondheim, Norway

Project secretary: Øystein Størkersen, Directorate for Nature Management, Trondheim, Norway

Translator: Richard Binns, RB Translations, Trondheim, Norway

Nordic Council of Ministers

Store Strandstræde 18

DK-1255 Copenhagen K

Phone (+45) 3396 0200

Telefax (+45) 3396 0202

Nordic Council

Store Strandstræde 18

DK-1255 Copenhagen K

Phone (+45) 3396 0400

Telefax (+45) 3311 1870

Web site: www.norden.org

Nordic Environmental Cooperation

aims to help improve the environment and prevent environmental problems arising in the Nordic countries and elsewhere. The cooperation is organised by the Nordic Committee of Senior Officials for Environmental Affairs. It determines common aims in action plans, decides on joint projects, promotes the exchange of information and administers aid schemes, for example to eastern Europe, through the Nordic Environmental Finance Corporation (NEFCO).

The Nordic Council of Ministers

was established in 1971. It submits proposals on cooperation between the governments of the five Nordic countries to the Nordic Council, implements the Council's recommendations and reports on results, while directing the work carried out in the targeted areas. The Prime Ministers of the five Nordic countries assume overall responsibility for the cooperation measures, which are co-ordinated by the ministers for cooperation and the Nordic Cooperation committee. The composition of the Council of Ministers varies, depending on the nature of the issue to be treated.

The Nordic Council

was formed in 1952 to promote cooperation between the parliaments and governments of Denmark, Iceland, Norway and Sweden. Finland joined in 1955. At the sessions held by the Council, representatives from the Faroe Islands and Greenland form part of the Danish delegation, while Åland is represented on the Finnish delegation. The Council consists of 87 elected members – all of whom are members of parliament. The Nordic Council takes initiatives, acts in a consultative capacity and monitors cooperation measures. The Council operates via its institutions: the Plenary Assembly, the Presidium and standing committees.

Preface

Nordic wetlands are vital for many species of plants and animals, especially birds, but are also of great importance as sources of water for people. Wetlands also are the source of a wide range of natural products, and are increasingly sites for ecotourism.

Presenting a complete view of the status of wetland conservation in the Nordic region, this report helps increase awareness about the species and landscape richness of Nordic wetlands. This report also sets out clearly their fragility, and the numerous threats they face. This reference document is thus an important tool for decision makers, and all people involved in the conservation and management of these outstanding global ecosystems – important in their own right, and also as mitigation against the threats from climate change.

The preparation of this report serves as an excellent example of fruitful transboundary collaboration between government instrumentalities dealing with environmental issues from Denmark, Finland, Iceland, Norway and Sweden.

This report also illustrates well the three “pillars” of the Ramsar Convention: working towards the wise use of wetlands, establishing a global ecological network through the development of the List of Wetlands of International Importance and encouraging international cooperation in the delivery of wetland conservation and wise use.

Indeed, helping conservation of wetlands in Nordic region means maintaining water quality and quantity, as well as biodiversity. It also shows the need for synergy between national efforts, as well as global and regional actions, under the Convention on Wetlands of International importance (Ramsar, Iran, 1971), the Convention on Biological Diversity, the Convention on Migratory Species, and the European Birds Directive.

The Ramsar Convention Secretariat is thus very pleased to have participated in this worthwhile joint effort, which will help nature conservation and biodiversity management more generally.

1st December 2003
Gland, Switzerland



PETER BRIGDEWATER
SECRETARY GENERAL
RAMSAR CONVENTION BUREAU

Preface

The Convention on Wetlands of International Importance Especially as Wildfowl Habitats, the Ramsar Convention, celebrated its 30th anniversary in 2001. It was also 30 years after the first major, joint Nordic nature conservation project began, which in fact concerned important wetlands in the Nordic countries, and 25 years after the European Wetlands Year, backed by the European Council. International efforts in classic nature conservation in the 1960s and 1970s were significantly oriented towards wetlands. Inspired by what was taking place elsewhere in the world, nature conservation work in several Nordic countries put considerable effort into protecting wetlands in the 1970s and 1980s.

These anniversaries and the new century and new millennium almost coincide in time, and these historic events help to make it relevant to examine the current status of wetlands and wetland conservation in the Nordic countries and undertake a scientific evaluation of what the future has in store here. It is opportune to look at our past efforts and experience against the perspective of the problems and challenges facing us in the future.

Using individually evolved measures, all the Nordic nations have been working on conservation plans and programmes linked with wetlands, and in recent years this effort has been integrated with work on biological diversity. All the Nordic countries have ratified the 1971 Ramsar Convention. In the Nordic countries which are EU member states, the EU directives dealing with habitat and bird protection have also considerably influenced the conservation of wetlands and their associated flora and fauna.

This report briefly presents some of the history of wetland conservation in the individual countries and in the Nordic countries as a whole. It also attempts to give a broad review of the information available on some wetland species and wetland areas, as well as describing the status of areas that have been directly or indirectly protected through one scheme or another, such as special national legislation, general biotope protection, being placed on the Ramsar List or other internationally recognised lists, or through the EU Habitat and/or Birds Directives. Relevant problems are assessed, together with future threats, challenges and needs.

The report concludes with recommendations based on experience gained and evaluations undertaken by scientific institutions in the Nordic countries and their partners over the past 30 years. These recommendations are principally aimed at the national bodies responsible for this work in the Nordic countries, but also the Nordic Council of Ministers and the international Ramsar Convention Bureau in Switzerland.

The work has been carried out by a project group composed of experienced staff who are responsible for the matters in question at the national management institutions. The secretariat and managerial functions have been at the Directorate for Nature Management (DN) in Norway. A scientific reference group set up in Norway to support the work has been composed of *Alv Ottar Folkestad*, Ulstein Borough Council, *Ingar Øyen*, Norwegian Ornithological Society, *Torris Ekker*, County Governor's Office in Sør-Trøndelag, *Svein Karlsen*, County Governor's Office in Nord-Trøndelag, and *Lars Løfaldi*, DN. In addition, *Asbjørn Moen*, Museum of Natural History and Archaeology, Trondheim, and *Peter Johan Schei*, DN, have provided valuable comments on the manuscript. *Tom Christensen*, Forestry and Nature Division at the Ministry of Environment and Energy has contributed information from Denmark, *Gísli Már Gíslason*, Department of Biology, University of Iceland, *Hlynur Óskarsson*, Agricultural College of Iceland, *Jóhann Óli Hilmarsson*, *Einar Þorleifsson* and *Ólafur Einarsson*, Icelandic Society for the Protection of Birds, and *Guðrún Þorvarðardóttir*, Nature Conservation Agency, have all contributed valuable input to various parts of the section on Iceland. The final version of the Finnish contribution is the work of *Esko Jakkola* and *Seppo Vuolanto*, Finnish Ministry of the Environment. The final version of the Greenland contribution is the work of Inge Thaulow, Directorate for Nature and the Environment in Greenland.

The report and its recommendations have been discussed and approved by the Nordic Working Group for Nature and Outdoor Recreation at its meeting on 8-9th August 2001.

This report has been partly funded by the Ramsar Bureau in Switzerland (see separate Preface).

The report is being published in separate Scandinavian (Norwegian, Swedish and Danish) and English editions.

Copenhagen/Nuuk/Reykjavik/Stockholm/Helsinki/Trondheim 1st June 2002

Sten Asbirk, Denmark

Thor Hjarsen, Greenland

Trausti Baldursson, Iceland

Torsten Larsson, Sweden

Timo Asanti, Finland

Jon Suul, Norway (project manager)

Øystein Størkersen, Norway (project secretary)



The crane (*Grus grus*) is one many Nordic waterbirds.

PHOTO: LARS LØFALDI

Contents

Preface (from the Ramsar Bureau).....	5
Preface.....	6
Where land and water meet.....	10
1 Introduction	
1.1 What are wetlands?.....	15
1.2 Convention on Wetlands of International Importance.....	15
1.3 Wise use concept.....	17
1.4 Wetland classification in EUs Corine Biotopes.....	17
1.5 Nordic wetlands in an international perspective.....	21
1.6 Trends in international wetland protection.....	22
2 Wetlands in the Nordic countries	
2.1 Types of wetland in the Nordic countries.....	29
2.2 The international importance of Nordic wetlands for flora and fauna.....	29
2.3 Important Bird Areas (IBAs) in the Nordic countries.....	35
2.4 Area of wetland in the Nordic countries.....	37
3 Wetland conservation in the Nordic countries	
3.1 Wetland report from the Nordic Council of Ministers in 1973.....	39
3.2 Nordic follow-up of the Ramsar Convention.....	40
3.3 Restoration of wetlands in the Nordic countries.....	46
3.4 Action plans to protect endangered species.....	46
3.5 Comments on the individual countries.....	48
3.5.1 Denmark.....	48
3.5.2 Greenland.....	68
3.5.3 Finland.....	82
3.5.4 Åland.....	95
3.5.5 Iceland.....	96
3.5.6 Norway and Svalbard.....	113
3.5.7 Sweden.....	131
4 Summary and evaluation of wetland conservation in the Nordic countries ...	147
5 Recommendations	154
6 Appendix	156
7 Sources and bibliography	170

Where land and water meet

Water is essential for life. In the passage of time, a vast richness and variation of life forms has arisen where water and land meet; many areas have particularly high biological production and good opportunities for both wildlife and people to find food. The first great cultures arose precisely in the richest areas of this kind on the Earth - near the outlets of the huge rivers, the Nile, Euphrates and Tigris, the Indus and Ganges, the Bramaputra, Yangtze and Hoang. Where these met and meet the sea, in the deltas they formed and form, where fresh water and salt water became and become brackish water, it was there the cultures had their origins.

Water is constantly moving. Water in the sea, in rivers, lakes, bogs and in all life evaporates to the atmosphere. There, the vapour condenses to form droplets of water that become life-bringing rain which finds its way back to its source through a perpetual cycle. The water cycle is essential for the dynamics in nature and the geological, chemical and physical processes upon which all life depends.

Natural climatic changes are among the phenomena which, over time, have been vital for nature and the species that, at any one time, have existed in the geographical region which is now called the Nordic countries. The Nordic landscape is characterised by processes that took place during and after the last Ice Age. Large parts of the North Sea were once dry land due to counterreaction from the weighing down of the adjacent land areas by the Fennoscandian ice sheet. In the Gulf of Bothnia, land uplift is still noticeable over a comparatively short period of time and new land is being formed from former areas of shallow water.

The seasonal variations in this part of the world mean that many wetlands are frozen and/or snow covered for parts of the year, while others are inundated. These contrasts during the year are one of the important characteristics of Nordic wetlands. Because

of the greatly changing conditions through the year, Nordic wetlands are able to perform a variety of functions for animal life in the various seasons.

Nature is not static. Now, when anthropogenic effects on the climate are being discussed, topics such as greenhouse effects, changes in ocean currents, melting of polar ice caps and rising sea level are relevant. Great changes may have dramatic consequences for all species, including man, for natural biotopes, like wetlands, and for areas created by man, like valuable farmland, cities, towns and villages.

The Ramsar Convention defines wetland as embracing all kinds of biotopes in which water is a primary element, down to a depth of 6 metres in salt water. Wetland is a collective term that includes many special biotopes, be they fresh water, brackish water or salt water, or permanent, temporary or highly variable as regards water content, and/or also biotopes with very special plant and/or animal species and communities.

Several factors account for the physicochemical and biological significance of wetlands. Wetlands are valuable for the water balance and for water buffering since they act as flood-delaying water traps with a capacity for storage. They also perform a valuable function in purifying water. Some types of wetland have also proved to be immensely important for storing CO₂ (carbon dioxide) and other climate gases (e.g. methane). Many are vital for water house-keeping, agriculture and other human activities. Wetlands are among the areas of the world with the highest biomass and the greatest biological production, and they also have a very broad range of functions for people and for plant and animal life.

For some time now, nature conservation circles have been particularly focusing on the many aquatic birds that depend upon wetlands in the breeding season, and/or during migration, and/or in winter. However,

there is every reason to draw attention to the multitude of large and small plants and animals that also live on and in wetlands and depend upon them for their very existence. That bird life, in particular, has been highlighted is no doubt because we have realised the need to literally take a bird's-eye view of wetlands. Many species do not recognise national boundaries, but migrate over long distances, using wetlands in many countries. Wetland conservation must therefore be implemented through an international effort so that vital biotopes along the migratory routes from south to north and the reverse are secured in common understanding. A migrating bird population is not the sole responsibility of one nation; problems associated with the protection of such species and their biotopes are the joint concern of several countries.

Traditionally, people have used, and are still using, wetlands in many different ways, for instance as places to live, for grazing, haymaking, obtaining wood or peat for fuel, and for hunting, shooting and fishing. The importance of wetlands for people can be indirectly seen through the many words and terms associated with them in, for example, the Nordic languages. Finnish, for instance, has more than 40 words describing different kinds of mire.

The ways in which people use wetlands took a more dramatic turn during the 20th century when more modern technology and practices, like the use of artificial fertilisers and pesticides, were introduced leading to the total reclamation or intensive use of many wetlands. Drainage, damming up, canalising, filling in, cultivation, regulation, building development and so on, for industry, electricity, harbours, transport, farming, recreation and other purposes led to significant, irreversible encroachments and a drastic reduction in the area taken up by certain types of wetland. This has had corresponding major repercussions for various habitats and life forms there. These forms of destruction and degradation of wetlands are still taking place in both the Nordic region and elsewhere in the world.

The threats to wetlands and the life associated with them have certainly not become fewer as time has passed. This applies both to wetlands in general and to areas protected through national legislation, or even inclusion on international lists. Resolutions to protect something do not automatically give protec-

tion; there has to be a will to follow up the decision. Many parties in both the private and public sectors will, over time, challenge the decision and perhaps try to have it reviewed. Taking the law into one's own hands - deliberately or unwittingly - has so far proved not to entail much risk of reprisal, police enquiries, or prosecution. Crimes against the environment and dumb fellow creatures are easily overlooked, and their spokespeople and guardians are few and weak.

Wetland conservation was part of classic nature conservation work throughout the 1900s. "Modern" wetland conservation was introduced internationally through the major thematic projects undertaken under the auspices of the World Conservation Union (IUCN) from 1965 onwards, namely Project Mar (wetlands and water birds), Project Aqua (fresh water and freshwater biology) and Project Telma (mires and their botany).

The work of the International Waterfowl and Wetlands Research Bureau (IWRB) in registering the waterfowl populations across all national borders, which began in the 1960s, also formed a valuable basis. These efforts did much of the spadework for what, in 1971, was to become the Convention on Wetlands of International Importance Especially as Wildfowl Habitats (the Convention on Wetlands, or CW), also known as the Ramsar Convention after the city in Iran where the concluding meetings were held. The Convention came into force in 1973.

Simultaneously, both the IUCN and the United Nations Educational, Scientific, and Cultural Organization (UNESCO) were laying the basis in the 1960s for two parallel international conventions, one on the World Natural Heritage and the other on the World Cultural Heritage. The ensuing debate led to them being viewed in a single context, somewhat in advance of its age, and the result in 1972 was a joint convention, UNESCO's World Cultural and Natural Heritage Convention, or World Heritage Convention. A number of other international nature conservation conventions and agreements have been adopted since then, which regulate the protection of areas and species, and which the signatory nations are obliged to follow up. These include the Bern Convention, the Bonn Convention and the Biodiversity Convention. The Biodiversity Convention can be considered a kind of umbrella agreement, upgrading and modernising

the Ramsar Convention, among others. It came into force on 29th December 1993. The Ramsar Convention and the Biodiversity Convention are now working closely together, in part through a joint work programme.

The importance of internationally binding cooperation on nature conservation, including wetland conservation, is becoming increasingly clear, as it is for a number of other areas of society, and it will grow still more important in the future. The impotence of nations, and local environmental crime perpetrated by both private and public sectors, intentionally or otherwise, and involving illegal encroachments of various kinds on protected wetlands and other protected areas, are likely to be more keenly focused upon in due course. Without international cooperation, conventions, agreements and stringent directives, as well as better follow-up and control, the opposing forces would have had much greater latitude. Consequently, the international effort does not just become active cooperation between the authorities that are responsible and scientists, it acquires at the same time an important strategic function in a long-term environmental conservation perspective through shifting times with differing national political regimes, fashions and ambitions.

The EU directives dealing with habitat conservation and bird protection, and to some extent the recent Water Directive from 2000, place the EU nations under substantial obligations within the sphere of classic nature conservation, including wetland conservation. According to these directives, wetlands that meet specific requirements regarding internationally important areas, including Ramsar sites, must be classified as Special Protection Areas (SPAs). Failure to follow up these directives, and violations of the regulations, may result in the matter being reported to the European Court of Justice and to penalties being meted out by the EU. The EU directives have meant that the value of, for example, the Ramsar Convention has decreased within the EU area because the directives have far more serious repercussions for nations that fail to fulfil their obligations. Contravening the Ramsar Convention does not have the same direct consequence as a breach of the EU directives.

The EEA agreement, which in the Nordic countries covers Iceland and Norway, deals with accommodation to the EU in many areas of society, but does not embrace nature conservation. Consequently, Nordic nations which are not EU members are so far not obliged to accommodate to the strict directives laid down by the EU for its member nations through, for instance, the Habitat and Birds Directives.

The European Council is one of the European bodies which, by degrees, has focused on wetlands and the need to protect them. Following Nature Conservation Year in 1970, the campaign theme for 1976 was wetlands. The European Council has also been engaged in this problem, in part through the recent establishment of the Emerald Network, a parallel to the EU Natura 2000 scheme for countries that are not members of the EU.

In a Nordic context, the first major cooperative project on nature conservation began in the same year, 1971, as the Ramsar Convention was adopted. It was no coincidence that the theme of this project was wetlands. This effort concluded with a report entitled "Important wetlands in the Nordic countries", published in 1973. It was of vital importance for raising awareness of the need for wetland conservation in several Nordic countries and led to priority being placed on national wetland conservation with national and/or regional plans for the necessary procedures to be implemented. This work, moreover, revealed good reasons for ratifying the Ramsar Convention.

The work on that report was one reason why the Nordic Nature Conservation Group (now the Working Group for Nature and Outdoor Recreation) was set up in 1974. After more than 25 years of national and international wetland conservation, it is natural that we should mark the theme once again and undertake a project that compiles and evaluates some of the national and international processes that have taken place in the Nordic countries and shows the current status and the problems and challenges facing us in the future.

Wetland conservation is at least as relevant today as it was 25 years ago, and the value of the efforts, and the results that have been achieved, have not decreased with time, rather quite the contrary. Nor has the need to continue the task of protecting wetlands, or to

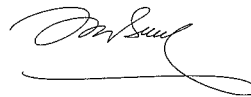
follow up the work with scientific and practical management. Many questions are likely to be raised in the future as to why much greater effort was not made earlier to protect and manage important wetlands. Within the EU, the European Court of Justice has already pointed out shortcomings in the national follow-up of the Habitat and Birds Directives in certain countries.

Nowadays, wetland conservation is part of a comprehensive environmental conservation perspective centred around biological diversity, at the same time as a number of cultural merits are linked with the problem. Wetland conservation, as part of classic nature conservation, has now been integrated with environmental conservation as a whole, and will continue to be so. This entails some risk that problems surrounding wetland conservation will be overshadowed by many other live environmental issues on national and international agendas if the topic is not regularly brought to the forefront for revision, revitalisation and renewed effort. It is now essential that we bring the topic forth again and restate the problems clearly. Much of what has been lost has gone forever through irreversible encroachments, and much of what has been won has not necessarily been won for ever. Lack of a sense of history, ignorance, unwillingness to stand by earlier decisions and shoddy management can, for instance, threaten wetlands, even those with international status. In the Ramsar context, there is therefore a special list of threatened Ramsar sites (the Montreux Record).

Nordic wetlands are under threat from many directions, and the next 25 years will present numerous challenges regarding both the conservation of unprotected wetlands and the management of those that have been protected. Protection is not normally directed against the traditional use of wetlands. In a historical perspective, many wetlands have been used by people for a very long time, and such traditional use (grazing, haymaking, fishing and so on) has had a great deal to say for the evolution of the landscape and the flora and fauna. In a modern sense, the concept of traditional use will often be synonymous with sustainable use. The threats normally have a completely different basis, and are just as much directed against the historical and traditional use of the wetlands. When traditional use ceases, new problems arise and, among other things, will entail

that conservation must also strive to maintain as much as possible of the most positive aspects of the traditional use. The conservation of some wetlands will therefore also be a question of natural heritage as well as cultural heritage, the Vejlerne in Denmark being one of many examples of this.

From the point of view of conservation management, Nordic experience in this field demonstrates that it is essential to strengthen the general effort to protect and secure wetlands. At the same time, it is vital to increase the effort to follow up the wetlands that have already achieved some kind of formal, national protection, and/or have received international conservation status. It is, moreover, important to extend the effort of reclaiming, restoring and maintaining wetlands, and making them readily available and attractive to the general public, as well as supervising, overseeing and monitoring their assets. To be able to perform this work, it is vital that the management authorities responsible for these tasks ensure that they build on previous experience and consciously strengthen their expertise. Likewise, it is essential that scientific institutions are put in a position where they can extend their knowledge and take part in discussions about the major management problems. There is, moreover, good reason to stress the important role which national non-governmental organisations can play in recording, monitoring and other work. A joint effort on the part of the Nordic countries will also be important for passing on previous experience and organising networks between national management authorities.



JON SUUL, DR. ING.
PROJECT MANAGER



Bogbean *Menyanthes trifoliata* and broad-leaved pondweed *Potamogeton natans* are characteristic species for northern lakes.

PHOTO: JON ARNE SÆTER

1 Introduction

1.1 What are wetlands?

Water is absolutely essential for all life on Earth, and wetlands are among the most important features influencing the environment and living conditions for plants and animals. Wetland is a generic term covering a large number of types of habitat that form the border zone between land and water. Such habitats may consist of shallow water, or water may be present just beneath the surface. Several definitions of wetland exist, but shallow lakes and seas, mires, swamp woodland and flowing water are usually looked upon as wetland, generally also areas covered with water for some parts of the year. The ground in large parts of the Nordic countries is snow covered in winter and this helps to cause the water level to vary greatly and leads to regular inundations beside lakes and rivers when the snow melts. The term wetland is really *relatively new*, being first used during the 1960s in connection with the development of international initiatives to protect various kinds of wetland as ecosystems and habitats for many species.

A number of different factors determine the appearance of wetlands and how they function. Precipitation, runoff and evaporation help to bring about special hydrological conditions in an area. The bedrock, soil structure and topography are other important factors. Running water produces completely different conditions for life than water which is static. Whether the water is fresh, brackish or salt also has a great deal to say for which life forms can live there. Wetland that is unmanaged differs greatly in character from that which is regularly grazed or mown. When these various factors are combined, a great range of variation in the types of ecosystem arises, all of which will be covered by the term wetland.

Wetland is thus complex and the term is used broadly to cover very many different and varied types of ecosystem. Since there is also a great deal of variation from south to north in the physical conditions supporting life, the assemblage of species also varies greatly. There is a need for both a brief definition of

the term and a more thorough elaboration of what the term covers in various countries. The Convention on Wetlands (the Ramsar Convention) has played a leading role in the latter task. By degrees, other institutions have provided further amplification of the term, for instance through EU efforts to devise common definitions and terms in connection with the establishment of a system to categorise European nature (cf. CORINE Biotopes) and with the setting up a network of protected areas (Natura 2000). In this report, the definition of wetland will primarily follow the description given in the Convention on Wetlands.

1.2 Convention on Wetlands of International Importance

This international agreement (Convention) is now best known as the Ramsar Convention, after the town in Iran where the already negotiated agreement was presented for signing. The Convention secretariat now has its office in Switzerland.

According to the Convention, wetland is found where the water table stands at or close to the ground surface, or where land areas are covered by shallow water. The Ramsar Convention now adopts a broader approach to wetland as a concept than when it was signed in 1971. The principal emphasis then was on protecting birds associated with wetland. Subsequently, focus has also been directed at endangered species in general and mire as a type of ecosystem.

Wetland is found in every country, from the tundra to the tropics. The exact proportion of the world's surface covered by wetland is not known. The World Conservation Monitoring Centre (WCMC) has estimated approximately 7.5 mill. km², or about 6 % of the land surface of the Earth. Approximately 2 % of this is lakes, 30 % mires, 26 % damp grasslands, 20 % swamps and 15 % inundated land. Mangrove swamps cover about 240 000 km² of coastal areas and coral reefs now cover an estimated 600 000 km². In

addition, it should be pointed that the Nordic countries have particularly large areas of shallow marine waters, archipelagos and skerry coasts, tidal flats, brackish water and estuaries.

The Convention defines wetlands thus:

"wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres" (Article 1.1) and "may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands" (Article 2.1).

The Convention describes in general terms five main types of wetland:

- *"marine (coastal) wetlands including coastal lagoons, rocky shores and coral reefs);*
- *estuarine (including deltas, tidal marshes and mangrove swamps);*
- *lacustrine (wetlands associated with lakes);*
- *riverine (wetlands along rivers and streams); and*
- *palustrine (meaning "marshy" - marshes, swamps and bogs*)."*

The Convention also mentions anthropogenic wetlands such as fish and prawn dams, farm ponds, irrigated farmland, salt flats, dams, ponds in gravel pits, sewage treatment plants and canals.

* The terms "bogs", "peatlands" and "mires" are often used interchangeably. However, the International Mire Conservation Group (IMCG) has decreed that "mire" must primarily be used as a generic English term for all such features.

National interpretations of the term wetland

In addition to the official, descriptive definitions, an intuitive understanding of what is regarded as wetland has evolved in some countries. For instance, oligotrophic fresh water (poor in nutrients) will not normally be thought of as wetland in Norway, in the sense that it has great conservation merit. This is partly because there are vast numbers of such large and small lakes in Norway. Nevertheless, it should be

pointed out that it is this type of fresh water that is considered endangered in a European context. The traditional view of wetland in Norway is therefore, in short, fresh water with a rich occurrence of vegetation, mires, damp grasslands, river deltas, tidal flats and shallow marine areas.

The countrywide inventory of wetlands that has been taking place in Sweden since the early 1980s has applied a much more limited definition than that employed by the Convention. The inventory only concerns parts of lakes covered by vegetation. The mapping of wetlands for this inventory therefore includes neither rivers nor shallow marine areas.

Criteria for identifying internationally important wetland

At the seventh meeting of signatory nations to the Convention on Wetlands, in May 1999, the parties adopted revised criteria for selecting internationally important wetlands (Ramsar sites).

Criteria for internationally important wetlands (Ramsar sites)*

Group A. Sites containing representative, rare or unique wetland types

1. A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

Group B. Sites of international importance for conserving biological diversity:

Criteria based on species and ecological communities

2. A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.
3. A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.
4. A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

Specific criteria based on waterbirds

5. A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.
6. A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

Specific criteria based on fish

7. A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.
8. A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

* See the web site "<http://ramsar.org>" for further details on, and explanations of, these 8 criteria.

1.3 Wise use concept

Guidelines for the protection and sustainable use of wetlands were discussed and approved at meetings of the signatory nations in 1990 and 1993. This resulted in a book on the subject published in 1993 ("Towards the Wise Use of Wetlands"). Wise use is defined here as: *"The wise use of wetlands is their sustainable utilization for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem."*

Sustainable utilisation is defined as: *"human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations."* The wise use concept applies to all types of wetland in countries signatory to the Convention, both those listed as Ramsar sites and all others. The concept seeks to formulate and guide the implementation of a general wetland policy and wise use of individual wetlands in the member countries. This is looked upon as an integral part of sustainable utilisation and development. The following principles form the basis for national implementation of the concept:

1. Establishment of a national wetland policy
 - a. Measures to improve institutional and organisational systems
 - b. Measures to improve legislation and national policy
 - c. Measures to enhance knowledge and awareness regarding wetlands and their merits
 - d. Measures to map the status of, and identify prioritised tasks for, all wetlands in a national context
 - e. Measures against problems in particular wetlands.

2. Prioritised measures at the national level.

1.4 Wetland classification in EUs CORINE Biotopes

Through its CORINE (Cordination of information on the Environment) programme, "Habitats of the European Community" (1988), the European Community broadly defined the habitats in the member states. This multi-thematic programme aimed to provide comprehensive, complete and compatible information on the environment across the European Community. One theme of the programme is "CORINE Land Cover", which, partly by using satellite data, recognised 44 mappable units, 10 of which belong under the concept of wetlands and water. This is primarily a land-use data base. Another part of the programme is "CORINE Biotopes", which, in addition to distinguishing a series of biotopes, also lists a set of criteria for identifying those which need protection to ensure their continued existence. Key criteria are the presence of endangered species and/or sensitive habitats, and the abundance of groups of species or of habitats. To ensure a broad geographical distribution, the areas must also fulfil a number of additional criteria. They must be one of no more than 100 such areas in the EU, or one of five in Europe, or one of the 100 most important and most representative areas in the EU, or one of the five most important or most representative areas in Europe, or they must support at least 1 % of the EU population of an endangered species.

"CORINE Biotopes" that are relevant for wetlands

"Coastal and halophytic communities"

Oceans and seas; sea inlets; tidal rivers and estuaries; mud flats and sand flats; salt marshes, salt steppes and gypsum steppes; coastal sand-dunes and sand beaches; shingle beaches, cliffs and rocky shores; islets and rocky stacks; machair.

Non-marine waters

Lagoons; standing fresh water; standing brackish and salt water; running water.

Bogs and marshes

Raised bogs; blanket bogs; water-fringe vegetation; fens, transition mires and springs."

Regional divisions in the EU

In connection with the work being done to implement the EU Habitat Directive, Europe has been divided into six large biogeographical regions, the alpine, boreal, continental, Atlantic, Macaronesian and Mediterranean regions.

The EU also applies the criteria of rarity and the importance of the areas for species (function) to identify habitats that are of special interest for the EU. This includes the rarity of the habitats in European and global perspectives, as well as the occurrence of endangered species. In the comparatively restricted Nordic region, the uniqueness (endemism) of habitats or species and/or whether the species are placed on European or global Red Lists may be additional criteria. In relation to which areas are representative, or in the case of habitats and species which the European nations have a large proportion of (responsibility habitats and responsibility species), previously defined thresholds can act as values for inclusion. For instance, a country or region that has more than 25 % of a habitat or the occurrence of a species.

Habitat Directive (1992)

"CORINE Biotopes" formed the basis of the Habitat Directive, which categorised and selected habitats in Europe to which the member states must direct special attention. It also established a network of important sites within the EU, referred to as Natura 2000. It

should be noted that the list is incomplete with respect to wetland, since it fails to include a number of types that are found within the EU.

Important Bird Areas (IBAs) (1989, 2000)

Based on the EU "CORINE Biotopes", and as a direct consequence of work on the EU Birds Directive in the 1980s and the establishment of criteria for identifying what were termed Special Protection Areas (SPAs), BirdLife International published for the first time in 1989 (and later in 2000) a list of what were called Important Bird Areas (IBAs) in, for example, Europe.

Categorisation of types of wetland in Europe applied in the IBA programme:

Tidal river and enclosed tidal waters

A zone of broadening in rivers entering the oceans or their connected seas, and river channels below the tidal limit. All marine and marine-pelagic and benthic plant communities, and all rivercourse and river-bed plant communities are included.

Mudflats and sandflats

Sands and muds on the coasts of the oceans, their connected seas and associated lagoons, submerged for parts of every tide or for part of the annual cycle, devoid of vascular plants, but usually coated by blue algae and diatoms. They are of particular importance as feeding grounds for wildfowl and waders.

Salt marshes

Communities of flowering plants, for the most part halophytes (salt-tolerant), colonising sites submerged by high tides at some stage of the annual tidal cycle of oceans and their connected seas. This category also includes similar halophyte communities colonising inland, permanently or temporarily saline, hypersaline or brackish water bodies and their periphery, including inland enclosed seas, lakes, pools, sabkhas, rivers, springs and seeps, as well as, by extension, azonal strongly differentiated communities developing on habitually dry, alkali, chloride or gypsum soils of the steppe or forest zones (e.g. salt steppes, salt scrubs, salt forests). Zonal communities of the desert and semi-desert areas, composed to

varying degrees of halophytes or gypsophytes, are listed under 'Desert' or 'Semi-desert'.

Sand dunes and sandy beaches

Sand-covered shorelines of the oceans, their connected seas and associated coastal lagoons, fashioned by the action of wind or waves. Sand bars and sand banks on rivers should be classified under 'Rivers and streams', and inland sand-dunes form their own category under 'Rocky areas'.

Shingle and stony beaches

Beaches of the oceans, their connected seas and associated coastal lagoons, covered by pebbles, or sometimes boulders; usually formed by wave action.

Coastal lagoons

Saline or hypersaline waters of the vicinity of the oceans and their connected seas, often formed from sea inlets by silting and cut off from the sea by more or less effective obstacles such as sandbanks or mudbanks.

Standing fresh water

Non-marine brackish, saline or hypersaline lakes, pools and ditches, their features, their associated pelagic and benthic communities, and their beds of macrophytic submerged or offshore vegetation. This category includes large inland 'seas', such as the Caspian Sea.

Rivers and streams

All rivers and streams (running water), permanent or temporary, fresh or saline.

Raised bogs

Highly oligotrophic (nutrient-poor), strongly acidic plant communities composed mainly of *sphagnum* moss growing on (and forming) peat, and deriving moisture only from rainfall (ombrotrophic). They form only in relatively cool climates with heavy rainfall. They are most widespread in the boreal zone and in the mountains and hills of the nemoral zone; they occur locally in the lowlands of the nemoral zone and rarely in the continental steppe zones. Aapa and palsa mires are included in this category.

Blanket bogs

Plant communities similar to raised bogs, on flat or gently sloping ground with poor surface drainage, in oceanic climates with heavy rainfall (north-west Europe only).

Water-fringe vegetation

Reed beds and large-sedge plant communities of the margins and floating rafts of lakes, rivers and brooks, and of fens and eutrophic (nutrient-rich) marshes.

Fens transition mires and springs

Small sedge and related plant communities of fens, transition mires and quaking bogs; vegetation of springs.

New Nordic habitats in the EU

The inclusion of Finland and Sweden among the EU member states in 1995 led to a need to supplement the existing list with several habitats that were not formerly defined in the EU.

Types of wetland in the Nordic countries which are included in the EU Natura 2000 list after Sweden and Finland became EU members*:

- "Coastal and halophytic habitats
- Sea-shore meadows and narrow inlets
- Freshwater habitats - standing water
- Freshwater habitats - running water
- Heaths
- Mires
- Wet forests"

* Appendix 6.1 gives a more detailed definition of habitats of a wetland character that became covered by the Habitat Directive after Finland and Sweden joined the EU.



Freshwater is an important part of Nordic nature. From Storsjön, Jämtland, Sweden.

PHOTO: JON SUUL

1.5 Nordic wetlands in an international perspective

The natural conditions in the European region vary greatly from north to south and west to east, for instance from the damp, maritime areas in the west with their heavy precipitation to the dry steppes in the east. The vegetation in wetland areas is affected by physical conditions, some of which are identical over extensive tracts of land so that types of vegetation and species have features in common over large areas. Despite the large distances involved, the forms thus often closely resemble one another, although many species are often different. Natural factors like distances, bedrock, soils and climate (temperature and precipitation) are among the most fundamental ones for evolving similarities within species and habitats, and also dissimilarities in types of species and habitats.

Regional divisions in the Nordic area

Based on climate, it is normal to divide Europe into six regions:

1. *Arctic region*, where the temperature in summer is generally below 10° C, winters are cold and there is a great deal of permafrost and little precipitation (<250 mm). Occurs only in Greenland, high altitudes in Iceland, the northernmost part of Norway, Svalbard and further east.
2. *Boreal region* is in the north, the areas being cool (summer temperature approximately 15° C) and relatively dry (<500 mm). The Scandinavian mountain chain blocks the passage of moist Atlantic air. Occurs in Norway, Sweden, Finland and further east.
3. *Atlantic region* is dominated by continuous low pressure systems which bring rain and mild air to the coasts of Europe. Depending on the local geographical conditions, the annual precipitation in these areas may reach 1000 to 2000 mm and frost in winter is comparatively unusual. Occurs along the outermost coast of Norway, in Denmark, Great Britain and Ireland, western France and Portugal.
4. *Central European region* is dominated by high pressure systems from the east which reduce and block the marked influence of moist, mild air from the west. The summer temperature is high (>20° C) and there may be frost during 1-3 months. Occurs from southern Sweden and eastern Denmark eastwards, and in central Europe.
5. *Pannonic region* (steppe areas) is the driest part of Europe (<450 mm) and there is great contrast between summer and winter temperatures. Occurs in south-eastern Europe and eastwards from there.
6. *Mediterranean region* has the most stable climate in Europe, with warm, dry summers.

As a consequence of this, the vegetation in the Nordic region can be divided into the following three main types: 1) *Treeless arctic and alpine areas* (Svalbard, parts of Iceland and mountainous parts of Fennoscandia), 2) *Boreal woodland and forest* (coniferous and deciduous woodland and forest over large parts of Fennoscandia and parts of Iceland), and 3) *warmth-demanding deciduous woodlands* (nemoral woodland in southern Norway, southern Sweden and Denmark). These three main types can be further subdivided into many more types of vegetation (see, for example, Types of vegetation in the Nordic countries (Nord 1994)).

Geography and anthropogenic impacts

The activities of people over thousands of years have radically altered the original landscape in most of Europe. Owing to poorer climate and far fewer inhabitants, the landscape in the arctic and boreal regions in the north has undergone significantly fewer changes, even though many wetlands here, too, have been subjected to varying degrees of exploitation.

Where natural conditions were appropriate, the European landscape once contained wide expanses of marshes, bogs and fens, but intensive, wide-ranging drainage and cultivation of these areas has led to such mire landscape becoming uncommon in central Europe. Species of flora and fauna on mires, which now have their main distribution in the northerly areas and are often looked upon as trivial species there, are therefore scarce in the central European landscape. Both mire as a habitat and the species associated with mires are therefore often placed on national Red Lists in these countries.

It may be said that in many ways the Nordic countries have types of wetland that represent a cross section of most of the types found in Europe, including, for instance, extensive intertidal zones, shallow lakes in southern areas, an extremely broad variation of mire types from the lowlands to the highlands and an equally broad variation in types of watercourses from those rich in nutrient to those with little nutrient and from the lowlands to the highlands. These varia-

tions also form the basis for a very great variation in the flora and fauna.

Types of wetland for which Nordic countries have special responsibility

In the effort to determine priorities in the conservation and management of habitats, it may be useful to identify habitats for which the Nordic countries have special responsibility in an international perspective. These are types of landscape or environment that are rare internationally, or the majority are located in the Nordic countries.

In an international perspective, the Nordic nations have special responsibility for the following types of wetland (see Nord 1995:501):

- *Archipelagos*: even though this type of wetland is so common in several Nordic countries, it is very uncommon elsewhere in the world
- *Wetlands*: the Nordic nations have a large percentage of the wetlands in western Europe, especially mires and swamp woodlands; the Nordic aapa mires are particularly interesting
- *Undeveloped rivers*: many of the still undeveloped rivers have great international value
- *Myvatn in Iceland*, where both the geology and the biology are unique
- The *large rivers in Iceland* that flow over lava fields are unique in the Nordic countries
- *Marine environments in the Baltic Sea* are unique in several respects
- The *Wadden Sea* stretching from southern Jutland to Holland (best preserved in Denmark).

1.6 Trends in international wetland protection

The history of modern nature conservation has roots going all the way back to the second half of the 19th century. At that time, the interest for safeguarding beautiful landscapes and undisturbed wildernesses was the important incentive for setting up protected areas. Then, as now, the interest for bird life also played a key role. The first societies for the protection of birds were founded in Europe and North America around 1900, and the first international nature conservation agreements (conventions), especially aimed at protecting birds from being hunted during

the breeding season, were negotiated in the early 1900s. They came as a consequence of reactions to the widespread collecting of feathers for the fashion industry, which led to hundreds of millions of birds throughout the world being killed during the breeding season and many species even being made extinct. Regulations to combat this came into force, and the fashion of using feathers gradually died out. Later on, in the second half of the 20th century, the destruction of wetland reached such a scale and became so obvious that a new international initiative was taken to halt the decline in the populations of birds associated with wetland.

The MAR project

The IUCN (International Union for Conservation of Nature), in cooperation with the ICBP (International Council for Bird Preservation, now BirdLife International) and the IWRB (International Wetlands Research Bureau, now Wetlands International), took the initiative to try to set up a strategy to combat the problems associated with the reduction of the area taken up by wetland and the related decline in bird populations. This led to a conference (the MAR Conference) being held in France in November 1962.

After the MAR Conference, the IUCN published a list of internationally important wetlands in Europe and North Africa, using birds as the selection criterion. The list was accompanied by a recommendation for the protection and sustainable utilisation of these areas. It was also recommended that the list be used as the basis for a future convention on wetlands. The localities were divided into two categories: "A) *sites of major importance for wetland bird populations*, and B) *sites of vital importance for migratory birds, usually not with huge concentrations or rare birds*." A systematic review of the types of wetland that were to be defined as wetland in this context was also included. These eight types were subsequently used as a basis for the definition now used in the Wetland Convention.

The IUCN report listed 25 A-category localities and 9 B-category localities in the Nordic countries (see Table 1.1). These two lists bear the hallmark of this being an initial attempt to identify internationally important wetlands. For instance, Iceland had contributed no localities, although it was mentioned in the text as having large numbers of wetlands, and two localities were used as examples.

Table 1.1 Important wetlands in the Nordic countries, according to an IUCN report in 1965.

	DK	FI	IC	NO	SW	Total
A	4	-	-	4	17	25
B	3	3	-	3	-	9

The MAR Conference, moreover, recommended that lists be drawn up of corresponding localities based on flora and other groups of species. The first list came as a result of the Aqua Project: "List of Aquatic Sites Proposed for Conservation on the Basis of their Scientific Value". The criteria here were limnological and hydrological. The Telma Project resulted in the drawing up of a list of mires in temperate regions, these areas subsequently becoming known as Telma mires.

Ramsar Convention

In response to the MAR Conference in 1962 and subsequent conferences, work began on establishing an international agreement on the conservation of wetlands. It was intended that this would place great emphasis on preserving wetlands as natural environments and features that are vital for the lives of both people and the organisms associated with them. The parties put the final touch to this new agreement in the city of Ramsar in Iran on 2nd February 1971. It was the first global agreement on the protection and sustainable use of natural resources.

From the outset, the emphasis was on birds associated with wetlands, but the Convention has subsequently been extended to cover several additional aspects of wetlands and their sustainable utilisation. The overriding aim of the Convention's effort is to promote a better understanding of wetlands as extremely important habitats for biological diversity and providers of functions upon which everyone depends.

Nations signing the Convention were required to designate at least one site within their borders for inclusion on the list of important wetlands (termed Ramsar sites) which the signatory nations were committed to preserve. The Convention has adopted special criteria which determine which sites can be regarded as fulfilling the requirements

of such areas and hence which areas are candidates for inclusion on the list of Ramsar sites. Since the Wetland Convention came into force in 1975, it had been ratified by 133 nations by October 2002. These nations had by then selected 1198 wetlands throughout the world, covering an area of 103.4 million ha, for inclusion on the list of wetlands of international importance.

Important Bird Areas (IBAs)

Other organisations have also been involved in compiling information about internationally important wetlands, including the "shadow lists" drawn up to aid the signatories of the Wetland Convention in their task of identifying wetlands that may fulfil the criteria demanded for adoption as Ramsar sites. A similar review for Europe was published in 1989 by the International Council for Bird Preservation (ICBP, now known as BirdLife International) and this was called "Important Bird Areas in Europe". These sites, commonly referred to as IBAs, have since achieved considerable attention through publications from BirdLife International and are used, for instance, by the EU as a basis for conservation plans. The second and most recent list of IBAs was published in 2000 (Table 1.2).

Table 1.2 Important Bird Areas (IBAs) in the Nordic countries, according to BirdLife International in 1989 (Grimmet & Jones 1989) and 2000 (Heath & Evans 2000). Due to the use of different selection methods, some data are not directly comparable between 1989 and 2000.

	1989		2000	
	Number	Area - km ²	Number	Area - km ²
Denmark	118	ca 1000	127	40 701
Faeroes	19	5.56	19	67
Finland	35	ca 2000	96	27 400
Greenland	65	ca 15 000	55	25 416 (ice-free area)
Iceland	53	5060	61	7345
Norway	49	7810	52	9307
Svalbard/ Jan Mayen	18	-	14	34 842
Sweden	33	9780	63	12 678
Total	390	ca 40 000	487	157 756

In 2001, BirdLife International published a new analysis of IBAs as potential Ramsar sites in Europe. This is a review of IBAs that fulfil the Ramsar criteria based on bird species (including endangered species) and ecological communities (criteria 2 and 4), and in relation to the waterbird criteria (criteria 5 and 6). It provides an indication of the current status in the effort to establish Ramsar sites in Europe and can be viewed in the light of Article 2 of the Convention "Each Party shall designate suitable wetlands within its territory for inclusion in a List of Wetlands of International Importance." The report shows that approximately 26 % of the IBAs in the Nordic countries had been designated as Ramsar sites by 2001 (see Table 1.3).

Table 1.3 Important IBAs in the Nordic countries that fulfil the requirements placed on Ramsar sites, and their status in 2001 in relation to the Ramsar Convention.

	IBAs that fulfil Ramsar criteria	IBAs designated as Ramsar sites
Denmark	59	32
Faeroes	18	0
Finland	47	7
Greenland	51	10
Iceland	59	3
Norway (incl. Svalbard/Jan Mayen)	61	9
Sweden	52	22
Total	320	83

BirdLife International also published a report in 2000 that concerned marine IBAs in the Baltic Sea and adjoining areas in the Kattegat (Skov et al. 2000). It presented 169 sites, some of which are within the economic zones of the respective nations (Table 1.4).

Table 1.4 Marine IBAs in the Baltic Sea and adjoining areas (Skov et al. 2000).

Country	No. of areas
Denmark	26
Finland	31
Sweden	35

Other Conventions and Agreements

Man and Biosphere (MAB) (1970)

At the end of the 1960s, UNESCO was engaged in the "Man and Biosphere" programme, which aimed to get the nations of the world to set aside Biosphere Reserves. By March 2001, 94 countries had designated 400 such areas. The overriding aims of the Biosphere Reserves are to protect the natural and cultural environment, evolve a sustainable utilisation of the natural resources and encourage research, education and the provision of information. The work has been given low priority in the Nordic countries. Norway (Svalbard), Greenland, Sweden and Finland have designated a total of five areas. In a wetland context, it is first and foremost the Finnish area that is of interest, an archipelago west of Helsinki that covers approximately 420,000 ha. Lake Torneträsk occupies the central part of the only Swedish area, which comprises 96,000 ha. Plans exist to designate the Ramsar site on the River Helge in southern Sweden as a new Biosphere Reserve.

World Heritage Convention (1972)

All the Nordic countries have ratified the UN World Heritage Convention, which aims to protect the most valuable cultural and natural environments in the world. The signatory nations themselves propose areas and sites, which are then evaluated in accordance with specific criteria for inclusion on the World Heritage List. When a nation ratifies the Convention, it not only commits itself to look after and protect the areas or objects selected in its own country, but also to endeavour to protect the heritage of other countries. By 31st December 2002, only Sweden had successfully nominated valuable areas of natural environment (three areas) for inscription on the World Heritage List. One of these (Laponia in northern Sweden) contains large tracts of wetland, including Sjaunja, a Ramsar site. On 31st January 2003, Greenland is nominating Ilulissat (Jakobshavn) at Isfjord, and Norway the Vega Archipelago (Vegaøyane) for inscription on the World Heritage List.

Bern Convention (1979)

The Convention on the Protection of Wild European Plants and Animals and their Habitats came into force in 1979 and the Secretariat is placed under the European Council. The Convention has been a fundamental instrument for protecting European flora and fauna through the drawing up of common, basic premises for the efforts of the European nations to protect nature, for instance through national legislation. The Convention has so far mostly focused on endangered and vulnerable species. The species on List 1 (flora) and List 2 (fauna) must be protected within the signatory nations. In addition, in accordance with Article 4.1, the signatories must ensure that the habitats of the wild flora and fauna are protected, especially as regards species on Lists 1 and 2. The work they undertake with regard to wetland protection is a natural consequence of this.

Since the protection of species demands international cooperation, the Bern Convention has also paved the way for close cooperation between the signatory nations and with other international initiatives such as the Biodiversity Convention and the EU. To be able to put Article 4, dealing with the protection of the habitats of the species, into operation, the parties have recently agreed to identify important areas of interest for conservation (Areas of Special Conservation Interest - ASCIs) and then register these in the Bern Convention. These ASCIs are intended to form a network of important areas in Europe, referred to as the Emerald Network, which extends across all the European nations and therefore has a pan-European character.

As in the case of Ramsar sites, it is the individual nations themselves that have to register the areas to the network and are thereafter obliged to comply with international premises for preserving them. The network has much in common with two other initiatives in Europe, the EU Natura 2000 and the Pan-European Ecological Network (PEEN). The Emerald Network is an extension of the principles of Natura 2000 to cover nations outside the EU. In relation to PEEN (see PEBLDS), the Emerald Network is one of several which are helping to develop a Pan-European Ecological Network.

Bonn Convention (1979)

The Convention regarding the Protection of Migratory Species is a global UN agreement on the protection of migrating species of wild animals. Because many species migrate between, for instance, breeding and wintering areas, international cooperation is essential to ensure that they have good conditions in which they can live throughout their geographical range. National or regional conservation measures alone may have little effect if they are undermined by negative impacts elsewhere. The placing of species on a List 1 and a List 2 indicates different levels of protection for the species concerned. In accordance with Articles 2 and 3, the signatory nations are called upon to implement the protection of species whose survival is in danger (List 1), and also to protect, and if necessary restore, their habitats. Article 4 states that for species figuring on List 2 (List 1 species may also be placed there) special regional agreements can be drawn up to provide guidelines for their management in the region concerned.

The Afro-Eurasian Waterfowl Agreement (AEWA), which came into effect in 1999, is an example of an operationalisation of the Bonn Convention on a regional level to protect and manage List 2 species. The agreement states which species it covers and for which species either national or international management plans must be prepared. The management plans also state the areas that are important for the species. Flyway management plans for geese are an example of management plans and international cooperation where all aspects of the management of the species are discussed and follow-up plans are presented.

EUs Birds Directive and Habitat Directive (1979 and 1992)

Two EU directives have direct importance for the preservation of habitats, including wetlands, and species within the borders of the EU. These are the Birds Directive (79/409/EEC) and the Species and Habitat Directive (92/43/EEC). The Nordic nations which are members of the EU, Denmark, Finland and Sweden, are legally bound to implement the provisions stated in these directives, although the Birds Directive contains a clause stating that its provisions do not necessarily need to be implemented in Greenland.

Since the Birds Directive was adopted as early as 1979, many years of experience have been gained in judging how the EU Commission views the implementation of this document by the member nations. The Commission has often reported nations to the EU Court of Justice for failing to comply with its provisions. Several of the judgements delivered have concerned wetlands. So far, no case has been raised against a Nordic country, but several of those from other EU nations may have significance for these countries, depending on their outcome.

Spain was convicted in the EU Court of Justice in 1993 for failing to protect a wetland (Marismas de Santona) which the Court judged should have been protected in accordance with the provisions stated in the Directive. The argument advanced by Spain that a balance was achieved between economic interests was dismissed by the Court, which added that only scientific grounds could form a basis for deciding which areas should be protected. Spain was also convicted for having planned a road into the area and for not having prevented other activities in the area which led to pollution and a consequent reduction of the importance of the area for bird life (Case C-355/90).

In a similar case against Great Britain in 1996, the Court of Justice found that the British authorities had no right to remove 22 ha from a 4700 ha wetland area (Lappel Bank) to enable the construction of a port for international shipping. The view of the British Government that it should be adequate to designate 99 % of the wetland as a Special Protection Area (SPA) was not accepted by the Court, which stated that any discretionary acts to aid economic interests could only be undertaken at a later stage, not when determining the boundaries of a valuable area (Case C-44/95).

France was convicted by the EU Court of Justice in 1999 for not having prevented the depreciation of the environment in a valuable wetland (Marais Poitevin). It had in fact classified part of the area as a Special Protection Area in keeping with the Birds Directive, but the Court considered that this did not cover a sufficiently large area. The authorities had, moreover, not prevented part of the area being drained and brought under cultivation. The French Government maintained that these actions were part of a rational form of agriculture which was encouraged by

subsidies provided through the EU common agricultural policy. The Court nevertheless ruled that, even though EU directives exist which in part entail conflicts of interest, the provisions of the Birds Directive had to take precedence and agricultural practices that entail a depreciation of the living conditions for birds were unacceptable (Case C-96/98).

Instructive court decisions are still lacking in respect of the implementation of the Habitat Directive. However, the EU Commission has reported, or threatened to report, several countries for breaches of the Directive, and the Court of Justice is likely to pronounce a number of judgements in the years to come.

Biodiversity Convention (1992)

The Convention concerning Biological Diversity is a global UN agreement that came into effect in 1993 and covers the preservation and use of all biological diversity. It functions as a framework convention, the intention being that the parties will negotiate to establish follow-up sub-conventions. A central aspect of the agreement is that the parties will ensure that the aims are integrated into the various sectors. This includes work concerned with endangered species, where the signatory nations must also undertake 'land studies' to provide a survey of the status of all the species within their borders. As regards the sectors, the parties must draw up action plans to cover their activities, and which show how they can help to protect and manage the biological diversity. Articles 7 and 8, in particular, deal with the protection and management of endangered species and their habitats, as well as measures to promote the rehabilitation and sustainable use of all biological diversity. The protection of natural environments and the sustainable management of areas that border up to these are relevant measures. The restoration of damaged ecosystems, such as wetlands, also forms part of the Convention. The Biodiversity Convention also has a separate work programme for wetlands (see www.biodiv.org) and an agreement has been entered into with the Ramsar Convention making it responsible for much of the practical follow-up.

This is an example of the Biodiversity Convention also being an agreement that aims to play the role of an overseer and coordinator for all relevant environmental conservation agreements, for instance through cooperation agreements. The Convention covers

ecosystems, species and genes, but there are many other regional or global Conventions that cover one or more aspects of these. For instance, the Ramsar Convention is considered to primarily concern ecosystems, and the Convention on Migratory Species (the Bonn Convention) deals with both ecosystems and species.

Wise use concept in the EU (1995)

Apart from work involved with implementing the Species and Habitat Directive, the EU Commission has so far spent comparatively little time on problems linked to special habitats. Nevertheless, as regards wetlands, it drew up a document in 1995 entitled "Wise use and conservation of wetlands", which took the form of a report from the Commission addressed to, among others, the European Parliament. The document contains a wealth of facts concerning threats to which wetlands are exposed and describes the negative trend that has taken place in most countries over the last century. However, because it lacks formal status, its content has never achieved any significance in a conservation context.

Pan-European Biological and Landscape Diversity Strategy - PEBLDS (1995)

This strategy was established by the European Environmental Ministers in 1995 as a European plan for following up the Biodiversity Convention. It is a framework plan determining which of the existing initiatives should be strengthened and continued. It covers 12 action themes, each of which has its own work programme. Several of these themes have special interest in relation to the work on wetlands. Theme 1: Establishing a Pan-European Ecological Network (PEEN), Theme 6: River ecosystems and related wetlands, Theme 7: Inland wetland ecosystems, and Theme 11: Endangered species. PEBLDS has sought cooperation with institutions that are already working in these areas. For instance, the Bern Convention has been allocated tasks regarding Themes 1 and 11, and the Ramsar Convention regarding Themes 6 and 7.

EU Framework Directive for Water (2000)

A new directive was approved by the EU in 2000 which can be expected to have some significance for the conservation of wetlands and other aquatic environments in the member countries. This is the Framework Directive for Water. It is principally concerned with matters relating to water quality, the utilisation of water and the monitoring of water. It is impossible to say yet to what extent it will have a bearing on the various kinds of wetland and the species associated with these environments, but it will probably prove advantageous for wetland conservation. This Directive is binding for EEA nations.

Ramsar and its relationship to Directives and Conventions

For formal reasons, the EU cannot ratify the Ramsar Convention as an independent body, but it participates as an observer in meetings held by the signatory nations. Nevertheless, a clear link exists between the Birds Directive and the Ramsar Convention. Article 4.2 states that when EU member states designate bird sanctuaries, special attention must be given to wetlands, not least wetlands of international importance. In practice, this concerns such Ramsar sites as are designated on account of their bird life.

To facilitate the work which the Ramsar Convention is doing in cooperation with other Conventions, separate agreements on closer cooperation have been drawn up, called Memoranda of Cooperation (MoC).



Mosaics of fresh water, bogs and swamps with sedges *Carex* spp., as here, are very common in parts of the Nordic region.

PHOTO: JON ARNE SÆTER

2 Nordic wetlands

2.1 Types of wetland in the Nordic countries

The Nordic countries have a great variety of wetland (e.g. Figs. 2.1-2.5) and large tracts of some kinds of wetland that are seldom elsewhere. Archipelagos, with their large areas of shallow water, are among the best examples of a type of landscape and wetland that is extensive along these northern coasts. The great variety of mires found in the Nordic countries is unique in the world. A third kind of environment that is unusual elsewhere in Europe is oligotrophic (nutrient-poor) lakes and rivers, of which there are numerous examples.

Nordic wetland varies greatly in type from north to south. The flat landscape of Denmark and southern Sweden is characterised by shallow lakes with extensive reed beds and other vegetation that require substantial quantities of nutrient. The same area also has enormous tidal flats and shallow marine areas which are of international importance for resting and wintering wetland birds because of their large production of invertebrates. Sand dunes with moist depressions are specially well developed and widely distributed in the southern part of the Nordic region, but are also found as far north as the Arctic coasts where natural conditions favour them. Many places in the Nordic region have well-developed estuaries and riparian landscapes with associated swamp woodlands. The estuaries are specially valuable because of their high biological production where they meet the sea and brackish-water conditions develop. Large areas of shallow sea and extensive kelp forests are of great importance for many wetland species, both during the breeding season and at other times of the year. Woodland with standing water is found in many places and provides good living conditions for specially adapted species. Numerous lakes and rivers are found in northerly and higher areas and form a mosaic with mires, woodland and bare rock that characterises large areas of wetland in the Nordic region.

People have been very aware of the high biological production of the wetlands of Europe ever since they began to cultivate the land. Using simple means, the first wetlands were drained and the water was channelled to where people had use for it. A significant percentage of the best arable land in Europe was originally wetland. Centuries of human impact have created a cultural landscape where many species have been favoured and have achieved a wide distribution whereas others have had their range curtailed. A new balance arose between the species which lived in the landscape and its utilisation. This balance was maintained for hundreds of years and did not change significantly until the beginning of the Industrial Revolution at the end of the 18th century. A characteristic aspect of the 20th century was the great shift that took place in the use of the cultural landscape and, with it, a dramatic change in the living conditions for many of the species attached to it, which suffered a substantial reduction in their populations. Parallel with the development of increasingly sophisticated ways of using wetlands and cultivated areas, the introduction of artificial fertilisers and sprays formed the most important basis for these changes.

2.2 The international importance of Nordic wetlands for flora and fauna

Function of flora and fauna

Fresh water makes up only 0.01 % of the water on the Earth and covers slightly more than 1 % of the Earth's surface. Since all human life and a large proportion of life otherwise depends upon access to fresh water, it is important how this vital resource is managed. An ever-growing world population requires greater quantities of water, and at the same time the quality of the water is dropping, partly because the natural purification of fresh water has become worse due to the extensive destruction of wetlands.

Wetlands are also of great importance for other reasons than as sources of human drinking water. In a global perspective, scarcely any other kind of habitat is more productive than wetland, measured by the



Figure 2.1 Stony beach.

PHOTO: JON ARNE SÆTER



Figure 2.2 Shallow marine area.

PHOTO: ØYSTEIN R. STØRKERSEN



Figure 2.3 Foreshore and dunes.

PHOTO: ØYSTEIN R. STØRKERSEN

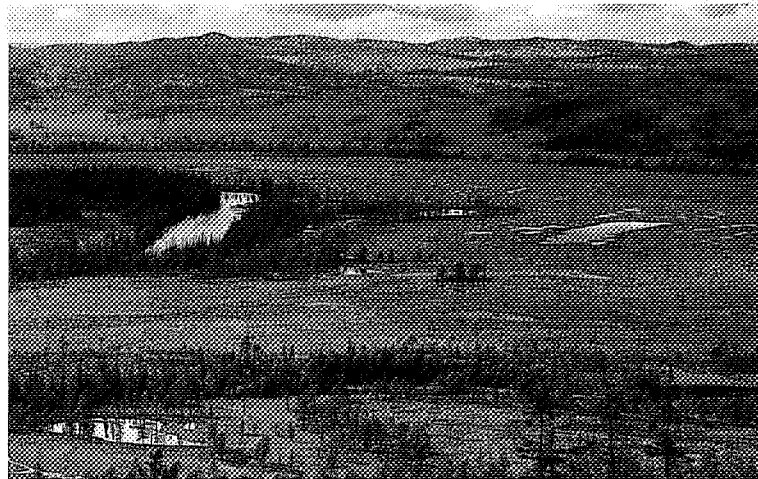


Figure 2.4 Mire.

PHOTO: JON ARNE SÆTER



Figure 2.5 Inland delta.

PHOTO: OLA JENNERSTE

quantity of biomass produced per unit area. Production on some kinds of wetland even exceeds the most productive agricultural land. Many species of birds and animals are therefore able to live in these areas, often in large concentrations. Wetlands are indeed vital for many species of plants and animals because they are only able to live in this kind of environment.

The Nordic region is specially fortunate as regards water housekeeping, because fresh water is available in large quantities and its quality is usually good. Since fresh water is a limited resource on the Earth and is becoming an increasingly critical factor for mankind, there is every reason to manage the wetlands in a long-term, sustainable manner. Their importance for the preservation of flora and fauna is an integral and important part of this picture.

Birds

The northern areas

Northernmost parts of Europe usually cannot boast the enormous numbers of individuals of some species of birds as parts of Denmark or other areas in Europe can. Such southerly areas are specially important for migrating and wintering birds, and hundreds of thousands of wetland birds may congregate in limited areas there. The Wadden Sea off the coast of Denmark, Germany and the Netherlands and the shallow lakes of southern Sweden, such as Tåkern, are good examples of such areas. Many of the species that occur in large concentrations breed in the northerly coniferous forest belt or in mountainous and tundra regions such as are found from Scandinavia eastwards into Russia. Their breeding areas are not first and foremost characterised by large concentrations of birds, but rather by widely spaced pairs. The breeding areas, migratory routes and winter quarters of the birds are equally important and must therefore be viewed and managed in a single context. Disturbances in important wintering areas will have an immediate effect on the species that are hit, but the effects of disturbances in the breeding areas may be more difficult to grasp because they affect fewer individuals. However, many minor disturbances are in sum equally destructive for the populations. Taking care of the breeding areas of these species is therefore at least as important as protecting the migratory routes and winter quarters, but must undoubtedly be solved in other ways than by just establishing protected areas.

Winter populations

The annual censuses of, among others, wintering swans, geese and ducks, performed by Wetlands International, provide a good impression of the total populations in Europe and where the largest concentrations are found. An example is the winter occurrences of whooper swans *Cygnus cygnus* in Europe, where the Fennoscandian and north-west Russian populations number approximately 60 000 individuals. Denmark is the most important wintering area in Europe for this population. The total population in January 1995 in mainland western Europe (including the Baltic States and Poland) numbered 21 700 in Denmark, 300 in Finland, 7800 in Norway and 8500 in Sweden, i.e. 38 300 or 65 % of the population. Other examples are that the majority of mute swans *Cygnus olor* which breed in Finland, Sweden, the Baltic States, Poland, Germany and

Denmark (about 170 000 individuals) winter in the Baltic Sea area, mostly in Danish waters. The Hoburg Bank, just south of Gotland, is probably the most important locality in Sweden for wintering sea birds. Approximately 0.7-1 million long-tailed ducks *Clangula hyemalis* congregate there each year. Numerous sea birds of various species also have their winter quarters along the Gotland coast. In mild winters, tens of thousands of geese winter in Denmark and many thousands in southern Sweden. Large numbers of diving ducks, in particular, have their winter quarters along Nordic coasts, especially in Norway, Denmark and southern Sweden. Of the total western European wintering population of common eiders *Somateria mollissima*, which numbers some 1.7 to 2.3 million individuals, 300 000 - 400 000 are found in the Kattegat, about 1 to 1.3 million in the Baltic Sea and 400 000 - 500 000 in Norway and Russia. In addition, around 700 000 - 1.3 million eiders winter in the area between Svalbard, Iceland and Greenland. Moreover, out of a total north-west European population of approximately 1 million tufted ducks *Aythya fuligula*, up to 150 000 are found in Denmark and up to 30 000 in Sweden. No large wintering populations of wetland species are known in Finland, but they may occur when ice conditions are favourable. Iceland, too, lacks large wintering populations, but does house the entire European populations of Barrow's goldeneye *Bucephala islandica* and harlequin ducks *Histrionicus histrionicus*.

Responsibility species, breeding and wintering

The Nordic countries, individually or combined, have more than 25 % of the population of many European species of birds. Such species are often referred to as responsibility species. Many of the species in the Nordic countries that are attached to wetlands are covered by this definition. Approximately 2100 pairs of the 5000-7000 strong world population of white-tailed eagles *Haliaeetus albicilla* breed in the Nordic countries and Norway has special responsibility for managing this species. The Nordic nations are also very important for wintering, wetland-related species (Table 2.1).

Table 2.1 European responsibility species (>25 % of the global population) in the Nordic countries linked with wetlands as a habitat (Tucker & Heath 1994, Nord 1997:614, BirdLife International Bird Census Council 2000).

Europe

Breeding population

White-tailed eagle *Haliaeetus albicilla* (45 %)

Osprey *Pandion haliaetus* (40 %)

Dunlin *Calidris alpina* (55 %)

Bar-tailed godwit *Limosa lapponica* (45 %)

Common redshank *Tringa totanus* (35 %)

Great black-backed gull *Larus marinus* (31 %)

Mew gull *Larus canus* (28 %)

7 of 11 European Red Listed species linked with wetlands as a habitat (excluding auks and black-legged kittiwake)

Winter population

Great northern diver *Gavia immer* (25 %)

Yellow-billed diver *Gavia adamsii* (90 %)

Great cormorant *Phalacrocorax carbo* (30 %)

European shag *Phalacrocorax aristotelis* (25 %)

Steller's eider *Polysticta stelleri* (30 %)

Common eider *Somateria spectabilis* (75 %)

Red-breasted merganser *Mergus serrator* (30 %)

Purple sandpiper *Calidris maritima* (60 %)

8 of 8 European Red Listed species linked with wetlands as a habitat (excluding auks and black-legged kittiwake)

Moulting populations

Large aggregations of moulting birds are a characteristic feature of many parts of the Nordic coasts. For instance, the entire north-west European population (approximately 300 000 individuals) of common shelducks *Tadorna tadorna* gather in the Wadden Sea during the moulting period in summer. The Nordic countries, indeed, have quite a number of nationally or internationally important localities where sea birds moult. For instance, many important moulting localities (>1 % of the "flyway population") for swans, geese and ducks are known in the Nordic countries, as follows: Denmark (26 localities), Greenland (6), Iceland (11) and Svalbard (3). It is chiefly the following species of swans, geese and ducks that occur in fairly large aggregations at these localities in the moulting period: whooper swans *Cygnus cygnus*, mute swans *C. olor*, greylag geese *Anser anser*, pink-footed geese *A. brachyrhynchus*, greater white-fronted geese *A. albifrons*, barnacle geese *Branta leucopsis*, red-

breasted mergansers *Mergus serrator*, black scoters *Melanitta nigra*, velvet scoters *M. fusca* and common eiders *Somateria mollissima*. Many male goosanders *Mergus merganser* from the western European population (200 000 individuals) gather to moult in the estuaries of the large rivers in the north, such as the Tana in northern Norway, where 10 000-20 000 may aggregate. In Sweden, large numbers of geese, swans and ducks moult at various places, one of the best known being Lake Tåkern, where greylag geese are particularly numerous. Specially large numbers of mute swans are found in Kungsbackafjord, south of Gothenburg, and various geese and ducks are seen on the east coast of Gotland.

Migration localities

Nordic wetlands are not only important for migratory birds from the Nordic countries themselves, but also for numerous birds migrating from further afield, particularly Russia. It is often wetland species like waders, geese and ducks that occur in spectacularly large aggregations. Denmark is specially noted for localities where huge concentrations of such birds rest while migrating, but such localities are also found elsewhere in the Nordic countries. Over the year as a whole, such localities will be used by an extremely large number of birds. The most important localities form the core in a network of resting sites that are essential for these birds and are therefore the most important from an international viewpoint. Many are either Ramsar sites or figure in the EU Natura 2000 Network.

Important migrating and resting localities for wetland birds in the Nordic countries

DENMARK: Wadden Sea, Ringkøbing Fjord, Vest Stadil Fjord, Nisum Fjord, Vejlerne, the southern Fyn archipelago, Tissø, Saltbækvig, Roskilde Fjord, the Tystrup and Bavelse Broads

FINLAND: Merenkurkku archipelago, Liminganlahti, areas near Pori, Saaristomeri archipelago, estuary of the River Porvoo

ICELAND: Faxaflói, Breiðafjörður

NORWAY: Balsfjord, Vega archipelago, Froan, Ørland, Smøla archipelago, Giske, Jæren, Lista

SWEDEN: River Ume delta, Kvismaren, Tysslingen, Tåkern, Lake Hornborga, Getterön, Ottenby, River Helge, River Klingaväl, Falsterbo

Iceland

Some species of birds that are common to Iceland and the rest of Europe figure on various European Red Lists, but not the one for Iceland (Table 2.3). The majority (50-80 %) of the breeding population of five species of European birds nest in Iceland. 30-50 % of the breeding population of eight more European species also occur in Iceland. Just under 80 % of all the razorbills *Alca torda* in Europe nest in Iceland, most of them on Látrabjarg, and they represent 70 % of the world population. The same may be said for the pink-footed goose *Anser brachyrhynchus*, just over 60 % of the world population of which breeds in Iceland, by far the majority in Þjórsárver.

If we view the bird populations in Iceland relative to the rest of the Nordic region, we see that Iceland has more than 50 % of the populations of 14 Nordic species. Moreover, 30 to 50 % of a further eight Nordic species breed in Iceland (Table 2.3). These figures therefore show that Iceland has a great responsibility for many more species of birds than those found on the Icelandic Red List.

In addition to the breeding populations, many migratory birds rest in Iceland en route between various parts of the world in spring and autumn. For instance, Iceland is an important staging post for barnacle geese *Branta leucopsis*, greater white-fronted geese *Anser albifrons*, brent geese *Branta bernicla*, red knots *Calidris canutus*, sanderlings *C. alba* and ruddy turnstones *Arenaria interpres*, and a stay of a few weeks probably determines their routes over long stretches of ocean.

Some species that occur in Iceland have been described as sub-species endemic to Iceland, for instance common ravens *Corvus corax*, black-tailed godwits *Limosa limosa*, winter wrens *Troglodytes troglodytes*, redwings *Turdus iliacus*, common redshanks *Tringa totanus* and Eurasian oystercatchers *Haematopus ostralegus*. Sub-species of migratory birds that pause in Iceland include greater white-fronted geese *Anser albifrons*, brent geese *Branta bernicla* and red knots *Calidris canutus*.

Table 2.2 Species of birds that are common to Europe and Iceland, and which figure on various Red Lists in other European countries but are not on the Icelandic Red List.

50-80 % of the population breeds in Iceland

Razorbill *Alca torda*
Pink-footed goose *Anser brachyrhynchus*
Whimbrel *Numenius phaeopus*
Glaucous gull *Larus hyperboreus*
Arctic tern *Sterna paradisaea*

30-50 % of the population breeds in Iceland

Dunlin *Calidris alpina*
Purple sandpiper *Calidris maritima*
Ringed plover *Charadrius hiaticula*
Atlantic puffin *Fratercula arctica*
Northern fulmar *Fulmarus glacialis*
European golden plover *Pluvialis apricaria*
Great skua *Stercorarius skua*
Common guillemot *Uria aalge*

Table 2.3 Icelandic bird populations relative to the remainder of the Nordic region.

More than 50 % of the breeding population is found in Iceland

Whooper swan *Cygnus cygnus*

Razorbill *Alca torda*

Northern fulmar *Fulmarus glacialis*

Pink-footed goose *Anser brachyrhynchus*

European golden plover *Pluvialis apricaria*

Glaucous gull *Larus hyperboreus*

Black-tailed godwit *Limosa limosa*

Arctic tern *Sterna paradisaea*

Common guillemot *Uria aalge*

Dunlin *Calidris alpina*

Red-necked phalarope *Phalaropus lobatus*

Ringed plover *Charadrius hiaticula*

Whimbrel *Numenius phaeopus*

Great skua *Stercorarius skua*

30 to 50 % of the breeding population is found in Iceland

Greater scaup *Aythya marila*

Common snipe *Gallinago gallinago*

Arctic skua *Stercorarius parasiticus*

Atlantic puffin *Fratercula arctica*

Black-legged kittiwake *Rissa tridactyla*

Purple sandpiper *Calidris maritima*

Common redshank *Tringa totanus*

Common eider *Somateria mollissima*

Red Lists and species attached to wetland

The most recent edition of the Nordic Red List contains 237 species of fish, amphibians, birds, mammals and vascular plants, and wetland is the most important habitat for 87 of these.

The corresponding total for all the most recent national Red Lists shows that between 22 and 61 % of the species in the same groups have wetland as their most important habitat. Appendix 6.2 lists the species of birds, mammals, amphibians, fish and vascular plants to which this applies in each country.

The Norwegian Red List from 1999 gives the habitats of all the 3062 listed species, and 12 % of these are primarily attached to wetland, an additional 11 % occurring in fresh water.

Together with woodland and forest (45 %) and agriculturally-related cultural landscape (28 %), these three habitats are also the types that are under the greatest pressure in Norway. For instance, six of the seven Critically Endangered species of birds and more than half the 55 birds on the Red List are attached to wetland (Tables 2.4 and 2.5).

Table 2.4 Total number of species among five groups on the Nordic Red List from 1995, and the number and percentage of these that are attached to wetland.

	Fish	Amphibians	Birds	Mammals	Vascular plants
Total on Red List	10	11	75	27	114
Attached to wetland	10	11	39	6	20
Percentage of wetland species	100 %	100 %	50 %	22 %	17 %

Table 2.5 Nationwide distribution of the total number of species on Red Lists and the number attached to wetland* (the total number of species originally present in the individual country is in brackets).

	Fish	Amphibians/ reptiles	Birds	Mammals	Plants	Total
Denmark: Red Listed	15 (38)	7 (21)	74 (200)	15 (50)	220 (1050)	331 (1359)
Attached to wetland	15 (100%)	7 (100%)	40 (54%)	4 (27%)	77 (35%)	142 (43%)
Finland: Red Listed	10 (92)	1 (5)	72 (240)	17 (65)	280 (1240)	380 (1642)
Attached to wetland	10 (100%)	1 (100%)	17 (24%)	2 (12%)	55 (20%)	83 (22%)
Greenland has no Red List!						
Iceland: Red Listed	0 (5)	0	32 (76)	-	52 (485)	84 (566)
Attached to wetland	5	0	19 (59%)	-	18 (35%)	37 (44%)
Norway: Red Listed	3 (45)	4 (6)	55 (251)	22 (77)	255 (1195)	339 (1574)
Attached to wetland	3 (100%)	4 (100%)	31 (56%)	1 (5%)	168 (66%)	207 (61%)
Sweden: Red Listed	33 (160)	12 (19)	88 (245)	23 (65)	505 (2272)	661 (2761)
Attached to wetland	19 (60%)	10 (83%)	48 (55%)	8 (35%)	185 (37%)	285 (43%)

* excluding marine mammals, marine fish and sea birds.

2.3 Important Bird Areas (IBAs) in the Nordic countries

BirdLife International issued a revision in 2000 of the original review of Important Bird Areas in Europe, published in 1989. These are looked upon as vitally important sites for protecting bird life and considered to meet required criteria (see Appendix 6.3). Sites are classified as IBAs when species gather there in large numbers, or they house globally endangered species or species that are endangered in Europe. One of the most important reasons for preparing this review is to provide a tool with which to identify the most valuable bird areas so as to be able to initiate measures to preserve them. In this context, the IBAs have been particularly important in helping the EU to identify areas for its Natura 2000 Network.

A total of 3619 IBAs have been identified in the whole of Europe. Wetland is the most important type of habitat in these areas, 69 % (2500 areas) of the localities having wetland (800 areas have more than 50 % wetland, 700 have 5-49 % and 1000 have less

than 5 %); an additional 13 % (450 areas) are marine areas (see Tables 2.6 and 2.7 for the Nordic countries).

Studies show that nearly all these areas are seriously threatened by at least one potential threat; only 17 % (238 areas) are not exposed to any known threats.

BirdLife International reports that 500 areas are threatened by drainage, 1300 by various kinds of disturbance related to farming, and all are to some extent threatened by recreation and tourism, reclamation, industrialisation, intensive forestry, aquaculture or hydroelectricity schemes. Tourism and disturbance together are said to be the negative factors affecting most areas (44 %). Owing to extensive, on-going threats to the IBAs in Europe through still intensive developments in agriculture, forestry, fisheries, transport, energy, industry and urbanisation, a great deal remains to be done before the IBAs may be said to be satisfactorily taken care of. Moreover, 40 % of European IBAs have one or other form of international protection, such as Natura 2000 or Ramsar (Table 2.8).

Proposals made by BirdLife International for national and international measures to manage IBAs:

1. Protect IBAs through national legislation
2. Embody IBAs in international agreements that can protect them
3. Follow up national legislation and international agreements regarding area conservation
4. Implement adequate management of IBAs
5. Involve local communities, NGOs, users and public authorities
6. Integrate environmental conservation goals in all sectors
7. Maximise, use and spread knowledge
8. Monitor IBAs to follow changes and provide guidelines for management and policy mechanisms.

Table 2.6 Number of Important Bird Areas (IBAs) in the Nordic countries, showing the occurrence of wetlands¹ and the percentage of wetland area relative to the total area in each IBA (Heath & Evans 2000).

Country	IBAs and occurrence of wetland			Total number of areas
	≤50%	5-49%	<5%	
Denmark	45 (35%)	52 (42%)	5 (4%)	102 (81%) of 127
Faeroes	1 (5%)	-	-	1 (5%) of 19
Greenland	19 (35%)	-	-	19 (35%) of 55
Finland & Åland	53 (55%)	18 (19%)	3 (3%)	74 (77%) of 96
Iceland	31 (51%)	15 (24%)	-	46 (75%) of 61
Norway	9 (17%)	6 (12%)	25 (48%)	40 (77%) of 52
Svalbard & Jan Mayen	-	1 (7%)	4 (28%)	5 (35%) of 14
Sweden	17 (27%)	17 (27%)	14 (23%)	48 (77%) of 63
Total	225 (46%)	124 (25%)	78 (16%)	427 (87%) of 487

¹ Wetland embraces: "Tidal river/enclosed tidal water, mudflat/sandflat, salt marsh, sand dunes/sandy beach, shingle/stony beach, coastal lagoon, standing fresh water, standing brackish and salt water, river/stream, raised bog, blanket bog, water-fringe vegetation, fen, transition mire and spring".

Table 2.7 Number of Important Bird Areas (IBAs) in the Nordic countries, showing the occurrence of marine areas¹ and the percentage of marine area relative to the total area in each IBA (Heath & Evans 2000).

Country	IBAs with marine areas			Total number of areas
	≥50%	5-49%	<5%	
Denmark	25 (20%)	2 (3%)	-	27 (81%) of 127
Faeroes	-	-	-	0 (0%) of 19
Greenland	15 (28%)	-	-	15 (28%) of 55
Finland & Åland	12 (13%)	2 (2%)	6 (6%)	20 (20%) of 96
Iceland	11 (18%)	5 (8%)	-	16 (26%) of 61
Norway	8 (15%)	7 (14%)	10 (19%)	25 (48%) of 52
Svalbard & Jan Mayen	-	1 (7%)	7 (50%)	8 (57%) of 14
Sweden	13 (21%)	7 (11%)	2 (3%)	22 (35%) of 63
Total	84 (17%)	24 (5%)	25 (5%)	133 (27%) of 487

¹ Marine area embraces open sea, sea inlets and coastal features

Table 2.8 Number and size of Important Bird Areas (IBAs) recorded in the Nordic countries and their conservation status (Heath & Evans 2000).

Country	No. of IBAs in each criterion ¹				Area protected				
	A	B	C	Total	Area (km ²)	None	<10%	10-90%	>90%
Denmark	63	19	45	127	48 701	24 (19%)	24 (19%)	55 (43%)	11 (9%)
Faeroes	18	1	-	19	67	19 (100%)	-	-	-
Greenland	33	22	-	55	25 416	39 (71%)	-	16 (29%)	-
Finland & Åland	43	52	1	96	27 400	34 (35%)	15 (16%)	29 (30%)	18 (19%)
Iceland	38	23	-	61	7345	42 (69%)	3 (5%)	5 (8%)	11 (18%)
Norway	47	5	-	52	9307	19 (36%)	5 (10%)	13 (25%)	15 (29%)
Svalbard & Jan Mayen	13	1	-	14	34 842	7 (50%)	1 (7%)	-	6 (43%)
Sweden	35	23	5	63	12 678	15 (24%)	9 (14%)	24 (38%)	15 (24%)
Total	290	146	51	487	165 756	199 (41%)	57 (12%)	142 (29%)	76 (16%)

¹ IBA criteria (see Appendix 6.3 for explanation of types A, B and C)

2.4 Area of wetland in the Nordic countries

Little thorough mapping of wetland has been carried out in the Nordic countries. Denmark has the best knowledge of its current area of wetland and of how much has been lost over time. For most countries, the information available on the area of their wetland mainly derives from mapping done with a view to potential commercial utilisation (Table 2.9). A classic example of this is the extensive mapping of mires in all the countries. For a long time, there has been considerable interest for bringing mires under cultivation, and by degrees also for draining them with a view to afforestation. There is therefore considerable economic interest in such work and substantial government grants have been made available for general drainage efforts and cultivation and afforestation of mires. The Icelandic Government, for instance, has been providing grants since the 1950s to encourage ditching of the largest mires with

a view to increasing the area under the plough. However, experience has shown that most of the drained area is unsuitable for cultivation. The result is that scarcely any large mires lacking evidence of disturbance survive. Because of less need, or for economic and political reasons, the Nordic countries have now greatly reduced, or are phasing out, these grant schemes.

A comparatively large amount of knowledge also exists about bodies of fresh water (lakes, rivers, etc.), because of economic and political interest in their potential for being utilised to produce hydro-electricity, for instance. These investigations have provided knowledge about the total area and volume of fresh water, but compared with the mapping of wetlands in the narrow sense this information has been of limited use. Recently, Sweden has been alone in initiating a new, countrywide wetland inventory with a view to acquiring detailed information on areas and precise locations of fresh water.

Table 2.9 Estimates of the area of wetland (km²) in the Nordic countries in 2001.

Country (km ²)	Shallow marine areas*	Mire**	Lakes***	Swamp woodland****	Others
Denmark	7750	100	470	15	
Finland	59 000	17 000	34 000	73 000	
Iceland ¹	396 ¹	9000	1280	-	
Norway	10 000 ?	20 000	17 600	10 000	
Sweden	6000	60 000	40 000	25 000	3000

¹Tidal flats 174 km², coastal rocks and cliffs 222 km² *Down to 6 m in Denmark, Sweden and Norway **Data partly from Raeymaekers (1999) (Conserving mires in the European Union) ***Lakes and rivers larger than 0.1 km² (1 ha) ****Habitat 91D0 in the Habitat Directive



Flood-plain woodlands like this, with grey alder *Alnus incana* and such plants as wood horsetails *Equisetum sylvaticum*, are habitats with great biological diversity and are often threatened.

PHOTO: ØYSTEIN R. STØRKERSEN.

3 Wetland conservation in the Nordic countries

In line with international trends, and following each Convention related with the protection of wetlands, work to do with wetland conservation has generally received high political priority in the Nordic countries in the 20 years after 1970. This specially applies to the designation of protected areas. There has also been considerable interest for commercial exploitation of wetlands. Thus, at the same time as environmental authorities have been instructed to implement wetland protection, subsidies have been allocated for, among other things, drainage to bring wetland areas under cultivation and schemes to produce hydro-electricity. In some parts of the Nordic region, substantially larger government subsidies than wetland conservation would cost have been made available to fund, for instance, drainage and afforestation of wetlands (see Tables 3.2 and 3.3). Even so, many valuable wetland areas have been secured through government decisions on conservation, and a network of very important protected areas has been established.

Better appreciation at every level of society of the values to be found in wetlands to thereby achieve their improved management and more sustainable use is now one of the foremost challenges following this period of conservation resolutions. The substantial reduction in the occurrence of many different types of wetlands means that this objective must be taken seriously if both protected areas and the last remnants of some types of wetland are to be preserved. Greater involvement on the part of the sectors and voluntary organisations in the community is therefore essential if we are to secure wetlands as future providers of important functions for people, plants and animals.

With a few exceptions, we know comparatively little about the occurrence of wetlands in the Nordic countries. There is broad agreement about the need for good statistics regarding their area, in part as a

basis for being able to document changes. The setting up of national wetland inventories is the only means of documenting whether stipulated targets for national and international wetland conservation are attained. Such inventories will also provide a valuable basis for being able to prioritise requirements and select appropriate means.

In relation to both the integration of sectors and the need for monitoring the status of an area, the Ramsar Convention has put forward plans for how this can be achieved. In particular, its Outreach Programme gives advice on how these and other targets can be attained through a number of specific proposals of measures. A key element here is the spreading of information, in part through the schools. Putting priority on information and the involvement of future generations are considered to be the most important tasks facing us.

3.1 Wetland report from the Nordic Council of Ministers in 1973

In response to the Convention on Wetlands in 1971, a Nordic project was initiated aimed at making an inventory of wetlands in the Nordic countries that fulfilled the criteria required of wetlands of international importance, particularly as valuable areas for birds attached to wetlands.

Emphasis was placed on establishing a network of areas which should be representative and should take in all the physical geographical regions found in the Nordic countries. The basis for drawing up this inventory was much better in 1970 than when the MAR project took place in 1965. Consequently, this 1973 report gives a better impression of the situation in the Nordic countries. The number of localities also increased to 222 (Table 3.1).

Table 3.1 The number of important wetlands in the Nordic countries listed in the 1973 report.

Denmark	Finland	Iceland	Norway*	Sweden	Total
41	40	37	40	64	222

*There are also 7 localities in Svalbard

Table 3.2 Reduction in the area of wetlands in three Nordic countries from 1950 to 1990.

	1950-80	1980-89
	%	%
Denmark	-16	-7
Finland	-23	-1
Sweden	-7	-

Source: OECD Environmental Data 1993

Table 3.3 Reduction in the area of mire in four Nordic countries from 1900-2000.

	Loss of mire area 1900-2000 in %
Denmark	99
Finland	30
Norway	ca17
Sweden	35

Source: Conserving mires in the European Union (Raeymaekers 1999)

3.2 Nordic follow-up of the Ramsar Convention

With regard to wetlands, the Nordic countries stand out in several ways from most other European countries. For instance, they have extensive areas of certain kinds of wetland, the wetland often occurring as part of a landscape mosaic of, for example, mire and damp woodland forming breeding areas for birds which do not breed in other European countries. Moreover, the density of birds there is frequently significantly lower than is found on some lakes and similar highly productive areas further south in Europe. In addition to an obvious need to protect specific localities that are of importance locally, regionally, nationally or internationally for the occurrence of, for example, birds or endangered

species of plants and animals, or as habitats, it is therefore also vital to secure homes for species that live in a dispersed fashion over large areas.

The Nordic nations were quick to ratify the Ramsar Convention and by January 2001 they had established 112 Ramsar. Additional sites have been designated subsequently (see Table 3.4 and Figure 3.1, 3.5 and 3.7 which shows their location in the Nordic countries).

Table 3.4 Ramsar sites in the Nordic countries updated to 1st January 2001, showing the ratification year and the number of areas.

Country/ Ratification year	Number of Ramsar sites
Denmark (1978)	27
Faeroes	0
Greenland (1988)	11
Finland (1975)	11
Åland	2
Iceland (1978)	3
Norway (1975)	23
Svalbard	5
Sweden (1975)	30
Total	112

New Ramsar sites and Natura 2000

The number of Ramsar sites in the Nordic countries and the area they cover varies greatly from one country to another. There is still considerable potential for establishing new Ramsar sites in the Nordic countries, including areas of mire. Moreover, the protection of a large number of areas in Sweden and Finland has been proposed under the Natura 2000 scheme, and a number of these may also be relevant as Ramsar sites. The work of establishing the Emerald Network in non-EU countries may also reveal new, potential Ramsar sites.

The conservation status of Ramsar sites varies considerably from one country to another. Whereas in Norway only areas that have been protected under the terms of the Nature Conservation Act may be chosen as Ramsar sites, several Nordic countries have designated Ramsar sites without first establishing their formal legal protection (Table 3.5).

Table 3.5 Conservation status of Nordic Ramsar sites, updated to 1st January 2003.

Country	Fully protected*	Partially protected**	Lacking protection	Total
Denmark	4	23	0	27
Greenland	2	3	6	11
Faeroes	0	0	0	0
Finland****	4	0	7	11
Åland***				2
Iceland	3	0	0	3
Norway	37	-	-	37
Sweden	15	30	6	51
Total	65	56	19	140

* >90 % of the area is protected under the terms of national legislation.

** <90 % of the area is protected.

*** included in Finland's 11 sites.

**** 50 additional sites proposed

All Danish and Finnish sites are also designated as Natura 2000 areas.

Upkeep and management plans

The signatories to the Ramsar Convention expressed the aim that at least half the Ramsar sites in the world would have management plans by 2002. Only 20 % already had such a plan, and plans were being prepared for 25 % of the remainder. This is also the situation in the Nordic countries (Table 3.6). To ensure the follow-up of the Wise Use Principle, partly to be able to document that the ecological state is being taken care of, it is essential that management plans draw up guidelines for managing Ramsar sites. The Convention has issued guidelines for the content of such a management plan, and it must primarily comprise 1) a description of the area, 2) determine the need for further investigations, 3) plans for measures that need undertaking and how these should be implemented, and 4) regular revisions and analyses of the measures undertaken and of additional requirements.

Table 3.6 Status for management plans for Nordic Ramsar sites, updated to 1st January 2001.

Country	Whole site	Parts of site	Lacking	Total
Denmark	1	-	26	27
Greenland	-	-	11	11
Finland	4	-	7	9
Åland*				2
Iceland	0	1	2	3
Norway	9	1	13	23
Sweden	9	15	6	30
Total	23	17	65	105

* included in Finland's 9 sites.

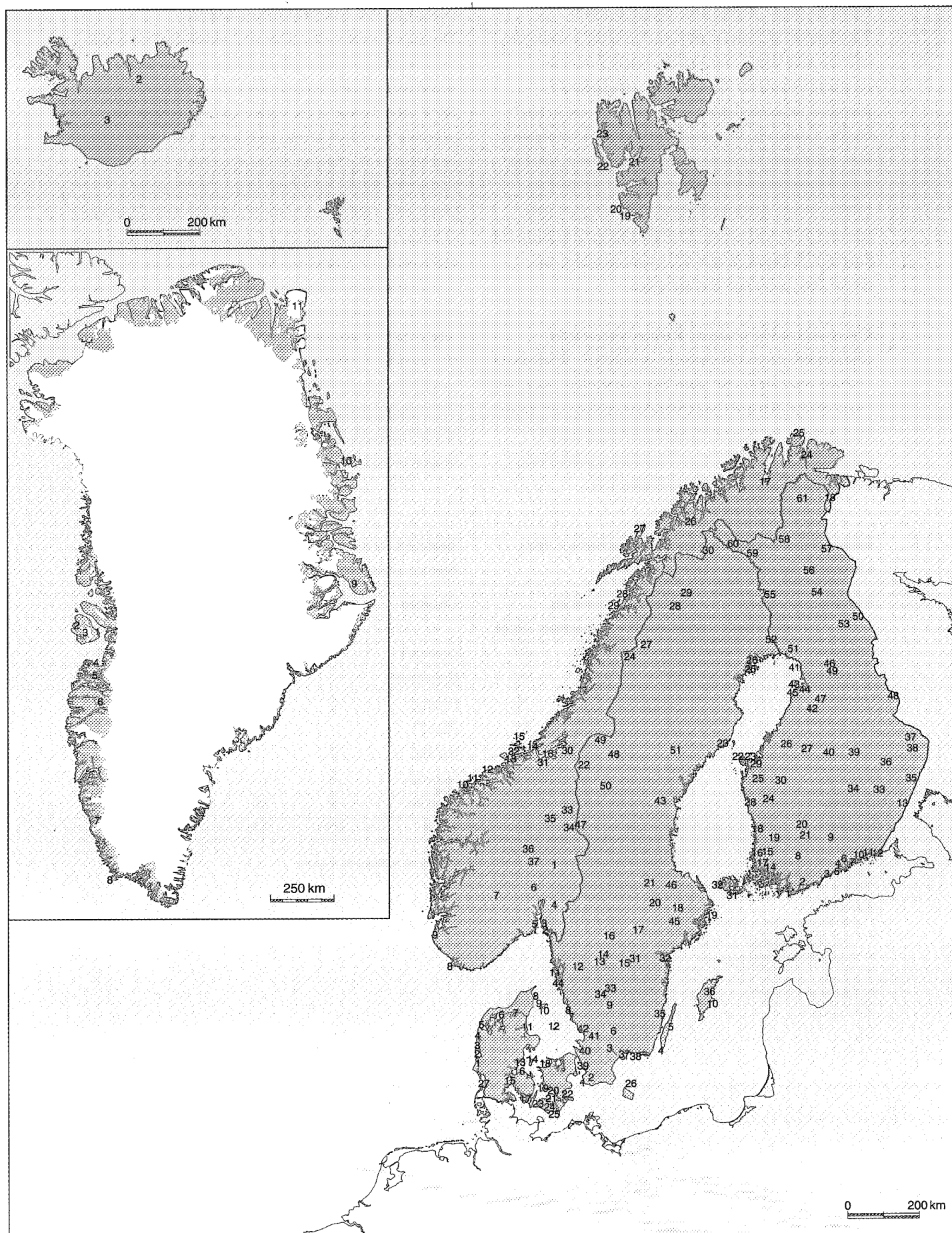


Figure 3.1 Ramsar sites in the Nordic countries.

Table 3.7 Ramsar sites in the Nordic countries (see Figure 3.1).**NAME****Denmark**

- 1 Fiilsø
- 2 Ringkøbing fjord
- 3 Stadil - Vest Stadil fjord
- 4 Nissum fjord
- 5 Harboøre - Agger tange
- 6 Vejlerne - Løgstør Broads
- 7 Ulvedypet - Nibe Broads
- 8 Hirsholmene
- 9 Northern Rønner
- 10 Læsø
- 11 Mariager - Rander's fjord
- 12 Anholt
- 13 Horsens's fjord - Endelave
- 14 Stavnsfjord
- 15 Little Belt
- 16 Næra strand - Æbelø
- 17 Southern Fyn Archipelago
- 18 Sejerø Bay
- 19 Northern Skælskør - Glænø
- 20 Karrebæck, Dybsø, Avnø fjords
- 21 Fejø - Femø
- 22 Ulshale - Nyord
- 23 Nakskov fjord - Indrefjord
- 24 Maribo Lakes
- 25 Rødsand - Guldborgsund – northern Botø
- 26 Ertholmene
- 27 Wadden Sea

Finland

- 1 Hankohalvön wetlands *
- 2 Läppträsket *
- 3 Vanhankaupunginlahti - Laajalahti
- 4 Porvoonjoki estuary
- 5 Söderskär - Långören
- 6 Pernajanlahti *
- 7 Aspskär
- 8 Torronsuo National Park *
- 9 Kutajärviområdet *
- 10 Valkmusa National Park *
- 11 Kirkkojärvi - Lupinlahti *
- 12 Kirkon - Vilkkiläntura *
- 13 Siikalahti area *
- 14 Oukkuläntura *
- 15 Koskeljärvi *
- 16 Otajärvi *
- 17 Mietoistenlahti *
- 18 Kokemäenjoki estuary - Previiikinlahti *
- 19 Puurijärvi - Isosuo National Park *
- 20 Kirkkojärvi area *
- 21 Vanajavesi area wetlands *

- 22 Valassaaret - Björkö Shoals
- 23 Mikkelsaaret *
- 24 Kauhanen - Pohjankangas National Park *
- 25 Levaneva *
- 26 Piivineva *
- 27 Salamajärvi National Park *
- 28 Lapväärtti wetlands *
- 29 Vassorfjärden *
- 30 Alavus wetlands
- 31 Björkö - Lågsjär
- 32 Signilskär - Märket
- 33 Rantasalmi 'bird lakes'
- 34 Suurenaukansuo - Isosuo - Pohjalampi *
- 35 Rääkkylä - Kitee 'bird lakes'
- 36 Sysmäjärvi *
- 37 Patvinsuo National Park
- 38 Kesonsuo *
- 39 Maaninka 'bird lakes' *
- 40 Heinä - Suvanto - Hetejärvi *
- 41 Krunnit
- 42 Haapevesi 'bird lakes' *
- 43 Hailuoto 'bird lakes' *
- 44 Liminganlahti area *
- 45 Siikajoki 'bird lakes' *
- 46 Aittojärvi - Kongasjärvi *
- 47 Veneneva - Pelso *
- 48 Elimyssalo *
- 49 Olvassuo *
- 50 Oulanka National Park *
- 51 Martimoaapa - Lumiaapa - Penikat
- 52 Kainuunkylä islands *
- 53 Riisitunturi National Park *
- 54 Luoro *
- 55 Teuvrakuoma - Kivijärvenkuoma *
- 56 Koitelainen
- 57 Urho Kekkonen National Park - Sompio Nature Reserve *
- 58 Lemmenjoki National Park *
- 59 Sotkakuoma *
- 60 Lätäseno *
- 61 Sammuttijänkä - Vajoenjäkä *

Greenland

- 1 Aqajaruq - Sullorsuaq
- 2 Qinnuata Marraa - Kuussuaq
- 3 Kuannersuit Kussuat
- 4 Kitsissunnguit
- 5 Naternaq
- 6 Eqalumiut Nunaat - Nassuttuup Nunaa

- 7 Ikkattoq and the archipelago
- 8 Kitsissut Avallit
- 9 Heden
- 10 Hochstetter Foreland
- 11 Kilen

Iceland

- 1 Grunnafjörður
- 2 Myvatn - Laxá
- 3 Þjórsárver

Norway

- 1 Åkersvika
- 2 Øra
- 3 Kurefjorden
- 4 Nordre Øyeren
- 5 Ilene - Presterødalen
- 6 Nordre Tyrifjorden Wetland System
- 7 Møsvassstangen
- 8 Lista Wetland System
- 9 Jæren Wetland System
- 10 Giske Wetland System
- 11 Harøya Wetland System
- 12 Sandblåst - Gaustadvågen
- 13 Mellandsvågen
- 14 Ørlandet Wetland System
- 15 Froan
- 16 Tautra - Svaet
- 17 Stabburnes
- 18 Pasvik
- 19 Dunøyene
- 20 Isøyene
- 21 Gåsøyene
- 22 Forlandsøyene
- 23 Kongsfjorden
- 24 Tanamunningen
- 25 Slettnes
- 26 Balsfjord Wetland System
- 27 Skogvoll
- 28 Karlsøyvær
- 29 Bliksvær
- 30 Øvre Forra
- 31 Trondheimsfjord Wetland System
- 32 Havmyran
- 33 Tufsing delta
- 34 Kvislefået
- 35 Fokstumyra
- 36 Hynna
- 37 Dokka delta

Sweden

- 1 Falsterbo - Foteviken
- 2 Klingavälsån - Krankesjön
- 3 Helgeån
- 4 Ottenby
- 5 Öland's east coast
- 6 Åsnen
- 7 Träslövsläge - Morups Tånge
- 8 Getterön
- 9 Kävsnö - Store Mosse
- 10 Gotland's east coast
- 11 Stigfjorden
- 12 Dättern
- 13 Hornborga Lake
- 14 Östen
- 15 Tåkern
- 16 Kilsviken
- 17 Kvismaren
- 18 Hjälvstaven
- 19 Stockholm's outer archipelago
- 20 Svartån
- 21 Hovran
- 22 Ånnsjön
- 23 Umeålvens delta
- 24 Tärnasjön
- 25 Gammelstadsviken
- 26 Persöfjärden
- 27 Tjälmejaure - Laisdalen
- 28 Laidare
- 29 Sjaunja
- 30 Tavvavouma
- 31 Västra Roxen
- 32 Södra Bråviken
- 33 Dumme mosse
- 34 Komosse
- 35 Emån
- 36 Kallgate - Hejnum
- 37 Mörrumsån - Pukaviksbukten
- 38 Blekinge archipelago
- 39 Lundåkrabukten
- 40 Skälderviken
- 41 Tönnersjöheden - Årshultsmyren
- 42 Fylleån
- 43 Sulsjön - Sulån
- 44 Nordre river estuary
- 45 Askövik - Sörfjärden
- 46 Dalälven - Färnebofjärden
- 47 Storkölen
- 48 Tysjöarna
- 49 Oldflån - Flån
- 50 Aloppekölen
- 51 Mossaträsk - Stormyrn

*) Proposed areas

3.3 Restoration of wetlands in the Nordic countries

In parts of the Nordic region, wetlands have been destroyed or impoverished over a long period, often as a result of government subsidies. Many lakes have been drained or had their water level lowered, and numerous small wetlands have completely disappeared. Such damage has particularly taken place in areas dominated by agriculture, where various forms of drainage have resulted in the survival of only a small proportion of the original areas of wetland. Ditching has also occurred extensively in connection with forestry.

In the course of the past 25 years, there has been an obvious increase in the interest for and knowledge about the possibilities for restoring various kinds of wetland environments, and a large number of wetland restoration projects have been carried out, above all in Denmark, Finland and Sweden (Table 3.8). The goal has usually been to further biological diversity, especially bird life. Many of the schemes have been very successful. In several contexts during meetings of signatory nations, the Ramsar Convention has discussed wetland restoration and how to encourage more schemes of this nature (see, for example, Recommendations and Resolutions deriving from various such meetings).

The restoration of Lake Hornborga in Sweden is the largest single project of this kind in the world. This lake underwent five episodes of water-level reduction over a period of 150 years, which ultimately led to it becoming totally choked with, for instance, common reeds *Phragmites communis*, trees and shrubs in the lake itself and along its shores. Plans to restore the lake were originally proposed in the 1960s, but protracted discussions about the objectives of the restoration and how to implement it, as well as long negotiations with the owners, meant that the scheme could not be carried out before 1992-1995. Since this used to be one of Scandinavia's most outstanding lakeland localities for birds, it was natural that its restoration should take place from the viewpoint of the needs of birds. Following the extensive clearance of reeds, trees and shrubs, and the filling in of old drainage channels, the more than 3000 hectare large lake was gradually able to attain a water level that was almost one metre higher than it had been at the start. The

restoration has resulted in a substantial increase in the numbers of birds that depend upon wetland, and this shallow lake is now one of the most important breeding and resting localities in northern Europe. The total cost of the project was 115 million SEK. A major information effort was initiated parallel with the restoration work, and facilities like exhibitions, bird-watching towers, hides, parking sites, paths and guided walks were made available to the public. The lake, and the thrill of observing up to 10 000 cranes resting there each spring, attracts more than 200 000 visitors a year.

A number of major restoration projects have also been carried out in Denmark, including raising the water level in several lakes choked with common reeds (e.g. Tipperne) and restoring meandering rivers (e.g. the River Skjern). However, most restoration schemes in Denmark and Sweden have concerned small areas and been relatively inexpensive. Table 3.8 summarises the present situation with regard to restoration schemes in the Nordic countries.

3.4 Action plans to protect endangered species

Better knowledge about endangered species and the following-up of national Red Lists have led to a need to implement projects to improve the situation for the most endangered species. Both nationally and internationally, we are now seeing a gradual shift in focus from gathering information and describing the situation to implementing measures to support the species affected. On the national level, species that have been the subject of protection plans have often been chosen fortuitously, and national strategies seldom form the basis for prioritising the measures required. Agreements have often been entered into across national borders regarding which species should be given priority, and focus has so far been placed on endangered vertebrates and, in particular, birds. However, it may be expected that the publication of global and European Red Lists, and the introduction of measures for species covered by conventions, will lead to far more groups of species becoming the subject of both national and international action plans. This concerns not least vascular plants and invertebrates (especially insects and bivalves). Since many of these species are attached to wetland

Table 3.8 Review of the status in the restoration of wetlands in the Nordic countries.

Status	Denmark	Finland	Iceland	Norway	Sweden
General situation	- Many projects, some large scale, have been undertaken to restore lakes, mires, damp grasslands and watercourses - Water Environment Plan II started in 1998, aiming to reduce the leaching of nutrients and establish 16,000 ha of wetland - From 1995, increased focus on entire landscapes (river valleys and marine bays)	- Started in the 1980s - Restoration of some mires and lakes with large bird aggregations - Growing interest in the 1990s, and investigation in 1999 of requirements linked with establishing Natura 2000 - Priority given to Natura 2000 areas	- In autumn 1996, the first attempt was made to reclaim a mire; 5 lakes and 3 mires restored from 1996 to 2000 - In response to an environmental impact assessment, the first wetland was restored in 1996	- Started in the 1980s - Wetland restoration mostly carried out by voluntary organisations working with landowners - Only small projects - Generally limited funding for upkeep and management of protected areas, but more government support to preserve and restore cultural landscapes	- Several small wetlands restored through the EU programme for environmental support - Government assistance to local authorities (LIP scheme) - Natural Environment Protection Board supports some major projects - WWF and the Hunter's Association support several small projects
Number of projects	1989-1998: 900	1999-2000: 43 + another 32 planned	1996-2000: 8 + ca 7 planned	1980-2000: ca 100	1996-1998: 450 (environmental support) 1998-2000: 119 (LIP)
Area	8140 ha	Ca 1000 ha	Ca 255 ha	Total: 2-3 ha	1600 ha with environmental support
Money spent	1989-1998: 1371 mill. DKK (incl. purchases)	1999: ca 100 mill. FIM	1996-2000: 17 mill. ISK	Total: 2-3 mill NOK	1998-2000: ca 400 mill. SEK (LIP)
Financial measures	- Government funding to purchase areas and for restoration - EU LIFE programme - Government support to counties, non-profit-making associations, private funds, EU agricultural support schemes	- Government support - EU LIFE programme - EU agricultural support schemes	- Government support - Merchants' Environment Fund - Item on the Ministry of Agriculture budget for the first time in 2001	- Government subsidies from the environment and agriculture departments	- Government support - Municipal assistance - EU LIFE programme - EU agricultural support schemes - Non-profit-making associations
Legal authorisation for restored schemes	- Nature Protection Act	- Nature Protection Act	- Act concerning Environmental Impact Assessment - Indirect authorisation through the Nature Conservation Act - Nature Conservation Strategy	- No authorisation under the terms of the Nature Conservation Act	- No authorisation under the terms of the Nature Conservation Act

habitats, it is natural to view this in the context of the protection of these species, the protection of existing wetlands and the restoration of more former wetlands.

Few action plans have been drawn up in the Nordic countries, but some countries have made a good start. Some examples of national measures and international cooperation to follow them up are described below.

Corn crake *Crex crex* in Denmark

Management and action plans have been drawn up in Denmark for species which create conflicts relative to commercial interests (e.g. great cormorants) and a number of endangered species, including the corn crake. The corn crake was common in Denmark and the rest of Europe up to about 1900. However, intensification of farming, including the introduction of rapidly operating harvesters, led to a major decline in corn crakes throughout their range. As a consequence, the corn crake is endangered worldwide and has been placed on the most recent IUCN Red List (2000) of endangered species. It has also been included in the EU Birds Directive as a species that is endangered in EU countries and for which special protective measures must be applied (referred to as Annex I species). It is also listed in the Bern and Bonn Conventions. In the Bern Convention, which concerns the protection of wildlife and plants in Europe, the corn crake is listed as a species that must be strictly protected (List II). In the Bonn Convention, which concerns the protection of migrating species of wild animals, the corn crake is listed among species for which an international agreement on its protection must be entered into. Finally, it should be mentioned in connection with the corn crake that nations that have signed the Biodiversity Convention are committed to make efforts to re-establish endangered species, for example through planning and management strategies.

The most recent Danish Red List (1997) records the corn crake among "Disappeared - Regionally Extinct" species since there is no longer considered to be a permanently breeding population in Denmark. The number of corn crake observations in Denmark has dropped since then. This is probably linked with a temporarily favourable situation in eastern Europe, where the former, large collective farms are now more or less defunct. Denmark therefore now has an excellent opportunity to re-instate the corn crake as a

regularly breeding bird. The Danish action plan for the corn crake may be looked upon as a follow-up of this situation. Its purpose is to build up and target the effort to save this endangered bird in Denmark. It contains specific proposals for "corn crake friendly" practices in selected localities where corn crakes have been heard in the past few years, and also for restoring former localities.

Amphibians in Sweden

Special action plans are drawn up in Sweden for certain endangered species of wildlife. One of the groups concerned is amphibians. Five action plans for these have so far been completed and several more are being prepared. The aim of such plans, which generally extend over a period of three years, is to give efforts to improve the environment for these species a firmer basis. More than 100 small wetlands have been created or restored in Skåne alone during the last ten years. Several new ones have been constructed in military training areas, for instance. Some species are the object of special attention, for instance through



Figure 3.2 The fire-bellied toad *Bombina orientalis* is one of several species of amphibians for which the Swedish environmental authorities have drawn up action plans. This species was made extinct in Sweden during the 1980s, but has now been re-introduced.

PHOTO: CLAES ANDRÉN

schemes to breed them for release in suitable environments. More information has been given to land-owners and other people, and in several places local groups comprised of municipal representatives, experts and members of societies have been set up to work on the problems involved. The cost of implementing such three-year programmes may amount to around 1 million SEK, but is usually less than that. Several species, including the common tree frog *Hyla arborea* and the fire-bellied toad *Bombina bombina* (Fig. 3.2), have substantially increased in numbers in response to this range of measures. The latter species had entirely disappeared from Sweden before the measures were implemented.

Lesser white-fronted goose *Anser erythropus* in Norway and Finland

The lesser white-fronted goose is globally endangered and is the only endangered goose species in the Palearctic region. The entire world population is now estimated to number 25 000-30 000 individuals. Ringing and satellite studies have shown that shooting is the principal cause of the decline of this species. Other significant threats include destruction of wetlands, human disturbance and in some areas increasing predation, partly by foxes. The population comprises two roughly equal sub-populations, in the east and west respectively. The western one breeds in the area from Fennoscandia to the Taimyr Peninsula, and migrates over north-western Kazakhstan to little known winter quarters around the Caspian Sea and the Black Sea. The eastern sub-population breeds in central and eastern Siberia, and chiefly winters in south-eastern China.

The lesser white-fronted goose is ranked in the highest threat category in the Finnish, Norwegian and Swedish Red Lists. Monitoring and mapping began in Finland in 1983, and a corresponding project started in Norway in 1987. These studies aim to perform a detailed investigation of all individuals in the Fennoscandian population, carry out satellite studies, map migratory routes, investigate threats during migration and map the winter quarters to uncover the threats to which the population is exposed and find out how to improve the situation. The view is that a viable Fennoscandian population should number at least several hundred pairs. The present population is only 30-50 pairs, which mostly breed in Norway. Joint consultation between national

authorities, the Bern Convention, the Bonn Convention, the EU and BirdLife International has resulted in the drawing up of action plans for the species. In Finland it is the World Wildlife Fund and in Norway the Norwegian Ornithological Society that have prime responsibility for the project. Information about the project and about the annual migrations, etc. can be found on the following web pages: <http://www.metsa.fi/natural/projects/lwfg/index.htm> (in English), <http://www.metsa.fi/luo/projektit/kiljuh/index.htm> (in Finnish), <http://www.museumsnett.no/stabburnsnekk/htm>. (including the annual migration, in Norwegian), <http://www.birdlife.no>. (English and Norwegian) and <http://www.naturforvaltning.no> (in Norwegian).

Protection of the southern dunlin *Calidris alpina* ssp. *schinzii* in Finland

About 60 endangered species live on shores on the Baltic Sea, where they depend upon open areas of salt marsh. The reduction of such areas has led to a great decline in the population of the southern dunlin. This sub-species breeds on some coasts of northern Europe, and in Finland it breeds in the south-west and in the Gulf of Bothnia. The breeding population was strongest in the 1950s and 1960s, when it probably numbered about 150-200 pairs. In 2000, no more than 50-55 pairs were left, which is why the status of the population is considered critical.

Cattle grazing on the salt marshes ceased almost completely in the 1960s, with the result that the spread of common reeds and willow scrub substantially changed the character of the marshes. This was the prime reason for the decline in the population because the area of suitable breeding biotopes has been significantly reduced. Another reason is predation by crows and beasts of prey, including the raccoon dog and American mink, whose populations have increased considerably. In southern Finland, the drainage of nesting sites has been an additional problem. In 2001-2002, the Finnish authorities therefore implemented a programme aimed at building up the population. The main intention is to gather data on the population, its distribution and the reasons for its decline, and on that basis propose measures to be put in place in various localities.

3.5 Comments on the individual countries

3.5.1 DENMARK

Wetlands form a very important part of Denmark. The sea bordering Denmark comprises an area of more than 100 000 km², amounting to approximately 2/3 of the total territory of the country. The coastline is more than 7000 km long. Danish waters are outstanding because of the interaction between marine life forms, the drop in salinity from the North Sea to the Baltic Sea, their shallowness and their interaction with the coastal landscapes. The extensive areas of shallow water are a particularly important reason why Denmark has a major international role to play in protecting many species of aquatic birds.

Denmark has some of the most important moulting, resting and wintering areas along the eastern Atlantic migration route. In excess of seven million aquatic birds belonging to more than 30 different species winter in Danish waters. Under the terms of the Ramsar Convention, an area is of international importance for a bird species if more than 20 000 individuals or 1 % of the population lives there for part of the year. On the national level, a species has been defined as a "responsibility species" if more than 20 % of the world population is in Denmark at any one time, or the species is considered rare on a global level. Twenty-nine birds are classified as responsibility species for Denmark. All are aquatic birds and 27 are on the list because they stop in Denmark while migrating, or have their winter quarters there. Very large portions of the Danish coast and coastal waters therefore have international importance under the terms of the Ramsar Convention.

Some 440 km² of salt marsh are found along the coasts, and this habitat is also very important for the aquatic birds. Danish freshwater wetlands comprise about 570 km² of lakes and some 900 km² of marshes. Such wetlands are particularly important as breeding sites for aquatic birds. Denmark has designated 27 Ramsar sites, amounting to about 7400 km², and all of them are in their entirety also EU Special Protection Areas, of which there are 111 covering approximately 9500 km².

In general, the populations of most species of aquatic birds have shown a positive trend, chiefly due to the

management effort that resulted from Denmark's ratification of the Ramsar Convention, the EU Birds Directive and the Bonn Convention for migrating species. The designation of Ramsar sites and EU Special Protection Areas in the 1970s and 1980s, and changes in shooting practices in the 1980s and 1990s, have meant that exploitation through shooting can now largely be looked upon as ecologically sustainable. An aspect that is peculiar to Denmark is that this process has been marked by growing mutual understanding between those keen on shooting and those interested in nature. However, the most recent trend in the aquatic bird populations is not entirely positive since a decline has been noted in the breeding and wintering populations of several species.

General description of the various types of wetland in Denmark

Watercourses

Denmark has approximately 64 000 km of watercourses, most of which are small streams. Table 3.9 shows the number of kilometres of watercourses of various breadths. About 3000 km of the 22 500 km of state-owned watercourses have been culverted.

Table 3.9 Length of watercourses of various breadth.

Breadth (m)	0-2.5 m	2.5-8.0 m	> 8.0 m	Total
Length (km)	48 000	14 500	1500	64 000

Approximately 90 % of the watercourses are believed to have been regulated at some time to improve drainage. The need for drainage arose because farmers wanted to bring the nutrient-rich alluvial soil under the plough to cultivate corn. This resulted in large areas being substantially drained by ditching. Many of the small streams disappeared, having been culverted to simplify farm work.

Lakes

Denmark has more than 7200 lakes, covering a total area of approximately 57 000 ha. However, well over half of these are ponds and small lakes, about 6000 being smaller than 2 ha and only 71 being larger than 100 ha. Naturally nutrient-rich lakes were originally the most common kind of lake in Denmark and in the European lowlands as a whole, but the dense population, industry and agriculture in Denmark and the rest of continental Europe have had negative impacts on virtually all the lakes. In Denmark, only

11 relatively large lakes of this kind remain in a non-polluted state. The number of lakes has been declining for many years as a consequence of changes in farming practices and the growth of urban centres. For instance, a study undertaken at Århus revealed a 70 % reduction in the number of lakes within the municipal boundaries since 1900. The smaller lakes have particularly suffered, but there has been a significant reduction in the number of larger ones, too. However, the trend has shifted recently since the county authorities are considering giving permission to construct several hundred new lakes each year. Moreover, consent to drain lakes is seldom given nowadays.

In Denmark, the more nutrient-poor lakes where, for instance, water lobelias *Lobelia dortmanna* grow, are chiefly found in Jutland, west of the main limit of the ice sheet during the last Ice Age, but they also occur in sandy areas elsewhere in the country. Eutrophication has meant that few of these lakes remain (fewer than 20 in the entire country). Elsewhere in Europe, such lakes are common in areas where the bedrock is near the surface, but more seldom in the lowlands, except in sandy parts.

Mires

Some 90 000 ha of mire have been registered in Denmark. The mires are found in wet areas close to rivers, streams and lakes. There are many different types of mire, because the vegetation varies depending on the content of nutrients, particularly lime, in the soil, the formation of peat, the height of the water table, the supply of water, and their former and present utilisation, for example for peat cutting and cattle grazing. The raised bogs, which belong in the category "concentric raised bogs of western type", are particularly interesting in an international context. This type was also developed in Holland, northern Germany, southern Sweden, southern Finland, Estonia, Latvia and Lithuania. Only 22 raised bogs, covering approximately 2500 ha, remain in their proper, natural state in Denmark. Lille Vildmose is by far the largest of these, and with its 2000 ha large, intact surface, it is also the largest in Europe. The area taken up by mires declined markedly during the 20th century, mainly because the mires had lost their former significant economic importance as grazing for freely roaming domestic livestock. The result was that agriculture was intensified in the majority of the

area and abandoned in the rest. The intensification meant that large areas were drained and either converted into cultivated fields or planted with trees. Where farming ceased, the mires became overgrown. Cultivation and afforestation characterised the trend up to the mid-1980s, but abandonment has been the dominant tendency since then.

The sea

The Danish coast is about 7300 km long. Denmark is bordered by the North Sea, the Skagerrak, the Kattegat, the Great Belt and the Baltic Sea, and has responsibility for approximately 101 240 km² of these waters. Danish inshore waters may be looked upon as a large estuarine system, which is unique in an international context. Nowhere else in the world is it possible to study the effect of a salinity gradient on plants and animals in such a wide range of biotopes. Owing to significant changes in salinity over relatively short distances, Danish waters are characterised by high biodiversity. Because of the great biodiversity of the marine environment and the special topographical aspects of these coastal areas, particularly the large extents of shallow water that are productive and generally ice free, the maritime parts of Denmark are among the foremost foraging, resting and wintering areas for aquatic birds in Europe. The Wadden Sea is a very unusual area of tidal, shallow water stretching along the North Sea coasts of Denmark, Germany and Holland. The Danish portion of the 12 000 km² area of the entire Wadden Sea amounts to 12 %, but is the most natural, least disturbed part. The mouth of the River Varde in Ho Bay is the last freely flowing estuary of the larger rivers entering the Wadden Sea, and Skallingen is the largest non-dyked marsh in northern Europe.

Salt marsh

About 44 000 ha of salt marsh have been recorded along the coasts of Denmark, an unusually large proportion compared with other parts of Europe. Everywhere along the coast are areas which to a greater or lesser extent contain salt marsh. As with other kinds of open habitats in Denmark, the area taken up by salt marsh has been significantly reduced during the 20th century. The main reason for this is the drainage and new cultivation that took place up to the mid-1980s, but discontinuation of cattle grazing leading to the land becoming overgrown has been the dominant tendency in the last couple of decades.

Protection and reclamation of wetlands in Denmark

Watercourse Act

Legislation has reflected shifting opinions on wetlands over time. Until fairly recently, it has been almost entirely concerned with watercourses and primarily aimed at satisfying the interest for diverting water, thereby supporting the desire to bring under cultivation as much as possible of areas designated as "swampy". The first fully embracing Watercourse Act dates from 1880. This has been regularly revised, but it was not before 1982 that the preamble stating its objective was changed so that the interest for drainage was to be weighed against interests oriented towards the environment and nature. Its preamble now states that the Act is to be an instrument for ensuring the ability of water to be diverted and that the quality of each individual watercourse complies with the purpose of the legislation. These objectives are stipulated, among elsewhere, in regional plans. Watercourse management now has to take into account both commercial interests and the interests of society that are attached to the individual watercourse. This change in the preamble of the Watercourse Act reflects the changes that have simultaneously taken place in the Nature Protection Act, especially concerning biotope protection.

Nature Protection Act

In Denmark, the concept of preserving sites where plants and animals live can be traced back to the 19th century. In his work "Jægenes skadelige dyr" (The harmful animals of the huntsmen), the zoologist Oluf Winge in 1886 alluded to the idea of securing sanctuaries for wild plants and animals. However, it was not before the Nature Protection Act of 1917 that the first small steps were taken to protect wetlands as places for plants and animals to live. Until the amendment of this Act in 1972, habitat protection was nevertheless limited to protecting specific areas which had a particularly valuable plant and animal life. Part of this work concerned the establishment of reserves for scientific purposes which, among other things, meant that the public had no right of access. Fundamental objectives of these efforts to ensure protection were that species should be secured as study objects and specially endangered ones should be prevented from disappearing.

Growing environmental awareness led to the enactment of the general protection of certain lakes and publicly-owned watercourses in 1972. This was followed by a number of amendments to the Act in 1975. When the Act was revised in 1978, the protection of wetlands was extended in that privately-owned watercourses and mires were covered by the general protection provisions. The Act was revised again in 1983, partly to introduce the protection of certain heaths, salt marshes and brackish swamps, as well as extended protection for lakes. This meant that the general protection provision concerned specified watercourses amounting to a length of approximately 28 000 km, lakes larger than 500 m², mires larger than 5000 m², heaths larger than 50 000 m² and salt marshes and brackish swamps larger than 30 000 m². Ultimately in 1994, the general protection provisions were extended and made more stringent so that they now cover specified watercourses, lakes of at least 100 m², and heaths, mires, salt marshes, brackish swamps, areas of freshwater shore vegetation and areas of drift-wall vegetation influenced by freshwater seepage exceeding 2500 m², altogether accounting for about 9 % of Denmark. Table 3.10 summarises these changes.

On the whole, the main feature of these regulations is that the state of a protected area may not be changed without the prior consent of the county council, the appeal body being the Nature Protection Board of Appeal. The Act does not list measures for which permission must be sought, because it is their effects on the protected areas rather than their physical character that determine whether consent is required. These kinds of regulations have proved to be a flexible form of legislation, appropriate for taking rapid action when new dangers threaten protected areas. They are primarily intended to protect wildlife. However, the provisions may also be used in respect of other aspects covered by the Nature Protection Act, such as landscape, cultural history and recreation. This is a form of regulation for which no compensation is payable, because it is general and does not interfere with the way the area has been used so far, so this use can continue unchanged. Another characteristic aspect is that it concerns areas which can always be classified under the definition of the ecosystem in question. An area can thus 'evolve' in and out of the protection, as the natural succession dictates.

Table 3.10 Summary of when the various kinds of wetlands were granted general protection under the terms of Danish legislation.

Type of biotope	1972	1978	1983	1994
Lakes	All natural lakes	All > 0.1 ha	All > 0.05 ha	All > 0.01 ha
Watercourses	State owned	State and privately owned	State and privately owned	State and privately owned & 2+2 m banks
Mires	-	> 0.5 ha	> 0.5 ha	> 0.25 ha
Salt marshes and brackish swamps	-	-	> 3 ha	> 0.25 ha
Freshwater shore vegetation and areas of drift-wall vegetation influenced by freshwater seepage	-	-	-	> 0.25 ha

Protection regulations and wildlife reserves

Parallel with the general protection, important wetlands have been protected and wildlife reserves established, in part to prevent birds and seals from being disturbed while breeding. The protection effort has been significantly boosted by the designation of internationally important wetlands, in response to Denmark's ratification of the Ramsar Convention in 1977 and the follow-up of the EU Birds Directive from 1979 and the EU Habitat Directive from 1993.

In connection with the approval by the Danish Parliament in 1993 of the Act concerning Hunting and Wildlife Management, it was decided that aquatic birds in Ramsar sites and EU Bird Protection Areas should be better protected from being shot or disturbed by recreational activities through the establishment of a number of new wildlife reserves, referred to as "core areas where shooting and disturbance are forbidden". Such areas should be established with a view to building up a continuous network of reserves which, when complete, would be able to ensure aquatic birds peaceful surroundings where they can rest and forage on some of the most important stretches of coast. The intention was to establish about 50 new wildlife reserves in 1993-2000. The initiative came from the Danish Hunters' Association, the Danish Ornithological Association and the Danish Society for the Conservation of Nature. As the initial step in realising this new network of reserves, a team of specialists on aquatic birds from the Danish National Environmental Research Institute undertook a biological evaluation of the value of the reserves that had been proposed. The objectives for an ideal network of such reserves were described.

Shortcomings in the existing system of reserves were identified and the complete proposal for new reserves was assessed, particularly from the viewpoint of evaluating whether gaps were filled so that the future network would be continuous. On the basis of this analysis, the Danish National Environmental Research Institute evaluated the specific reserves proposed. Based on these evaluations and the proposals put forward by the above organisations, the Danish Forest and Nature Agency began in 1993 establishing core areas where no shooting or other disturbance would be permitted. It drew up an action plan which laid down the procedures for establishing the new reserves. The aim of this plan was to ensure that available biological knowledge was applied when determining the general location of the reserves, while at the same time giving local people an opportunity to exert considerable influence with regard to the precise location and size of the new reserves. Consequently, a user group was set up for each reserve, composed of local representatives of the three organisations which put forward the proposal, other organisations and users with interests in the area concerned, and landowners who were affected. When local desires to be able to continue using sites or parts of sites are to a certain extent met, this will generally take place at the cost of the most ideal solution from the biological viewpoint. The ultimate result will therefore reflect compromises that lead to a workable solution. From a biological viewpoint, a compromise will give less protection, but it will generally be received with greater understanding by the local community and may in the longer term prove to give the best result for both birds and people.

By the time the 1999 shooting season opened, 31 new reserves had been designated and 7 existing ones extended. The reserves are dispersed throughout the country (Fig. 3.3), but the majority are in the south-east and in northern and north-eastern Jutland. The reasons why specially large numbers of new reserves have been established in these two areas are that there were only a few small reserves there and, together with western Jutland and the Wadden Sea, they contain a considerable number of the really important staging sites for migrating waterfowl.

Before the work of establishing the new reserves began in 1993, Denmark already had 67 reserves for resting waterfowl. Shooting is banned in approximately 705 km² of these reserves, about 275 km² of which were in the Wadden Sea district and the remaining 430 km² in the rest of the country. The newly designated reserves and extensions of existing reserves increased the total area where shooting has been banned with effect from the 1999 open season to 835 km², excluding the Wadden Sea district. Reserves there add another approximately 1240 km², in response to a trilateral agreement between Holland, Germany and Denmark regarding better protection of the migrating bird populations. The Danish National Environmental Research Institute has been monitoring the trend in the utilisation by waterfowl of the newly established reserves and their immediate surroundings since 1994. Records of human activities and studies of how the ground vegetation is faring are also being undertaken in most of the areas.

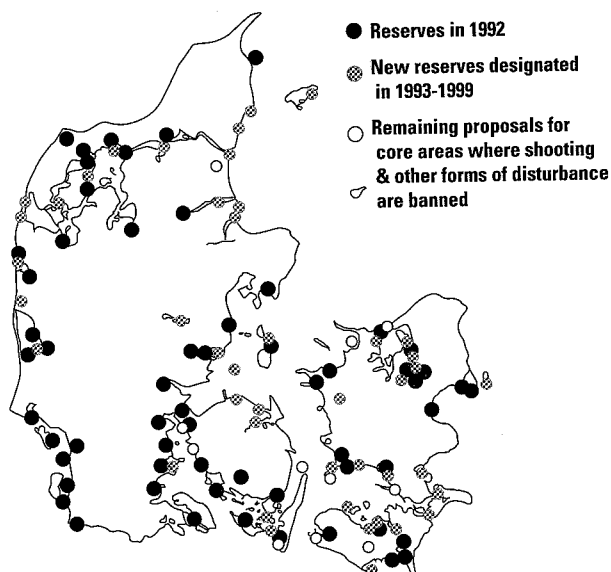


Figure 3.3 Status for the designation of reserves for migrating waterfowl in Denmark on 1st September 1999.

Most of the reserves were set up in 1996-98, but a few were already established in 1994-95. The full effect of the programme cannot yet be determined, but a clear tendency is already becoming apparent for an increase in the numbers of resting dabbling ducks and geese in several of the core areas spread throughout the country, where shooting and other forms of disturbance are forbidden. Several species of waterfowl that are sensitive to shooting pressure, such as the dabbling ducks, mallard and Eurasian wigeon, as well as the greylag goose and Canada goose, which are allowed to be shot, have shown a clear rise in numbers. This applies especially to greylag geese and mallards, the former having increased five-fold, and the latter having doubled (Figs. 3.4 and 3.5).

The establishment of two sanctuaries on the Nibe and Gjøl Broads and the Ulvshale peninsula and nearby island of Nyord led to the number of resting dabbling ducks multiplying by 4-40 times. The number of Eurasian wigeon and northern spoonbills in the whole of Denmark doubled as a consequence of these two sanctuaries, and they also resulted in larger numbers of waterfowl species.

A reserve will naturally limit opportunities to shoot and carry on other recreational activities. However, reserves can be designed in such a way that such pastimes can be available in adjacent areas. The establishment of a reserve will lead to increasing numbers of aquatic birds, not only within the reserve but also in the adjacent area, and the birds will remain in the district longer. This may be favourable for those interested in shooting, and also give nature lovers better chances to observe the birds. Denmark is the first European nation to draw up a strategy for a complete network of reserves for migrating waterfowl. The Danish model can form the basis for similar initiatives to provide protection in other countries.

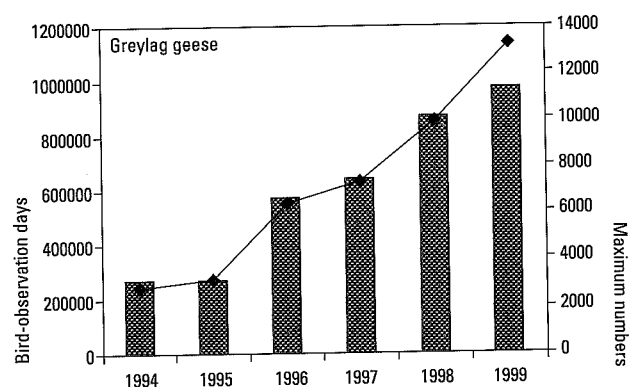


Figure 3.4 Trends in 1994-1999 in the total maximum numbers of resting greylag geese (curve) and their total exploitation, shown as bird-observation days (bars), in 19 reserves.

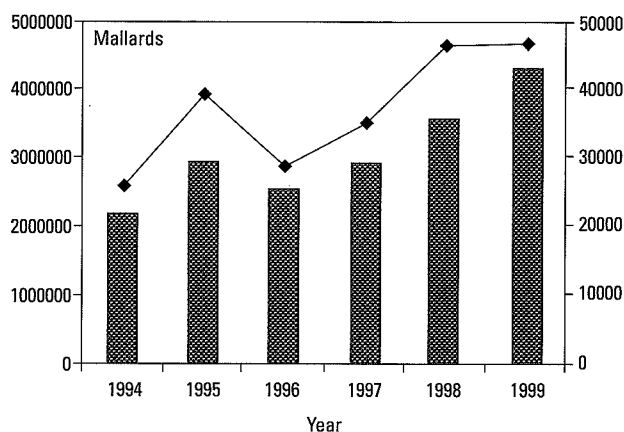


Figure 3.5 Trends in 1994-1999 in the total maximum numbers of resting mallards (curve) and their total exploitation, shown as bird-observation days (bars), in 38 core areas where shooting and other forms of disturbance are forbidden.

Restoration

The previous section dealt with the protection of existing areas of wetland, but a feature that characterises Denmark is that the country has been increasingly intensively exploited and wetlands have been drained, significantly reducing their extent. It will therefore be impossible to achieve a favourable state of preservation solely by maintaining and improving the protection of existing wetlands. The Danish Parliament has therefore decided to restore substantial areas of drained lakes and fjords to a wetland state, and considerable sums of money have been allocated for this purpose and to restore and manage other kinds of habitat.

The work began in 1989, and approximately 1.4 billion DKK were spent on several hundred projects in the first 10-year period. It is estimated that about one-third of the sum has been spent on restoring wetlands. The restoration programme is fundamentally based on the principle that the landowners and local communities are willing to voluntarily cooperate to realise the projects, since positive participation is the best assurance for their future. Experience shows that it is generally possible to obtain areas for the projects through voluntary participation on the part of landowners.

The landowners sell land in the project area to the Danish Forest and Nature Agency. Acquisition and re-apportionment of land often takes place in the case of the larger projects, this being advantageous to the farmer, who can still remain actively employed. For instance, the individual farmer can get the various

plots of land that belong to the farm more closely located around the farm buildings. The re-apportionment thus improves the structure of agricultural production locally, and productivity rises. In some restoration projects, some landowners have wanted to release their land in return for a down payment that compensates them for the project permanently limiting their chance to cultivate their land.

It is particularly the major restoration schemes that combine land acquisition and re-apportionment, and compensation payments, accommodated to local conditions and the desires of individual landowners. Grants can also be made to defray the cost of restoration schemes, the applicants being county and municipal authorities, non-profit-making societies and landowners.

Experience in re-establishing lakes, wetlands, damp grasslands and meanders in rivers and streams has shown that restoration can make a significant contribution towards limiting nitrogen leaching and improving water quality locally and regionally. When wetlands are restored with the aim of securing more and better habitats for plants and animals, improved self-cleansing comes as a "free" side effect.

As part of the fulfilment of the EU Nitrate Directive regarding reduction in the discharge of nitrogen and phosphorus to water, the Danish Parliament adopted a Water Environment Plan in 1998, one measure of which was the restoration of wetlands, since the re-establishment of 16 000 ha of wetlands would reduce the leaching of nitrogen to fjords and coastal waters by 5600 tons. Approximately 100 million DKK have been allocated to this task annually until 2003. The many new wetlands are intended to both reduce the leaching of nitrogen and create habitats for wild plants and animals.

Ramsar sites, EU Special Protection Areas and NATURA 2000

Ramsar sites

In 1977, Denmark ratified the 1971 Ramsar Convention and designated 26 Ramsar sites. The Wadden Sea has been added subsequently, which means that the 27 Danish Ramsar sites together make up approximately 7350 km². Eighteen of these are shallow inshore waters. In addition, there are the fjords of western Jutland and the Danish portion of the Wadden Sea. The few Danish freshwater localities that are Ramsar sites are Stadil and Vest Stadil Fjord, Lake Fiil and the Maribo lakes, totalling 1350 ha. The Wadden Sea is the only Danish Ramsar site for which a management plan has been drawn up covering the whole site. This is a coordinated, trilateral plan for Denmark, Germany and Holland that has resulted from the three nations having joined forces to protect the entire Wadden Sea. The Common Wadden Sea Secretariat was set up in 1998 to organise this work. The trilateral cooperation, the secretariat and the joint management plan can be looked upon as a good example of international cooperation on a jointly administered area of valuable countryside.

EU Special Protection Areas

Two years after the Danish ratification of the Ramsar Convention, the EU Council of Ministers adopted the "Council's Directive of 2nd April 1979 Regarding the Protection of Wild Birds" – popularly called the Birds Directive. This commits the member nations to improve the situation for the populations of wild birds in the Union – both birds that breed in the member nations and those that only occur there on migration or in winter. The Directive contains a number of provisions regarding the shooting and capturing of wild birds which resulted in Denmark having to revise its Hunting Act in 1983 and ban the shooting of several species and the use of certain forms of hunting and shooting. The Directive also commits the member nations to designate and secure habitats for specific species of breeding birds and migrating species that regularly return. Consequently, at the same time as it revised the Hunting Act in 1983, Denmark also designated 111 Special Protection Areas (SPAs). These comprised the 26 Ramsar sites that existed at the time and 85 new areas. The latter were both additional wetlands and, particularly, areas containing types of habitat that are

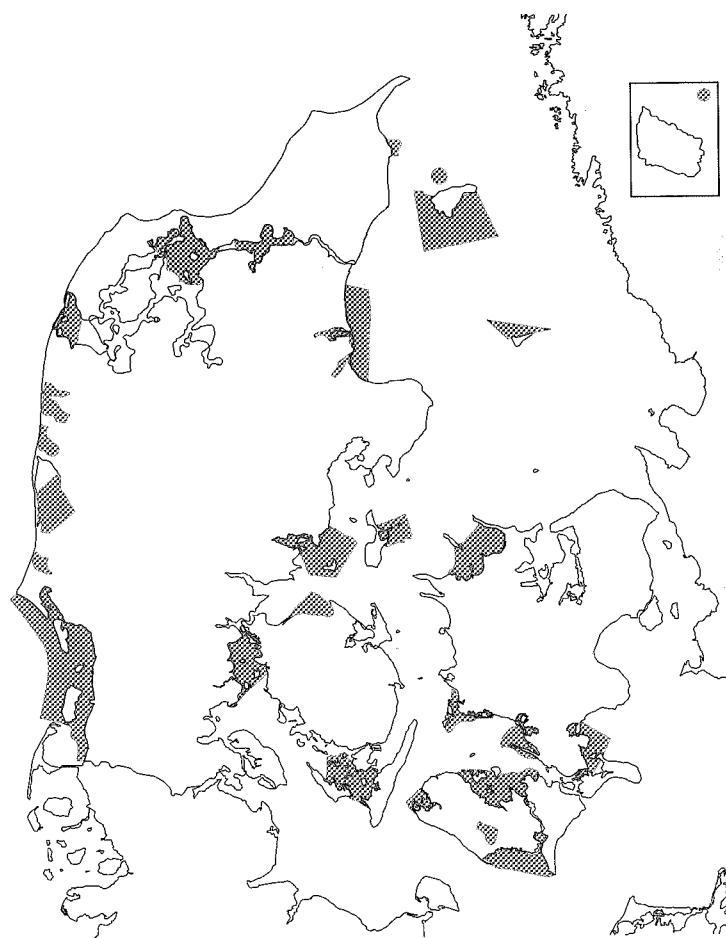


Figure 3.6 Danish EU Special Protection Areas.

typical for Denmark, such as salt marsh, freshwater grassland, heath, woodland and bog. All told, Danish SPAs cover approximately 9500 km². Figure 3.6 shows their distribution.

In 1994, the Ministry of the Environment issued a Departmental Order regarding the demarcation and administration of Ramsar sites and EU Special Protection Areas. Two of its stipulations are that the areas must be included in regional and municipal plans, and that no constructions may be built that can result in a depreciation of the environment within the areas or to disturbances that have significant consequences for the species for which the areas have been designated. Hence, for instance, in the future no sites for weekend cottages may be parcelled out and no main roads or major installations (e.g. windmill parks) may be constructed within these areas. The Departmental Order includes a clause allowing for the possibility to depart from these regulations, but

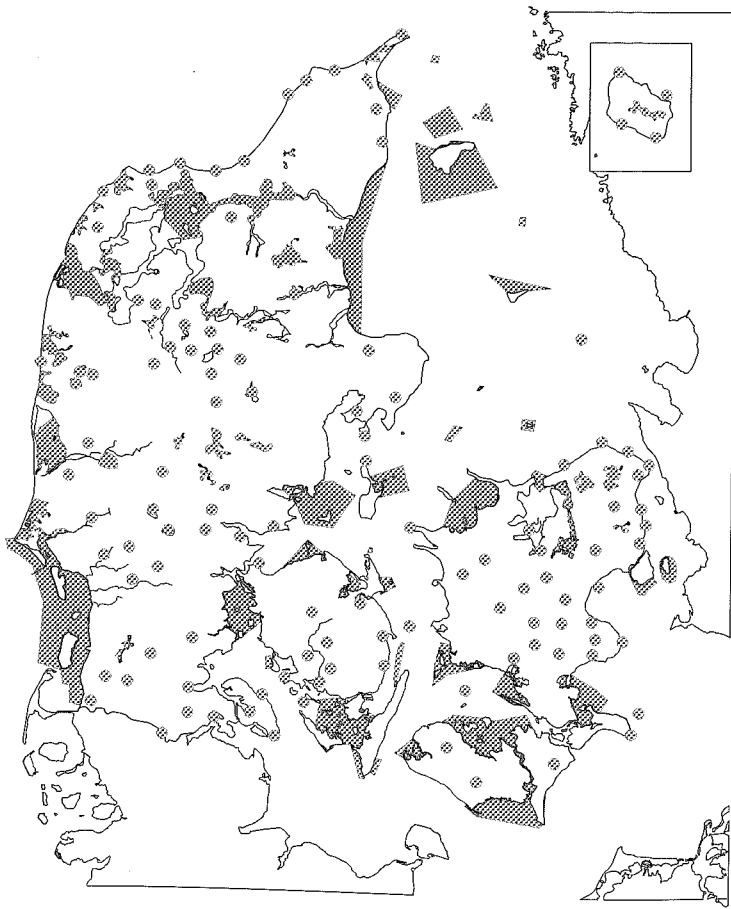


Figure 3.7 Danish EU Habitat Areas.

only when it is absolutely essential to do so for the sake of vital interests for society, including those of a social or economic nature, because no alternative exists.

EU Habitat Areas – NATURA 2000

In 1992, the EU Council of Ministers adopted the "Council's Directive of 21st May 1992 Regarding the Preservation of Habitats and of Wild Animals and Plants", also called the Habitat Directive. This directive commits the member nations to maintain or restore a favourable state of preservation of habitats and of species of wild animals and plants that are important for the Union. The Habitat Directive contains a number of provisions dealing with the establishment, for ecological purposes, of a continuous network of specially preserved areas in Europe, termed NATURA 2000, and the protection of a large number of species. The Directive commits the member nations to designate and secure a large

number of habitats for species that are endangered within their borders. In 1998, Denmark therefore proposed 194 areas for designation as EU Habitat Areas. The majority of these overlap with already designated Ramsar sites and EU Special Protection Areas, but many new areas are included that have types of habitat that are of interest for preservation in a European perspective, including several kinds of wetland. Table 3.11 summarises these wetlands and the areas of which have been proposed for designation. Figure 3.7 shows the proposed EU Habitat Areas in Denmark. The Danish proposal for designating Habitat Areas has been considered by the EU Commission which pointed out that it is inadequate in several respects. In spring 2001, Denmark was therefore considering which supplementary areas might be designated.

In 1998, the Ministry of the Environment issued a Departmental Order regarding the demarcation and administration of the international nature protection areas in Denmark. These include all the Ramsar sites, EU Special Protection Areas and EU Habitat Areas, and, together, they are referred to as International Nature Protection Areas and form part of the EU NATURA 2000 Network of Protected Areas. The Departmental Order states that the objective of preserving International Nature Protection Areas is to secure and restore a favourable state of preservation for the species and habitats for which the areas are designated. An additional objective for the Ramsar sites is that their protection is to be encouraged.

Table 3.11 Areas of various kinds of wetland in Denmark that were proposed in 1998 as EU Habitat Areas (Natura 2000 Network). Currently being revised, with supplementary proposals

Type of habitat	Natura 2000 habitat code	Area (ha)
COASTAL AND HALOPHYTIC HABITATS		
Sand banks which are slightly covered by sea water all the time	1110	251 311
Estuaries	1130	2018
Mudflats and sandflats not covered by sea water at low tide	1140	67 447
Coastal lagoons	1150	12 163
Large shallow broads	1160	208 652
Reefs	1170	21 998
Glassworts <i>Salicornia</i> spp. and other annuals colonising mud and sand	1310	2104
SEA-SHORE MEADOWS AND NARROW INLETS		
Atlantic salt marshes	1330	29 719
Established coastal dunes with herbaceous vegetation	2130	4141
Moist dune slacks (wet depressions in sand dunes)	2190	614
Coastal dunes with junipers	2250	224
FRESHWATER HABITATS - STANDING WATER		
Oligotrophic waters containing very few minerals, on sandy plains	3110	773
Hard, oligo-mesotrophic waters with benthic vegetation comprised of stoneworts <i>Chara</i> spp.	3140	490
Natural eutrophic lakes with <i>Magnopotamion</i> - or <i>Hydrochariton</i> -type vegetation	3150	9025
Natural dystrophic lakes and ponds	3160	207
FRESHWATER HABITATS – RUNNING WATER		
Watercourses on plains and montane plateaus with <i>Ranunculion fluitans</i> and <i>Callitricho-Batrachion</i> vegetation	3260	406
HEATHS		
Northern Atlantic wet heaths with heather <i>Erica tetralix</i>	4010	2026
Purple moor-grass <i>Molinia caerulea</i> meadows on peaty or clay-silt rich soils	6410	757
MIRES		
Active raised bogs	7110	2713
Degraded raised bogs still capable of natural regeneration	7120	567
Transitional mires and quaking bogs	7140	127
Fennoscandian mineral-rich springs and spring fens	7160	-
Calcareous fens with great fen-sedge <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> alliance	7210	43
Petrifying springs with tufa formation	7220	4
Alkaline fens	7230	262
OTHER ROCKY HABITATS		
Submerged or partially submerged sea caves	8330	1
WET FORESTS		
Bog woodland	91D0	1517

Threats, challenges and scientific requirements

Discharge of nutrients - eutrophication

The nature and the biological diversity of the wetlands are affected by numerous human activities, among the most important of which is the discharge of nutrients, first and foremost from agriculture. This began in the 1950s, and the concentration of nutritive substances in Danish offshore waters increased from 1975 until the beginning of the 1990s. Their concentration in individual years is closely related to the runoff from land, and hence the precipitation that particular year. When the figures were corrected for runoff, it was estimated that the discharge of nitrogen from Denmark to Danish waters in 1989-98 was reduced by approximately 15 % relative to the average for 1981-88. During the last 10 years, between 2000 and 9500 tons of phosphorus have reached the sea each year. This influx dropped markedly during this period, mainly because of better sewage cleansing.

The influx of nutrients has brought about eutrophication that, in turn, has increased the production of algae. Moreover, there seems to have been an increase in the number of mass blooms of algae, and several of the species concerned are toxic. A change in the composition of the vegetation has also been observed in several places. Another effect of the eutrophication is a reduced depth of visibility now compared with earlier, among other things, leading to a marked reduction in the depth limit for eelgrass *Zostera marina* and several macroalgae since the beginning of the 20th century; a declining concentration of oxygen has also been noted in many bodies of water in recent decades.

Past and present environmental legislation relating to agriculture has largely focused on limiting the loss of nitrogen to the aquatic environment. Measures implemented with a view to reducing the loading of the aquatic environment with phosphorus have primarily been undertaken in connection with cleansing of sewage from towns and industry. As the discharge of phosphorus from specific sources has been reduced, the diffuse phosphorus load from cultivated land has now become the largest single source of eutrophication of coastal waters and lakes. The application of phosphorus to agricultural land is now partially regulated, among other ways by regulations on the use of fertilisers. However, the norms determined for the

application of phosphorus to crops are only intended as guidelines. The amount of phosphorus reaching Danish farmland through commercial fertilisers fell from 16.8 kg P/ha in 1985 to 7.3 kg P/ha per unit area in 1999, whereas that derived from animal manure rose from 17.0 kg P/ha to 20.7 kg P/ha in the same period. Phosphorus removed with crops has varied between 17 and 22 kg P/ha. The net addition of phosphorus to farmland has thus fallen from approximately 15 to just less than 11 kg P/ha from 1985 to 1999. It is thus particularly animal manure that, in some districts, leads to a significant accumulation of phosphorus in the soil. Today, more than 50 % of Danish farmland has no need of phosphorus to achieve optimal plant production. The high phosphorus content in the soil means that erosion products carried to watercourses, and particulated substances washed into drainage pipes from the topsoil, have a high phosphorus content. Moreover, investigations in other countries have shown that leaching of dissolved phosphorus rises strongly with a high content of phosphorus in the soil. Consequently, a sustainable development of agriculture should include an effort to tackle the phosphorus load in agriculture for the sake of the aquatic environment.

It is their phosphorus content that is important for the environmental state of the great majority of lakes, since this often determines the growth of algae in the water. A high phosphorus content results in many algae in the water and excessive amounts of algae in the water keep the light away from aquatic plants. The lack of aquatic plants means that the biological structure of the lake breaks down and the lake loses much of its biological value. A prerequisite for improving the state of the lakes is therefore a continued effort to reduce the external load from specific sources and the diffuse influx from farming and scattered habitation. The kind of land use around the lakes is also important in this context. However, such efforts will not always be adequate. Even in lakes where the influx of nutrients has been reduced to an ecologically acceptable level, an immediate improvement in the water quality is not always observed. In many cases, this is because a chemical or biological inertia or imbalance has been built up in the lake due to excessive phosphorus having entered the lake over many, many years to accumulate in the bottom sediments from which it is slowly released into the water. The lake in a way pollutes itself and,

depending on the physical and chemical conditions in and around the lake, this release may continue for many years.

The biological inertia is often caused by the presence of a fish population that lacks predating fish, and just a few abundantly occurring species, such as roach and bream, dominate. Such a population means that large numbers of the small creatures that live on the algae in the water will be consumed. This in turn means that there will be no biological regulation of the algae, which therefore grow without restraint due to the large quantities of nutrients in the water. The algal blooms result in reduced visibility in the water so that aquatic plants are unable to recolonise and help to restore a better biological balance in the lake. In such lakes, the implementation of bio-manipulation, that is the mass fishing of fish that eat zooplankton and the release of fish that predate on the remaining fish, as well as perhaps the introduction of aquatic plants, will help to achieve a better ecological state in the lake.

Several ways of restoring lakes have been evolved and tested in Denmark during the last 20-30 years, but by far the majority of restorations have been carried out in recent years. In most cases, the efforts have been directed at breaking the chemical and/or biological inertias. No proper survey exists of how many lakes have undergone restoration, but a report from 1998 describes the experience gained from attempts to restore 27 lakes (Miljøstyrelsen 1998). Experience won from the first restorations suggest that many years may pass before an effect is seen, and the most recent appraisals indicate that many of the measures need to be repeated for a shorter or longer series of years if a long-term effect is to be achieved.

Ammonia deposition

Airborne influx of nitrogen in the form of ammonia deposition constitutes a significant problem, particularly for rivers, streams and lakes that are very poor in nutrients. There are few of those in Denmark, and they are given high priority and are protected. When ammonia is deposited, the water becomes still more acidic, resulting in the basis for the very special plants and animals being reduced or threatened. At the same time, such deposition in nutrient-poor water systems represents a fairly substantial influx of nitrogen, thus contributing to harmful eutrophication.

This problem is greatest in central and western Jutland, where the soil is poor.

Ochre pollution

In some areas, particularly in western Jutland, the lowering of the water table, generally due to drainage, results in iron-bearing soil being oxidised, forming ochre which finds its way into rivers and streams. There, the opacity and low oxygen content of the water have a marked negative impact on all life. A separate piece of legislation, the Ochre Act, aims at preventing and combating the ochre pollution of rivers, streams, lakes and the sea in connection with the ditching and drainage operations of the agricultural industry. The Act includes a scheme to provide grants for ochre-reducing measures, including such that improve the quality of the water system. Monitoring has shown that such measures generally have a positive biological effect on the plant and animal life in the watercourse and that small animals and fish which are sensitive to ochre extend their distribution up watercourses contaminated with ochre.

Environmentally toxic substances

Little information exists in Denmark concerning the occurrence and possible harmful effects on lakes, rivers and streams of heavy metals, pesticides and other substances that are not normally present in the environment. However, a few studies in Denmark and Sweden do seem to reveal a connection between the content of pesticides and the environmental state of lakes. Environmentally toxic substances reach coastal waters through diffusion via watercourses, direct discharges, ocean currents and the atmosphere. Exact knowledge about the various chemical substances that have an impact on the marine environment is limited. However, such toxic substances may affect the biological community at all levels from bacteria to mammals, for instance through their effect on reproduction and growth.

In Denmark, the antifouling substance, TBT, and its breakdown products are examples of substances that have spread throughout the marine food chain. Because of the high density of shipping, these compounds are found everywhere in Danish waters and they accumulate up the marine food chain. Very high concentrations have thus been found in fish in ports, and at the top of the food chain the concentrations in porpoises are the highest measured any-

where in the world. Ostrogene-like substances, and other substances that disturb hormones, pose a special threat in relation to biodiversity in that they probably affect important reproductive functions. It has been well documented that TBT can cause sea snails to change sex. Four sea snail species have been investigated for this in Danish waters and the effects of TBT have proved to be widely dispersed everywhere.

Oil pollution will pose a special threat to bird life should a major oil spill take place at an unfortunate time and place. Discharge of oil waste into the sea is forbidden throughout Danish waters, but it is difficult to monitor and to apprehend those who infringe the regulations. The introduction of compulsory pilotage is being discussed at present because of a collision between two ships in April 2001, one of which was an oil tanker. The collision led to the largest oil spill that has taken place in Denmark.

Physical conditions – watercourse maintenance

Many Danish rivers and streams have been regulated to improve the drainage of surrounding areas. Originally, this was primarily aimed at creating better reliability for cultivating summer crops. Nowadays, it is often expected that the draining ability of the watercourses can ensure year-round cultivation of fields in the river valleys. This expectation, compared with the position of the fields along the watercourses, generally leads to greater pressure on the river authorities to maintain the watercourses. Where watercourses flow through extensively cultivated areas, or uncultivated areas where there is less interest for drainage, the maintenance can be carried out with less disturbance, or not be done at all. The prerequisite for a limited amount of maintenance, or no maintenance at all, will often be that the extent of the watercourses is increased enabling them to develop naturally with the result that the physical conditions are improved, forming a basis for a more varied plant and animal life. An integral effort in relation to the natural quality of the river valleys and the quality of the watercourses is therefore essential to produce a satisfactory aquatic environment. The physical conditions that have a decisive impact, particularly on migrating species, include dams and other obstructions on the watercourses. Such obstructions are currently being registered, and an effort is being made to remove them or make gaps through which wildlife may pass.

By-catches of mammals and birds

By-catches of dolphins *Delphinus delphis* and common porpoises *Phocoena phocoena* take place in several EU fisheries and the EU Commission acknowledges the need to reduce the by-catches of small whales in accordance with, for instance, the Habitat Directive and the ASCOBANS Agreement regarding the protection of small whales in the North Sea and the Baltic Sea. Denmark is the only EU nation which, with the active participation of the fishing industry, has adopted an operational plan of action to reduce by-catches of common porpoises and has implemented the mandatory use of acoustic transmitters in the North Sea net fishery. This effort will be continuously evaluated and adjusted, and is supported by specifically directed research.

There is a need to undertake a specific evaluation of the extent of by-catches of birds in Danish fisheries and to adopt appropriate measures.

Disturbances

Many species of birds and seals breed on the coast and are particularly vulnerable to disturbance from people during the breeding season. Outside the breeding season, comparatively intense shooting periodically takes place in inner coastal waters in Denmark, and the heavy traffic of small boats constitutes another disturbing element. Moreover, the open sea and coastal waters are exposed to disturbance in the form of tourism and recreation, shipping, air traffic, working of gravel, sand and stone, construction of harbours, bridges, coastal protection works, wind-mills, and so on.

Target and scientific requirements for rivers and lakes in Denmark

The following proposals for a target and requirements for bodies of fresh water in Denmark are currently being discussed.

Target

The overriding target for Danish rivers and lakes is to increase their biodiversity by bringing water back into the landscape. The intention is to restore the free dynamics of the watercourses by broadening the way the land close to them is used and re-opening culverted rivers and streams. The water in the lakes must be clear and have deep visibility, and the diversity of the various kinds of lakes must be preserved, whether they be large, deep ones, small ones, or those with few nutrients. This is to be realised by drawing up overall plans to ensure the continuity of bodies of water through the countryside and the integration of environmental and countryside projects.

Scientific requirements

The following initiatives are recommended to realise this target:

1. A scheme should be agreed upon that will restore areas of semi-cultural landscape along rivers and streams throughout the country over a 15-year period with the aim of increasing and recreating the interaction between the self-cleansing effect of rivers and streams and the areas close to them, at the same time as the natural qualities of the river valleys as a whole are increased. Concerted planning and administration of the river valleys will be an important aspect in the implementation of the EU Framework Directive for Water.
2. A national plan of action should be drawn up to safeguard the quality of the internationally important Danish lakes where water lobelia *Lobelia dortmanna* is found. It must in part tackle the problem of leaching and re-deposition of nutrients and substances that have an acidifying effect and in part be concerned with the management and utilisation of surrounding areas. Moreover, the protection of the few reference lakes and rivers should be considered.
3. When the current Water Environment Plan II expires, a targeted effort should begin in connection with a future Water Environment Plan III to

tackle the diffuse runoff of nutrients, including phosphorus, from farmland.

4. The physical conditions in the watercourses, including corridors for animals and fish to get past obstacles, should be improved on the basis of investigations and prioritising of the work. More public funds should also be made available to restore watercourses and remove obstacles, and more focus should be placed on ensuring a flow of water in dried up stretches of river with the help of dams.
5. The Watercourse Act should be revised, partly in response to the Framework Directive on Water. The objective of the Act and its administrative structure should be more oriented towards nature and towards taking all aspects into account so that it can reflect the multipurpose value of watercourses for Danish society, such as to drain water, act as ecological corridors and in other ecological contexts, ensure biological diversity, serve recreational pursuits and educational purposes, and so on.
6. The following aspects should also be incorporated into the future management strategy for biodiversity in fresh water:
 - principles for maintaining altered watercourses should be laid down that provide better opportunities for abandoning their upkeep and strengthening and promoting maintenance that causes little damage
 - the possibility of constructing flexible, protective banks along rivers and lakes to protect the biodiversity
 - the effort to reduce the impact of water reclamation should be maintained and intensified
 - a system should be provided to set targets for preservation efforts and their fulfilment, including the setting up of a monitoring system to be able to keep a continuous check on the status of the preserved object and its ecological state (cf. the Habitat Directive and the Framework Directive for Water).

Overriding targets and scientific requirements for marine areas in Denmark

The following proposals are currently being discussed regarding the overriding targets and recommendations for ecosystems in Danish waters, and hence the wildlife and biological diversity in the sea.

Overriding targets

- Native species of plants and animals must be present in healthy, self-reproducing populations that are viable in the long term within their natural ranges.
- The physico-chemical conditions must underpin the attainment of the targets for biological diversity in marine habitats.
- Human utilisation of the marine resources must be ecologically sustainable and must take place in keeping with the precautionary principle.

It is recommended that these overriding targets are attained by setting specific targets for the quality of coastal waters and the open sea based on the natural conditions of the areas and the targets and obligations which Denmark has undertaken to fulfil nationally and internationally.

Scientific requirements

Seven groups of sub-targets have been formulated under the umbrella of the overriding targets, and these deal with the following aspects:

- nature management based on available knowledge
- physical protection of species and habitats
- release of species
- ecological quality
- exploitation of marine species
- overall view and ecosystem-related way of thinking
- sectoral responsibility.

For each aspect, a number of means and actions are discussed which are considered necessary to achieve a substantial measure of fulfilment of these targets. The following may be mentioned because of their special interest in the context of this report:

1. When the programme for monitoring the sea under the terms of the Water Environment Plan is revised, the chemical parameters should be evaluated and the biological parameters should be expanded with relation to factors that influence them. Furthermore, emphasis should be placed on finding indicators that reflect a broader spectrum of the biological diversity in the sea than the parameters built into the Framework Directive for Water, for instance birds, fish and marine mammals. It is therefore suggested that a panel of experts (with open terms of reference) be set up to consider the management and monitoring of marine diversity.
2. Large, continuous areas of sea should be demarcated to prevent them being affected by significant forms of human impact of a physical nature, including some kinds of fishing such as trawling, mineral extraction, oil and gas extraction, express ferries, aquaculture, shooting from motor boats, and technical installations. The purpose of such areas is chiefly to protect the nature there and to ensure that the natural environment can function and evolve on its own premises, but also to act as future biological reference areas for use when monitoring and carrying out scientific investigations, and thereby help to ensure adequate knowledge for the long-term management of nature and fish resources.
3. Discharges from ships are forbidden in all Danish waters. The risk of spills caused by accidents should be minimised, partly through more stringent rules regarding obligations to deliver waste oil, destruction of hulls, special sailing lanes, monitoring and readiness.
4. There is a need for a specific assessment of by-catches of birds in Danish fisheries and the adoption of appropriate preventive measures.
5. The principle of maintaining an overall view and an ecosystem-related way of thinking is embodied in a number of agreements, such as the Biodiversity Convention and the Ramsar Convention, and also in the notion of sustainability. However, there is a great need to apply it to the everyday task of managing nature and natural resources. Thus, agreement should be reached for integral planning of the coastal zone, covering both land and water, and which is coordinated with the planning of aquatic areas in accordance with the Framework Directive for Water, the Habitat Directive and the Birds Directive. Links should be created between the quality targets and the efforts in coastal waters and areas of open sea in the shape of strategic planning for nature. The planning process must include a statement of goals, the implementation of an active effort to attain the goals and an evaluation of their attainment. Furthermore, monitoring of nature is included as a strategically important, independent activity.

See Chap. 7 for relevant references.

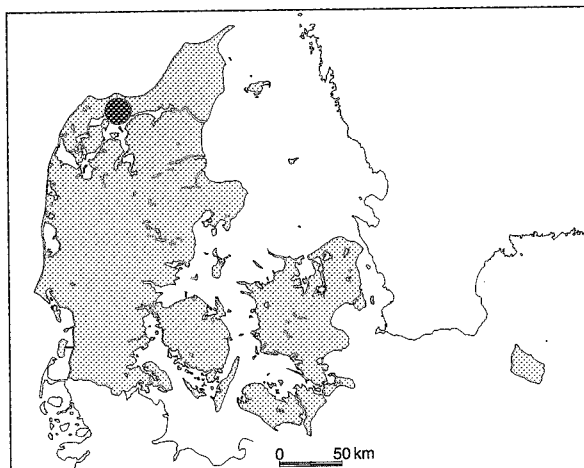
Examples of wetlands in Denmark

Vejlerne – a reclaimed fjord landscape



Figure 3.8 In the 1870s, large, shallow broads in Limfjord, northern Jutland, began to be reclaimed. The effort was unsuccessful and the partially reclaimed areas eventually developed into the largest, most famous wetland in Denmark with more birds than any other Danish wetland. The area comprises extensive salt marshes, reed beds, swamps, lakes and channels. However, the drainage conditions are still producing problems, partly because large quantities of nutrients are entering the area from adjacent arable land. The photograph shows the eastern Vejler. Note the difference in colour between the brown water of the broad in the foreground that has most nutrients and the less nutrient-affected blue water in the background. An effort is now being made to keep the majority of the agricultural runoff away from the unfarmed land.

PHOTO: JWLUFFOTO



National protection: An area of approximately 6000 ha was protected in 1958 and designated as a scientific reserve in 1960.

International status: Ramsar site and EU Special Protection Area.

Description of the area

Until the 1870s, the Vejlerne were shallow parts of Limfjord. During the 1870s, an English consortium dammed and began draining the eastern part, and the reclaimed area was planted with grass to produce hay fields and grazing. The western part was dammed about 10 years later. Following some technical problems and dyke breaches in connection with high tides and storm surges, the consortium gave up pumping out the greater part of the area around 1903 and instead allowed low-water floodgates to regulate the drainage. In 1912, the Vejlerne were taken over by a Danish consortium which, in 1917, abandoned the final, extensive pumping out of water. The water level was maintained slightly below the level of Limfjord, and since then the Vejlerne have remained as large, continuous wetlands. Thousands of aquatic birds quickly made their homes in this paradise. The dominant habitats are shallow, freshwater and brackish-water lakes, large reed beds on wet and dry substrates, and mostly fallow grassland. The area has been used for cattle grazing, haymaking, harvesting reeds for thatching, shooting and fishing. Shooting has been forbidden since 1996.

Management problems

In 1965, a main road was built and a new, efficient central sluice was constructed on the Bygholm Dam. This sluice was instrumental in lowering the water level in the eastern part and led to a drastic reduction in the bird life. Over the past 25 years, the water quality has also deteriorated due to contamination from nutrients derived from farms and towns. In addition, wetlands surrounding the Vejle Nature Reserve have been drained and brought under cultivation.

Thanks to private landowners raising the water level in some areas in recent years, and extensive cattle grazing and cutting of reeds for thatching, large populations of many bird species have been restored. The area has become famous for its large breeding population of great bitterns, an endangered species throughout Europe. However, further raising of the water level and entire or partial separation of the drainage from surrounding farmland and the nature reserve are desirable to improve the water quality and the conditions for the birds. Several technical reports dealing with this have been completed.

Scientific requirements

- pilot studies on the water level, water quality and drainage conditions need to be completed
- based on these, the bird life needs improving by raising the water level in several parts of the area, improving the water quality and changing the drainage conditions.

Bibliography

- Hald-Mortensen, P. (ed.) 1998. *Vejlernes natur – status over reservatets mangfoldighed 1998*. Aage V. Jensens Fonde. 302 pp.
- Jensen, F. Pagh 1996. *EF-fuglebeskyttelsesområder – kort og områdebeskrivelser, status 1995*. Skov- og Naturstyrelsen. Pp. 36-37, 50-51.
- Laursen, K. (ed.) 1999. *Overvågning af fugle 1997-98, resultater fra feltstationerne. Faglig rapport fra Danmarks Miljøundersøgelser nr. 267: 10-15, 39-47*.
- Laursen, K. (ed.) 2001. *Overvågning af fugle, sæler og planter 1999-2000, med resultater fra feltstationerne. Faglig rapport fra Danmarks Miljøundersøgelser: 12-28*.
- Lynghus, et al. 2000. *Naturgenopretning, De Østlige Vejle, tekniske forundersøgelser*. COWI.

Vest Stadil Fjord – a drained brackish-water area under restoration



Figure 3.9 Vest Stadil Fjord before its restoration

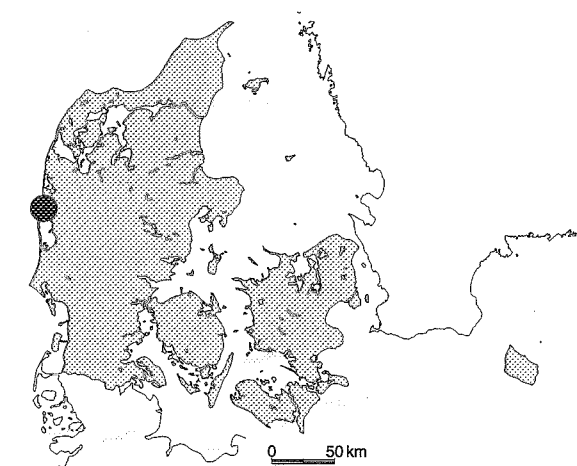
PHOTO: DANISH FOREST AND NATURE AGENCY



Figure 3.10 Vest Stadil Fjord after its restoration.

PHOTO: DANISH FOREST AND NATURE AGENCY

Vest Stadil Fjord is situated on the west coast of Jutland, on the route used by many waterfowl when migrating from their breeding areas north of Denmark to their winter quarters in Denmark or further south. It was an important staging post on this route before the area was drained in 1949-55. The restoration of this area was therefore given high priority when such schemes became feasible in the 1990s. The land was purchased by the nation from 1994 onwards, and in 1999 the water level was raised. Now, some 1500 ha of the inlet have been restored to their natural state, and thousands of swans, geese, ducks and waders have already taken up residence. Figures 3.9 and 3.10 show the area before and after the restoration.



National protection: An area of about 1500 ha was protected in 1969 and 1974

International status: Ramsar site, EU Special Protection Area and EU Habitat Area

Description of the area

Prior to the drainage of the area, which chiefly took place from 1949 to 1955, Vest Stadil Fjord was continuous with Stadil Fjord and Ringkøbing Fjord. Large, swampy areas surrounded these inlets. The whole district was one large, continuous, undisturbed area richly endowed with plant and animal life. Between 1862 and 1949, many attempts were made to dam, drain and cultivate the inlet, but the area close to the west coast was exposed and was often inundated by storm surges. In 1949, an electric pump was installed that was intended to maintain the water level about 40 cm below sea level. With the help of grants and loans made available under the terms of the Land Reclamation Act, the landowners lowered the water table by an additional almost 1 m in 1955, enabling approximately 1000 ha of former sea bed to be put under the plough. Only three areas of water, amounting to some 400 ha, remained intact in Vest Stadil Fjord. Plans were put forward for a further lowering of the water level at the end of the 1960s, but protection orders in 1969 and 1974 prevented this.

Management problems

In July 1994, the Ministry of Agriculture purchased all the 1518 ha of agricultural land and unused land. These areas were well suited as supplementary land for neighbouring properties and could help to bring about an expedient structuring of properties in the area. A working group composed of representatives from the county of Ringkøbing, the Agricultural Commission and the Danish Forest and Nature Agency proposed the implementation of a restoration project, reserving 280 ha which could be made available to local farmers as supplementary land when the area had become stabilised in its new state. The plans thus ensured a balanced use of the agricultural land and unused wetland. The Directorate for Land Reallocation has subsequently entered into agreements with landowners and undertaken a redistribution of land. Even though some 425 ha of agricultural land have been taken out of intensive use, the local farmers have been guaranteed a livelihood for the

future, in part through being able to cut reeds for thatching, graze livestock and make hay.

The restoration project has raised the water level in the area, and several large bodies of water have been re-created. Extensive reed beds and marshes will eventually develop making it possible for the former very rich bird life to return. The newly restored areas have already attracted large flocks of resting waterfowl. In the first autumn following the raising of the water level, more than 30 000 migrating swans, geese, ducks and waders were recorded resting and foraging in the area. Several of the species figure on both national and international Red Lists of endangered species.

In a beautiful area where no motor vehicles have access, 10 km of paths and cycle tracks have been constructed for the use of visitors. Viewing towers have been built, and a shooting lodge dating from the 1930s has been restored to serve as an information centre telling the history of the inlet. A hide has been constructed in the new reed beds so that keen bird-watchers can study the waterfowl without disturbing them.

The cost of the project, including acquisition, planning, constructional work and recreational activities, has amounted to approximately 30 mill. DKK, or about 25 000 DKK a year. The EU LIFE-Nature scheme contributed about 6 mill. DKK towards the cost of the construction work.

Scientific requirements

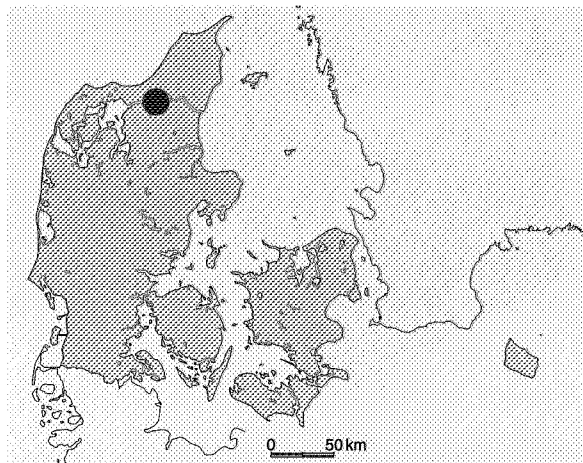
- continue monitoring the habitats and the trends in bird populations
- based on the monitoring, consider possible adjustments to the restoration project and the running of the area.

Bibliography

Skov- og Naturstyrelsen 1999. Naturforvaltning gennem 10 år – 1989-1998. Pp. 158-160, 167-168.

Nibe and Gjøl Broads – an area where shooting and other forms of disturbance are forbidden

In 1989-96, a number of experiments were carried out involving periodical bans on shooting and other forms of disturbance in different parts of the Nibe and Gjøl Broads. The distribution of birds in the area had been mapped prior to that. While the experiment lasted, it was found that species which were allowed to be shot gathered in the protected parts of the area, whereas protected species did not change their distribution pattern. The number of waterfowl, particularly Eurasian wigeon, in the area increased significantly, and the birds stayed longer. The conclusion drawn from the study was that the establishment of such areas where shooting and other forms of disturbance are not permitted is an efficient way of enhancing the value of wetlands for waterfowl.



National protection: The islands and an area of about 18,000 ha have been protected as a wildlife reserve since 1976, parts of the broads were designated as an experimental reserve in 1989 and since then protected as a permanent wildlife reserve.

International status: Ramsar site and EU Special Protection Area.

Description of the area

The area is part of Limfjorden. It comprises two large, shallow broads with adjacent lagoons, a reclaimed arm and the surrounding salt marshes and swamps. The uninhabited islands on the broads are home to large breeding populations of gulls, terns and waders.

Most of the islands are protected as wildlife reserves and it is forbidden to visit them during the breeding season. These shallow broads provide important resting and foraging areas for numerous waterfowl, particularly in winter. Thousands of swans, ducks and coots migrate through the area or stay there for shorter or longer periods to eat eelgrass *Zostera marina* in the shallow water.

Management problems

In Denmark, everyone holding a game licence has the right to shoot in territorial waters, including the fjords. Because of the large numbers of waterfowl on the Nibe and Gjøl Broads and the connecting waters, a great deal of shooting has taken place in the area. The negative impact on the bird life of various forms of shooting and other recreational pursuits like fishing, sailing and windsurfing was studied in 1985-88. It transpired that shooting, especially that taking place from punts, was the most disturbing activity for the resting waterfowl.

In response to these studies, an experimental reserve was established in the area in 1989-96, where shooting and other forms of disturbance were forbidden in varying parts of the area (Fig. 3.11). The results showed that ducks that were allowed to be shot moved to the areas where shooting and other forms of disturbance were not permitted, whereas no change took place in the distribution of protected species (Fig. 3.12 shows data for the non-protected Eurasian wigeon). The numbers of non-protected dabbling ducks increased by 4-5 times. These ducks also extended their stay in the area from the autumn into the winter.

Protected species and the non-protected common coots did not change their distribution within the area, and their numbers fluctuated or rose. The number of species in general also increased from before to after the experiments. Changes in the availability of food, the intensity of recreational activities outside the reserve, the climate and the sizes of the popula-

tions in general were unable to explain the increases observed. In other words, it was the establishment of the areas where shooting and other forms of disturbance were forbidden that led to the successful result.

The conclusion drawn from the study was that the establishment of areas where shooting and other forms of disturbance are forbidden is an effective way of improving the value of wetlands for waterfowl. A permanent wildlife reserve has therefore been established in the area. There has been a marked reduction in the distribution of eelgrass in the area in recent years, leading to a significant drop in the waterfowl population. The precise reasons for the decline in eelgrass is still not known, but hypereutrophication probably plays some part.

Scientific requirements

- continue monitoring the bird populations
- continue monitoring the distribution of eelgrass and other aquatic plants in the area
- investigate possible reasons for the decline in eelgrass.

Bibliography

Madsen, J. 1998a. Experimental refuges for migratory waterfowl in Danish wetlands. I. Baseline assessment of the disturbance effects of recreational activities. *Journal of Applied Ecology* 35: 386-397.

Madsen, J. 1998b. Experimental refuges for migratory waterfowl in Danish wetlands. II. Tests of hunting disturbance effects. *Journal of Applied Ecology* 35: 398-417.

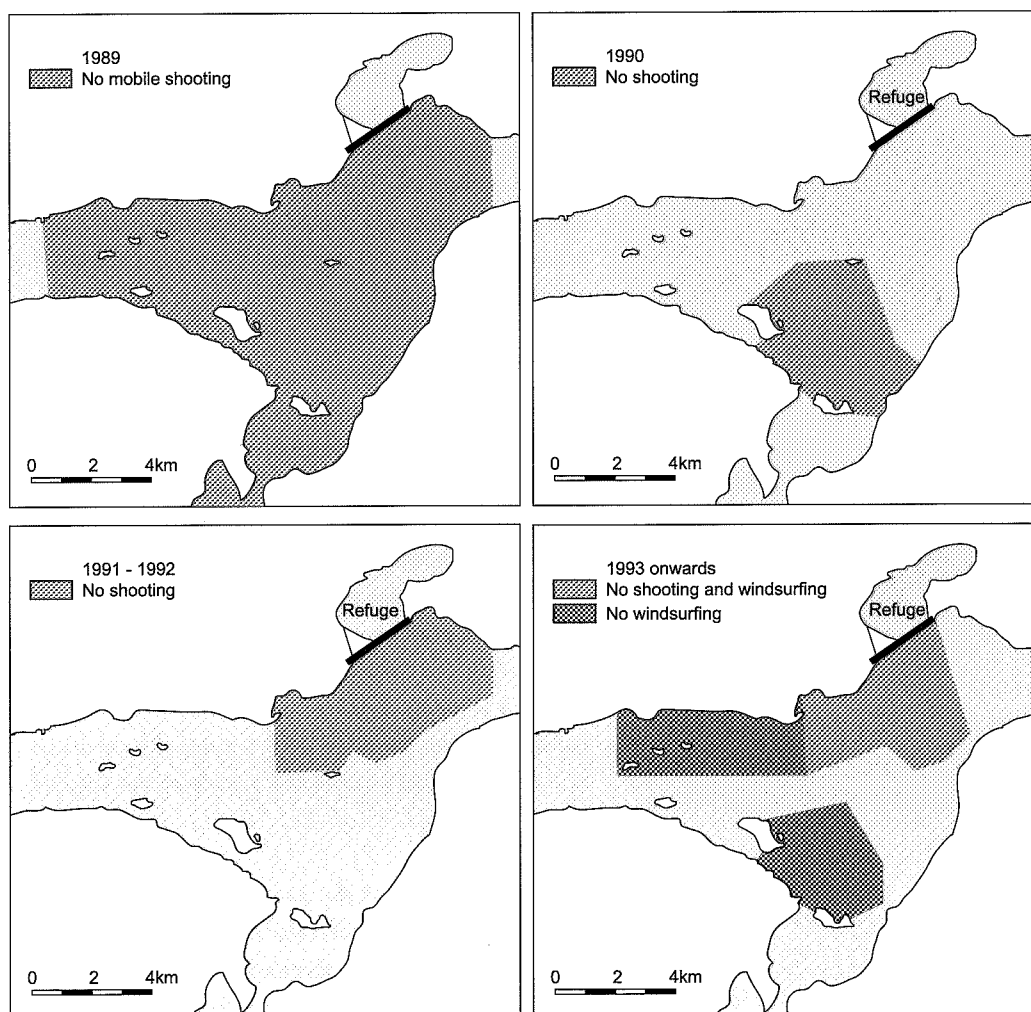


Figure 3.11 Map of the area showing the parts where shooting and other forms of disturbance were not permitted. Experimental regulations of shooting in the experimental reserve on the Nibe and Gjøl Broads in 1989-92, and the permanent wildlife reserve from 1993. In 1989, the effect of a ban on shooting from punts in the whole area was assessed. In 1990, the effect of a total ban on shooting in a sub-area in the south was assessed, and likewise a similar ban in 1991-92 in a sub-area in the north. From 1993, the effect of a total ban on shooting in a sub-area in the north and a ban on windsurfing in the same sub-area and two more sub-areas were assessed.

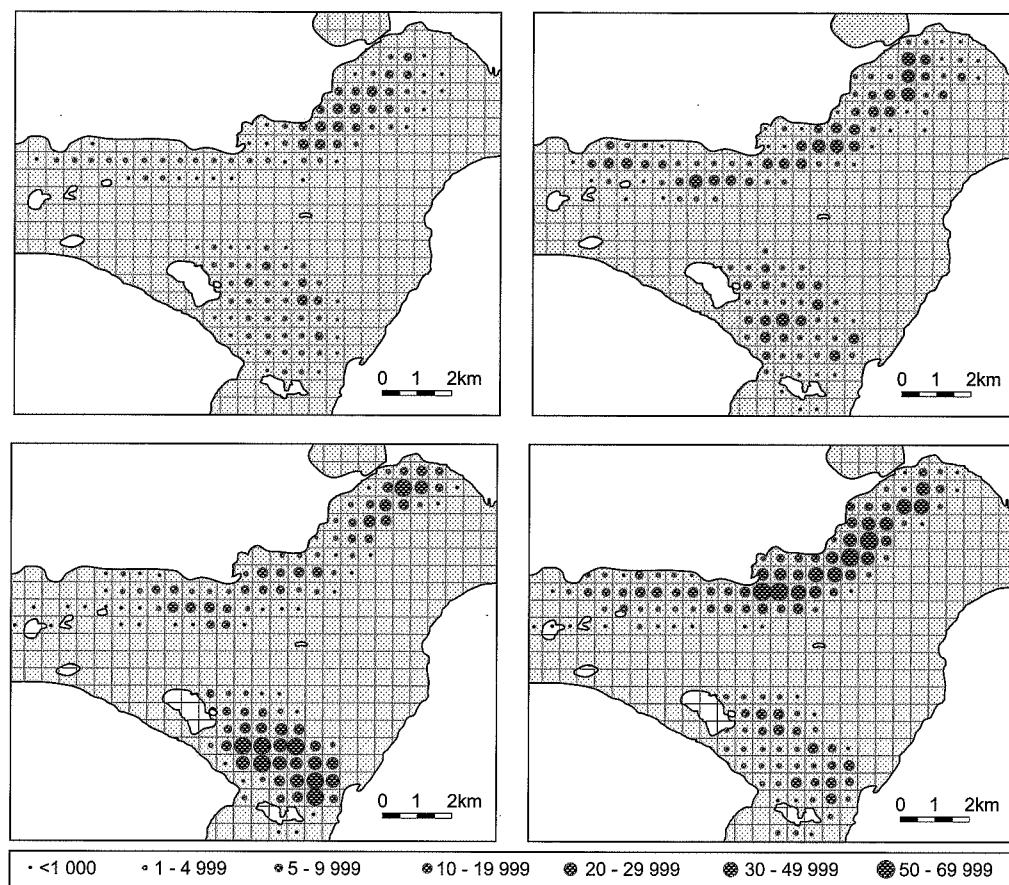


Figure 3.12 Distribution of Eurasian wigeon *Anas penelope* on the Nibe and Gjøl Broads before the shooting was regulated (in 1987-88) and during the years with various kinds of experimental regulations of shooting (1989-91) expressed as the number of bird-observation days in August to December, in 500 x 500 m quadrants.

3.5.2 GREENLAND

Greenland, the largest island in the world, comprises a total land area of 2.1 million km², 4/5 of which is covered by ice. The population, numbering approximately 55,000, is concentrated in the south-west. Fishing, trapping, hunting and sheep rearing form the traditional livelihoods of most of the inhabitants.

Greenland, the Faeroes and Denmark make up the Kingdom of Denmark, Greenland and the Faeroes having a large measure of autonomy. The Greenland Home Government (Landsting), which sits in Nuuk, was established in 1979 and is responsible for a number of community-related tasks, including managing nature and the environment. Denmark has retained responsibility for foreign policy, including the right to negotiate and enter into international agreements and conventions regarding the environment. However, international agreements that are binding for Greenland have to be put before the Landsting to obtain its opinion before they come into force in Greenland. Greenland has designated 11 areas that have been placed on the Ramsar List of Internationally Important Wetlands.

The use of the natural resources by the inhabitants of Greenland through shooting, hunting, fishing and trapping constitutes the greatest challenge for nature management. Because of the enormous size of the country and its very small population, land use and consequent wear and tear on nature is limited. Shooting, hunting and trapping, on the other hand, put a great deal of pressure on several species and cause considerable traffic with small boats among the islands, particularly in West and South-west Greenland. The extent of these activities is illustrated by the fact that approximately 8300 people in Greenland possess a licence for hobby shooting and hunting, and 2706 one for professional shooting and hunting, amounting to almost 20 % of the Greenland population.

Wetlands in Greenland

Melting of ice and snow is appreciable in spring and summer, and is vital for the formation and maintenance of the majority of wetlands in Greenland. This meltwater accumulates in bodies of fresh water and supplies water to rivers, lakes and pools. The quantity of organic substances in the soil, and their turnover, is limited and most bodies of fresh water in

Greenland are consequently poor in nutrients. Such oligotrophic bodies of fresh water are particularly found in southern Greenland and close to the coast, whereas those with most nutrients occur further inland. No up-to-date estimates exist of the total area of wetland in Greenland, but earlier estimates show that lakes take up 10-12 % of the ice-free land in central West Greenland.

Two types of wetland may be distinguished, wetland with running water and wetland with standing water.

Wetland with running water in Greenland comprises ice-free areas traversed by a multitude of rivers and streams which transport meltwater from the ice sheet and glaciers.

- Rivers which transport meltwater from glaciers are cold and the water contains a great deal of sediment. They are therefore largely lifeless, or contain just a few living organisms. Further from their source, there is generally more lush vegetation comprised of mosses and sedentary algae.
- Streams, which are numerous, generally contain some animal and plant life, even though they often dry up in summer.
- Outlets from lakes which have clear water are usually rich in nutrients and vegetation is generally well developed, especially algae and mosses, and there is also, for Greenland, a rich fauna of non-biting midges (Chironomideae) and small crustaceans.
- Springs are mainly found in the Qeqertarsuaq-Disko district and are characterised by their very stable temperature throughout the year (homothermic). The temperature of most springs is 0-3° C, and some freeze in winter. A few have a significantly higher temperature and are termed hot springs. The island of Uunartoq in South Greenland has three such homothermic springs whose temperature is about 37° C. The homothermic springs are most definitely unique sites with an unusual flora and fauna compared with other bodies of fresh water. In their vicinity, the growing season of the plants is prolonged owing to the warm microclimate, and several plants have their northernmost occurrence beside hot springs. The fauna is generally rich in snails, oligochaetes and beetles.

Wetland with standing water in Greenland comprises lakes, pools and moist inland areas (fens). Unlike lakes, the pools freeze solid in winter. The northernmost lakes in Greenland may be continuously ice covered, but the ice on the largest ones along the coast melts in summer. The ice on large lakes has a direct erosive effect on the bank zone, which influences the vegetation. Lakes close to glaciers have turgid water due to suspended particles. Such lakes are also found far from glaciers (e.g. Lersletten). Most lakes are dominated by plankton comprised of yellow algae, diatoms and green algae (*Desmidiaceae*).

- *Oligotrophic lakes* are found in places where the ice has retreated recently. Vegetation is sparse and the supply of organic matter is poor. Typical plants are spring quillwort *Isoetes echinospora*, a northern bur-reed *Sparganium hyperboreum* and alternate water-milfoil *Myriophyllum alterniflorum*.
- *Eutrophic lakes and pools* are found in places where there is runoff from superficial deposits such as strandlines and moraines, and from areas of calcareous bedrock. Characteristic plants include slender-leaved pondweed *Potamogeton filiformis* and spiked water-milfoil *Myriophyllum spicatum*. The lakes which are rich in nutrients, particularly pools with abundant vegetation, have the richest fauna, which consists of crustaceans (*Crustacea*), water beetles (*Coleoptera*) and insect larvae.
- *Salt lakes* are found in areas with little precipitation, for instance at the heads of many large fjords. The low precipitation means that evaporation from these lakes exceeds the influx of water, leading to an accumulation of salts (potassium, sodium and magnesium) derived from the erosion of cliffs by the meltwater. Only a few plant species grow in these lakes. The plankton includes diatoms and yellow algae that tolerate salt.
- *Fen* is a type of vegetation dominated by sedges and grasses occurring in inland areas on wet or moist ground that never dries out. Fens are particularly found in association with rivers, streams and lakes, but also occur in depressions on heaths. A distinction is made between poor fens on acid soils (mainly in southern Greenland) and rich fens on soils formed on basic rocks (basalt) or sediments (mainly in northern Greenland).

The **coastal areas** refer to the archipelagic coast with numerous fjords and bays. This coastline is mostly

cliffed and has a multitude of islets and skerries. It is more than 40 000 km long and the fjords cover an enormous area of some 170 000 km². Some fjord systems in Greenland are among the largest in the world (e.g. Emperor Franz Joseph's Fjord and Kangertittivaq - Scoresby Sound). There are both open fjords with free water exchange far into the fjord, and *threshold fjords* where the water may be shallow in parts. The archipelagos and fjord systems in Greenland are of the greatest importance as breeding, foraging and wintering areas for many kinds of wildlife, including fish, shrimps, birds and marine mammals.

Nature conservation legislation

Nature management in Greenland is regulated by Act no. 11 of 12th November 1980 concerning Nature Protection in Greenland. Other legislation regulates shooting, hunting, trapping and fishing. The basic purpose of the Nature Protection Act is to prevent areas from being excessively exploited. The Act opens for the possibility of giving areas special protection from, for example, traffic on land and water, the erection of buildings and other human activity. However, it is not specially directed towards protecting them from hunting, trapping and shooting.

In recognition that the existing Act is outdated and inadequate, it was decided in 2001 to revise it. The objective of the new Nature Protection Act is to protect the natural environment of Greenland and ensure that social development and exploitation of the living resources take place on the basis of the principle of sustainability. The Act is intended to modernise the existing Act to accommodate it better to the present social situation in Greenland and to employ new knowledge now available on the natural environment in Greenland. The Act will furthermore offer an opportunity to live up to the international obligations to which Greenland has committed itself. The new Act is expected to come into force in 2003.

Greenland has only a few areas that are actually protected (Table 3.12), even though they cover quite a large area. A total of 965 098 km² of land, sea and ice are protected in some way that regulates human activities. The largest protected area is the North-east Greenland National Park. At 957 000 km², this is the largest national park in the world. However, irrespective of its protection, the park is really mostly

Table 3.12 Areas protected under the terms of Act no. 11 of 12th November 1980 concerning Nature Protection in Greenland.

Area Wetland or not	Legislation	Size and main natural history qualities	Threats
Qinnguadalen (<i>No</i>)	National Council Decision of 13th September 1962	45 km ² . Unique natural history, birchwood, rivers and lakes	Tourism, destruction of vegetation
Area surrounding the Arctic Station in Godhavn, Disko Island (<i>Heath - No</i>)	Proclamation on 2nd April 1986	2 km ² . Unique type of habitat	Building
Nature Reserve in Melville Bay (<i>Marine - Yes</i>)	Departmental Order no. 21 of 17th May 1989	7957 km ² . Calving area for narwhales, bird cliff	Illegal trapping and shooting in a protected core area. Tourism (inexpedient boat traffic).
Arngarnup Qoorua, Borough of Maniitsoq (Paradisaldalen) <i>No</i>	Departmental Order no. 31 of 20th October 1989	90 km ² . Landscape and cultural heritage qualities, lakes and pools	Tourism, hunting, shooting and trout fishing
North-east Greenland National Park (<i>Partly</i>)	Departmental Order no. 7 of 17th June 1992	957,000 km ² . Landscape and biological qualities	Tourism (expeditions) Mineral extraction
Akilia Island, Borough of Nuuk (<i>No</i>)	Departmental Order no. 19 of 1st November 1998	1.4 km ² . Geological site	Illegal collecting of rocks and minerals
Ikkafjord, Borough of Ivittuut (<i>Yes - marine</i>)	Departmental Order no. 11 of 25th April 2000	6 km ² . Geological structures on the fjord floor, unique submarine flora and fauna	Boat traffic

unspoilt because no-one lives in the area. The significance of the protection must therefore mainly be viewed in the light of possible future human activities in the shape of tourism and extraction of raw materials.

All the areas are protected under the terms of the current Nature Protection Act from 1980. The reasons for the protection may be special qualities in their natural history, cultural heritage or geology.

The Directorate for Nature and the Environment, on behalf of the Landsting, is responsible for administering the protected areas. A draft management plan has been drawn up for Paradisaldalen and the Government has adopted a strategic plan for the national park.

Protection of bird localities in Greenland

When regulations were drawn up regarding the shooting of birds in Greenland, all the birds were basically given total protection. However, an open season was stipulated for a number of species, and several regulations were introduced controlling human traffic during the breeding season. In general, bird colonies and bird cliffs are protected from unnecessary disturbance in the breeding season in that it is forbidden to cause non-essential noise within a radius

of 5 km from large bird cliffs and 200 m from smaller colonies on islands. The conservation provisions also forbid any landing and traffic during the breeding season (1st May - 31st August) in 12 important breeding areas (Special Protection Areas) and within a radius of 500 m from these. The following localities are covered by this ban (the local authorities concerned are shown in brackets):

1. Lion Islands south of Qerqertat (Avernasuaq)
2. Kuup apparsuit / Cape Shackleton (Upernavik)
3. Torquusaq (Upernavik)
4. Kingittuarsuk (Upernavik)
5. Upernaviup apparsuit / Sanderson's Hope (Upernavik)
6. Salleg (Uummannaq)
7. Assissut / Brændevinsskær near Kronprinsen's Island (Qeqertarsuaq)
8. Nunatsiaq / Rotten near Hunde Island (Aasiaat)
9. Saattuarssuit near Green Island (Aasiaat)
10. The fjord branch of Tasiussarssuaq behind Naternaq, near the Nordenskjöld Glacier, Ritenbenk (Ilulissat)
11. Appat / Ritenbenk (Ilulissat)
12. Ydre Kitsissut (Qaqortoq)
11. Appat / Ritenbenk (Ilulissat kommune)
12. Ydre Kitsissut (Qaqortoq kommune)

All these areas are marine wetlands.

No management plans have been drawn up for the Special Protection Areas.

In the case of activities (e.g. scientific or relating to tourism) in the national park, the Directorate for Nature and the Environment stipulates requirements that expeditions have to meet regarding their mode of transport, which parts may be visited and their period of stay to safeguard particularly sensitive parts of the park.

There is probably a need to keep other areas than these free of disturbance. These particular areas have been selected for the sake of breeding birds, and similar limitations on access mostly do not exist for areas that are important for resting or wintering birds. However, the two Ramsar sites in the North-east Greenland National Park offer formal protection for resting birds in so far as they are within the park.

To provide protection for species, there may be a need to regulate shooting and traffic in some additional areas, particularly on the west coast, that are important for breeding and resting birds. A number of the Ramsar sites in Greenland are actually in areas which, by Greenland standards, are densely inhabited and therefore exposed to considerable traffic and shooting.

The last 10 years have seen an increase in the building of weekend cabins in open country. The authorities have to give permission for this by determining their location. In the vicinity of towns and villages, the individual local authority is responsible for this allocation and for giving building permission. Permits to build in remote places are given after the application has been considered by the Directorate for Nature and the Environment, among others. In such cases, requirements may be made regarding the precise location of the building and other activities to safeguard, for example, bird colonies and resting areas for birds.

Utilisation and protection of birds

Of the 58 species of birds breeding in Greenland, 37 occur on both sides of the Atlantic Ocean, 8 have their main distribution in North America and 13 in Europe. Greenland has no endemic species, but there are 6 endemic sub-species. Three of the sub-species

winter elsewhere: dunlin *Calidris alpina arctica*, Iceland gull *Larus glaucoideus* and greater white-fronted goose *Anser albifrons flavirostris*. Three other sub-species are genuine endemics and only occur in Greenland: mallard *Anas platyrhynchos conboschas* and two sub-species of rock ptarmigan *Lagopus mutus cap-tus* and *L. m. saturatus*. Some authorities also look upon the Greenland white-tailed eagle *Haliaeetus albicilla groenlandicus* as an endemic sub-species (Salomonsen 1967).

Under present legislation, there is an open season for 20 species of birds, and eggs may be collected for private use from 4 species. According to official statistics, the bags per year for the most sought after species in 1993-1997 were:

Brünnich's guillemot *Uria lomvia* and common guillemot *U. aalge*: 187 000 - 254 000
little auk *Alle alle*: 49 000 - 104 000
common eider *Somateria mollissima*: 65 000 - 83 000
black-legged kittiwake *Rissa tridactyla*: 52 000 - 63 000
black guillemot *Cepphus grylle*: 10 000 - 35 000
king eider *Somateria spectabilis*: 4000 - 5500
various geese: 1000 - 2000.

The hunting statistics depend upon mandatory reports to the Greenland Government from the licence holders. However, substantial underreporting is assumed to take place. For instance, it is estimated that 300 000 - 400 000 guillemots are taken each year in Greenland. No information exists regarding the number of eggs collected.

A new Departmental Order concerning Birds came into force in January 2002, replacing one from 1989. The former Order permitted the shooting of, for instance, common eiders and king eiders until as late as 1st June, and the autumn open season started on 15th August. This very brief closed season was unable to prevent the serious decline in the eider population in Greenland during the 20th century, or give adequate protection to other birds breeding in Greenland. For instance, the Brünnich's guillemot colonies at southern Upernavik (North-west Greenland) have been reduced by 80-90 % since the 1930s. Consequently, the new Order also revised the regulations concerning the shooting of this species.

Iceland has recently published a Red List on which the Brünnich's guillemot figures as *Vulnerable* (IUCN criteria), and the shooting in Greenland and Canada of wintering Icelandic guillemots is claimed to be the probable cause of this situation. However, a corresponding decline among Norwegian guillemots, which also winter off the coast of South-west Greenland, has not been registered.

Egg collecting has always been a widespread tradition in Greenland. Each spring, many Greenland families take their boats to the islands to collect sea-bird eggs, arctic tern *Sterna paradisaea* eggs being particularly popular. The arctic tern population in West Greenland has declined substantially in the last 40 - 50 years, and one reason for this may be the substantial egg collecting.

Tern eggs are also collected in Iceland, but there it is the owner of the area where the colony breeds who decides when and how many eggs may be gathered. This 'ownership' of the resource has probably helped to ensure its sustainable utilisation. There is no tradition in Greenland for ownership of nature or its resources. No land is owned. Consequently, the tern colonies, for instance, are visited each spring by many people, all of whom gather eggs. The new Departmental Order on Birds has banned the collecting of tern eggs, and also those of several other species that breed on cliffs. This will presumably result in better protection of cliff-nesting sea birds in general, since fewer people will visit the sites to collect eggs.

Greenland has not drawn up a Red List of endangered birds. The only species in Greenland that is listed on the IUCN International Red List is the white-tailed eagle. However, the Directorate for Nature and the Environment prepared a status report in 2000 for animals and birds that are hunted, trapped or shot in Greenland. This classified the species according to existing biological knowledge about the trend in their population and will be used for management purposes. With regard to birds, the report states, among other things, that:

1) Guillemots, common eiders, king eiders and arctic terns are declining due to shooting or other causes and there is adequate knowledge in Greenland to introduce management measures.

2) Northern fulmars *Fulmarus glacialis*, great cormorants *Phalacrocorax carbo*, Iceland gulls, glaucous gulls *Larus hyperboreus*, black guillemots, little auks, rock ptarmigans, pink-footed geese *Anser brachyrhynchus*, greater white-fronted geese and barnacle geese *Branta leucopsis* apparently have stable populations where their utilisation is regulated, but knowledge is somewhat inadequate.

Greenland participates actively in international efforts to protect and manage the viability of the North Atlantic sea-bird populations. This takes place through the Circumpolar Seabird Working Group (CSWG) in CAFF and bilateral cooperation, particularly with Canada.

Ramsar sites in Greenland

In 1987, the Danish Parliament selected 11 areas in Greenland for nomination as Ramsar sites and these were placed on the international list the following year (Table 3.13). The total area taken up by the Ramsar sites in Greenland is 13 423 km² and the sites are situated on both the west and east coasts, between 60°45' N and 81°15' N. There are no permanent settlements in any of the Ramsar sites.

As mentioned above, no other Ramsar sites than the two in the national park (nos. 10 and 11) have actual statutory protection outside the breeding season. One site (no. 8) is protected from shooting and being visited in the breeding season, and corresponding protection applies to two small skerries in no. 4.

In 2001, the Danish National Environmental Research Institute completed a status report on the Ramsar sites in Greenland (see p. 87). The institute has also written a technical report concerning three Ramsar sites at Disko Bay in West Greenland.

Table 3.13 The Ramsar sites in Greenland (modified from Egevang & Boertmann (2001a)).

No.*	Name and size	Habitat	Reason for designation	Status and threats
1 (385)	Aqjarua-Sullorsuaq (224 km ²)	Large U-shaped valley with fens and eutrophic lakes.	Formerly the largest known moulting area for king eiders in the western Arctic. Breeding area for > 1 % of the greater white-fronted geese in Greenland.	<i>No formal protection.</i> Popular area for recreation and shooting. The moulting king eiders have mostly abandoned the area. The population of resting and breeding greater white-fronted geese has increased.
2 (386)	Qinnquata Marraa and Kuussuaq (65 km ²)	Innermost part of a fjord and a valley with numerous lakes and pools.	Important resting area for king eiders and greater white-fronted geese.	<i>No formal protection</i> , but remote. Increased population of resting king eiders in the whole fjord, and more than 20 % of the Greenlandic resting population occurs here in August. The site should be extended to cover the whole fjord.
3 (387)	Kuannersuit Kuussuat (52 km ²)	Moraine landscape with many lakes.	Inland breeding area for eiders.	<i>No formal protection.</i> The area has been poorly studied.
4 (388)	Kitsissunnguit / Green Island (69 km ²)	Low islands in an archipelago, with pools, fens and salt-water lagoons.	Probably once had the world's largest colony of arctic terns. Important breeding area for several species of waterfowl. Importance as a resting area not well studied.	<i>1.8 % of the Ramsar site is protected from being visited during the breeding season.</i> The remainder is exceedingly disturbed by boat traffic, shooting and illegal egg collecting. The arctic tern colony has been decimated.
5 (389)	Naternaq / Lersletten (1840 km ²)	Damp heath and fen with numerous pools and streams.	Resting area for greater white-fronted geese and Canada geese. Breeding area for, among others, great cormorants, common eiders and greater white-fronted geese.	<i>No formal protection.</i> Comparatively undisturbed, but some shooting and summer camps.
6 (390)	Eqalummiut Nunaat and Nassuttuup Nunaa (5795 km ²)	High habitat diversity with grassy plains, fens, pools, willows, etc.	Important resting area for greater white-fronted geese and Canada geese, among others. 13 waterfowl and waders breed there, including greater white-fronted geese, common eiders, red-necked phalaropes, arctic terns and great cormorants.	<i>No formal protection.</i> Stable or rising goose population. Little human activity in the area, despite close proximity to an international airport.
7 (391)	Ikkattoq and archipelago to the west (449 km ²)	Shallow fjord with mudbanks.	Largest area for moulting red-breasted mergansers.	<i>No formal protection.</i> No existing threats, but more boat traffic in the innermost part of the fjord will pose a potential threat to moulting ducks.
8 (392)	Kitsissut Avaliit / Outer Kitsissut (45 km ²)	Group of mainly flat, rocky islands.	Important area for sea birds, including resting harlequin ducks. Largest colony of common guillemots in Greenland.	<i>Bird Sanctuary.</i> Protected from being landed on or approached closer than 500 m from 1.5 - 31.8. Boat traffic and illegal egg collecting are current and potential threats.
9 (393)	Heden (Jameson Land) (2524 km ²)	Flat tundra with shallow lakes, fens and damp heaths.	Largest moulting area for pink-footed geese and barnacle geese.	<i>No formal protection.</i> Disturbance from hunting. Potential threats are petroleum prospecting, tourism, hunting and shooting.
10 (394)	Hochstetter Foreland (1848 km ²)	Extensive, low-lying area of damp heaths, small lakes and pools.	Third most important moulting area for pink-footed geese. Important breeding area for 12 species of waterfowl and waders.	<i>Protected</i> because the area is in the North-east Greenland National Park. No current or potential threats.
11 (395)	Kilen (513 km ²)	Ice-free 'oasis' with interglacial flora.	Largest resting area for brent geese.	<i>Protected</i> because the area is in the North-east Greenland National Park. No current or potential threats.

* The international Ramsar site number is in brackets

Perspectives in the protection of the wetlands

The intention of the new nature conservation legislation being planned for Greenland is to open for more conservation and protection of areas with important natural qualities. However, wetlands in Greenland are not immediately threatened by significant pollution or destruction of habitats.

Nevertheless, the inhabitants do use them for fishing, shooting, trapping and hunting, thereby exerting an impact on a number of species of birds and animals. This utilisation plays a significant role for the Greenland economy and culture, but the popular species require long-term management because of a larger population equipped with modern weapons and boats. Pressure is so great in some areas that more active management of the bird populations and/or limitations on access to the areas will probably be required to ensure the continued presence of the species.

Fisheries and hunting are believed to have had an impact on king eiders resting east of Disko Island, and a recent pilot study at Nuuk suggested that the net fishery in inshore waters gives by-catches of eiders. In March 2000, close on 30 % of the eiders sold at the local market had drowned in fishing nets. A number of important moulting areas lack formal protection, and no regulation exists that can prevent resting birds from being disturbed.

In 'Important Bird Areas in Europe - Priority Sites for Conservation', BirdLife International identified 55 Important Bird Areas (IBAs) in Greenland. They cover 25 416 km², 5 % of the ice-free area in the country. Eight are fully or partially protected, having the status of Protected Breeding Areas for Birds and a further eight are protected because they are in the North-east Greenland National Park. Ten of the IBAs are, moreover, within Ramsar sites.

The designation of core areas where shooting, trapping and hunting are forbidden may be one way of creating the necessary legal protection of all the most important Ramsar sites in Greenland.

Present Greenland legislation does not open for general protection of particularly sensitive or endangered types of habitat. This matter will also be taken up in connection with the new Nature Protection Act.

An important task for nature management in Greenland in the years ahead will be to provide targeted information regarding existing closed and open seasons and, not least, to change attitudes. The Landsting determined in 2002 to implement an intensive information campaign in Greenland on the sustainable utilisation of the living resources. In several places, problems exist with regard to respect for the present legislation, and extremely limited resources and manpower exist to provide supervision. For instance, there are no more than eight game-keepers for the whole of Greenland, and they are responsible for supervising bird shooting, hunting and trapping of marine and terrestrial mammals, and certain forms of coastal fishery. However, the police are the authority with powers to deal with infringements, and police officers in Greenland are continuously receiving training in the regulations covering shooting, fishing, trapping and hunting.

The Ramsar sites in Greenland

Carsten Egevang and David Boertmann at the Danish National Environmental Research Institute completed a status report on the Ramsar sites in Greenland in 2001 (Egevang & Boertmann 2001a). This will form the basis for a revision of the protected areas for breeding birds in Greenland, and for improved protection of birds outside the breeding season. Among other things, the report offers the following advice regarding the Ramsar sites.

No. 1: Aqajaruna and Sullorsuaq

The area has lost its importance since the king eiders that used to rest here have largely disappeared, presumably because of shooting and fishing. However, it still fulfils the Ramsar criteria, as a substantial and increasing proportion of the greater white-fronted goose population moults here. *It is recommended* that fishing, shooting and boat and helicopter traffic are regulated.

No. 2: Qinnquata Marraa and Kuussuaq

Now the most important area for moulting king eiders, having more than 20 % of the moulting population in Greenland in August. Its importance has probably increased because of disturbance at Aqajaruna and Sullorsuaq (Ramsar site no. 1). *It is recommended* that the area is extended and the mussel fishery and boat and helicopter traffic are regulated.

No. 3: Kuannersuit Kuussuat

This site has previously not fulfilled the criteria stipulated by the Ramsar Convention, and still fails to do so. Unless new counts reveal internationally important occurrences of birds, *it is recommended* that the area be removed from the List.

NB After the report (Egevang & Boertmann 2001a) was published, it has nevertheless been determined that the site does fulfil criteria stipulated by the Ramsar Convention, not because of occurrences of birds, but due to the many unique wetlands in the area.

No. 4: Kitsissunnguit

Despite a dramatic decline in the arctic tern colonies, the site is still of national and international importance. *It is recommended* that the present protection of the colonies of breeding birds is extended to cover all the islands, and that the existing bird protection legislation is enforced at the site.

No. 5: Naternaq

An extremely important site for moulting greater white-fronted geese. *It is recommended* that the site is extended and helicopter traffic is regulated.

No. 6: Eqalummiut Nunaat and Nassuttuup Nunaa

An important site for moulting greater white-fronted geese and also has a high diversity of waterfowl. *It is recommended* that helicopter traffic is regulated.

No. 7: Ikkatoq

The site is of national importance for wintering marine ducks and of international importance as a breeding area for white-tailed eagles. *It is recommended* that boat and helicopter traffic is regulated in the inner part of the fjord.

No. 8: Kitsissut Avaliit

Few places in Greenland have more species of sea birds. Even though landing is forbidden here in the breeding season, the bird population is declining. *It is recommended* that existing bird protection legislation is enforced in the area.

No. 9: Heden

This site covers most of the largest area of tundra in Greenland and is of international importance for moulting geese. *It is recommended* that helicopter traffic in the area is regulated.

No. 10: Hochstetter Foreland

This site is of great international importance for moulting geese. *It is recommended* that helicopter traffic is regulated, even though the area is in the North-east Greenland National Park.

No. 11: Kilen

This site is of great international importance for moulting geese. *It is recommended* that helicopter traffic is regulated, even though the area is in the North-east Greenland National Park. Moreover, the site should be extended to cover Henrik Krøyer's Islet and the adjacent polynia.

The report further recommends that:

- the Ramsar Convention is more extensively implemented in legislation and physical planning in Greenland
- specific management plans are drawn up for Ramsar sites, also monitoring programmes (particularly for sites 2, 4 and 8), and the boundaries of the sites are revised
- information work is carried out in Greenland to enhance awareness about the protection of Ramsar sites and the qualities they contain.

Table 3.14 shows potential Ramsar sites recommended by the report because they fulfil the criteria stipulated by the Convention.

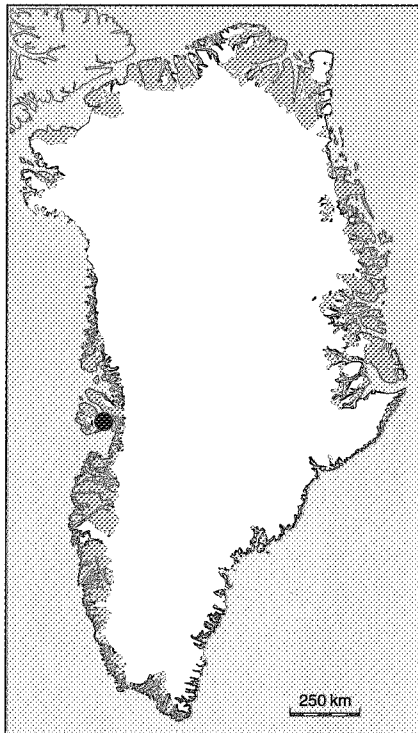
See Chap. 7 for relevant references.

Table 3.14 Potential Ramsar sites in Greenland recommended by the Danish National Environmental Research Institute. The table shows current and potential threats and whether, in connection with active management, conflicts may arise with community interests (1 - lowest, 3 - highest). Modified after Egevang & Boertmann (2001a).

Locality (local authority in brackets)	Ornithological qualities	Present and potential threats	Risk of conflict	Management needs
Germania Land, western part; in national park	Most important area in Greenland for resting pink-footed geese; many breeding waders	Helicopter traffic	1	1
Itsako (Uum-mannaq)	Moulting area for > 1 % of the greater white-fronted goose population; 150-271 resting Canada geese	Shooting, hunting and helicopter traffic	2	3
Umiaarfik (Upernavik)	About 15 % of the population of moulting king eiders; important resting area for greater white-fronted geese	Shooting, hunting and helicopter traffic	2	3
Qilangaarsuit and nearby islands (Nuuk)	Internationally important resting area for harlequin ducks in July-August; important wintering locality for long-tailed ducks, common eiders and harlequin ducks; 6 colonies of breeding razorbills numbering 160 pairs and 5 colonies of Atlantic puffins numbering 819 pairs	Intensive shooting, hunting and boat traffic; some helicopter traffic	3	3
Foulkefjord in Inglefield Land (Avanersuaq)	Large colony of breeding little auks	No current threats	1	1
Haklyut Island (Avanersuaq)	Large colonies of breeding little auks, Brünnich's guillemots and black-legged kittiwakes	No current threats	1	2
Saunders Island (Avanersuaq)	Large colony of breeding Brünnich's guillemots	No current threats	1	2
Coast between Cape York and Cape Atholl (Avanersuaq)	Large colonies of breeding little auks, Brünnich's guillemots and black-legged kittiwakes	No current threats	1	2
Cape Shackleton and Kipakku (Upernavik)	Large colonies of breeding Brünnich's guillemots and other birds	Shooting, hunting, egg collecting and helicopter traffic	2	3
Søndre Isortoq (Maniitsoq)	Several colonies of breeding Brünnich's guillemots, razorbills, black-legged kittiwakes and other gulls in a narrow fjord	Shooting, hunting, egg collecting and helicopter traffic	3	3
Evighedsfjord (Maniitsoq)	Several colonies of Brünnich's guillemots, razorbills, great cormorants, black-legged kittiwakes and other gulls in a narrow fjord	Shooting, hunting, egg collecting and helicopter traffic	3	3
Sermilinnuaq (Maniitsoq)	Several colonies of breeding Brünnich's guillemots, razorbills and black-legged kittiwakes in a narrow fjord	Shooting, hunting, egg collecting and helicopter traffic	3	3
Nipisat Sund (Nuuk)	Large concentrations of resting common eiders and king eiders; important resting area for waders	Shooting, hunting, net fishing and boat traffic	3	3
Cape Brewster (Ittorqortoormiit)	Colony of breeding Brünnich's guillemots and black-legged kittiwakes, as well as little auks and black guillemots	Shooting, hunting and egg collecting	3	3
Østed, Colorado, Enhjørningen and Pingel valleys (Ittorqortoormiit)	Breeding and moulting area for barnacle geese and pink-footed geese	Helicopter traffic	1	1
Storsletten and Wollaston Foreland in the national park	Moulting area for pink-footed geese	Helicopter traffic	1	1

Examples of wetlands in Greenland

Aqajarua (Mudderbugten) and Sullorsuaq (Kvandalen) in the Borough of Qeqertarsuaq



National protection: The area has no special protective status under Greenlandic law. No management plans have been drawn up. The area covers 224 km², 80 % being terrestrial and 20 % marine.

International status: Ramsar site

Description of the area

The area consists of a large U-shaped valley, Sullorsuaq, a shallow marine bay, Aqajarua, and the northern part of the low foreland of Flakkerhuk. A large river flows along the valley and there are extensive areas of damp grassland along the river and between the many lakes and pools. The river mouth has a large delta where mudbanks and sandbanks are exposed at low tide. Along the Flakkerhuk coast are beach ridges and salt-water lagoons. Dwarf shrubs grow extensively in the drier areas. More than 35 homothermic springs are found along the north side of the valley. A large freshwater lake north of the river has a high concentration of freshwater snails *Lymnea* sp., which are presumably an important source of food for the birds in the area.

Management problems

The inhabitants of the nearby towns, especially Ilulissat, frequently shoot birds in the area. Net fishing for trout is also popular. The greatest threats to the birds in the area derive from illegal shooting, disturbance from boat traffic and fishing.

The area was designated a Ramsar site mainly because of the large concentration of king eiders which used the mudbanks at Aqajarua as a moulting area in late summer and early autumn. Around 1950, Salomonsen (1967) estimated that about 30 000 birds rested in the area. In 1975-76, about 2500 king eiders moulted in the area. The decline of king eiders has continued since then, but in the 1990s a tendency was noted for some oscillation in their numbers, from 104 to 1575.

More than 1 % of the world population of the Greenland sub-species of the greater white-fronted goose *Anser albifrons flavirostris* moults in the area in July and August. The population of breeding and moulting greater white-fronted geese seems to have grown in the past 20 years, which is a general tendency for this sub-species (Table 3.15).

Table 3.15 Figures for breeding, moulting and resting birds in the Ramsar site at Aqajarua and Sullorsuaq (modified from Egevang & Boertmann (2001b)).

Species	No. of breeding birds (pairs)	Number of moulting and resting birds (individuals)
Red-throated diver <i>Gavia stellata</i>	6 (2001)	-
Greenland sub-species of the greater white-fronted goose <i>Anser albifrons flavirostris</i>	34 (2010)	468-637 (2001)
Canada goose <i>Branta canadensis</i>	87 (2001)	199 (2001)
Mallard <i>Anas platyrhynchos</i>	15 (2001)	42 (2001)
Common eider <i>Somateria mollissima</i>	-	100-150 (2001)
King eider <i>Somateria spectabilis</i>	-	1575 (2001)
Red-necked phalarope <i>Phalaropus lobatus</i>	34 (2001)	-
Arctic skua <i>Stercorarius parasiticus</i>	10 (2001)	-
Arctic tern <i>Sterna paradisaea</i>	8 (2001)	-

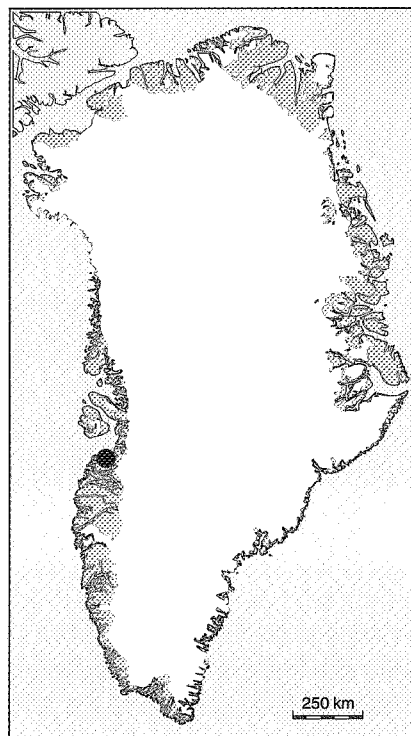
A number of other waterfowl and waders have been recorded in the area, resting (r) and/or breeding (b): long-tailed duck *Clangula hyemalis* (r + b), northern pintail *Anas acuta* (b), Eurasian teal *A. crecca* (r), red knot *Calidris canutus* (r + b), ruddy turnstone *Arenaria interpres* (r), ringed plover *Charadrius hiaticula* (r + b) and European golden plover *Pluvialis apricaria* (r + b).

Kitsissunnguit (Green Island), Boroughs of Qasigiannnguit and Aasiaat



Figure 3.13 Kitsissunnguit (Green Island).

PHOTO: THOR THORSEN



National protection: The area has very limited protection status under Greenlandic legislation since the two westernmost islets, Saattuarsuit, are bird sanctuaries where landing is forbidden from 1st June to 31st August, but they comprise only 1.8 % of the total area of the Ramsar site. No management plans have been drawn up for the area. The area comprises 69 km², 12 % terrestrial and 88 % marine.

International status: Ramsar site

Description of the area

The area consists of many large and small islands and skerries. Their coastlines are mostly rocky, but a few shore ridges are present on the larger islands, and these have salt-water lagoons and damp grassland on their landward side. Four of the largest islands have small water holes. The sea north of the islands is comparatively shallow.

Management problems

The area is exceptionally popular for recreational shooting and hunting for the inhabitants of the nearby towns of Aasiaat and Ilulissat, and is situated close to the sea route between these settlements. Egg collecting is another exceptionally popular spring pastime for the inhabitants, and the islands were visited by 150-200 people during the egg-laying period in June 1996. The Departmental Order on Birds bans the collecting of arctic tern eggs, but has not halted the practice. Illegal collecting was observed several times during the summer of 2002. A wolffish fishery takes place in early spring. The local borough councils have built three "hunting lodges" on the islands, and these are often used by the local inhabitants in winter.

The greatest threats to the birds in the area are shooting, illegal egg collecting, disturbance from boat traffic, disturbance from people on land, and presumably by-catches during the wolffish fishery. A few arctic foxes live on the largest islands and a cull of these each spring would certainly reduce their predation on the bird colonies. Kitsissunnguit has several times been cited in 2000, 2001 and 2002 in national and local media as a valuable natural history site. Local people have expressed a desire for the area to be specially protected.

This Ramsar site is thought to have formerly had the world's largest colony of arctic terns. In 1946, Salomonsen estimated that 100 000 pairs bred in this group of islands and their eggs were, and still are, a delicacy for the Greenlanders and earlier when the tern population was large and the human population small it was possible to collect up to 100 000 eggs a year in the colony. The tern population has shown a general negative trend (Fig. 3.14), but fluctuates from year to year in common with the populations of many other arctic species, thus making it difficult to unambiguously determine the causes of a decline.

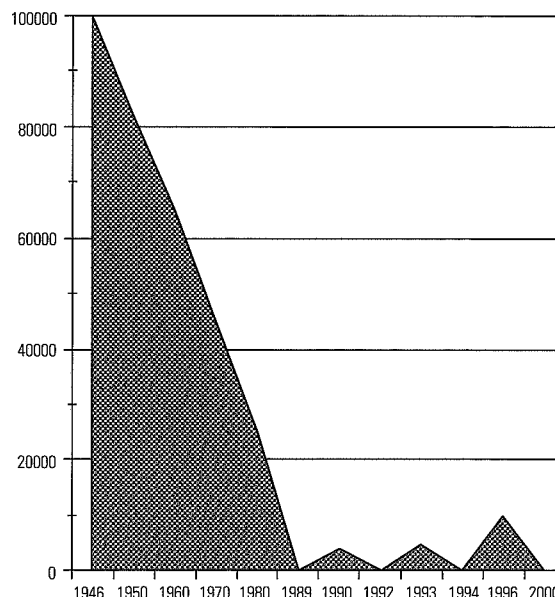


Figure 3.14 Trend in the arctic tern population at Kitsissunnguit.

The Danish National Environmental Research Institute in cooperation with the Greenland Institute of Natural Resources began a study of the food ecology of the arctic terns in this area in 2002. The preliminary results indicate that one reason for the decline in the population is shortage of food. Possible illegal egg collecting may further aggravate the negative effect.

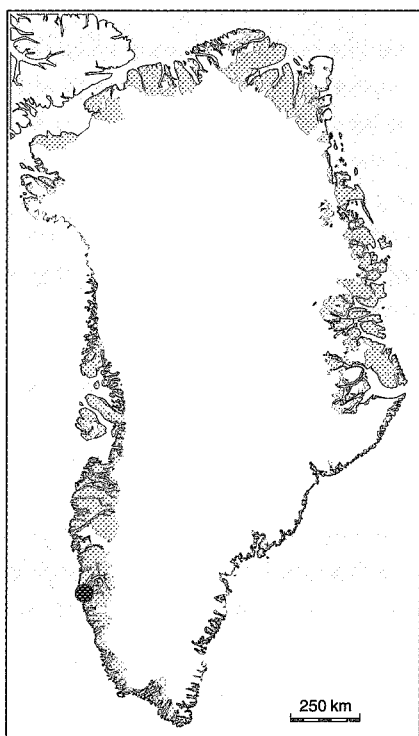
Table 3.16 shows the main waterfowl and waders breeding in the area. Kitsissunnguit is the only known breeding area for the Ross's gull *Rhodostethia rosea* in West Greenland and is also one of very few known breeding areas for the long-tailed skua *Stercorarius longicaudus*. In general, the numbers of breeding and resting species are exceptionally high and many species of waders have been recorded on the islands, as well as gyr falcons *Falco rusticolus* and peregrine falcons *Falco peregrinus* and several kinds of small birds, such as northern wheatear *Oenanthe oenanthe*, mealy redpoll *Carduelis flammea*, Lapland longspur *Calcarius lapponicus* and snow bunting *Plectrophenax nivalis*.

Table 3.16 Survey of waterfowl and waders breeding in the area (excluding gulls). No counts have been made of resting or moulting birds.

Species	Number of breeding pairs or individuals	Number of moulting and resting birds (individuals)
Red-necked phalarope <i>Phalaropus lobatus</i>	56 - 100 (1990, 1996)	-
Ruff <i>Philomachus pugnax</i>	15 (1996)	-
Black guillemot <i>Cephus grylle</i>	179 (1996)	-
Little auk <i>Alle alle</i>	235* (2000)	-
Atlantic puffin <i>Fratercula arctica</i>	200* (1980)	-
Arctic tern <i>Sterna paradisaea</i>	0 - 10 000 (1996, 2000)	-
	15 000 - 20 000 (2002)	-
King eider <i>Somateria spectabilis</i>	-	800 - 900 (2002)

*individuals

Qilangaarsuit (Ravneøerne) - a potential Ramsar site



The Danish National Environmental Research Institute has suggested a number of areas as potential Ramsar sites in Greenland. These proposals are based on new censuses and new knowledge acquired since 1988, when Greenland put forward the present 11 Ramsar sites.

One of these new areas is Qilangaarsuit (Ravneøerne - Raven Islands) and some islands to the south (63°55' N, 51°40' W). The area measures 328 km² and comprises a substantial part of the archipelago south



Figure 3.15 Qilangaarsuit.

PHOTO: DAVID BOERTMANN

and south-west of Nuuk, the capital of Greenland. Bird censuses undertaken during the last 2 or 3 years by the Danish National Environmental Research Institute, the Greenland Institute of Natural Resources and local ornithologists have documented the international importance of the area.

The large number of moulting harlequin ducks makes the area internationally important for that species, and it is one of the largest known occurrences of this species in the North Atlantic. At least 5-10 % of Greenlandic harlequin ducks occur here in the course of the summer. The area is, moreover, of national importance as a breeding locality for a number of sea birds. It is particularly important for Atlantic puffins, since approximately 15 % of the Greenlandic population breed here (Table 3.17). White-tailed eagles breed in the area, and both gyrfalcons and peregrine falcons forage here.

The area fulfils the following updated Ramsar criteria: B3 (high species diversity), B4 (moulting harlequin ducks *Histrionicus histrionicus*) and B6 (high concentration of harlequin ducks) (cf. Egevang & Boertmann 2001a).

The area consists of a large number of low islands and skerries with rocky coasts. Small, sandy beaches are found in a few places. The islands largely lack vegetation, except for crowberries *Empetrum nigrum* and grasses. West of the islands, the sea is comparatively shallow, and these waters are included in the proposed Ramsar site.

The island of Akilia is within the area, and is already protected on geological grounds to prevent rock samples being taken. Landing, egg collecting, boat travel and shooting are not regulated over and beyond the general regulations concerning shooting and landing. The area is less than 45 minutes boat journey from Nuuk and can be reached by small dinghies. The inhabitants of Nuuk use the area a great deal for shooting and hunting, carrying on intensive sealing throughout the year and taking sea birds (black-legged kittiwakes, common eiders, king eiders and Brünnich's guillemots) in the open season. A considerable number of private weekend cabins have been built on the islands.

Table 3.17 Survey of breeding, moulting and resting birds in the Qilangaarsuit (Ravneøerne) area.

Species	Number of breeding pairs or individuals (year)	Number of moulting and resting birds (year)
Great shearwater <i>Puffinus gravis</i>	-	thousands (August-September)
Harlequin duck <i>Histrionicus histrionicus</i>	-	112 (2000) - 896 (1999)
Common eider <i>Somateria mollissima</i>	20 (1992)	common
King eider <i>Somateria spectabilis</i>	-	common
Lesser black-backed gull <i>Larus fuscus</i>	10 (1999)	-
Great black-backed gull <i>Larus marinus</i>	100 (1992)	-
Glaucous gull <i>Larus hyperboreus</i>	20 (1992)	-
Arctic tern <i>Sterna paradisaea</i>	900 in 4 colonies (1992)	-
Brünnich's guillemot <i>Uria lomvia</i>	3000 individuals (1992)	common
Common guillemot <i>Uria aalge</i>	30 individuals (1992)	-
Black guillemot <i>Cephus grylle</i>	220 (1992)	-
Razorbill <i>Alca torda</i>	160 (1992-98)	-
Atlantic puffin <i>Fratercula arctica</i>	819 in 5 colonies (1992)	-

See Chap. 7 for relevant references.

3.5.3 FINLAND

Nature conservation started officially in Finland in 1923 when the first Nature Conservation Act came into force. Various efforts to update this Act have been made during the past 30 years, but it was not before Finland joined the EU in 1995 that the Government succeeded in accommodating Finnish legislation to EU legislation and other international obligations, and the new Nature Conservation Act finally came into force in 1997. However, wetlands have been in the forefront of interest in terms of nature conservation, because of international obligations and the threats which drainage and other destruction pose for wetlands that merit protection.

The revised Act aims to maintain biological diversity, protect landscapes, promote the sustainable use of natural resources and the environment, enhance interest for nature among the public in general, and further scientific research. It also incorporates the EU Nature Protection Directives (92/43 EU and 79/409/EEC) with Finnish legislation, providing detailed provisions regarding the protection of biological diversity as well as enhancing the effect of international conventions.

The 1996 Forestry Act includes special provisions ensuring the protection of some specially valuable biotopes. The Water Act, revised in 1996, contains provisions that protect important types of habitat. An Appendix to the Act also provides more opportunities for ensuring sustainable development and habitat protection. The Water Act also states that nature conservation, as an asset in its own right, must from the outset be an important aspect of Finnish legislation with respect to both pollution control and the utilisation of natural resources.

Environmental planning has to some extent played an active role when protected areas have been designated, even though its legal status was doubtful before the new Nature Conservation Act came into force. Nationwide surveys of small watercourses that remain in their natural state began in 1988, but no measures have so far been implemented here.

In connection with the implementation of EU Directives, it is intended that the Natura 2000 Network will embrace all the present 11 Ramsar sites, which were nominated in 1975, as well as 50

additional wetlands with international conservation status that will be nominated as new sites under the terms of the Ramsar Convention.

Nature conservation authorities

The management of nature conservation and the natural assets of the countryside takes place at both central and regional levels. The Ministry of the Environment takes care of matters concerning both land and water, and also deals with regional planning. Nature conservation belongs under its Department of Land Use. Thirteen regional environmental centres monitor the land-use planning performed by local authorities, as well as implementing nature conservation programmes and dealing with other practical aspects of nature conservation under the terms of current legislation.

The Ministry of Agriculture and Forestry and several other ministries also have responsibilities in the fields of environmental conservation and biological diversity. Matters relating to hunting, shooting and fishing belong under the Ministry of Agriculture and Forestry, for example. The environmental centres function first and foremost as research and development units for the Ministry of the Environment and the environmental administration, but also play an important role for the Ministry of Agriculture and Forestry in matters relating to water and land drainage (reclamation).

The Finnish Forest and Park Service administers state-owned land, national parks and other state-owned protected areas and nature reserves. It has established a substantial organisation to plan, perform the practical implementation of, look after and maintain national parks and other legally protected areas.

The Forest and Park Service is also responsible for the commercial exploitation of state-owned forests. At the municipal level, the largest local authorities have their own environmental and nature conservation authority. The local authorities which are obliged to perform land-use planning play an important role in helping to preserve biological diversity.

Finnish wetlands and ornithologically important lakes

Wetlands are commonly understood as areas consisting of various kinds of mire and moist woodland, salt marshes, small bodies of water, shallow inshore waters or waters that are either natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including marine waters whose depth at low tide does not exceed 6 m (Ramsar definition).

A brief explanation of conditions in Finland may help to acquire a better impression of the full situation regarding wetlands in Finland. Finland is called "the land of a thousand lakes". There are 187 888 large and small lakes with a surface area of more than 0.05 ha; 56 012 of them are larger than 1.0 ha and 2609 exceed 1.0 km². The density of lakes is greatest in northern Finland because the topography there favours the occurrence of numerous bogs and small lakes. Northern Finland now has 1960 small lakes per 100 km². The total area covered by lakes in Finland is 32 600 km². Approximately 88 % of the lakes are situated between 50 and 200 m above sea level, only 3.5 % are higher than 200 m and a mere 0.35 % are higher than 400 m. About 70 % of the volume of the lakes has a depth of 0-10 m, and only 0.3 % has a depth exceeding 50 m. In Finland, the richest occurrences of wetland birds occur in areas of shallow, fresh water, in coastal bays and on sea shores. Shores, shallow lakes and land that is often flooded are specially valuable for birds and many other organisms. The Programme for Protecting Ornithologically Important Lakes undertook censuses in 1300 areas in 1967-80. Subsequently, 299 of these areas were approved as specially valuable and suitable as protected areas. They have a total surface area of approximately 90 000 ha, 60 000 ha of which is water and only 30 000 ha is wooded mineral soil.

The term 'bird lakes' is used in Finland specifically for such aquatic sites and environments that are important for birds. They are typically rich in nutrients and vegetation, and of course birds. Naturally eutrophic lakes are relatively rare in Finland, but human activities increase the content of nutrients and, hence, the eutrophication of lakes and sea bays. Some valuable wetlands have been created when the water level in lakes was lowered to obtain more arable land, without cultivation ever having begun. The

term 'bird lake' is not employed for places where peat has been cut, for mires, outer parts of archipelagos, large lakes with clear water, or rivers. Such sites may be valuable haunts for red-throated divers *Gavia stellata*, but are not particularly important for other kinds of birds. However, the term wetland also covers bogs and fens, irrespective of their importance for birds. As a concept, 'bird lake' was conceived mainly with a view to protecting birds. Some ornithologically important lakes are classified on the basis of the vegetation found in the lake. This applies in particular to types of eutrophic lakes, which may be termed *Typha-Alisma*, *Scirpus lacustris* or *Stratiotes* lakes.

Various kinds of mire and mire complexes

After the ornithologically important lakes, various kinds of mire form the second most important type of habitat for birds in Finland. Finland is famous for its vast numbers of mires, 2.5 % of the mire area in the world is found here. Originally, Finland had about 10 million ha of mire, i.e. about 30 % of the land area, and about 9 million ha still remain. The amount has continually decreased as the mires have been drained. More than 70 % of Finnish mires have been used for forestry, agriculture, peat production or been inundated by reservoirs. The vegetation on mires varies greatly because a large number of ecological factors may affect it. The greatest variations arise when rainwater enters the mire. Ecological research has refined the classification of mires, and more than 80 types can now be distinguished.

Mire ecosystems can be divided into two main groups depending on the source of the water in the mire. Rainwater, which is poor in nutrients, is sufficient to sustain a limited range of mire vegetation, and this type of vegetation is termed *ombrotrophic*. When a mire also receives water from the surrounding mineral soil, a richer type of mire vegetation, termed *minerotrophic*, is formed. Since the nutrient status and acidity of an ombrotrophic mire scarcely vary, differences in the vegetation are caused by differences in the height of the mire surface relative to the level of the groundwater. Few plant species are found on such mires. Ombrotrophic vegetation is usually found in the centre of the mire, but may also occasionally occur on the margins.

A minerotrophic mire can be recognised by the large number of species present, sedges and mosses being

particularly abundant. Because the nutrients originate primarily from the mineral soil, the nutrient status on such mires depends directly on the kind of bedrock, additional sources of minerals in superficial deposits and the thickness of the peat. Mire vegetation on a thin layer of peat that obtains additional water from sources beyond the mire is regarded as being subject to the mire-margin effect. This effect is seen in the vegetation on spruce mires, fens and beside springs.

Similarly, a mire-centre effect is seen on fairly dry mires in that they become pine bogs, whereas treeless oligotrophic mires become poor fens and eutrophic mires become rich fens. The most obvious differences in the mire vegetation are caused by the relative difference in the height of the mire surface and the level of the groundwater. Three kinds of mire, hummock, lawn and flark, are distinguished on the basis of their wetness; a fourth type, hollow, occurs on bogs.

Individual mires, or a particular part of a large mire, comprised of a number of mire types are called mire complexes. Mire complexes that have similar vegetation, ecosystems, morphology and peat stratigraphy and occur in the same region are distinguished as specific types of mire complex. The main types of mire complex in Europe, from the south northwards, are the fens of the southern part of the deciduous forest zone, the *raised bogs* of the northern part of the deciduous forest zone and the southern part of the coniferous forest zone, the *aapa mires* of the middle and northern parts of the coniferous forest zone and the *palsa mires* of the tundra zone where remnants of permafrost exist.

Descriptions of the protected areas also refer to mire types and variants of mire complexes. Various types of wet, open *aapa mires* are specially important as they have the greatest number of bird species. Treeless *Sphagnum* bogs which have an abundance of pools are another typical example, and numerous species also occur on open flark fens and *palsa mires* in northern Finland.

Ramsar sites in Finland

The Programme for the Protection of Marshland and the Programme for Ornithologically Important Wetlands were initiated in 1979 and 1981 as a conse-

quence of the ratification of the Ramsar Convention in 1975. Eighteen percent of the Programme for Ornithologically Important Wetlands and as much as 93 % of the Programme for the Protection of Marshland had been implemented by the beginning of 2000. Both programmes are founded on extensive investigations and studies of the habitats concerned and it has been possible to identify the most important wetlands and marshlands for birds in each biogeographical zone and category of habitat.

The National Mire Protection Programme (Committee Reports 1977:48, 1980:15, 1980:38 and 1983:38) covers 600 protected areas totalling 490 000 ha. In addition, there are 200 000 ha of mire in national parks and nature reserves. The 25 most representative areas have been selected for protection under the terms of the Ramsar Convention. These areas amount to a total of 400 000 ha, the mires themselves comprising approximately 310 000 ha.

The criteria for choosing the present 11 Ramsar sites range over almost all the types of wetlands mentioned in the Ramsar Convention as valid criteria, i.e. sea bays, eutrophic lakes, raised bogs, *aapa mires* and archipelagic areas with water depths of less than 6 m. Finland has, moreover, been preparing nominations of new Ramsar sites for a long time. These are 50 wetlands of international interest. All the new sites (asterisked) are listed in Table 3.18. The intention is to submit this new list to the Ramsar Secretariat soon. The list has been part of the official process for gaining support for the Natura 2000 Network in connection with the application for EU membership and the implementation of the Baltic Sea Protection Areas (BSPA).

BirdLife Finland and the Finnish Environmental Centres have, moreover, started a project aimed at identifying internationally Important Bird Areas (IBAs) in Finland, and 96 such sites have been published in a book issued by BirdLife International in 2000. A further 2500 nationally important (FINIBA) areas have also been surveyed. The majority of the IBAs are included in the Natura 2000 Network. The Ramsar and BirdLife International criteria were applied when these sites were selected.

Table 3.18 List of present and proposed Ramsar sites.

Provinces and Sites	Type of wetland	Area (ha)		Total
		Water	Dry land/mire	
SOUTHERN FINLAND				
1. Important water bodies for birds on the Hanko peninsula*	A+B			6859
2. Läppträsket*	C	127	72	199
3. Vanhankaupunginlahti and Laajalahti	B	272	236	508
4. Porvoonjoki estuary	B	721	609	1330
5. Söderskär and Långören	A	20 334	149	20 483
6. Pernajanlahti*	B	1105	39	1144
7. Aspskär	A	695	36	731
8. Torronsuo National Park*	D+C	0	3093	3093
9. Kutajärvi*	C	982	70	1052
10. Valkmusa National Park*	D	1	1709	1710
11. Kirkkojärvi and Lupinlahti*	B+C	558	91	649
12. Kirkon-Vilkkiläntura*	B	115	79	194
13. Siikalahti*	C	582	100	682
WESTERN FINLAND				
14. Oukkulanlahti*	B	883	15	898
15. Koskeljärvi*	C	1253	568	1821
16. Otajärvi*	C	523	58	581
17. Mietoistenlahti*	B	394	192	586
18. Kokemäenjoki estuary and Preiviikinlahti*	B+C	8018	419	8437
19. Puurijärvi - Isosuo National Park*	D+C	859	2345	3204
20. Kirkkojärvi*	C	260	45	305
21. Vanajavesi area*	C	549	150	699
22. Valsö Islands and Björkö Shoals	A	15 900	830	16 730
23. Mickel Islands*	A	27 713	2800	30 513
24. Kauhaneva - Pohjankangas National Park*	D	62	6803	6865
25. Levaneva*	D	246	3097	3343
26. Pilvineva*	D	41	3626	3667
27. Salamajärvi National Park*	D+C	515	8433	8948
28. Lapväärtti*	B	874	350	1224
29. Vassorfjärden*	B	1215	322	1537
30. Alavus	C+D	564	926	1490
ÅLAND				
31. Björkör and Lågskär	A	6075	234	6309
32. Signilskär - Märket	A	22 146	420	22 566

EASTERN FINLAND

33. Lakes at Rantasalmi	C	629	480	1109
34. Suurenaukeansuo - Isosuo and Pohjalampi*	D+C	70	1570	1640
35. Lakes at Rääkkylä and Kitee	C	656	571	1227
36. Sysmäjärvi*	C	687	47	734
37. Patvinsuo National Park	D	908	11 819	12 727
38. Kesonsuo*	D	667	8113	8780
39. Lakes at Maaninka*	C	516	5	521
40. Heinä-Suvanto and Hetejärvi*	C	447	777	1224

OULU

41. Krunnit	A	4076	360	4436
42. Haapavesi*	C+D	1255	2361	3616
43. Hailuoto*	A+B	4347	2164	6511
44. Liminganlahti*	B	10 022	2253	12 275
45. Siikajoki*	B	1250	1442	2692
46. Aittojärvi and Kongasjärvi*	C	234	469	703
47. Veneneva - Pelso*	D	100	11 939	12 039
48. Elimyssalo*	D	369	7924	8293
49. Olvassuo*	D	160	26 913	27 073
50. Oulanka National Park*	D	1100	28 289	29 389

LAPLAND

51. Martimoaapa - Lumiaapa - Penikat	D	378	13 708	14 086
52. Kainuunkylä Islands*	C	248	757	1005
53. Riisitunturi National Park*	D	93	12 368	12 461
54. Luiro*	D	26	12 319	12 345
55. Teuravuoma - Kivijärvenvuoma*	D	48	5740	5788
56. Koitelainen	D	204	38 636	38 840
57. Urho Kekkonen National Park and Sompio Strict Nature Reserve*	D	1950	307 821	309 771
58. Lemmenjoki National Park*	D	3368	282 623	285 991
59. Sotkavuoma*	D+C	406	2196	2602
60. Lätäseno*	D	2130	41 237	43 367
61. Sammuttijänkä - Vaijoenjäkä*	D	4000	47 749	51 749

Abbreviations: A = Archipelago, B = Sea bay, C = Lake with many birds, D = Mire

*Proposed Ramsar sites

Area of main types of wetland

Total areas:	A =	115 138 ha	(9) (archipelagos)
(according to	B =	31 474 ha	(12) (sea bays)
dominant type	C =	16 968 ha	(16) (lakes with many birds)
of wetland)	D =	907 771 ha	(24) (mires)
Total		1 071 351 ha	(61)

All the Ramsar sites are part of the Natura 2000 Network.

Survey of Finnish nature reserves

Protecting various kinds of wetlands helps conserve biological diversity, which is one of the principal aims when natural resources are being protected. Wetland conservation has always been a priority in Finland.

More specific measures have also been introduced to preserve biological diversity. As in other countries, these include protecting areas and landscapes, and endangered animals and plants, both wild and domesticated. These measures are implemented through the auspices of both governmental bodies and a number of voluntary organisations (the Finnish Society for the Conservation of Nature, WWF and BirdLife Finland).

The Nature Conservation Act is responsible for protecting habitats, wild plants and most wild animals in Finland. It provides for the designation of different types of protected areas on both state-owned and privately owned land (Table 3.19). At present, there are the following main categories of protected areas on state-owned land:

- *Strict nature reserves* are specific areas of special scientific interest designated with the aim of fully protecting all the species present there and preventing any disturbance. Restricted access and reindeer husbandry are allowed in some reserves.
- *National parks* are state-owned areas that have outstanding natural beauty and are preserved in a best possible manner. The public has free access and the areas are intended to serve the needs of visitors who want to both study and enjoy nature. Local inhabitants are permitted to carry on reindeer husbandry, fish and hunt in some parks.
- *Mire reserves and other nature reserves* have been established to safeguard the quality of the water and the flora on mires and in other areas, such as woodland.

No use of the land itself is permitted, and drainage and tree felling are forbidden, but these areas may be used for recreational purposes. There is also a miscellaneous category of areas specially protected for specific purposes, including the protection of eskers, moraines, marine ecosystems and cultural heritage objects.

Protected areas on privately owned land are established by private persons, communities and local authorities to safeguard important bird colonies in archipelagos, copses, small woodlands and so on.

Since the landowner takes the initiative to protect such areas, their protective status differs from that of areas on state-owned land and the landowner generally retains the right to use the area to some extent. The owner also usually receives some financial compensation.

When the Wilderness Act came into force in 1990, it became feasible to protect another important category of area, and some parts of Lapland were protected as wilderness areas. The minimum size of such areas is 15 000 ha, and they have virtually no roads. They are on state-owned land and cover a total area of nearly 1.5 million ha (Table 3.19). Their use is regulated and managed by the Finnish Forest and Park Service on the basis of individual care and maintenance plans that take into account the needs of the particular area.

By 1st January 2001, 2.98 million ha in Finland had been protected under the terms of the Nature Conservation Act or the Wilderness Act (Table 3.19).

A number of rapids are protected through the Act concerning the Protection of Rapids, either individually or as parts of an entire watercourse; 53 watercourses or individual rapids are protected in this way.

The Act prevents the construction of power stations at such sites and thus has a strong influence on ecosystems in the protected area. For instance, more than half the area bordering the River Kiiminki is wetland. Special Acts also protect the rivers Ounasjoki and Kyrönjoki. A nationwide inventory of small rivers began in 1988, but has so far not given any concrete results.

Table 3.19 Number and size of protected areas in Finland on 1st January 2001 established under the terms of the Nature Conservation Act and the Wilderness Act.

Category	Number	Area (ha)
Strict nature reserves	19	152 000
National parks	33	777 000
Mire reserves	173	422 000
Other protected areas on state-owned land	186	60 000
Wilderness areas	12	1 489 000
Protected areas on privately owned land	2487	80 000
Total	2910	2 980 000

The majority of protected areas in Finland are the product of long-term planning initiated in the 1970s, primarily with the aim of protecting biological diversity. This planning first dealt with national parks and strict nature reserves, but mires and wetlands were added subsequently. More recently, national conservation programmes for herb-rich woodlands, lake and coastal shores and old-growth forests and woodlands have been approved and their implementation is under way.

The programme for shores covers some 8000 km of shoreline (about 5 % of the total length of shoreline in Finland) and these will be kept in their natural state and remain unaffected by buildings and other constructions. There are still a number of problems associated with the regional distribution of certain types of ecosystem in the network of protected areas.

Most of the areas currently protected are in northern Finland, and this clearly means that some kinds of habitat are inadequately protected. For instance, most areas of old-growth forest are in southern Finland and the area protected is too small to effectively maintain their special kinds of fauna and flora.

The Natura 2000 Network in Finland

In Finland, the EU Habitat Directive is mostly being implemented under the terms of the Nature Conservation Act. Finland has proposed that 1458 areas be included in the Natura 2000 Network. Their total area is about 4.8 million ha, two-thirds of which is land and one-third water, and amounts to about 12 % of the country. About 97 % of the proposed areas are already protected.

The Government approved the decision on these areas in August 1998 and March 1999, and some minor additions came in 2001 (see Table 3.19). The EU Birds Directive refers to 450 Special Protection Areas (SPAs) in Finland, and these cover an area of 2.81 million ha. Table 3.20 lists those SPAs that are important wetland habitats for birds and which are therefore proposed as Natura 2000 sites under the terms of the Habitat Directive.

Table 3.20 Finnish wetland habitats proposed for inclusion in the Natura 2000 Network.

Habitat type	Code	Area in the Natura 2000 database, ha
COASTAL AND HALOPHYTIC HABITATS		
Sandbanks partly exposed at low tide	1110	6480
Estuaries	1130	19 700
Coastal lagoons	1150	8800
Large shallow inlets and bays	1160	6800
Reefs	1170	3600
Sub-total		45 380
SEA-SHORE MEADOWS AND NARROW INLETS		
Sandy and shingle beaches with sub-littoral vegetation on islands along bouldery ridges	1610	2990
Boreal islets and small islands	1620	12 900
Baltic-type sea-shore meadows	1630	2300
Boreal sandy beaches with perennial vegetation	1640	270
Narrow inlets on the boreal Baltic coast	1650	4200
Moist dune slacks	2190	370
Sub-total		23 030
FRESHWATER HABITATS - STANDING WATER		
Mineral-poor oligotrophic lakes on plains (shoreweed type <i>Littorelletalia uniflorae</i>)	3110	302 500
Hard, oligomesotrophic waters with benthic stoneworts <i>Chara</i> spp.	3140	5000
Naturally eutrophic lakes with <i>Magnopotamion</i> or <i>Hydrocharition</i> vegetation	3150	6560
Naturally dystrophic lakes and ponds	3160	84 300
Sub-total		398 360
FRESHWATER HABITATS - RUNNING WATER		
Naturally dystrophic lakes of Fennoscandian type	3210	22 450
Alpine rivers with herbaceous vegetation along their banks	3220	11 700
Watercourses in lowlands and montane plains with <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation	3260	7800
Sub-total		41 950
SEMI-NATURAL, MOIST TALL-HERB MEADOWS		
Hydrophilous tall-herb fringe communities on montane and alpine plains	6430	2300
Boreal alluvial meadows	6450	2900
Sub-total		5200
BOGS, MIRES, FENS		
Active raised bogs	7110	96 500
Degraded raised bogs still capable of natural regeneration	7120	3500
Open, slightly domed bogs, poor and intermediate fens and quaking bogs	7140	29 800
Fennoscandian-type mineral-rich springs and spring fens	7160	1900
Calcareous fens with great fen-sedge <i>Cladium mariscus</i> and typical species of the <i>Caricion davallianae</i> alliance	7210	1
Petrified springs with tufa (<i>Cratoneurion</i>)	7220	600
Rich fens	7230	8400
Alpine formations with <i>Caricion bicoloris-atrofuscae</i> vegetation	7240	3100
Aapa mires	7310	752 400
Palsa mires	7320	2600
Sub-total		898 801
MOIST WOODLANDS		
Fennoscandian-type deciduous swamp woodland	9080	2600
Wooded bog	91D0	124 500
Alluvial woodland with alder <i>Alnus glutinosa</i> and ash <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>)	91E0	22 000
Sub-total		149 100
Total		1 561 821

Important Bird Areas (IBAs) in Finland

Ninety-six sites are identified as Important Bird Areas (IBAs) in Finland, according to a recently published book from BirdLife International (2000). They cover 8 % of Finland, an area of 2.8 billion ha. The archipelagos on the inner coast have many IBAs, but the mainland has few ornithologically valuable areas except for a number of large oligotrophic lakes and small eutrophic lakes which are important for wetland birds. Almost all the areas that are most important for birds when they are congregating on their migration routes are on the coasts of the Gulf of Bothnia and the Gulf of Finland. The largest numbers of birds occur on the wetlands of the Oulu region, the Pori archipelago and the Kvarken archipelago. The

only important site where birds congregate to winter is the Långskär-Nyhamn area where up to 400 Steller's eiders *Polysticta stelleri*, 6 % of the Baltic Sea wintering population, gather. Table 3.21 lists the aquatic birds that winter in Finland, and their approximate numbers. A total of 115 SPEC species (Species of European Conservation Concern) occur in Finland, 102 of which breed regularly. Seventy-four IBAs (77 %) are wetlands. The various habitats represented are woodland and forest (15), peatland (19), wetland (26), large, open inland lake (6), archipelago (20), alpine (6) and cultural landscape (4). Ninety-two (93 %) of the IBAs have been proposed as sites in the Natura 2000 Network.

Table 3.21 Aquatic birds wintering in Finland.

Species	Wintering population in Finland ¹
Red-throated diver <i>Gavia stellata</i>	20-100
Black-throated diver <i>G. arctica</i>	20-100
Little grebe <i>Tachybaptus ruficollis</i>	20-100
Great crested grebe <i>Podiceps cristatus</i>	10-50
Great cormorant <i>Phalacrocorax carbo</i>	3000-4000 ²
Mute swan <i>Cygnus olor</i>	500-1500
Whooper swan <i>C. cygnus</i>	100-500
Canada goose <i>Branta canadensis</i>	100-300
Eurasian wigeon <i>Anas penelope</i>	10-50
Eurasian teal <i>A. crecca</i>	10-50
Mallard <i>A. platyrhynchos</i>	10 000-20 000
Common pochard <i>Aythya ferina</i>	10-50
Tufted duck <i>A. fulicula</i>	50-5000
Greater scaup <i>A. marila</i>	10-100
Common eider <i>Somateria mollissima</i>	100-1000
Steller's eider <i>Polysticta stelleri</i>	100-500
Long-tailed duck <i>Clangula hyemalis</i>	2000-10 000
Black scoter <i>Melanitta nigra</i>	50-500
Velvet scoter <i>M. fusca</i>	50-500
Common goldeneye <i>Bucephala clangula</i>	500-2000
Smew <i>Mergellus albellus</i>	10-50
Red-breasted merganser <i>Mergus serrator</i>	200-2000
Goosander <i>M. merganser</i>	2000-10 000
Common coot <i>Fulica atra</i>	20-2000

¹Koskimies, P. 1993: I Finland häckar 50 miljoner fågelpar. Fåglar 2/1993: 6-15.

²Pekka Rusanen (2001 unpublished)

Summary of Finnish policy on wetlands

The National Action Plan for Biodiversity in Finland, applicable for 1997-2005, includes programmes and measures for wetlands. Its main aims are to make biodiversity conservation part of all national planning and decision making in Finland. Nature and wetland protection should be an integral part of all planning, legislation and environmental policy.

Priority has been given in Finland to restoring wetlands, the main aim being to restore and take care of wetlands based on a survey of 163 areas and an examination of the requirements, a review of the human resources and funding available for restoration, and a fixed schedule for the project. The areas being proposed as Natura 2000 areas and Ramsar sites figure highest on the list and will be given priority. The work is being funded by the Ministry of the Environment, the Ministry of Agriculture and Forestry and Life-Nature, an EU organisation.

A monitoring programme for a representative number of protected sites will also be drawn up. The studies that concern biodiversity must be supplemented because the estimates available for species and habitat diversity vary, ranging from intensive studies of individual sites to nationwide assessments. These studies require large data bases, modern remote sensing techniques and equipment for GIS (Geographical Information Systems) surveys.

The Integrated Coastal Zone Management Demonstration Programme is a joint EU initiative for environmental, fisheries and regional policy. Its objectives are to acquire the information needed to maintain and fund the sustainable management of coastal zones and stimulate broad cooperation between those responsible for its planning and implementation.

The following international initiatives will be used to protect coastal and marine areas in Finland:

Protected areas in the Baltic Sea are areas to be specially set aside to protect representative marine ecosystems and maintain the sustainable use of the natural resources. This is important since it is vital to ensure the immediate protection of the environment and biodiversity.

Biosphere reserves are areas set aside both now and for the future to attempt to protect the integrity of plant and animal communities in their natural ecosystems and safeguard the genetic diversity on which their continuing evolution depends.

The deteriorating water quality in the Baltic Sea may have serious consequences for the fauna and flora in shallow waters if the present trend is not broken. A reduction in the discharge of nitrogen is obviously essential if harmful effects of climate change in the Baltic are to be prevented. The ecotoxicological impacts of lead shot and dioxins are currently being studied.

The need for trained specialists in various institutions is great. There is also a need in both biology and water management for people with interdisciplinary skills. Inservice training for wetland managers is also required, especially regarding the restoration and management of wetlands. The Government allocates resources annually to manage, perform research on, monitor and restore wetlands. In addition, a separate system exists in Finland to fund the restoration of degraded wetlands.

Potential threats to wetlands in Finland

Despite their obvious value, wetlands are being lost in both Finland and the rest of Europe. Available information indicates that approximately two-thirds of the European wetlands that existed at the beginning of last century have now disappeared. Rivers and deltas have been seriously affected by a variety of water-related construction schemes.

Numerous salt marshes, flooded grasslands and temporary freshwater marshes have been lost through damming to construct reservoirs, drainage schemes and conversion into pastures and arable land. Peatlands have also been extensively damaged through unsustainable peat extraction and afforestation.

Finnish wetlands are exposed to these general threats and also to more specific ones. There is heavy pressure on shore areas for building schemes connected with recreational activities. Eutrophication due to excessive manuring of fields is a serious threat all over the country. Motorways built beside and across wetlands have caused damage. Large power lines crossing protected areas pose a great risk to many birds.

The American mink *Mustela vison* and the raccoon dog *Nyctereutes procyonoides* are serious threats to colonially breeding birds. Some unprotected islands in the archipelago in south-west Finland suffer in spring from boat traffic and shooting of waterfowl. The transport of oil by sea and oil spills from land pose the most serious threats to the fragile environment in the archipelagos.

Breeding birds are disturbed by the increase in boat traffic during the breeding season and infringements of protection regulations when people land on protected islands with unleashed dogs. The increase in camping, hiking and driving of snow machines may also disturb birds in some areas. When embankments are built and vegetation is cleared to prevent flooding, alluvial meadows and reed beds are destroyed, seriously damaging wetlands.

Variations in the water level caused by the regulation of rivers can endanger the existence of several wetland species. Changes in the water level in reservoirs may damage mire margins. Felling trees beside mires reduces the biodiversity and affects the landscape in the area.

See Chap. 7 for relevant references.

Examples of wetlands in Finland

Liming Bay

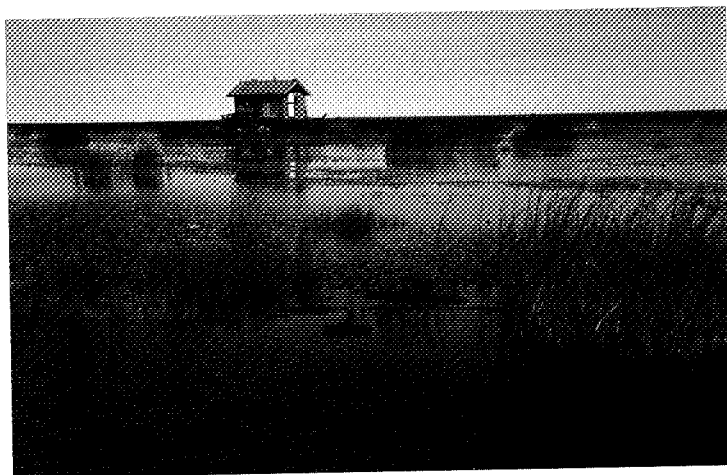
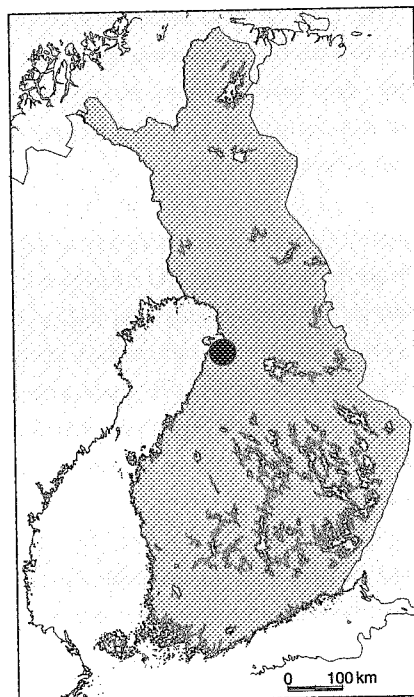


Figure 3.16 Liming Bay.

PHOTO: JORMA PESSA (COPYRIGHT: NORTHERN OSTROBOTHNIAN ENVIRONMENT CENTRE)



National protection: Approximately 12 000 ha unprotected

International status: Ramsar site

Description of the area

Liming Bay (Fig. 3.16) is the largest bay in the Gulf of Bothnia, and one of the finest wetlands and therefore the most important Ramsar site in Finland. It extends over an area of 109 km² and its shoreline is 110 km long. Liming Bay is specially notable for its flatness, the effects of the ongoing land uplift, varying salinity, variations in soils and its high content of nutrients. The landscape at Liming Bay is continually changing. The land uplift causes a successive shift in the vegetation, with wetland forming the first stage, gradually being replaced by woodland.

More than 100 species of birds occur regularly in the area and when migrants are added the total figure observed reaches 280. The bay is outstanding on a world scale as a site where aquatic and shore birds congregate. Thousands of Eurasian teal *Anas crecca*, northern pintails *A. acuta*, Eurasian wigeon *A. penelope*, tufted ducks *Aythya fuligula*, common goldeneyes *Bucephala clangula* and goosanders *Mergus merganser* feed and rest here each spring and autumn. Around 20 000 ruffs *Philomachus pugnax*, 7000 wood sandpipers *Tringa glareola*, 4500 dunlins *Calidris alpina* and 600 common cranes *Grus grus* have been observed here. In spring, it is possible to see almost 30 000 aquatic birds and up to another 30 000 waders at any one time. All told, more than 2000 whooper swans *Cygnus cygnus* and 20 000 bean geese *Anser fabalis*, 25 % of the north-west European population, rest here in spring. The numbers of aquatic birds during the autumn migration can be almost as large as in spring; indeed there are still more whooper swans, 3000, or 15 % of the population.

The effort to protect the environmental qualities in Liming Bay gained momentum in 1995 when the *Liminganlahti Life* project, supported by the European Union, started. This project and the protection of the Liming Bay wetlands were among the first EU-funded nature protection projects in Finland. The principal aim was to preserve the unique environment by integrating nature conservation and land use in a manner consistent with the principles of sustainable development. The project was divided into three inter-related parts, nature protection, biotope management and promotion of environmental awareness.

Extensive reed beds, low-lying meadows and areas of shallow water dotted by patches of reeds characterise

the Liming Bay landscape. The shores are mainly lined by sea-shore meadows, which used to be important for the local economy. Where the shores are muddy, this zone of grassland is broad and richly vegetated, but it is narrow where the shores are sandy. Estuaries, salt marshes, lagoons and woodland formed during the primary stage of land uplift, along with islets and islands, are the most important habitats. The habitats of threatened birds and plants can be protected both by setting aside protected areas and adopting such measures as are required to restore and preserve the threatened habitats. The vegetation in Liming Bay is unique and valuable from a nature conservation viewpoint; many endemic and threatened species grow in the area, and some are widely distributed here.

The sea-shore meadows in Liming bay, as elsewhere in the Gulf of Bothnia, have been shaped by traditional agriculture over hundreds of years. The grass was mown in summer to provide winter fodder for the cattle, which grazed the mown areas later in the summer. Changes in farming practices meant that grazing began decreasing in the early 1950s and hay lost its value. Thanks to agri-environmental subsidies, cattle grazing and mowing have been revived since 1995. The area of low-lying grassland has increased and living conditions for wetland birds have improved.

Hunting and fishing have probably taken place in Liming Bay as long as people have lived there, but more primitive equipment and the smaller population made them less intensive in the old days. However, the natural resources were utilised more efficiently, not least when times were hard. In its present form, hunting (shooting) has only been going on in this area for a few decades. Nowadays, an extremely intensive fowling season opens on 20th August, greatly disturbing the migrating birds resting and feeding in the area. Geese, ducks, waders and gulls are forced to begin their autumn migration in August. As one aspect of the Liminganlahti Life project, shooting restrictions were introduced in 1998 in some broad shallows and on stretches of shallow mudflats, low-lying meadows and areas with varied, lush vegetation, the aim being to ensure undisturbed places for the birds where they can rest and feed, thus being able to prepare for their autumn migration in peace.

A substantial number of the species listed in the EU Birds Directive are found in the Liming Bay area, and for many it is their most important area for congregating and resting prior to their autumn migration. Liming Bay and its nearby fields is the most important staging post in Finland for geese on their spring migration. Along with the shores on the nearby island of Karlö, this area is now the only permanent resting site for the endangered lesser white-fronted goose *Anser erythropus*, whose protection requires the existence of a sufficiently large area, particularly of coastal meadows, where shooting is restricted. The southern race of the dunlin *Calidris alpina schinzii* is another endangered species in Finland. Some 15-20 pairs, approximately 25-30 % of the Finnish population, breed in Liming Bay. The protection of this species also requires the protection of sea-shore meadows.

The EU has given priority to the great bittern *Botaurus stellaris*, and its occurrence at Liming Bay depends on the availability of wet reeds. It is therefore essential to protect and preserve sufficiently extensive reed beds to be able to protect this population, which is relatively dense, approximately 6-7 % of the great bitterns in Finland breed here.

The Eurasian marsh harrier *Circus aeruginosus*, little tern *Sterna minuta*, black-tailed godwit *Limosa limosa* and yellow-breasted bunting *Emberiza aureola* still nest in the area. Nearly 10 % of the Finnish breeding population of marsh harriers are found here. The breeding population of the yellow-breasted bunting has declined greatly and the species is critically endangered in Finland. Only a few individuals have been seen in recent years.

Facilities for birdwatchers were improved in the 1990s with EU support. A new visitor centre and six bird-watching towers have been built, and nature trails and other facilities are now available. It is easy to observe birds in Liming Bay, since the visitor centre provides accommodation, and highly experienced guides are available when needed.

Martimo and Lumi aapa mires and Penikat

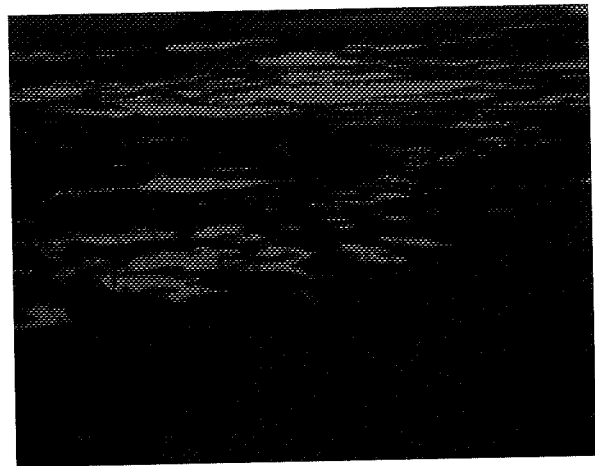
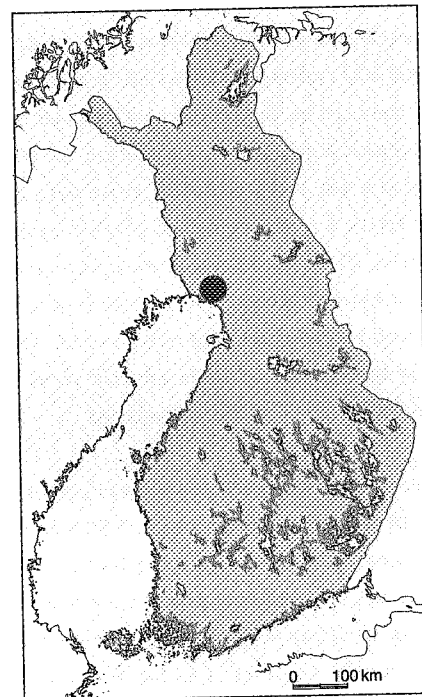


Figure 3.17 The Martimo aapa mire.

PHOTO: AARNO TORVINEN (COPYRIGHT: REGIONAL ENVIRONMENT CENTRE OF LAPLAND)



National protection: An area of 13 606 ha was protected as a nature reserve in 1981.

International status: Ramsar site

Description of the area

The protected Martimo aapa mire complex (Fig. 3.17) is one of the most diversified in Ostrobothnia, because of the alkaline soils on its lush, dry hummocks. It has a varied assemblage of types of aapa mire and raised bog. The mires have numerous flarks and pools, which offer an excellent environment for an exceptionally rich and varied avifauna. This 13,606 ha Peatland Reserve was established in 1981 and is state owned.

A substantial part of it is covered by the Mire Conservation Programme, and 641 ha formed part of a former programme to protect old-growth woodland. The whole area is in the Natura 2000 Network, designated as a Special Protection Area. The natural woodland on the mires and the well-preserved old-growth forest in the southern part of the area increase its value as a protected area.

The Martimo and Lumi aapa mire complexes and Penikat also include several extensive fens that are close to one another, and near these wet, well-developed fens are several raised bogs. The Martimo aapa mire itself also includes one of the best preserved examples of a northern raised bog as well as hummocks with old woodland, and large pools. Kivalo, a chain of low hills, has distinctly richer vegetation than the rest of the area because of its calcareous soil. The hill slopes have wooded grassland and various kinds of alkaline fens.

Both southern and northern species of birds are found in the area. Surveys have shown that approximately 30 pairs of bean geese *Anser fabalis* and 30 pairs of common cranes *Grus grus* breed in the reserve. The most abundant aquatic species are Eurasian teal *Anas crecca*, mallard *A. platyrhynchos* and pintail *A. acuta*. The population of red-throated divers *Gavia stellata*, numbering 10-15 pairs, is probably the densest in Finland. Some 1500 pairs of waders, belonging to 16 species, breed in the reserve. The proximity of the area to the Gulf of Bothnia increases its importance as a resting place for migrating birds.

3.5.4 ÅLAND

Åland is an autonomous part of Finland. It is one of the largest archipelagos in the Baltic Sea, and is continuous with the archipelago of south-west Finland. The Åland archipelago has approximately 6500 islands. The Åland Sea lies to the south-west and the Baltic Sea proper to the north-west, both of which are deep.

Because it is a demilitarised zone and is self-governing, Åland enjoys a special position in Finnish society. It has its own Provincial Government, its own legislation and its own Landscape Board. Åland nature protection legislation differs considerably from that which applies to the rest of Finland.

The long-term effort to protect the natural environment is primarily focused on the two most marked types of habitat and the most endangered species of plants, animals and biotopes, and takes place continuously through the Landscape Board. One of its important tasks is to maintain the nature reserves and their facilities. Another is to continue to implement the proposals of sites for inclusion in the Natura 2000 Network.

Åland is well known for its leafy woods and its grassland. A habitat that has survived in Åland is wooded grassland, and it is often associated with wetland. The archipelago is a paradise for birds and birdwatchers. Two groups of islands, Björkö and Långskär, and Signilskär and Märket, are Ramsar sites. The former is located in the outermost part of the archipelago, close to the open sea. It consists of two small, wooded islands and more than 150 treeless skerries and rocky islets.

The vegetation is exceptionally diverse considering the harsh conditions. The area is owned partly by the Åland government and partly by the Finnish government. Björkö was protected in 1966. The site belongs to the Natura 2000 Network, being designated as a Site of Community Importance (SCI). Its shores are important feeding and resting areas for migrating waterfowl. In spring, up to 5000-10,000 common eiders *Somateria mollissima* and long-tailed ducks *Clangula hyemalis* rest here. Långskär is one of the few important wintering areas for Steller's eiders *Polysticta stelleri* in the northern Baltic Sea, an average of around 400 individuals congregating here.

The Signilskär-Märket Ramsar site is also in the outer archipelago and consists of four relatively large islands along with about 60 small, mostly treeless islands and islets. Signilskär is a flat, 1.5 km long island with low deciduous woods, grassland, heath and a small bog.

The great variation in water depth creates a rich selection of underwater biotopes. The area is owned by the province of Åland. It has the oldest bird observatory in Finland and has been a bird sanctuary since 1927. The site is included in the Helsinki Commission (Helcom) Network of Baltic Sea Protected Areas and the Natura 2000 Network, where it is designated as a Site of Community Importance (SCI).

The bird life is diverse and abundant. The most abundant species is the common eider (about 2250 pairs). Some 600 pairs of black guillemots *Cepphus grylle* and around 200 pairs of razorbills *Alca torda* are among the other waterfowl that breed here. The surrounding waters are important for ringed seals *Phoca hispida* and grey seals *Halichoerus gryphus*.

See Chap. 7 for relevant references.

3.5.5 ICELAND

Iceland covers an area of approximately 103 000 km², about 25 000 km² of which have a vegetation cover. The country is situated on the Mid-Atlantic Ridge and is traversed by an active volcanic zone. The landscape varies greatly, having many fjords and bays, mountains, glaciers and lowlands. Woodland covers only a small proportion of the country (about 1 % or 1000 km²), and is mostly birch. Approximately 70 % of the country is more than 300 m above sea level. Geologically speaking, Iceland is young, no more than about 15 million years old. Wetland (mires of one kind or another) comprises approximately 8000 - 10 000 km² (30-40 %) of the total vegetation, even though large areas have been drained in the last century. The Icelandic coast is about 6000 km long. The tidal zone varies from 1.5 m on the north, east and part of the south coasts up to as much as approximately 5 m during spring tides on the west coast, particularly at Breiðafjörður, but decreases again at Vestfjordene. This means that there is a great difference in the area of wetland and the width of the shore on the coast from one part of the country to another. Western Iceland has extensive tidal flats and salt marshes, which are uncommon elsewhere, although some do occur on the south-east coast.

The majority of the Icelandic avifauna is dependent upon wetland of one kind or another. Fifty-three (69 %) of the 76 species of birds found in Iceland breed on wetlands, and 30 of them are completely dependent upon them, either for their nesting sites or to find food during the brooding period; 18 species use wetlands a large part of the time and 5 are partially dependent upon them.

Wetland

In addition to mires, lakes, rivers and river mouths, salt marshes, tidal flats, shores (intertidal zones) and shallow-water marine areas down to a depth of 6 m are among the areas characterised as wetland according to international definitions for Ramsar sites. However, the geothermic wetlands of Iceland are a special feature for the Nordic countries.

Mires, periodically inundated grasslands, palsa mires and swamps are very luxuriant, since the soil is rich in minerals, mainly from ash and other tephra deriving from volcanic eruptions and also from soil derived from eroded areas and flood deposits. In

Iceland, it is usual to classify mires in four categories, hallamýri (sloping fen), flói (moist fen), flæðimýrar (periodically inundated grassland) and flár (palsa mire).

Sloping fens are found on hillsides and other places where the inclination of the land and other factors are favourable for maintaining a high water table. The peat layer on sloping fens is a little thinner than on moist fens, typically 1-3 m. Sloping fen is the type of mire that is most widely distributed in Iceland, but mostly in the lowlands. It is characterised by the water table never reaching the surface, except perhaps for a short period in spring, and never being completely still owing to the slope. Sloping fens are therefore supplied with many mineral nutrients and are not as acid as moist fens. Sloping fens are richer in species than moist fens and are characterised by different plants, such as common sedge *Carex nigra*, stiff sedge *C. bigelowii*, horsetails *Equisetum* spp. and deergrass *Trichophorum cespitosum*. Dwarf birch *Betula nana* and bog bilberry *Vaccinium uliginosum* are among the dominant species on scrub-covered fen, which is distinguished from all other mires by the water always being in motion.

Moist fens are often found where lakes once existed, these having become filled with remains of vegetation, but the water table is still close to or at the surface, or water flows over the vegetation. In many places, moist fens are very infertile and are called brok or klóffuflói in Icelandic after the species that is most conspicuous (common cottongrass *Eriophorum angustifolium*). The peat layer in moist fens is typically 2-5 m thick. The various types of moist fen can be named after the dominating plant that is present, such as mountain bog-sedge *Carex rariflora*, bottle sedge *C. rostrata*, Lyngbye's sedge *C. lyngbyei*, string sedge *C. chordorrhiza* and russet sedge *C. saxatilis*.

Periodically inundated grassland typically occurs where the water table is very high in spring and water floods the vegetation. Such grasslands are only found near rivers, particularly in sea or lake deltas. Water flows over the grassland for at least part of the year. The most common plant is Lyngbye's sedge, but other species include common sedge, water horsetail *Equisetum fluviatile*, marsh horsetail *E. palustre*, bogbean *Menyanthes trifoliata*, marsh-marigold *Caltha*

palustris, white sedge *Carex curta* and marsh cinquefoil *Potentilla palustris*.

Palsa mires are found in a few places in the highlands and have a distinctive character. Their vegetation is arctic (semi-tundra) in type. They are typically large mounds, 1-1.5 m high, rarely wider than 10 m, and a little longer. They have an ice core which keeps them upraised, but if that melts in summer small pools form in its place. Between the mounds are lakes surrounded by moist fens. The most dominant plants where the water table is highest are, for example, bottle sedge and stiff sedge *Carex bigelowii*. Other species become dominant where the water table is lower, such as common cottongrass *Eriophorum angustifolium*, arctic cottongrass *E. scheuchzeri*, mountain bog-sedge *Carex rariflora*, narrow small-reed *Calamagrostis stricta* and common sedge *Carex nigra*.

Lakes, rivers and streams - Iceland differs from the rest of the Nordic countries by being geologically much younger and repeatedly experiencing volcanic activity. There are three main categories of river in Iceland, surface rivers, spring rivers and sub-glacial rivers (Table 3.22). The type of river found in the individual part of the country depends among other things on the age and type of bedrock. Despite receiving a great deal of precipitation, some parts (e.g. Snæfellsnes) have scarcely any rivers because of the porous lava. Other parts lack rivers because they are located in a rain shadow (e.g. the area north-east of Vatnajökull). The largest rivers have their source in the mountains and on glaciers. Every type of river is associated with a cold climate and varying amounts of precipitation. Iceland receives a great deal of precipitation, but evaporation is comparatively slight, and the runoff is 1.73 tonnes of water/km² per year, among the highest in Europe. The rate of erosion is high and deposition of sediment is substantial, 500 t/km². Lakes vary in size, but most are small (Table 3.23). Compared with the rest of Europe, the fauna in Icelandic lakes and rivers is poor and resembles an arctic fauna (Table 3.24). For instance, there are only 5 species of freshwater fish (6 with a newly discovered eel). The main reasons for this are the isolated position of the country and the short time that has elapsed since the land became ice free and lakes were formed after the last Ice Age. The climate and the temperature of the water also play important roles. However, there are exceptions, such as Lake Mývatn and the River Laxá.

Table 3.22 The number of rivers in the three categories distinguished, and their total length in kilometres.

Total	Spring rivers	Surface rivers	Sub-glacial rivers
Single category	37 (51%)	520 (83%)	18 (38%)
Mixed category	72	629	48
Length (km)	1709	10 406	1520

Source: Hilmar J. Malmquist 1998, Íslensk votlendi.

Table 3.23 Number of lakes in Iceland larger than 0.1 km², and their total area.

Size categories	Number and percentage	Area km ²
0.1 - 1.0 km ²	1648 (90%)	414 (32%)
1.1 - 5.0 km ²	162 (9%)	313 (24%)
5.1 - 10.0 km ²	14 (1%)	93 (7%)
> 10.1 km ²	17 (1%)	460 (36%)
Total km ²	1841	1280

Source: Hilmar J. Malmquist 1998, Íslensk votlendi.

Coasts, intertidal zones, archipelagos and marine areas - as mentioned earlier, the Icelandic coast is approximately 6000 km long. The difference between high and low tide varies from 1.5 m on the north, east and part of the south coast up to approximately 5 m at maximum spring tides on the west coast, especially in Breiðafjörður, the only protected marine area in Iceland. Breiðafjörður was protected by a Special Act in 1995. The protected area covers some 3000 km² and includes about 3000 islands and skerries. The great difference between high and low water in parts of the country results in a corresponding difference in the extent of wetlands. The west coast has extensive tidal flats and salt marshes, which are not so common elsewhere, although they are found, but are generally very small. Plants such as common salt-marsh grass *Puccinellia maritima*, *Carex subspathacea*, *C. mackenziei* and *C. salina* are confined to the salt marshes. About half the intertidal zone in Iceland is found in Breiðafjörður, and extensive kelp *Laminaria* forests are found there. Breiðafjörður also has more than half the rocky coast, and that has a high production of macroalgae, bladder wrack *Fucus vesiculosus* and knotted wrack *Ascophyllum nodosum*.

Iceland has about 174 km² of tidal flats, approximately 70 km² of them being in Breiðafjörður and 70 km² in Faxaflói. There are approximately 222 km² of coastline with shingle, cobbles and rocks, and the greater part (140 km²) is in Breiðafjörður. Because of the large coastal zone and high biological production

on the west coast, the most important foraging sites for many species of birds are also found there, both Icelandic birds and migrants en route further north. The coast and the sea are the most important wintering areas for Icelandic birds which do not migrate south. However, some, such as ducks, also inhabit sites where warm water ensures that some parts do not freeze, particularly some lakes and moist fens.

Various kinds of lagoons (shore lakes, portions of the sea that have been more or less cut off from the actual sea) are found in many places. There are 101 lagoons that are larger than 10 ha. Their salinity is generally not less than 0.3-1.0 parts per thousand, and in some places about the same as the nearby sea. Some lagoons have a great deal of bottom vegetation, such as eel-grass *Zostera marina* and beaked tasselweed *Ruppia maritima*, which are important food for swans and ducks, but the animal life is otherwise very dependent upon the salinity.

Geothermic wetlands with hot springs that have an outstanding flora, algae, bacteria and other micro-organisms are a special aspect of Iceland and are not found in many parts of the world. However, they have so far been very little studied. Hot springs are found in the intertidal zone in some places.

Table 3.24 Estimated number of species in lakes and rivers in Iceland.

Plants	Number
<i>Bacteria</i>	100 – 1000?
<i>Cyanophyta</i>	20 – 30?
<i>Euglenophyta</i>	10?
<i>Pyrrophyta</i>	10 – 20?
<i>Chrysophyta</i>	20 – 30?
<i>Diatomea</i>	1000?
<i>Chlorophyta</i>	100?
<i>Charophyta</i>	3
<i>Fungi</i>	100?
<i>Bryophyta</i>	20?
<i>Pteridophyta - Spermatophyta</i>	25
Total	1400 – 2300?
Animals	
<i>Protozoa</i>	200 – 300?
<i>Porifera</i>	2
<i>Cnidaria</i>	2
<i>Platyhelminthe</i>	50?
<i>Nematoda</i>	50 – 100?
<i>Rotatoria</i>	145
<i>Annelida</i>	26
<i>Mollusca</i>	8
<i>Bryozoa</i>	3
<i>Crustacea</i>	25
<i>Hydracarina</i>	10
<i>Insecta</i>	140
<i>Pisces</i>	5 (6)
<i>Aves</i>	30 – 50
<i>Mammalia</i> (mink)	1
Total	650 – 900?
Total number of species	2050 – 3200?

Source: Hilmar J. Malmquist 1998, Íslensk votlendi.

Protection of wetlands

A Special Act protected þingvellir in 1928. At that time, it was its importance for Icelandic cultural history that determined its protection. However, nowadays it is at least as highly valued for its geology and other kinds of natural history, not least the lake itself, þingvallavatn.

In 1940, the decision was taken to protect Eldey, an island with one of the world's largest colonies of northern gannets *Morus bassanus*, this time exclusively based on nature conservation. However, the first species was protected as early as 1913, when the

white-tailed eagle was protected by a Special Act. Another Act closely linked with wetlands is the 1923 Water Act ('Vatnalögin') that is still in force; it prescribes the management of rivers, streams and lakes.

When the Act concerning þingvellir was adopted, a debate was already taking place regarding the need for a Nature Conservation Act, but the first such Act did not reach the statute books before 1956. One reason was that people were travelling around the countryside more and had become aware of the great changes modern technology was capable of inflicting on the landscape. It was not least obvious that all the mires in some parts of the country had been drained. People asked, "Perhaps it will be necessary in the future to protect some undisturbed mires?" From 1956 to 1990, when the Ministry of the Environment was set up, the Ministry of Education was responsible for administering the Nature Conservation Act.

The first Nature Conservation Council was set up under the terms of the Act in 1956. This was not a directorate or an institute responsible to the Ministry, but an independent council elected by the Nature Conservation Board, and the chairman was appointed by the Ministry. It existed until 1997 when the National Association for the Protection of the Icelandic Environment took over its role, and like all other similar institutes it was made responsible to the Ministry of the Environment. The 1956 Act had no specific provisions that gave the protection of, or special consideration for, wetlands greater priority than other types of vegetation or landscape. The Act was based on the protection of species, individual natural phenomena and areas that had outstanding landscape, flora or fauna. The Act was revised in 1971 and again in 1996 when the National Association for the Protection of the Icelandic Environment took over the role of the council. The most recent major revision took place in 1999 and was followed by a minor one in 2001.

Right from the first period of settlement in Iceland in AD 870-930, mires, especially periodically inundated grasslands, have been used for grazing and hay-making, and peat was cut for fuel. To obtain better farmland and raise agricultural production, mires began to be drained around 1920, when the first mechanical excavators were imported. However, it was not before the early 1940s and after the Second

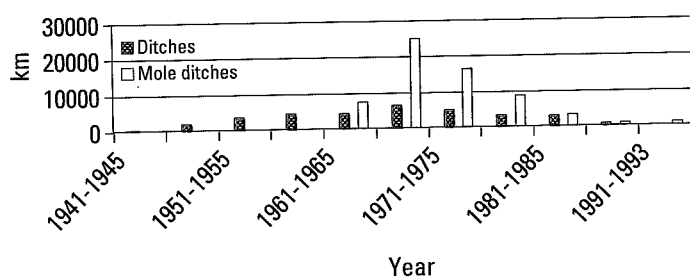


Figure 3.18 Length of ditches dug to drain wetlands in Iceland in 1941-1993.

World War that this work began in earnest. Since 1941, approximately 32,000 km of ditches have been dug (Figs. 3.18). Some people believe this means that about 1600-1800 km² of mires have been drained, but others put the figure much higher (1 km² per 7.3 km, estimated for western Iceland, or about 4500 km² for the country as a whole). Grants were given to drain mires until 1987, by which time a large proportion of the lowland mires had been drained. For instance, in Borgarfjarðarsýsla, where there had been 240 km² of mires in 1930, only 22 km² of undisturbed mires remain today. The situation is still worse in a large part of southern Iceland (a lowland area stretching from Ölfusá in the west to Markarfljót in the east) where it has been estimated that there were 1100 km² of mires at the beginning of the 20th century, but now only 170 km² of almost undisturbed mires and a mere 33 km² (only 3 %) of completely natural mires remain, chiefly because it was actually impossible to drain them.

On 31st December 1970, Halldór Kiljan Laxness wrote an article in Iceland's principal newspaper, *Morgunblaðið*, entitled "Krigen mod landet" ("The war against the countryside"). There, he described how large parts of the wetlands around the country were being thoughtlessly drained and destroyed, often without being used, but with serious consequences for bird life and so on. More and more people, both scientists and ordinary people, were at that time becoming aware of the importance of the wetlands for biological diversity, and particularly for bird life. The first survey of Icelandic wetlands came in 1973 when "Oversigt over vigtige våde fugleområder i Norden" ("Survey of important wetland areas for birds in the Nordic countries") was published as a result of Nordic cooperation. A Special Act to protect Lake Mývatn and the River Laxá was adopted in 1974 as a consequence of a hard struggle surrounding the construction of a dam and a hydroelectric power station at Laxá. This Act underlined the fact that

Mývatn and Laxá, together, have more species than almost any other lake in the world, let alone Iceland, and constitute one of the world's most important habitats for birds, with a primary production that is among the highest in the world. In recent years, the great significance which wetlands have as habitats for various kinds of wildlife has certainly been accepted. The revised Nature Conservation Act from 1996 for the first time enabled the protection of valuable habitats. Another step was taken when the Act was again revised on 1st July 1999. It now contained provisions regarding the protection of landscapes, and mires larger than 3 ha, lakes larger than 1000 m², salt marshes and tidal flats, waterfalls and hot springs were afforded special protection, even though they were not directly protected. The current Act has five categories which may be used to implement protection: 1) National park, 2) Nature reserve, 3) Natural monument, 4) Recreational area, and 5) Protection of single species of animals or plants, their habitats or ecosystems.

Other legislation which directly or indirectly has a bearing on the protection of wetlands includes the Act concerning the Utilisation, Protection and Management of Rivers and Lakes (the Water Act, or *Vatnalögin*), dating back to as early as 1923, the Act concerning Environmental Impact Assessments from 2000, and the Planning and Building Act from 1997. In addition, there are the two aforementioned Acts that concern the protection of Breiðafjörður, where the intertidal zone is greater than anywhere else in Iceland, and of Mývatn and Laxá.

Apart from Breiðafjörður (Special Act) and the three Ramsar sites, Lake Mývatn and the River Laxá (Special Act), Þjórsárver and Grunnafjörður, only nine of the 85 protected areas in Iceland can be said to have been protected as wetlands solely on account of their merits and qualities as wetlands; these are Friðland in Svarfaðardal (1972), Salthöfði and Salthöfðamýrar (1977), Vestmannsvatn (1977), Ástjörn (1978), Ósland (1982), Varmárósar (1980), Pollengi and Tungueyjar (1994), Oddaflóð (1994) and Blautós (1999). Table 3.25 lists the 49 protected areas in Iceland which include some wetlands. The decision was recently taken to protect an area of farmland at Hvanneyri (where the Agricultural University is situated) as a habitat area, particularly owing to some moist fens and because it is a locality where greater white-fronted geese congregate.

Table 3.25 Protected areas in Iceland which include some wetlands, when they were protected, their estimated size (km²) and the type of wetland concerned.

Place	Year	Size	*Wetland	Rivers & lakes	Coast	**Sea
Askja in Ódádahrauni	1978	50		10.7		
Álftaversgígar	1975	36.5		0.3		
Ástjörn	1978	0.25	0.05	0.2		
Bárðarlaug	1980	0.5		0.5		
Blautós	1999	2.47		1	1.98	
Breiðafjörður***	1995	2874			214	2600
Búðahraun	1977	9.15			0.7	
Dynjandi	1981	7			0.17	
Dyrhólaey	1978	5.1				0.05
Fossvogsbakkar	1999	0.18			0.14	
Fólkvangur Neskaupstaðar	1972	3			0.04	
Friðland at Fjallabaki	1979	470		9		
Friðland in Svarfaðardal	1972	5.4	5.3	0.1		
Grótta	1974	0.05			0.06	
Grunnafjörður (Ramsar site)	1994	14.7			14	
Gullfoss	1979	1.6		0.01		
Háubakkar við Elliðavog	1983	0.02			0.01	
Herdísarvík	1988	40			0.2	
Herðubreiðarfriðland	1974	170		0.1		
Hornstrandir	1975	580	10.3	6.3	2	0.4
Hólmanes	1973	2.6			0.04	
Hraunfossar and Barnafoss	1987	0.39		0.05		
Hvannalindir in Krepputungu	1973	43		0.07		
Jökulsárgljúfur	1973	120		1.3		
Kringilsárrani	1975	85	7	0.1		
Lakagígar	1971	160		4		
Laugarás	1982	0.01				
Lónsöræfi	1977	320		0.2		
Miklavatn	1977	15.5	9.5	6		
Mývatn and Laxá*** (Ramsar site)	1974	4400	38.5	63.5		
Oddaflóð	1994	5.4	5	0.4		
Ósland	1982	0.15			0.1	
Pollengi and Tungueyjar	1994	6.84	6.4	0.4		
Rauðhólar	1961	0.45	0.3			
Reykjanesfólkvangur	1975	300		10		
Salthöfði and Salthöfðamýrar	1977	2.2	2.1	0.01		
Skaftafell	1968	1600	0.1	13		
Skógafoss	1987	22.04		0.08		
Skrúður	1995	0.92			0.1	
Spákonufellshöfði	1980	0.3			0.07	
Ströndin við Stapa and Hellna	1979	0.58			0.5	
Surtarbrandsgil	1975	1.5		0.01		
Surtsey	1965	2.7			0.2	
Teigarhorn	1975	1.2		0.04	0.03	
Varmárósar	1980	0.096			0.1	
Vatnsfjörður	1975	200	0.18	19	1.4	2.4
Vestmannsvatn	1977	6	2.1	2.8		
Þingvellir***	1928	50		16		
Þjórsárver (Ramsar site)	1981	375	150	13		
Total area of wetland in protected areas		11 991.796	236.83	178.17	235.8	2602.8
Estimated total area for the whole country		103 000	9000	2200	500	
% of wetland in protected areas		0.63	2.6	8.1	47.2	

*Wetland is defined here as an area on land, excluding rivers and lakes. **Sea denotes shallow water. ***Protected by a Special Act. The figures for the area of sea show the whole extent except for the coast. Some areas (e.g. Breiðafjörður) have depths in excess of 6 m. The high figures for the protection of the coast are mainly due to the protection of Breiðafjörður. Most of the figures are estimates. All the figures are in km².

Ramsar sites

At the same time as developments were taking place on the national level, Iceland ratified the Ramsar Convention on 2nd April 1978. There are now three Ramsar sites in Iceland.

1. Mývatn and Laxá (protected through a Special Act in 1974, Ramsar site since 1977) make up the most fertile freshwater system in the country. Mývatn is a shallow lake with many islands and Laxá is a river draining from it. The area amounts to approximately 200 km² and comprises lake and river banks, mires, swamps and periodically inundated grassland. There are numerous birds, and the lake and its environs is also famous for its outstanding geology.
2. Þjórsárver (nature reserve in 1981, Ramsar site in 1990) is an approximately 375 km² area of semi-tundra, palsa mire with periodically inundated grasslands, lakes, ponds and bogs. It is a breeding site for many species of birds, the largest in the world for pink-footed geese, and has numerous remarkable plant communities.
3. Grunnafjörður (nature reserve in 1994, Ramsar site in 1996) is an approximately 14 km² area of wetland with muddy shores which many waders depend upon for finding their food. A breeding, resting and wintering area for birds. It has many eiders and is an important foraging site for migratory birds (e.g. brent geese) in spring and autumn.

EU Habitat Directive

Iceland is not in the EU, but participates in the EEA cooperation. In connection with the Joint Plan (see below), an investigation of habitats defined on the basis of the Habitat Directive is almost complete in two areas, the highlands north of Hofsjökull and Kárahnjúkar north-east of Vatnajokull. The work is being carried out by the Natural History Institute. Vegetation maps have been used as the basis for defining the kinds of habitat. Habitats in Iceland differ in type from the definitions given in the Directive, since definitions that are appropriate in the EU area cannot always be easily applied in Iceland. Other parts of the country have still not been mapped, and the mapping of geodiversity and of lake and river habitats is also lacking, but the University of Iceland, the Nature Institute in Kópavogur and the Institute for Freshwater Fish are making efforts to fill

these gaps. The aim of the work is to agree on criteria which can be employed when judging the natural merits of various places and habitats.

As Iceland is not a member of the EU, no Natura 2000 areas have been designated. A report on the status of biological diversity in Iceland was published in 2001.

Joint Plan

Work on a Joint Plan (Rammaáætlun) has been going on for more than two years. It is intended that the plan will put priority on deciding which power stations are to be constructed, based on an evaluation of the various localities from the viewpoint of natural and cultural merits, tourism, outdoor recreation, grazing, fishing, bird shooting, economy, regional policies and other factors. Some of the largest wetlands and areas of valuable vegetation in the highlands are found in places where plans exist to construct reservoirs. Which areas are given priority may therefore have a considerable influence on the protection of wetlands.

Mapping farmland in the lowlands

The Agricultural Research Institute (RALA) is currently mapping all farmland in Iceland, including wetlands (fens and bogs). This will provide better knowledge of the situation regarding wetland habitats in the lowlands.

Red Lists

The Natural History Institute has completed Red Lists for plants and birds. They show that a large proportion of the plants and birds on the lists are attached to some kind of wetland. The Icelandic Nature Conservation Authority is now preparing a nature conservation plan which will propose that wetland habitats be preserved in one way or another, the decision process being partly based on the Red Lists.

Important Bird Areas (IBAs)

The Natural History Institute has drawn up a list of Important Bird Areas using criteria laid down by BirdLife International. The list identifies 61 areas, covering approximately 7 % of the country, or 7345 km²; 38 of these have international interest. Wetland makes up more than 51 % in over half the areas. It must be emphasised that the protection of the IBAs is not covered by any form of Icelandic legislation, but

as their selection is based on work undertaken by the Natural History Institute they have been chosen on a sound scientific basis.

Restoration

Another milestone in the history of wetland conservation in Iceland was the appointment of a committee in 1996 to look into the need for, and feasibility of, restoring drained mires and lakes. The first attempt to restore a mire was made in autumn 1996. 1996 was also the first time a decision was taken, on the basis of an environmental impact assessment, to restore a wetland instead of an undisturbed mire that was being used as a waste disposal site. The Icelandic Society for the Protection of Birds (Fuglaverndarfélag Íslands) has made a valuable contribution towards the struggle to protect wetlands in Iceland. It was founded in 1963 mainly with the aim of protecting individual species of birds (e.g. the white-tailed eagle), but is now putting more emphasis on protecting ecosystems and has been largely responsible for a start having been made to restore mires and lakes.

Other research

A great deal of research is taking place that perhaps is not always directly linked with wetland conservation, but provides a valuable contribution to it. The University of Iceland is engaged in studies of both freshwater and coastal areas, and a great deal of its research is connected with Mývatn and Laxá, Þjórsárver, and the classification of watercourses, in cooperation with, for instance, the Energy Institute, the Nature Institute in Kópavogur and the Institute for Freshwater Fish. Some investigations, not least at Þjórsárver, have been carried out due to plans to construct power stations.

Management

The Icelandic Nature Conservation Authority is responsible for managing and administering all the protected areas, except Breiðafjörður and Þingvellir. Breiðafjörður may become more closely linked with this institution in the future, in line with suggestions in the new management plan (see below). Advisory boards, partly composed of representatives from the local authorities, have been set up for some protected areas and they deal with various matters concerning these sites. Under the terms of the Act concerning Mývatn and Laxá (which is being revised in 2002), the unusual step was taken of setting up a research institute at Mývatn, generally referred to as RAMÝ.

This institute is carrying out highly efficient research to acquire a thorough understanding of the Mývatn ecosystem. The head of RAMÝ also acts as advisor to the Icelandic Nature Conservation Authority in matters concerning the natural environment at Mývatn. The new Nature Conservation Act opens the way for handing over the supervision and running of protected areas to, for instance, individual persons, voluntary societies or local authorities. A contract must be entered into which deals with all the rights and obligations relating to the area, and this must be approved by the Minister of the Environment. The Icelandic Nature Conservation Authority will, however, always oversee that the contract is complied with. The management and administration of Þingvellir belongs directly under the Icelandic Parliament (Althing) and the Ministry of State. The Parliament appoints three of its members to a committee which acts as a management body. Þingvellir is always referred to as a national park, even though it is not so according to the Nature Conservation Act, and the term national park does not figure in the Act concerning Þingvellir.

The Minister of the Environment is directly responsible for Breiðafjörður. He or she has an advisory board composed of seven members, four of whom come from the local authorities, one is chosen by the Natural History Institute and the Western Iceland Nature Centre, one comes from the National Museum, and one is appointed by the Minister and takes the Chair.

The management of environmental matters like pollution is the responsibility of the Food Technology Board, and the Directorate of Hunting oversees matters concerning game.

Management plans

Actual management plans for wetlands still do not exist, except for Breiðafjörður, the plan for which was approved in 2001, but has not been put into force. The then Nature Conservation Board investigated and classified the natural merits of Mývatn and Laxá as early as 1987. This work has been used as a guideline when decisions have to be taken regarding new building works or other activities within the protected area, and as a basis for a municipal plan. Work on a new management plan for Mývatn and Laxá has just started, and it is hoped that many more such plans will follow for the most important areas.

Management plan for the whole country

According to the revised Nature Conservation Act from 1999, the Icelandic Nature Conservation Authority, in cooperation with the Natural History Institute and municipal nature conservation committees, must prepare a management plan for the whole country to be completed during 2002. It will then be debated and approved by the Althing. Among other things, this plan must include information about natural monuments (national parks, sanctuaries and other protected areas), geological features, valuable habitats and ecosystems, and life forms there is reason to protect. Their importance for nature must be demonstrated. Regard must also be taken for cultural history, nature restoration and the utilisation of nature and wilderness areas. It must also have a plan or proposal for a management strategy, and proposals will be put forward for necessary research and monitoring. When selecting areas that merit management, specific criteria must be followed, for instance a habitat area must be important for a rare species or a species figuring on a Red List, be particularly rich in species or sensitive to threats, be essential for the maintenance of strong populations of specific species, have international value or be representative for the natural environment of a region. The future management plan will place emphasis on wetlands, especially those near the coast.

Threats

Ramsar sites

Despite improved Acts, new management plans, the recognition of the importance of ecosystems and the protection of biological diversity, three important wetlands in Iceland, two of them Ramsar sites, are being threatened by development schemes. Firstly, diatomaceous earth is being extracted from the bed of Mývatn and an extension of this extraction has recently been approved following an environmental impact assessment. A larger part of the lake bed will therefore be affected. Some demands must be met, including monitoring plans, mapping of the bed, and that the extraction must not have a significant effect on the lake ecosystem. Despite these stringent demands, it is not known at the moment what changes the extraction may inflict on the lake ecosystem.

Secondly, the national power company (Landsvirkjun) has plans to construct a 28 - 62 km² reservoir at Norðlingaöldumiðlun in Þjórsárver, which will significantly detract from the quality of both the landscape and this outstanding highland wetland.

Thirdly, until recently, plans existed for a dam and reservoir in Eyjabakkar, an area that is not a Ramsar site, but which fulfils the criteria for one; 27 km² of wetland and vegetation would be inundated. These plans are probably no longer relevant and a proposal was recently put before the Althing to designate Eyjabakkar as a Ramsar site. Eyjabakkar is one of the most important moulting areas for pink-footed geese in Iceland and the world.

Grunnafjörður is the only one of the three Ramsar sites in Iceland that is not directly threatened, although there have been plans to construct a bridge across the mouth of the fjord. There has also been a slight increase in the building of weekend homes in the vicinity, but there is probably no reason to fear that these will disturb the bird life too much.

Farming

Over the years, farming has been the greatest threat to the wetlands of Iceland and, as mentioned previously, farmers have drained the majority of mires, in some parts of the country as much as 90 %, and all told between 2000 and 4500 km². At present, farming is taking place in one way or another in 72 % of the areas that are characterised as Important Bird Areas (IBAs), and most of these are wetlands.

Forestry

The Althing has recently adopted several Acts (one for each part of the country) that provide for higher grants in aid of forestry and the planning of new plantations in every part of the country. This will lead to a great increase in tree planting, up to 5 % of the lowlands, about 2000 km², will be afforested over the next 40 years, a figure equal to that which is cultivated today. This will, or may, lead to the direct or indirect draining of mires and lakes, and to changes in other habitats. In future, we will therefore most probably witness substantial changes in landscape, habitats and biological diversity in Iceland.

Alien species

All the new trees that will be planted will naturally constitute some threat, but there is also an indirect threat from other plants such as Nootka lupins *Lupinus nootkatensis*. The American mink *Mustela vison*, imported since 1930, poses a growing threat, particularly for birds. It is believed that the draining of mires, along with mink, have been the principal cause of the extinction of the water rail *Rallus aquaticus* in Iceland. No protective efforts or management plans were implemented to prevent this happening, or to enable the water rail to re-establish. A completely new threat to coastal areas and wild strains of salmon are the plans for large-scale salmon farming on the coast, some facilities having applied for an annual production of up to 8000 tonnes. Applications have only been made for permits to import Norwegian cultivated salmon, which may, among other things, result in genetic contamination of the wild salmon strains in Iceland.

Tourism

Tourism has grown appreciably in recent years, and 2000 was the first year the number of tourists visiting Iceland exceeded the population (about 300,000). The disturbance of wildlife in wetlands is the greatest threat. Fortunately, tourism is so far mostly concentrated in a few areas near the larger towns.

The coastal zone

Coasts and shores are first and foremost threatened near large towns, owing to the construction of roads and harbours, but landfill sites are appearing widely along the coast to acquire new areas of land for various purposes, and they cause pollution. A recent trend is that several wetlands, especially tidal flats, are in danger of being destroyed because of the desire to reduce distances by placing new roads across fjords or along the shoreline. An entirely new threat for coastal areas and strains of wild salmon is the plan for large-scale salmon farming, perhaps giving an annual production per unit of up to 8000 tonnes. The construction of new buildings and roads near the larger towns has also led to extensive areas of wetland and vegetation being destroyed, and it will lead to further destruction of mires.

Discussion and evaluation of the protection of wetlands in Iceland – future requirements and problems

With hindsight, it is always possible to see that many things could have been done better. For instance, the Nature Conservation Act of 1956 and the then nature conservation authorities, the Nature Conservation Board and the Ministry of Education, were incapable of slowing down the hasty draining of mires around the country. This was a consequence of rapid development in every sphere following the Second World War and a general lack of understanding for nature conservation. Iceland is a comparatively large country with few inhabitants, and substantial areas are uninhabited. This situation and the delay in industrial "development" have meant that large parts of the country were virtually unknown until the last 60 years or so, and many places have been more or less naturally protected. However, following the Second World War, the trend rapidly began to go in the other direction, mires were drained and enjoyed no respect. It was not before the 1971 Act, improved research and more knowledge and enlightenment among the general public regarding wetlands and their value, at the same time as agricultural development was close to peaking, that the need for nature conservation began to be widely acknowledged. Between 1970 and 1990, 64 areas were protected out of a total of 85 (the last one being protected in 2001).

Management

The nature conservation administration has been struggling with a lack of resources for many years. Modern, good-quality maps on a scale of, say, 1:50 000 are lacking for large parts of the country and few of those that do exist are available in digital format. Vegetation maps on a scale appropriate for management purposes are unavailable. Monitoring for nature protection purposes is practically non-existent, although a few relevant research projects can also be used for this purpose. Nevertheless, a management institution like the Icelandic Nature Conservation Authority lacks the resources to run trial and monitoring projects in cooperation with, for instance, the Natural History Institute, the prime aim of which might be to acquire knowledge for managing specific areas that are protected. For example, no real monitoring is now being performed to find out what is taking place in the newly afforested areas, what is being planted there, what changes they will lead to, and where. Most of what is being undertaken that has

direct relation with nature protection is research performed at the Natural History Institute and, as regards pollution, at the Foodstuffs Directorate. Nonetheless, as mentioned previously, many isolated research results can be used, such as bird censuses done at Þjórsárver.

Management plans and municipal master plans

Persistent lack of money, and often of human resources, means that management plans and municipal master plans are lacking for the great majority of protected areas with the result that all management and supervisory efforts are more imprecise than they need be. Since biological data are lacking for large fields, knowledge of biological diversity is very limited. Even though many data exist in some fields, resources are lacking to fully compile existing knowledge, for example about a specific place, to be able to survey and plan in relation to the knowledge that exists. Finally, there is a great lack of provision of information and teaching about nature and the importance of nature protection and this is no doubt the most important way of achieving results. Since the great majority of local authorities lack regional and municipal plans, it can be extremely difficult to know, for example, which wetlands may be threatened, or indeed even where wetlands exist; for instance, only those protected under the terms of the paragraph dealing with landscape protection in the Nature Conservation Act are known.

Environmental impact assessment

Environmental impact assessment has certainly helped considerably in gaining an understanding of the importance of investigating the consequences a specific scheme may have. It has also increased the amount of research at many localities and in many fields. On the other hand, it has so far contributed little towards gaining an understanding of Icelandic nature as a whole. It must also be said that the driving force for gathering basic data about Icelandic nature must not be environmental impact assessment. It is unfortunately often the case that those institutions which are intended to acquire basic knowledge lack money to do so and are often engaged in other things, like work associated with impact assessments.

In terms of the area of land affected, afforestation is certainly the greatest threat to wetlands. It is therefore essential that major regional plans for afforestation undergo impact assessment and are not implemented

without being approved through municipal master plans. This must not be for the sake of the impact assessment or the municipal master plan, as many people think, but to protect the natural development of biodiversity, in wetlands for example.

Restoration

As mentioned earlier, restoration of nature has been accepted as one way of compensating for the negative consequences of some encroachment on nature. Hundreds of square kilometres of land exist that have been drained but never actually used for the intended purpose, whatever that might have been, or the drainage effort was not completely successful. Such areas remain unsurveyed, and the condition of the land as wetland remains unassessed. If these tasks were performed, restoration might be able to start, and might often prove relatively inexpensive.

A nation with barely 280 000 inhabitants has limited funds for nature protection, as for other things. However, it must be said that 14 million DKK a year to administer 85 protected areas, and do a great deal more, is not much money and simply means that only absolutely essential tasks can be carried out.

Scientific requirements

1. Icelandic wetlands need to be investigated and the results viewed in the context of municipal master plans and other major plans that may alter their state (e.g. afforestation plans).
2. A status report on biological diversity in Iceland needs to be prepared.
3. There is a need to study the various kinds of habitat in wetlands, not least in the coastal zone.
4. Protection plans and management plans need to be prepared for all existing Ramsar sites and other protected wetlands.
5. In view of, for example, pollution and tourism, more monitoring-oriented research and monitoring the biodiversity of representative wetlands are needed.
6. Information to enhance the understanding of wetlands and their importance is required.
7. New sites should be added to the Ramsar List.
8. Important wetlands should be selected that can become part of a conservation strategy in the new protection plan for Iceland.

See Chap. 7 for relevant references.

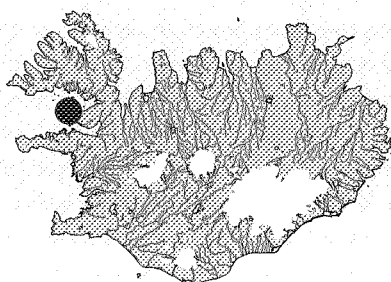
Examples of wetlands in Iceland

Breiðafjörður



Figure 3.19 Breiðafjörður is particularly well known for its sea birds. A typical colony is seen here on a basalt cliff.

PHOTO: JÓHANN ÓLI HILMARSSON



National protection: An area of 2874 km² is protected under the terms of a Special Act from 1995.

International status: IBA

Description of the area

Breiðafjörður (Fig. 3.19) is a large, shallow "bay" on the west coast of Iceland. About 50 km broad and 125 km long, it is encircled by mountains, Snæfellsjökull on Snæfellsnes in the south and the Vestfjörðene in the north. There is little lowland along the fjord. A few farms and other houses are located near the shore and there are some medium-sized settlements on the south coast. Breiðafjörður is

characterised by shallow water, many small fjord arms and inlets. There is a considerable difference between high and low water, and a strong tidal current. About half the shoreline of Iceland and a third of its coastline is located here. In some places, there are extremely strong currents owing to the great difference between low and high tide, which under some circumstances can reach 6 m. However, it is the 3000 or so islands and skerries that dominate the scenery. The average temperature varies from -3° C (February) to +10° C (July).

The bedrock at Breiðafjörður was formed in the Late Tertiary and is 6-13 million years old. It mostly consists of a stack of basaltic lava flows with a few extinct volcanoes here and there. The land was shaped by Ice Age glaciers, and there are a few geothermal springs, some of which can be seen on the beach at low tide.

Flora

The vegetation beside Breiðafjörður has been little investigated, and only 1-2 % of the islands have been studied. About half the flowering plants in Iceland, 230, are found at Breiðafjörður and the shore vegetation is lush. The most important area for vegetation is Flatey, the largest island, which has fields, grasslands, mire with Lyngbye's sedge *Carex lyngbyei*, salt marshes, shore and marsh vegetation.

In the Vatnsfjörður Nature Reserve, which extends inland from Breiðafjörður, downy birch *Betula pubescens* scrub is conspicuous, tall rowans *Sorbus aucuparia* are seen in some places, and willows *Salix* spp. are a very attractive element. Even though birch is not a shore plant, in some places hereabouts it grows right down to the beach. Wood crane's-bill *Geranium sylvaticum* occurs extensively and common juniper *Juniperus communis* and ferns are more common than in most other places. There are also some heath plants, particularly bilberry *Vaccinium myrtillus*. Stony ground in the highland area has a colourful carpet of lichens and mosses. In common with other places around Breiðafjörður, there is a large tidal range and a variety of algae and numerous small marine creatures can be found on the shore.

Some Red List species can be found in the Breiðafjörður area, such as lesser sea-spurrey *Spergularia*

marina, a lichen *Umbilicaria hirsuta*, field garlic *Allium oleraceum*, a sedge *Carex heleonastes*, sea milkwort *Glaux maritima* which grows on sandy salt marshes, a sub-species of arctic poppy *Papaver radiculatum* ssp. *stefanssonii*, burnet rose *Rosa pimpinillifolia* and common twayblade *Listera ovata*.

Fauna

The Breiðafjörður biosystem is unusually rich in wildlife and the biodiversity is great. Breiðafjörður is the primary producer for a large part of many populations of birds and mammals. The number of species and the bioproduction on the shore are high. Extensive kelp forests of bladder wrack *Fucus vesiculosus* and knotted wrack *Ascophyllum nodosum* are found in the fjord, as well as other habitats for molluscs and fish which are important in the food chain. Approximately 50 species of birds of the more than 70 found in Iceland breed regularly beside the fjord. They include great cormorants *Phalacrocorax carbo* and European shags *P. aristotelis*, glaucous gulls *Larus hyperboreus*, white-tailed eagles *Haliaeetus albicilla*, common eiders *Somateria mollissima*, black guillemots *Cephus grylle* and grey phalaropes *Phalaropus fulicarius*. Breiðafjörður is an important area for sub-arctic migrants like brent geese *Branta bernicla* and red knots *Calidris canutus*. Large bird cliffs are found close to the fjord, including Látrabjarg, although it is outside the protected area. Salmon and trout rivers enter the fjord.

The two species of seals which occur on the coast of Iceland, the common harbour seal *Phoca vitulina* and the grey seal *Halichoerus grypus*, have their main breeding sites at Breiðafjörður. Some species of whales occur in the fjord, including the common porpoise *Phocoena phocoena*, white-beaked dolphin *Lagenorhynchus albirostris*, killer whale *Orcinus orca* and lesser rorqual *Balaenoptera acutorostrata*.

Many species of fish and other marine animals that are of great importance for the Icelandic economy spawn and grow up in Breiðafjörður. For instance, there are important fishing sites for lumpfish *Cyclopterus lumpus*, clams *Chlamys islandica*, cod *Gadus morhua* and shrimps *Pandulus borealis*. A sea urchin *Strongylocentrotus droebachiensis* fishery took place from 1993 to 1996, when the market failed. Recently, common whelks *Buccinum undatum* and common mussels *Mytilus edulis* have begun to be utilised.

Nature protection

Even though Iceland is an island with an approximately 6000 km long coast with many beaches and

areas of sea abounding with life, only one area of coast and sea, Breiðafjörður, enjoys general, legalised protection. At present, the Breiðafjörður Committee takes care of issues regarding the reserve. A conservation plan for the area has just been completed, but has not come into force yet. The reserve takes in all the islands, islets and skerries in Breiðafjörður, as well as the shore zone. The purpose of the Act is to protect the Breiðafjörður ecosystem, landscape, geological formations and cultural heritage sites, and support its sustainable utilisation in the spheres of fisheries, tourism and seaweed processing, as well as sustaining traditional ways of using the area. Three areas in the Breiðafjörður district are protected under the terms of the Nature Conservation Act, part of Flatey, Vatnsfjörður and Surtabrandsgil.

Management problems

People have been using the islands, sea and land as long as Breiðafjörður has been inhabited. There are notable relics from fishing and farming, which were the main occupations earlier, as they are now. Agriculture on the islands in Breiðafjörður was very much based on other occupations than traditional farming, such as eggling, fowling, sealing, fishing and not least collecting eider down, in addition to the traditional sheep rearing. Nowadays, people only live permanently on two groups of islands, but more islands are used in summer. The collecting of eider down is still very important for many farmers. The tourist trade is growing, including whale safaris and sightseeing trips around the islands. Knotted wrack *Ascophyllum nodosum* and tangle *Laminaria digitata* have been processed by the fjord for a while now.

The main task for the future is to reach agreement on the sustainable utilisation of the Breiðafjörður ecosystem, such as fish, birds and algae. Only cooperation and agreement between all the parties concerned can achieve this. That is the only way the protection of Breiðafjörður will be able to strengthen the economy of the area at the same time as the ecosystem of the fjord as a whole will be improved. The intention for a long time has been to have Breiðafjörður designated as a Ramsar site.

Recommendations

The proposals made in the management plan need following up, including improving the definitions of the boundaries of the protected area and categorising the habitats in the area. Who has practical responsibility for the area and how this should be implemented needs to be established and clarified.

Bibliography

Petersen, Æ., Þorvarðardóttir, G., Pagnan, J. & Einarsson, S. 1998. Breiðafjörður. West-Iceland: an Arctic marine protected area. *Parks* 8 (2), 23-28.

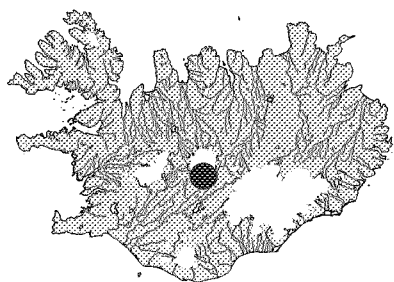
Ólafsson, G.P. 1995. Ströndin í náttúru Íslands (Stranden i Íslands natur). Mál og Menning. Reykjavík.

Þjórsárver



Figure 3.20 Þjórsárver.

PHOTO: JÓHANN ÓLI HILMARSSON



0 100 km

National protection: An area of 375 km² was protected as a nature reserve in 1981.

International status: Ramsar site in 1990; IBA

Description of the area

Þjórsárver is the name applied to an approximately 140 km² vegetated area in the highlands of Iceland around the source of the River Þjórsá (Tyre), south of the Hofsjökull glacier, almost in the centre of the country. The area is about 600 m above sea level. The majority of the area is located west of the River Þjórsá. Most of Þjórsárver was protected in 1981 and was listed as a Ramsar site in 1990 as an internationally important wetland, particularly with regard to its bird life. Þjórsárver has many vegetated areas, all of which have names ending in 'ver', such as Tjarnaver, Oddkelsver and Þúfuver. Þjórsárver is one of the largest and most isolated oases in the Icelandic highlands. Its uniqueness is explained by the interplay of many factors, the glacier, water, soils, climate, vegetation and wildlife. Þjórsárver is part of a magnificent plateau landscape, offering a fantastic view of mountains, luxuriant vegetation, wetland and the River Þjórsá with the glacier in the background (Fig. 3.20). Most of it is still undisturbed.

The oases in the highlands are the remains of formerly more extensive and continuous vegetated areas and home to numerous organisms which do not thrive in the surrounding desert. The importance of Þjórsárver must therefore also be viewed as a place where seeds can survive, a sort of "seed bank" to be taken advantage of when conditions in the surroundings permit. Part of Þjórsárver is inundated grassland, which is uncommon in the highlands. Þjórsárver contains one of the most varied areas of stagnant-ice hummocks in the country, a seldom geomorphological feature. Þjórsárver is the richest highland oasis in the country as regards the number of species, embracing most categories of organisms, such as higher plants, bryophytes and lichens, small mammals and birds. Þjórsárver is extremely important for biodiversity conservation.

Research, vegetation maps and so on have shown that habitats at Þjórsárver are more varied than in other highland oases. These habitats are inundated grasslands, damp grasslands with bottle sedge *Carex rostrata* and Lyngbye's sedge *C. lyngbyei*, cottongrass bogs, palsa mires with a striking mosaic of stagnant-ice hummocks and kettle holes, and various kinds of heath and alpine vegetation. Þjórsárver is the largest breeding site in the world for pink-footed geese and there has been consensus among scientists for many years that the area may be essential for the existence

of this population. However, Þjórsárver has to be viewed in a much broader context because it is not fortuitous that these geese have chosen to breed in the area. Þjórsárver must be grateful to water for its existence, water from both glaciers and springs. Water is everywhere, rivers and streams flowing on the surface, springs, lakes and pools.

Nature protection merit

The main importance of the Þjórsárver area is the preservation of habitats and outstanding landscape entities that are still largely undisturbed, the exception being Kvíslaveita, a 25 - 30 km² area of lakes and channels that have already flooded 6 km² of vegetated land. The landscape as a whole around Þjórsárver is widely famed for its great beauty, having a glacier as a backdrop, varied vegetation, large and small lakes, rich bird life, numerous small mammals, and glacial rivers, not to mention the plateaus. There are fewer and fewer areas lacking roads, cabins and other small buildings, reservoirs and other constructions. Þjórsárver is therefore undoubtedly the most valuable area in the highlands.

Management problems

Ever since the reserve was designated, and still earlier, there has been talk of utilising a large part of its area for a reservoir in connection with power stations, the Norðlingaölduveita Scheme. Plans have been put forward for a reservoir whose maximum regulated level would be at between 575 and 581 m above sea level. When agreement was reached to protect part of Þjórsárver, it was decided to lay plans for a reservoir reaching up to 581 m above sea level, as long as the Icelandic Nature Conservation Authority, the body entrusted with implementing protection measures, did not consider that this detracted too much from the nature conservation merits of the area. The Þjórsárver Committee, which consists of representatives from the local municipal authorities, the Electricity Power Company (Landsvirkjun) and the Icelandic Nature Conservation Authority also had to consider the matter. This committee has an advisory function. Recently, it reported on its deliberations, and opposed any thought of a reservoir at Þjórsárver whose water level would reach higher than 575 m above sea level. The committee also rejected plans for a reservoir outside the protected area which would divert water from the River Þjórsá that runs through the reserve. The committee decided to postpone a

decision regarding a reservoir with its highest water level at 575 m above sea level until more information was available. A reservoir at Þjórsárver whose water level was between 575 and 581 m a.s.l. would cover an area of 28 - 62 km². A reservoir for the Norðlingaölduveita Scheme would inflict great direct damage on the vegetation and the Þjórsárver landscape as a whole, and also put the vegetation at risk of still more destruction as a consequence of wind and water erosion. It is difficult to predict the damage to vegetation because the area is very flat. The whole area has to be considered as an entity, whether the reservoir is inside or outside the protected area. The consequences of a reservoir might be far-reaching for this outstanding part of the Icelandic highlands.

Recommendations

There is a need for a management plan for the protected area, for monitoring aimed at nature protection, for better information about the protected area, for surveillance and for the natural development of the protected area to be safeguarded.

The 'reserve' at Flói

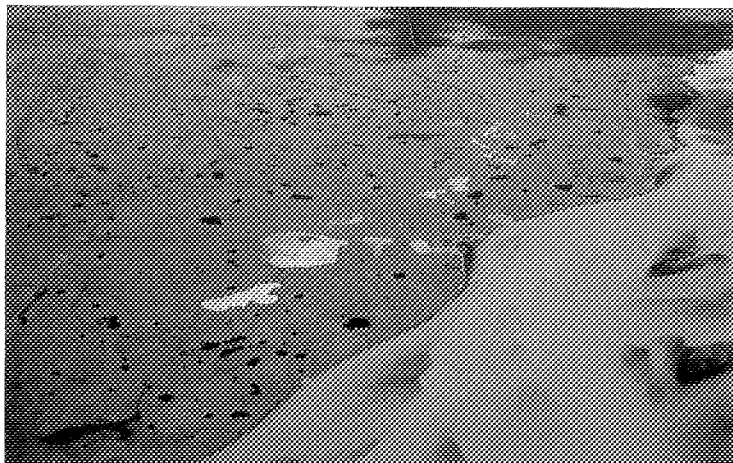
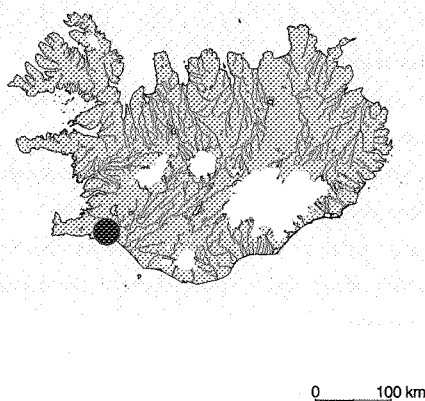


Figure 3.21 Flói and the Ölfus delta. PHOTO: JÓHANN ÓLI HILMARSSON



National protection: The area is not legally protected, but is protected by the local municipal authority under the terms of the 1997 Planning and Building Act. An area of 5 km² is listed as an important area that deserves to be protected, and consequently derives some measure of protection under the terms of the Nature Conservation Act.

International status: Part of an IBA.

Description of the area

Flóinn (moist fen), as the area is called, is part of the delta of the River Ölfus (Fig. 3.21). It stands on lava formed by an eruption of the Þjórsá volcano 8000 years ago, one of the largest lava eruptions in the world after the last Ice Age. The reserve has a large number of small pools and lakes because hollows in the lava surface are filled with water owing to the

high water table. These lakes and inundated grasslands are a very notable feature of the reserve. Flóinn has thousands of pools and lakes, varying in diameter from 4 m up to some scores of metres, and most are not particularly deep. The area is very low-lying, and the average height above sea level is only about 2 m. Sea water enters the reserve during spring tides.

Bird life

Waders are a characteristic sight in the reserve, which is continuous with areas where the bird life is very rich, like the shore, the Ölfus delta and the Ölfus swamps. Particularly large numbers of birds and a great variety of species are found there during the breeding season. They include whooper swans *Cygnus cygnus*, greylag geese *Anser anser*, mallards *Anas platyrhynchos*, Eurasian wigeons *A. penelope*, Eurasian teals *A. crecca*, greater scaups *Aythya marila*, tufted ducks *A. fuligula* and red-breasted mergansers *Mergus serrator*. Among the more seldom species of ducks found nesting there have been northern pintails *Anas acuta*, northern shovelers *A. clypeata* and garganeys *A. querquedula*. Quite a large common eider colony breeds close to the reserve, on the Kaldaðarneseyjar islands. Red-throated divers *Gavia stellata* breed in many places beside the lakes and on the islands, and black-headed gulls *Larus ridibundus* and arctic terns *Sterna paradisaea* breed in some places. A few arctic skuas *Stercorarius parasiticus*, lesser black-backed gulls *Larus fuscus* and great black-backed gulls *L. marinus* breed in the area.

The waders dominate the wetland. Dunlins *Calidris alpina*, the large Eurasian curlews *Numenius arquata* and black-tailed godwits *Limosa limosa*, common snipes *Gallinago gallinago*, red-necked phalaropes *Phalaropus lobatus* and meadow pipits *Anthus pratensis* breed on the mires and European golden plovers *Pluvialis apricaria* on drier sites. A greater density of breeding dunlins has not been observed elsewhere in Iceland, and the densities of red-necked phalaropes and black-tailed godwits do not fall far short. During the spring and autumn migrations, greylag geese, greater white-fronted geese and ducks like Eurasian wigeons and Eurasian teals are the most prominent birds, along with various waders like common snipes. The water rail *Rallus aquaticus*, which must now be considered virtually extinct in Iceland, is occasionally seen in the Ölfus delta, particularly beside open streams in winter.

Other wildlife

Sticklebacks are common in the reserve, and trout and eels are found in channels and lakes. The River Ölfus has salmon and trout. Insects include water boatmen, bugs, non-biting midges and particularly kelp fleas that live in salt water. Common seals are often seen in the River Ölfus, beyond the reserve boundaries, particularly in autumn and winter.

Vegetation

Varied wetland vegetation characterises the mires. Inundated grasslands are covered by Lyngbye's sedge *Carex lyngbyei*, but woolly willow *Salix lanata*, tea-leaved willow *S. phylicifolia*, common sedge *C. nigra* and common cottongrass *Eriophorum angustifolium* dominate on drier ground, along with various grasses. Most lakes are rimmed by bottle sedge *C. rostrata*, and pondweeds *Potamogeton* spp., bogbean *Menyanthes trifoliata*, alternate water-milfoil *Myriophyllum alterniflorum* and several other aquatic plants also grow there. Former peat cuttings have a bur-reed *Sparganium hyperboreum*, thread-leaved water-crowfoot *Ranunculus trichophyllus* and a water-starwort *Callitriche palustris*. Two attractive flowers that are common in the reserve, but otherwise rare in Iceland, are devil's-bit scabious *Succisa pratensis* and chickweed-wintergreen *Trientalis europaea*. Species like wild angelica *Angelica sylvestris*, which is conspicuous, Baltic rush *Juncus arcticus* ssp. *arcticus*, sea pea *Lathyrus japonicus*, cuckooflower *Cardamine pratensis* and rush-leaved fescue *Festuca arenaria* also occur.

History

In spring 1997, the Icelandic Society for the Protection of Birds received a grant from the Mercantile Environmental Fund enabling it to restore a wetland at Flói in the Ölfus delta. The task began the same summer in cooperation with Eyrarbakkar Rural Council. The reserve contains many relics from the major irrigation scheme that took place at Flói from 1922 to 1927, when water diverted from the River Hvít was dispersed over a large part of the area. Approximately 300 km of irrigation channels and about 540 km of dykes were excavated, and some 200 bridges and as many dams were constructed. At that time, it was the largest project in Icelandic agriculture

and the irrigation system was the largest in Europe. Shortly after the system came into use, Icelandic farming began to implement drainage schemes, and some of the irrigation system was changed into a drainage system.

The "Reserve in Flói", as it is called, is not protected under the terms of the Nature Conservation Act, or a Special Act, but rather through a decision taken by the local municipal authority. The Icelandic Society for the Protection of Birds and the Borough of Árborg (which the former Borough of Eyrabakkar is now part of) undertake supervision and upkeep in the reserve. The Ölfus delta is an internationally Important Bird Area (IBA). The IBA extends over about 74 km², but the reserve is only 5 km². The reserve is also on a list of areas where nature is protected. A management plan for the area, prepared in cooperation with the British Royal Society for the Protection of Birds, is almost complete.

Recommendations

There is a need to follow up the most important proposals put forward in the management plan, including the drawing up of research and monitoring plans for the area, to extend the reserve, thus enhancing its quality and making it more efficient and less vulnerable, and to provide more information about the reserve.

Bibliography

- Hilmarsson, J.Ó., Þorleifsson, E. & Einarsson, Ó. 2000. Islands fuglebeskyttelsesforening.
- Hilmarsson, J.Ó. 1998. Fugleliv og vådområde ved Ölfusá-deltaet. Háskólaútgáfan.
- Register over naturminder. 1996. Naturbeskyttelsesrådet.

3.5.6 NORWAY, INCLUDING SVALBARD

Lakes and rivers on hard bedrock or moraine are characteristic for many freshwater wetlands in Norway, and this type of watercourse is the most distinctive and unusual one in a European context. Characteristic for such watercourses is their relatively low production and paucity of species compared with other watercourses in Europe. It is such a valuable type of watercourse and its species composition is so unusual in a European context that it is of great interest and has a high conservation value.

Many plant, animal and bird species that are common in Nordic wetlands have either disappeared or figure as endangered on the various Red Lists elsewhere in Europe because much of the wetland in densely populated parts of Europe is now greatly disturbed or completely altered. A good example is the great reduction in the area taken up by mire.

The bird life on wetlands is usually better investigated than other kinds of fauna and flora. These studies show that neither Norwegian nor other Fennoscandian wetlands (both freshwater and marine types) generally have large concentrations of breeding birds. Nevertheless, the large area of land concerned and the total number of breeding birds mean that these wetlands are of great importance for a number of northerly birds that are otherwise scarce or absent as breeders elsewhere in Europe. In Norway, there is no doubt that, irrespective of the time of year, estuaries, intertidal zones and shallow archipelagic areas have the largest numbers of birds.

With the partial exception of mires and bodies of fresh water, good, countrywide surveys of the distribution and state of quality of the various kinds of wetland are lacking in Norway. Compared with many other countries in Europe, it is difficult to obtain complete information about all the types of wetland in Norway. One reason is that Norwegian wetlands, in common with those elsewhere in northern Europe, generally occur as part of a landscape mosaic and are seldom clearly demarcated.

Fresh water

The most dominant type of freshwater habitat in Norway, and the most unusual one in a European context, is oligotrophic watercourses (those poor in nutrients) located on hard bedrock. Norway has some 300 000 lakes (>2500 km²) and 42 major rivers. Even though all fresh water belongs under the definition of wetland, most people generally look upon lakes and slowly flowing rivers bordered by dense vegetation as typical wetland. Such eutrophic lakes and rivers typically have common reeds and common club-rushes, for instance. Freshwater wetlands with the most vegetation are often found in the lowlands, generally where the population is densest and often where a great deal of farming is taking place. In many areas, agriculture is the direct reason why many of these wetlands are now richly vegetated, this being related to the spreading of nutrients on surrounding farmland and their subsequent runoff; the areas have become what may be termed culturally eutrophic. In the worst cases, such as where the load of nutrients exceeds the capacity of the water, the consequence may be algal blooms or anoxic conditions. In general, a moderate supply of nutrients can be considered to have a favourable effect, at any rate for bird life. In Norway, lakes with rushes and reed beds are mostly just small, local occurrences, the largest ones being in the county of Østfold and in the Lista and Jæren districts. Other types of lakes and rivers which may have a higher production of plant material, for instance, than is normal in the district concerned, or which stand out in other ways, will often be adequate to form a basis for large occurrences of, for example, birds. Such freshwater environments can be found anywhere in the country. A more detailed account of the various types of freshwater environments can be found in the section giving a more general description of wetlands (section 1.4).

Freshwater and alluvial vegetation The physical conditions along watercourses vary enormously, influencing the composition of the vegetation, which is also affected by other factors, like climate and bedrock. Three main types of aquatic vegetation are distinguished here, riparian vegetation, aquatic vegetation, and vegetation that depends upon the physical effects resulting from regular flooding or floating ice.

Types of freshwater and pioneer alluvial (sandbank) vegetation in Norway

1. Freshwater vegetation: five types, including water horsetail - sedge swamp, rich sedge swamp and common reed - common club-rush swamp,
2. Aquatic vegetation: five types, including nymphæid - lake-meadow vegetation, stonewort - bryophyte - lake-bed vegetation, elodeid - lake-meadow vegetation and elodeid - river-meadow vegetation,
3. Pioneer alluvial (riparian) vegetation: five types, including herb and grass-rich vegetation, alluvial scrub and woodland, almond willow scrub and sea buckthorn scrub.

Mires

The occurrence of mires has been mapped, partly because of the commercial interests linked with them with respect to bringing them under cultivation, or using them for forestry or peat. The plant and animal life associated with many of them has also been investigated, particularly in connection with the preparation of conservation plans. There are estimated to be around 3 million ha of mire, amounting to just less than 10 % of the land area. Approximately 2/3 of this area is below the tree line, 1.2 million ha being below the coniferous forest limit. More than 650,000 ha of mire have been ditched, and neighbouring areas have been affected by the ditching. Owing to the great differences in topography and climate here, the types of mire in Norway vary greatly.

Types of mire Mires are characterised by moisture-demanding vegetation which produces much dead plant material that accumulates as peat. Peat mosses *Sphagnum* spp. dominate on northern mires and give rise to the majority of the peat accumulation. Mires are usually classified according to one of two factors, their form (morphology) and hydrology, or their vegetation.

Classification of mires in Norway according to their form and hydrology

1. *Raised bogs*, also called ombrotrophic bogs, are mires that obtain most of their nutrients through precipitation
2. *Blanket bogs* are found on both flat and sloping ground, and are dominated by ombrotrophic bogs; they are only found in the wettest parts of the country
3. *Flat fens* are a common type of mire and are fed by nutrients derived from their surroundings (they are minerotrophic mires)

4. *Sloping fens* are also fed by nutrients derived from their surroundings

5. *String fens* form where the ground is frozen for long periods, and are common in cold, continental parts of the country; they consist of a regular alternation of elongate stretches of dry fen (strings) and wet, minerotrophic bog

6. *Palsa mires* are mixed mires consisting of peat mounds (palsas) cored by peat and lenses of ice that remain frozen all summer.

The classification of mires according to their vegetation depends upon three main factors: 1) the poor - rich gradient, 2) the hummock - mud-bottom gradient, and 3) the mire margin - mire expanse gradient.

Sixteen main types of mire vegetation have been described in Norway, and these depend on variations in the ecological conditions. They, in turn, may be divided into a considerable number of sub-types depending on their morphology and the composition of their vegetation. The dominant species inventory may vary according to the region concerned. Six regions are distinguished in Norway: the Atlantic mire region, the fjord mire region, the raised bog region, the sloping fen and string fen region, the alpine mire region and the palsa mire region.

Swamp woodland and flood plain vegetation

In areas with a high water table, such as the inundation belts along watercourses and in very wet districts, there are often extensive areas of grey alder - bird cherry *Alnus incana* - *Prunus padus* woodland. Such woodland dominated by grey alder is a characteristic feature in Scandinavia and other northern parts of Europe. Grey alder is replaced further south by the more warmth-demanding alder *A. glutinosa*. These grey alder woodlands, which sometimes occur extensively along rivers and on marine clay deposits in several parts of Norway, form a distinctive feature of the landscape and have considerable conservation merit in a European context. For instance, studies have shown that the density of breeding birds in grey alder woodland is as high as in the richest woodlands elsewhere in Europe.

In Norway, true swamp woodlands are usually only found as minor elements in boreal woodland, but small areas of, for instance, alder woodland are also found in the boreonemoral and nemoral vegetation zones. Extremely wet or swampy coniferous woodland (not wooded mire) is found in many places in most of the country, but usually only patchily and seldom

over large, continuous areas. The special ecological conditions found in swamp woodlands make these habitats a distinctive and valuable element in the woodland. For example, they form refuges for 'continuity' species which require prolonged, stable conditions and an absence of fires. Hence, even though swamp woodlands that are rich in nutrients are often looked upon as having many species, those that are poor in nutrients may also contain unusual or unique species.

Flood plains are found in valleys whose rivers regularly inundate the valley floor. Because the floods rework the superficial deposits and vegetation that is in different stages of succession occurs here, a distinctive environment is created that is continually changing. The flood plain zone is generally dominated by sand and gravel bars where moist depressions and pools occur at the transition between the shrub and tree layers. Several vascular plants and invertebrates are specially attached to this kind of habitat. A more detailed description of alluvial vegetation can be found in the section on fresh water. Swamp woodland vegetation is generally divided into five main types: poor swamp woodland, grey alder - willow woodland, rich swamp woodland, thermophilous swamp woodland and alder - seashore woodland.

Shallow-water coastal and marine areas

The fjords, mainly excavated by ice, are a characteristic feature of Norwegian scenery. The Norwegian coastline is approximately 80 000 km long and includes a large variety of shallow-water habitats, some of the most important of which are described here. Kelp *Laminaria* spp. grows to a depth of about 30 m in marine archipelagos and it has been estimated that Norway has some 10 000 km² of kelp forests. An average of about 5000 tonnes of kelp grows per kilometre of coastline, and estimates range from 3-10 million tonnes for the total quantity along the coast. Kelp forest plays an important ecological role for fish, sea birds and other creatures along the coast. Studies have shown that the number of organisms growing on the kelp increases with the age of the kelp forest and usually reaches a peak when that is 10 years old. The composition of the flora and fauna in narrow sounds largely depends on the presence and strength of tidal currents flowing along them. Few studies of such localities have so far been carried out in Norway, but they are known to have an unusual array of species and great biological diversity. Four types of more or less cut off, rounded bays are distinguished, cold-water bays, warm-water bays, *Chara* (stonewort) bays, and bays with permanently

anoxic bottom water. Many of these bays contain a special flora and fauna. Because they are almost cut off, such bays are specially vulnerable to pollution. Where rivers enter the sea, a circulation arises that has a pronounced effect on the marine environment, and the water becomes more or less brackish. Such estuaries are characterised by an extremely high production of algae and invertebrates. The beach, where the land and the sea meet, is a specially productive part of the coast and the appearance and composition of the flora and fauna there vary greatly, partly depending on differences in topography and substrate, and exposure to wind and waves. The substrate on beaches varies from boulders, sand, mud and clay (soft bottom) to rock (hard bottom). Littoral zones influenced by salt water (e.g. salt marshes, brackish swamps and dune slacks (damp areas in dunes)) develop specially adapted plant communities. Sandy and pebbly beaches with seaweed banks are particularly valuable for migrating and wintering wetland birds because of their high biological production.

Sea-shore vegetation in Norway

1. Sandy shores: six types, including drift-influenced sandy foreshore, marram - lime-grass primary dune, dune meadow and dune heath, dune slack,
2. Sand-dunes, rocky shores and bird cliffs: six types, including annual orache drift-wall, herb gravelly/stony and seaweed-covered shores, perennial grass/herb drift-wall, rocky shore,
3. Salt marshes and brackish swamps: nine types, including seaweed vegetation, brackish foreshore, glasswort/annual sea blite foreshore pan, saline grassland - salt marsh, club-rush - common reed brackish swamp, sea club-rush - sedge salt marsh, swampy shore.

Conservation of wetlands

The first environmental conservation measures implemented in Norway date back to the mid-19th century and resulted from private initiatives. The Norwegian Geographical Society put forward a proposal for nature conservation legislation in 1909, and the following year saw the adoption of the first Act concerning Nature Preservation. The first nature conservation society was formed in 1914, called the Norwegian Society for Nature Preservation (later the Norwegian Society for the Conservation of Nature). Greater public sector interest for protecting Norwegian nature followed in its wake. The first political resolution concerning conservation took place in 1911 when the Government protected 52 plant species in the

Dovrefjell district, owing to excessive collecting on behalf of European museums. During this first phase, conservation efforts centred around the protection of plant species and of areas for the sake of their botanical value (administrative decisions to protect coniferous forest or thermophilous deciduous woodland). The first areas of wetland and coniferous woodland, and the first geological sites, were protected during this period. The first important, large wetland to be protected in Norway was the Fokstumyra bog in 1923 (800 ha), this being a result of the construction of a railway across the bog which led to a reduction in the bird life and a consequent desire to protect the area. Until 1950, Fokstumyra made up 90 % of the area that was protected in Norway. A new Nature Conservation Act came into force in 1954, and the

following year saw the setting up of a management body specially for nature conservation, the National Council for Nature Conservation. The first publicly employed nature conservation inspector was appointed in 1960. The period up to 1970, when the current Nature Conservation Act was adopted, is often called the national park period. During this period, work started on establishing national parks and the first one (Rondane) came in 1962. A national plan to protect Norwegian nature and designate national parks was put before the National Council for Nature Conservation in 1964 and was fulfilled when the Saltpjellet-Svartisen National Park was designated in 1989. Table 3.26 shows the wetlands that had been protected by 1979.

Table 3.26 Wetlands in Norway protected by 1979.

Name and size (ha)	County	Habitat, species and function	Protected
Tofteholmen (11)	Buskerud	Archipelago, sea birds, flora, breeding area	1919
Fokstumyra (785)	Oppland	Alpine mire, fresh water, breeding area	1923
Presterødkilen (86.7)	Vestfold	Intertidal zone, reed beds, breeding & migrating birds	1969
Vardnesmyra (220)	Troms	Mire, breeding area	1969
Bliksvær (400)	Nordland	Archipelago, shallow water, breeding sea birds	1970
Leinøra (5.5)	S-Trønd.	Flood plain, swamp woodland	1971
Færdesmyra (1200)	Finnmark	Mire, breeding area	1972
Orsjømyra (37.5)	Telemark	Mire, breeding area	1973
Borgan/Frelsøy & Kvaløy/ Rauøy (9350)	N-Trønd.	Archipelago, sea birds, breeding, migrating & wintering birds	1973
Fiskumvatn (114.5)	Buskerud	Lake with reed beds, breeding & migrating birds	1974
Åkersvika (415)	Hedmark	Fresh water, swamp woodland	1974
Grudevann (74)	Rogaland	Lake with reed beds, breeding, migrating & wintering birds	1974
Sølandet (321.9)	S-Trønd.	Hay-making fen, upland area	1974
Skittenskarvholmene (40)	Nordland	Archipelago, sea birds, breeding area	1974
Stenmyra (131.5)	Hedmark	Mire, breeding area	1974
Kvannesvatn (12.5)	Troms	Fresh water, area for breeding & migrating birds	1975
Lamyra (34)	Buskerud	Mire, swamp woodland, flora, breeding site	1975
Vidmyr (18)	Telemark	Mire, flora, breeding site	1975
Nordre Øyeren (6260)	Akershus	Delta, swamp woodland	1975
Sagelvvatn (30)	Troms	Lake, site for breeding & migrating birds	1975
Semka-Stødi (1300)	Nordland	Alpine area, fresh water, flora	1976
Gapøya (450)	Nordland	Archipelago, sea birds, breeding area	1976
Arekilen (43)	Østfold	Reed beds, brackish water, swamp woodland, breeding & migrating birds	1976
Børsesjø (116.5)	Telemark	Lake with reed beds, breeding & migrating birds	1976
Karlsøyvær (5000)	Nordland	Archipelago, sea birds, breeding & wintering area	1977
Nesøytjern (49.5)	Akershus	Lake with reed beds, swamp woodland, flora, breeding area	1978
Ferkingstadøyane (30)	Rogaland	Archipelago, sea birds, breeding area	1978
Gjellebekkmyrene (46)	Buskerud	Mire, flora	1978
Kavringen (1.6)	Oslo	Archipelago sea birds, nesting site	1978

Name and size	County	Habitat, species and function	Protected
Conservation plan 11 areas (248.4)	Østfold	Archipelago, sea birds	1978
Conservation plan 17 areas (36.2)	Akershus	Archipelago, sea birds, breeding areas	1978
Conservation plan 4 areas (17)	Buskerud	Archipelago, sea birds, breeding areas	1978
Conservation plan 20 areas (397.9)	Vestfold	Archipelago, sea birds, breeding areas	1978
Conservation plan 14 areas (616.3)	Østfold	Mire, flora, breeding areas	1978
Gulltjernmose (12.5)	Akershus	Mire, flora	1978
Kurefjord (30)	Østfold	Intertidal zone, reed beds, area for migrating, wintering & breeding birds	1978
Rønnåsmyra (160)	Hedmark	Mire, flora	1979
Stavsholtmyrane (32)	Telemark	Mire, flora	1979
Øra (230)	Østfold	Brackish water, archipelago, breeding, migrating and wintering birds	1979

Watercourse conservation

The first watercourse conservation plan was adopted as early as 1973, the second in 1980, the third in 1986 and the fourth in 1991. So far, 341 watercourses have been protected, primarily from being developed to produce hydroelectricity. They have an energy potential of about 32 TWh, the total potential in Norway being estimated at 171.5 TWh. The legislation provides little protection against other forms of use, such as diversion along artificial channels and sand and gravel extraction. National Guidelines have therefore been issued outlining how the land bordering these watercourses should be managed.

Norwegian watercourses that are naturally acidic are particularly vulnerable to the external impacts of acid precipitation since their pH level is often already low and further acidification will have a negative impact on aquatic organisms like fish. Acidification of watercourses is a particularly serious problem in southern Norway and fallout of contamination from the atmosphere and precipitation has led to widescale mortality among fish. Studies have shown that acidification affects the availability of nutrients and leads to the leaching and accumulation of substances that have a negative effect on food chains. Since the 1980s, the Norwegian authorities have therefore been undertaking major liming projects in the worst hit areas, particularly with the aim of maintaining or re-establishing fish stocks.

Thematic and county conservation plans

When the new Nature Conservation Act was enacted in 1970, a serious, systematic effort began to designate protected areas in Norway. The initial step was to

create the first Environmental Ministry in the world in 1972, and this had a Department for Nature Conservation and Outdoor Recreation. A new National Plan for the Protection of Norwegian Nature was then put forward in 1975. Outdoor recreation and nature conservation officers had been appointed in the offices of the County Governors in 1971, and in 1982 a Division for Nature Conservation was set up in each county in line with a recommendation made in White Paper no. 68 (1980-81) on "Conservation of Norwegian Nature". Systematic conservation work thus developed gradually and the White Paper also proposed nationwide thematic and county conservation plans. The idea was to systematise the conservation effort to make it easier for sectoral bodies to accommodate their schemes to the conservation plans, thus making their implementation easier. The county authorities began preparing conservation plans for wetlands, mires and sea birds in the 1970s. All the wetland plans were completed during 1997, but some counties are still working on the other plans (Tables 3.27 and 3.28).

Protected areas in Svalbard

The environmental conservation legislation that applies to mainland Norway is not valid in Svalbard (Fig. 3.22). This 62 700 km² archipelago has its own set of regulations linked to the Svalbard Act from 1925. A new Act to protect the natural environment in Svalbard was proposed in a government report "Legislation regarding environmental conservation for Svalbard" (NOU 1999). This proposal was adopted in 2001 and the new Nature Conservation Act for Svalbard came into force on 2nd July 2002. See also White Paper no. 9 (1999-2000) regarding Svalbard.

In addition to three national parks totalling 950 000 ha and three nature reserves totalling 2 542 600 ha, 15 smaller sanctuaries have been designated for sea birds, the smallest being 450 ha. These areas were designated on 11th October 1973, except for the Moffen Nature Reserve which was added on 3rd June 1983. Most of Bjørnøya (Bear Island) was also protected as a nature reserve in 2002, and a new conservation plan for biologically productive areas is being prepared. Bjørnøya is, for instance, an internationally important site for sea birds breeding in the Barents Sea and fulfils the requirements of a Ramsar site.

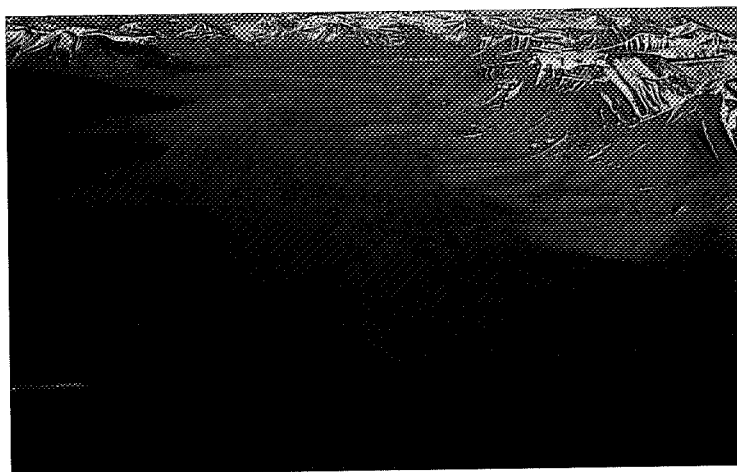


Figure 3.22 A large part of Svalbard has been protected. Despite the extreme arctic conditions, many parts of the wetlands have rich wildlife.

PHOTO: ØYSTEIN R. STØRKERSEN

Status of conservation work in Norway

Table 3.27 The number and scope of conservation plans for wetlands, mires and sea birds drawn up by each county as of 1st January 2001.

County	Number			Size (ha) (incl. areas of sea)		
	Wetland	Mire	Sea birds	Wetland	Mire	Sea birds
Østfold	20	14	11	2030	616	410
Akershus	18	21	17	7340	1050	36
Oslo	3	1	1	140	30	0.16
Hedmark	19	3	-	14 000	1800	-
Oppland	20	16	-	7600	140	-
Buskerud	10	15	4	970	980	17
Vestfold	10	11	20	550	110	398
Telemark	6	17	27	310	370	150
Aust-Agder	6	17	27	510	1460	2870
Vest-Agder	7	13	32	220	420	520
Rogaland	31	7	41	2100	280	960
Hordaland	22	10	70	1350	550	1060
Sogn & Fjordane	17	*	57	2810	-	1270
Møre & Romsdal	28	20	*	2270	4470	-
Sør-Trøndelag	13	20	*	4150	2950	-
Nord-Trøndelag	16	22	*	2020	16 100	-
Nordland	24	16	3	12 430	9650	8940
Troms	27	13	*	6320	2040	-
Finnmark	20	*	14	10 460	-	15 110
Total	324	246	324	76 580	33 016	31 741

* not implemented

Table 3.28 Other protected areas that mainly consist of wetland (nature reserves and bird sanctuaries), as of 1st January 2001.

County	Wetland Number & size (+ area of water)	Sea birds Number & size (+ area of water)
Akershus	1 0.5 km ²	2 1.20 km ²
Oppland	6 4.9 km ²	-
Vestfold	-	1 0.16 km ²
Telemark	-	4 33.30 km ²
Vest-Agder	-	7 1.85 km ² (+0.2 km ²)
Rogaland	-	6 2.50 km ² (+22.4 km ²)
Sogn & Fjordane	4 3.7 km ² (+0.5 km ²)	-
Møre & Romsdal	16 8.7 km ² (+17.8 km ²)	-
Sør-Trøndelag	7 1.7 km ² (+18.8 km ²)	-
Nord-Trøndelag	7 5.1 km ² (+21.2 km ²)	-
Troms	-	1 0.50 km ² (+0.15 km ²)
Total	41 24.6 km² (+58.3 km²)	21 39.50 km² (+22.75 km²)

Scientific investigations (based on the knowledge available at the time) determined the areas proposed for protection and their size. The areas investigated were grouped in one of four categories according to whether they had local, regional, national or international interest. Only those that were of national or international interest were included in the conservation plans that were put forward. Those in the other two groups were intended to be taken care of through regional planning at the local authority level, or under the terms of the Planning and Building Act. Using this procedure, several hundred localities in a county were usually investigated, but typically only some 10-30 of them would subsequently be included in a conservation plan.

Management

Most of the protected mires, wetlands and sea bird sites have been designated as nature reserves, the most stringent level permitted by the Nature Conservation Act. The establishment of a nature reserve protects the area from all kinds of disturbance and all the flora and fauna are protected, in some cases also within the marine water column and on the sea or lake bed. The protection regulations contain a paragraph that lists exceptions to what is prohibited. These will generally be activities that are normally considered not to be significantly detrimental to what is being protected, or they may further the purpose of the conservation. Typical exceptions include grazing by farm animals and other traditional forms of land use in the area. Some important wetlands in Norway are protected as "protected landscape areas" or in

many cases as a combination of that and the protection of their animal and/or plant life. As a rule, protected landscape areas are, or will be, affected by land use to a greater extent than nature reserves. Nevertheless, the combination of landscape and animal and/or plant life protection may achieve a level of protection that approaches close to that in nature reserves.

The respective County Governors are responsible for managing all the areas protected under the terms of the Nature Conservation Act. They are therefore responsible for drawing up management plans that may include schemes for taking care of the area and providing facilities and information for the public. Within the scope of the guidelines stated in the provisions relating to the individual area, the County Governors have the power to authorise exceptions to the provisions. The Directorate for Nature Management considers appeals against decisions taken by a County Governor. As a step towards fulfilling the Government's aim that environmental conservation policies should be integrated into the work of the various sectoral bodies, a project began at the end of the 1990s to delegate the management of protected areas to the respective local authorities.

Follow-up of the Ramsar Convention

Norway ratified the Convention on the Protection of Wetlands in 1974 and the agreement became binding for Norway from 21st December 1975. The Åkersvika Nature Reserve near Hamar was the first area to be designated as an internationally important wetland (a Ramsar site). On 24th July 1985, a further 13

protected areas were added to the Norwegian Ramsar List. These 14 sites covered nearly 16 000 ha. A further 9 areas were designated on 19th March 1996, taking the total area to 68 000 ha. This compares poorly with the situation in Sweden (382 000 ha), Denmark (734 000 ha), Finland (101 000 ha) and Iceland (57 000 ha). Partly as a consequence of the recent designation of a number of internationally important protected areas, a plan for a fourth group of proposed sites, 14 in number, was submitted to the Ramsar Bureau in 2001. These were approved on 6th August 2002, giving a total of 38 sites (Table 3.29). The need for a fifth round can also be expected, partly in the event of the future designation of several marine areas and large archipelagic areas. It has been a proviso for the designation of all the existing Norwegian Ramsar sites that the areas concerned had already been protected under the terms of the Nature Conservation Act. This practice is not followed in most other European countries.

Management

Nine of the 38 Norwegian Ramsar sites have either an approved management plan, one that has been completed but not yet approved, or one that is almost complete. The way conservation provisions are drawn up today, it is merely recommended that the management authorities should draw up plans for how an area should be taken care of. However, the Directorate for Nature Management, as the management body responsible for the Ramsar Convention in Norway, has requested that the County Governors give priority to the task of preparing management plans for the Norwegian Ramsar sites, in line with the recommendations made by the Convention.

The Convention emphasises the importance of sites being managed in such a way as to ensure that their ecological function is maintained, their protection is furthered and any use to which they are put is in keeping with the principle of sustainability (see Articles 2.2 and 3.1). Article 3.2 states that any changes to the wetlands must be followed up by the management authorities. A management plan therefore has a key function if these principles are to be followed. It must also take care of the need to monitor the sites with a view to revealing any changes and must lay down guidelines for the use, protection and management of the sites. Even though the habitats at several of the Norwegian Ramsar sites have no special need to be taken care of, it is still important to investigate and analyse their present state and provide guidelines for

how the sites should be managed. This is the only way any ecological changes can be traced and possible measures be put in place to maintain the status quo.

National follow-up of the Convention

Based on Article 3.1, the Convention has drawn up guidelines, and through resolutions agreed during meetings between the parties to the Convention it has stressed the importance of establishing a national strategy for wetland conservation. In addition to the protection provisions embodied in the Nature Conservation Act, the most important mechanism for protecting and managing any wetland in Norway, and Ramsar sites in particular, is to ensure that the sectoral bodies are involved when the land-use planning and actual use of the areas is taking place. In Norway, the intention is that each of the government ministries concerned draws up a general policy for the area and then follows this up with annual action plans. A national programme of environmental monitoring has been established and an expanded programme is intended to be in place by 2003. The environmental reports from the sectors will also provide more information about the state of the environment in Norway. General guidelines for which areas and types of habitat are of special interest are now being drawn up and will be able to be used to put measures in place that are targeted at types of wetland that are considered to be under threat. Local authorities have begun to map their biologically valuable sites and this work is intended to be completed in 2003. The setting up of a species data bank has been approved as part of the task of collecting information and obtaining a survey of the biological diversity. In addition to collating information, this will also enable the preparation of action plans for protected sites and other areas in Norway. The voluntary nature conservation organisations will have a significant role to play in this work, and efforts should be made to improve cooperation with them and use their skills better.

The Ramsar Convention guidelines on national strategies for wetlands cover far more than just how to determine important occurrences. They primarily provide advice on establishing a national strategy for investigating and preserving wetlands in each signatory nation. Preparing conservation plans is one way this has been followed up in Norway, but a national strategy as such for wetlands is still lacking. Other forms of advice include establishing national and local wetland forums (still lacking in Norway), establishing legal measures to ensure protection and

sustainable use in all sectors (strongly focused upon in Norway), a plan for education at all levels, including a fuller understanding of the value of wetlands by the general public and people employed in the public sector (poorly followed up in Norway), involving voluntary nature conservation organisations (partly applied in Norway through financial support and involvement in investigations), analysing the need for

updating wetland conservation (still not begun in Norway), setting up a programme to establish a national inventory of wetlands (still not begun in Norway), making plans for restoring and reconstructing wetlands (only just started through various grant schemes), and a time schedule for when the various targets are to be attained.

Table 3.29 Ramsar sites in Norway on 1st January 2003 (see also Table 3.7 and Fig. 3.1).

Ramsar status	Site & county	Formal status	Status & problems	Recommendations
I. 21.12. 1975	Åkersvika, Hedmark	NR 1974	II/M/5, 8	5, 7
II. 24.7. 1985	Øra, Østfold	NR 1979	I/2	2, 3, 7
	Kurefjord, Østfold	NR 1978	I/1, 3	3
	Nordre Øyeren, Akershus	NR 1975	I/M	9
	Ilene & Presterødalen, Vestfold	NR 1969 & 1981	II/1, 3	1, 3
	Jæren wetland system - 4 sites, Rogaland	NR, PLA 1974 & 1977	II/1, 4, 6, 9	1, 3, 4, 6
	Ørland wetland system - 4 sites, Sør-Trøndelag	NR, BS 1983	II/M/1, 3, 6, 9	1, 3, 4, 6
	Tautra & Svaet, Nord-Trøndelag	NR, BS 1984	III/M/1, 8, 9	1, 4, 5, 7
	Stabbursnes, Finnmark	NR 1973	I/M	-
	Forlandsøyene, Svalbard	NR 1973	I	-
	Dunøyene, Svalbard	NR 1973	I	-
	Kongsfjorden, Svalbard	NR 1973	I	-
	Isøyene, Svalbard	NR 1973	I	-
	Gåsøyene, Svalbard	NR 1973	I	-
III. 19.3. 1996	Nordre Tyrifjord wetland system - 5 sites, Buskerud	NR 1975 & 1985	I/3, 7, 9	2, 4
	Masvasstangen, Møre & Romsdal	PLA 1989	I/M/1	1.3
	Lista wetland system - 10 sites, Møre & Romsdal	NR, BS, PPL 1987 & 1988	II/M/1, 3, 4, 6, 9	1, 2, 3, 6
	Giske wetland system - 6 sites, Møre & Romsdal	NR, BS 1988	II/6, 8, 9	3, 6
	Harøya wetland system - 4 sites, Møre & Romsdal	NR, BS 1988	II/6, 9	3, 6
	Sandblåst & Gaustadvågen, Møre & Romsdal	NR 1988	I	2
	Mellandsvågen, Møre & Romsdal	NR 1988	I	2
	Froan, Nord-Trøndelag	NR, PLA 1979	II/M/4, 6	4, 6
	Pasvik, Finnmark	NR 1993	I/M/9	
IV. 6.8. 2002	Kvisleflået, Hedmark	NR 1981	I	
	Tufsing delta, Hedmark	NR 1988	I	
	Fokstumyra, Oppland	NR 1923	I	
	Dokka delta, Oppland	NR 1990	I	
	Hynna, Oppland	NR 1990	I	
	Jæren wetland system - 15 new sub-sites, Rogaland	NR, BS, PPL	II/1, 3, 5, 8, 9	1, 2, 3, 4, 5, 6
	Havmyran, Sør-Trøndelag	NR 1982	I	
	Øvre Forra, Nord-Trøndelag	NR 1990	I	
	Trondheimsfjord wetland system, Sør- & Nord-Trøndelag	NR, PLA 1984 & 1983	II/3, 6, 9	3, 4, 6
	Bliksvær, Nordland	NR 1970	I	
	Karlsøyvær, Nordland	NR 1977	I	
	Skogvoll, Nordland	NR 1983	I	
	Balsfjord wetland system - 2 sites, Troms	NR 1995	II/9	6
	Mouth of River Tana, Finnmark	NR 1991	I	
	Slettnes, Finnmark	NR 1996	I	

Explanation: *Formal status*: NR - Nature Reserve, PLA - Protected Landscape Area, BS - Bird Sanctuary, PPL - Protected Plant Locality.

Status: I - Good, II - Problems, III - Great need for action, M - Management plan exists. *Problems*: 1. Traffic, wear and tear, disturbance, 2. Refuse tips and the like, 3. Agricultural contamination, new housing, etc., 4. Poor protection provisions, inappropriate protection category, 5. Need for management and care, or other measures, 6. Sand and gravel extraction, aquaculture and kelp trawling, 7. Becoming overgrown, 8. Erosion, 9. Encroachments, landfills, road constructions, watercourse regulations, etc. *Recommendations*: 1. Limitations on visiting the area, forbid shooting, etc., 2. Measures to prevent or reduce pollution, 3. Set up buffer zones, 4. Extend the protection, change the protection provisions or the form of protection, 5. Management and care, 6. Halt encroachments, 7. Other special problems that need solving.

Status, threats and challenges

In addition to the 18 national parks, by 1st January 2002 there were 1786 protected areas in mainland Norway, 1485 of which are nature reserves and 106 areas of protected landscape. Together, they make up 8.12 % of the land area (including fresh water). In addition, 1160 km² of sea have been protected, approximately 1 % of the area inside the territorial limit (30 nautical miles). 894 areas have been designated to protect mires, wetlands and sea birds under the terms of the Nature Conservation Act. As much as 56 % of Svalbard has been protected under the terms of the Svalbard Act through the designation of 3 national parks and 18 nature reserves.

Designating protected areas under the terms of the Nature Conservation Act is extremely valuable for safeguarding both habitats and species diversity linked with, for instance, various kinds of wetland. Several kinds of habitat are rare (either because they are naturally rare or they have become rare as a consequence of disturbance), or they contain rare species of plants and/or animals that have to be legally protected. However, such occurrences make up only a small portion of the entire natural heritage of the country. The area that remains unprotected will always be much larger and will be decisive for the long-term preservation of both habitats and species which have a wider distribution than the more local and rarer occurrences. The way we manage nature in general is therefore at least as interesting if we are to maintain the diversity of species in stable and viable populations. It is therefore vital that sectoral bodies are involved in the general task of looking after the natural environment.

The official objective in Norway is to increase the area of the country that is protected to approximately 12 % of the land area (see, for instance, White Paper no. 62 (1991-92) "New national plan for national parks and other large protected areas in Norway". This plan is expected to be fully implemented by 2012. Many of the proposed protected areas will include large occurrences of various kinds of wetland, particularly mires in north Norway.

Evaluation of the conservation effort made under the terms of the Nature Conservation Act

County conservation plans were conceived in the early 1970s and the task of realising them began in earnest

in the second half of the 1970s. The obvious advantage of the scheme was that it ensured an overall presentation and evaluation of a topic instead of the former case-by-case procedure.

Almost 30 years after the task of protecting the Norwegian environment began, little has been done to analyse the work that has been accomplished. For instance, it is natural to look at what percentage of various habitats has been protected, and to examine the way the various categories of protection are being utilised. Another question that could be asked is which species are really present in the areas that have been designated? These are relevant questions, partly to be able to judge whether the aims of the conservation work are being attained.

Conservation plans that include a large number of localities that need to be assessed have made the process of selecting sites that merit conservation difficult. This is partly because of a lack of resources to investigate areas that may be relevant for protection. Another reason has been the need to reduce the number of sites due to the costs that would be incurred in the subsequent process of awarding compensation. In this context, more knowledge about the areas that have already been protected and also other areas has revealed that several of the protected areas were evaluated on the basis of limited scientific knowledge, and new investigations have, not surprisingly, shown that non-protected areas exist that contain qualities which match or exceed those present in designated areas. Even so, no opportunity to redress this error has been provided.

Another aspect of the conservation process is that opposition from various sectoral interests and public and private landowners has meant that non-scientific criteria have been applied when areas have been selected for conservation. For instance, areas that merit conservation have been disregarded, selected areas have been significantly reduced in size, or the type of conservation or the conservation provisions have been accommodated to fit the needs. Hence, more emphasis has often been placed on making the protected areas as small as possible to reduce the level of conflict, rather than securing their conservation merits and achieving ecologically wisely founded boundaries. The use of different kinds of restriction level from nature reserve to bird sanctuary is an

example of a way of reducing conflict. For these reasons, there is a great need to revise a number of the protected areas, including several Ramsar sites that have a weak level of protection embodying few opportunities to prevent physical encroachment.

In Norway, it has been usual to expropriate the right to use an area, but its ownership has not normally changed unless the landowner has demanded redemption, or desired voluntary sale. In other Nordic countries, the acquisition of land by the nation has usually been succeeded by a national conservation process. If this had been practised in Norway, it would in most cases have made the management of the areas much simpler and more effective than it is today. In reality, the present policy threatens the safeguarding of the protected areas.

Too much focus has often been directed at the category of protection and the topic of the conservation plan, with the result that protected areas have often not been given natural boundaries, or a buffer zone to fully protect their core areas, thus reducing the effect of any disturbances taking place beyond their boundaries. For instance, when the boundary of a protected mire is located at the limit between mire and dry land, or such that it divides a mire in two, or is placed strictly in keeping with the objective of the conservation plan (for example, mire) thus excluding other types of habitat, a protected area is created that is ecologically unwise. Landowners, local authorities and the business community frequently hold the view that land that was originally proposed for protection but was not included in a conservation plan, or borders up to a protected area, was not considered by the national authorities to merit conservation and was therefore released for other forms of use. This problem can perhaps be solved by adding a clause to the Nature Conservation Act awarding all wetlands (and other specially selected kinds of habitat) automatic protection until proposed encroachments are assessed and perhaps approved.

Evaluating the work of managing wetlands

During the 1990s, it became increasingly obvious to people engaged in conservation work that no victory is won forever. Even protected areas have been subjected to encroachment, sometimes of a far-reaching kind. In 1995, a study carried out by the Norwegian Ornithological Association showed that nine of the

southernmost counties in the country had 237 wetlands that merited conservation on the regional, national or international level and encroachments were registered in 149 of these. Moreover, after the conservation plan process was initiated encroachment was registered in a further 66 localities and after 131 of the 237 sites had been protected 37 of them had experienced encroachments. A study of Norwegian Ramsar sites performed in 2000-2001 shows the same tendency. Reports from the Directorate for Nature Management in 1996 showed a great need for the preparation of management plans and the care and maintenance of protected areas. In 1997, the Norwegian Nature Inspectorate undertook an investigation of the situation regarding the inspection and management of all the protected areas in Norway. It revealed that the vast majority had little or no follow-up, and concluded among other things that surveillance procedures should be revised and made more professional.

One of the many reasons for this situation is the long-term, gradual reduction in funding for practical work in protected areas. This has partly resulted in a lack of communication with landowners and local inhabitants, and illegal encroachments made by both private individuals and public sector concerns go unnoticed. In counties where supervision and management has been more professionally organised, the number of infringements reported to the police has risen dramatically, showing how poor the supervision has been earlier. Despite the greatly reduced management budgets, less traditional methods have generally not been applied. For instance, voluntary individuals and organisations could be employed under professional guidance to keep a watch on and do practical work in protected areas, a practice widely employed in several other European countries. This would, moreover, have the positive side-effect of gaining greater acceptance and understanding for the protection of the natural heritage among the general public.

An important aspect of a management plan is the need to acquire an overview of the qualities held by a protected area and their status. This work has been given low priority and very little funding. A fundamental element in the management of wetlands is knowing their original state, partly so as to be able to trace changes that have a natural origin or are a response to active management. Another aspect is

that the Ramsar Convention requires that the ecological conditions in a Ramsar site are maintained or improved. It is difficult to fulfil this demand in the absence of reasonably good basic knowledge.

The responsibility for managing protected areas in Norway has recently begun to be transferred from national to local authorities. While local support is very important when protected areas are to be kept under supervision and managed, the question has been raised whether it is right to transfer every aspect of their management, since the areas concerned have qualities that are of national or international interest. It has been pointed out from several quarters that local authorities lack the skills required to look after protected sites that are rated at the national level and may experience difficulty implementing neutral decisions on management issues. The total lack, or scarcity, of funding both locally and nationally does not improve the situation either. It may therefore be difficult to attain the aims of having the same management practice, an equal legal basis and a common scientific fundament.

Only nine of the 38 Norwegian Ramsar sites have an approved management plan, or one that is nearing completion. This is in conflict with the plan which the parties to the Convention have adopted that all the areas must have an approved management plan by 2002. Moreover, several protected wetlands and some Ramsar sites have a great need for active management. For instance, some areas are being cleared to restore former grazing, which is favourable for bird life. A number of the sites have a high production of biomass, either because nutrients are seeping from surrounding farmland or for more natural reasons, and in time this leads to the land becoming overgrown. If the water level is lowered, this often takes place unusually rapidly. These are examples of problems facing several Norwegian wetland reserves. The removal of biomass is an accepted means of restoring such sites, but requires financial resources that are far greater than those which the management authorities now have available. Encroachments within, or close to, protected areas have also created new problems, a solution of which calls for substantial resources. One example of this is the canalisation and landfill scheme undertaken at the mouth of the River Glomma, which has led to major changes in the ecological state of the protected area at Øra. Another is the construc-

tion of the causeway across the shallow Svaet sound between Tautra and the mainland, blocking the flow of the tidal current; the ultimate cost of the on-going construction of a bridge in the causeway is estimated at NOK 50 million. Both these examples are described in detail below.

The sectors

Following an extensive assessment of wetlands with regard to their potential for commercial exploitation, there has been growing realisation since the 1970s that this type of habitat has other qualities and functions, too. Gradual changes in legislation, provision of subsidies, etc. are positive measures, but their results still largely remain to be seen. Growing problems with flooding and storm damage as a consequence of climatic change are thought to have been aggravated by the systematic reduction of wetlands over many years. However, several European countries have shown considerable interest in the ability of wetlands to absorb potential floodwater and reduce the effect of storms, and a number of plans have been put forward to restore and create wetlands to meet these problems.

Commercial activities in the coastal zone are currently expanding greatly. In Norway, this means that wetlands there are being generally threatened by new kinds of encroachment and activities. In addition, demands are being voiced in several quarters to accommodate new, and revise existing, protected marine wetlands to meet the needs of the business community. The internationally accepted concept of conserving special natural environments as they are at the time they were protected is thus being set aside and commercial interests are gaining a freer hand.

Norway has few large reference areas in the coastal zone where ecosystems that are little disturbed may be used for reference purposes to study the impact of such activities as aquaculture, kelp harvesting, shell-sand extraction and natural changes in various populations. Four such areas exist now, but only one has sufficiently restrictive provisions to be usable as a reference area. The coastal conservation plans for Troms and Nordland are opening the way for more protected areas of this kind. Norway has protected 1160 km² (about 1 %) of the sea within its territorial limits). However, this mostly concerns only the surface of the sea, thus making it difficult to prevent

such activities as kelp harvesting, shell-sand extraction and bottom trawling in these areas. This is an example of the need to revise and adjust conservation provisions to face new threats that did not exist when the areas were protected.

Scientific requirements

1. Complete the coastal conservation plans for Troms and Nordland in their intended form and implement the conservation plans for wetlands in Finnmark and for mires and wetlands on Smøla.
2. Set up a national plan to revise all the conservation plans for mires and wetlands, particularly with a view to improving their delimitation, protection category and protection provisions.
3. Significantly strengthen the Norwegian Nature Inspectorate and draw up management plans for protected wetlands, in part by involving voluntary nature conservation organisations.
4. Follow up the recommendations made by the Ramsar Convention and provide funding to:
 - a) establish a national strategy for the wetland effort and a national forum for protection and management of wetlands which, among other things, must involve voluntary nature conservation organisations
 - b) complete a national survey of wetlands
 - c) complete management plans for the Ramsar sites
 - d) improve the focus of the sectoral bodies on the protection of wetlands, and enhance the educational effort directed at schools and the general public
 - e) substantially improve basic knowledge about protected areas, particularly Ramsar sites
 - f) identify and establish additional Ramsar sites.
5. When the Nature Conservation Act is amended, it is desirable to consider including the need for buffer zones around protected areas to be able to maintain control with activities taking place adjacent to them.

See Chap. 7 for relevant references.

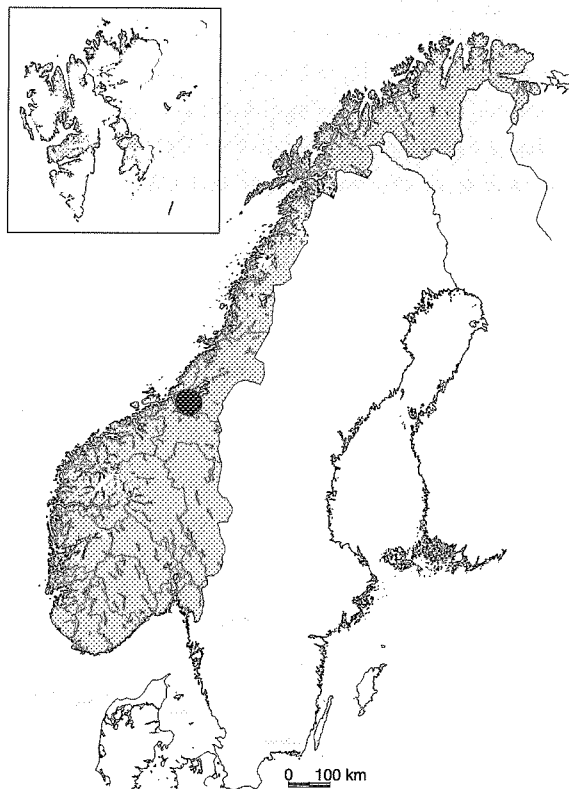
Examples of wetlands in Norway

Tautra - a cultural landscape and shallow marine area



Figure 3.23 In the mid-1970s, a causeway was constructed over Svaet, a shallow area of sea (on average about 10 m deep) separating the island of Tautra from the mainland. It completely blocked the strong current that once flowed through Svaet and soon led to a build-up of sediment and changes in the production of marine invertebrates (bivalves, etc.) and other creatures. This transformation in the ecological conditions has brought about a marked reduction in the number of aquatic birds inhabiting the shallows, and the number of sea birds breeding on Tautra has also dropped dramatically due to predation from terrestrial mammals, such as mink, that have gained access to the island.

PHOTO: ØYSTEIN R. STØRKERSEN



National protection: Two nature reserves covering 2.8 km² (incl. 2.46 km² of sea) and two bird sanctuaries covering 17.7 km² (incl. 16.3 km² of sea) were approved on 14th December 1984.

International status: Designated a Ramsar site on 24th July 1985.

Description of the area

The island of Tautra is situated in the middle of Trondheimsfjord in the county of Nord-Trøndelag. It is 3.5 km long, rather narrow, and is dominated by a small-scale cultural landscape comprised of tilled fields and meadows alternating with groups of trees and stretches of shore. The island has two very small lakes, one with brackish water and the other with fresh water, and these are popular sites for birds. The island has a specially rich range of plants and insects, including several species that are otherwise rare in the region. Tautra and the surrounding wetlands are well known for the numerous wetland birds that breed, rest while migrating, or have their winter quarters there. The nearby islet of Øksningen is, moreover, an important breeding site for sea birds. Tautra and Svaet are widely known as being among the richest areas for wetland birds in Norway, having particularly large numbers of divers, grebes, diving ducks, surface-feeding ducks and waders during the spring and autumn migrations and in winter. For instance, 5000-10 000 common eiders *Somateria mollissima* used to congregate here during the spring migration. Svaet, the area of shallow water (average depth 10 m) between Tautra and the mainland, and the extensive stretches of intertidal shoreline on Tautra and the mainland, are the most important basis for the rich bird life.

Management problems

Causeway construction A 2.3 km long causeway across Svaet was completed in 1976, before the area was protected. The result was that the strong tidal current that passed through Svaet was broken and fine-grained sediment began to be deposited on the sea bed. This brought about a major transformation in the production of bivalves and other marine creatures in the area. In addition, terrestrial predators gained access to Tautra for the first time resulting in dramatic reductions in the numbers of breeding sea birds. Studies of the tidal currents, the marine animal life

and the bird life provided documentation of the problems after the area was protected and subsequently acquired Ramsar status. They concluded that an opening in the causeway would restore sufficient tidal current over Svaet to improve the conditions for bivalves and other marine organisms sufficiently for the area to once more become an important feeding ground for sea birds. Using this as the basis, the transport and environmental authorities proposed in 1997 to fund a plan to construct a 350 m long bridge to re-open the causeway for the tidal currents.

Predators The construction of the causeway over Svaet gave terrestrial predators like mink, pine martens, foxes and badgers their first opportunity to avoid the strong currents flowing over Svaet and reach the large bird colonies on Tautra. They quickly made noticeable inroads into the ground-nesting sea birds. On average, some 1200 pairs of common eiders used to nest on Tautra annually. This figure has now dropped to 200 pairs, and studies show that the population is collapsing due to lack of recruitment. Moreover, only remnants remain of the large colonies of other species, such as mew gulls *Larus canus* and black guillemots *Cepphus grylle*. Regular shooting of predators has kept their numbers down, but the bird colonies have failed to recover. In connection with the opening of the causeway, plans are in hand to create barriers that will prevent predators reaching Tautra. This is probably essential if the bird colonies are to be able to re-establish.

Cultural landscape Intensively grazed, open grassland with wild rose scrub and junipers has provided good conditions for plants that require plenty of light and warmth, and for an unusually rich insect life. Ground-nesting sea birds also found numerous suitable nesting sites beneath the bushes and in the scrubland. However, general changes in farming practices have also had their effect on Tautra, and the transformation of the cultural landscape is having dramatic consequences for the plant and animal life. Grazing has ceased in some areas, resulting in the grassland becoming overgrown by other plants and trees, whereas grazing pressure has increased elsewhere, leading to erosion. This change in the cultural landscape has consequences for plants, birds, butterflies and moths that depend upon open grasslands and the like.

Recommendations 1) Complete the management plan. 2) Revise the protection provisions to bring them more in line with modern knowledge about the merits of the environment. 3) Monitor a selection of plants and other wildlife. 4) Improve measures for care and maintenance. 5) Construct a bridge in the causeway and set up effective barriers to stop roaming predators.

Bibliography

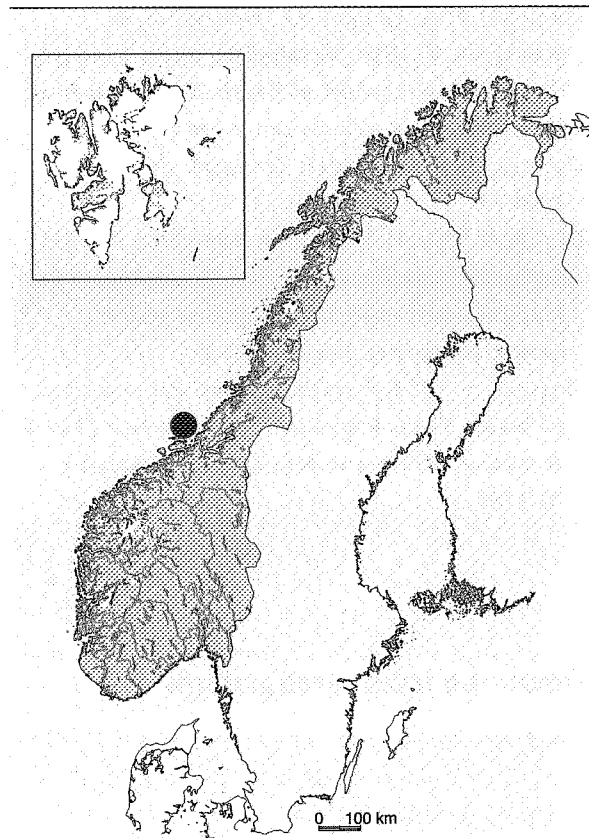
- Austrheim, G. 1991. Vegetasjonsdynamikk i tørreng og einerkratt på Tautra i Nord-Trøndelag. Beskrivelse av gjengroing og utprøving av restaureringsmetoder. Unpubl. thesis, UNIT.
- Aagaard, K. 1987. Dagsommerfugler på Tautra. et trøndersk kulturlandskap. Økoforsk notat 1987:1.
- Baadsvik, K. 1975. Vegetasjon og flora på Tautra. Frosta kommune. Nord-Trøndelag. Foreløpig rapport i forbindelse med landsplanen for verneverdige naturområder og forekomster. Universitetet i Trondheim. DKNVS Museet. Botanisk avdeling.
- Bjørndal, S. 1995. Tautra. Erosjon og sedimentasjon. Rapport. SINTEF - Norsk Hydroteknisk Laboratorium.
- Brørs, B. & Lothe, A. 1996. Strømforhold på Tautrasvaet. Numerisk simulering. SINTEF. Kyst og havteknikk.
- Fremstad, E. 1995. Skjøtsel av beitemark på Tautra, Nord-Trøndelag. NINA fagrapport 002:1-49. Fylkesmannen i Nord-Trøndelag/Nord-Trøndelag fylkeskommune 1996. Verneplan for kulturmiljø.
- Jule, K. 1989. Kulturlandskapet i Nord-Trøndelag. Regionale kulturlandskapstyper. Natur- og kulturverdier i Levanger og Frosta. Landskapsplan på øya Tautra. Hovedoppgave - Norges landbrukshøgskole.
- Lande, E. 1974. Undersøkelser av bunnfaunaen i Svaet mellom Tautra og Frosta. Universitetet i Trondheim. Vitenskapsmuseet.
- Nilsen, L.S. 1996. Registrering av utvalgte kulturlandskap i Nord-Trøndelag. Fylkesmannen i Nord-Trøndelag. Miljøvernavdelingen. MVA Rapport 3-1996.
- Thingstad, P.G. & Frengen, O. 1990. Kvantitative og kvalitative ornitologiske observasjoner fra Tautra. UNIT Vitenskapsmuseet. Notat 1990-3.
- Thingstad, P.G., Frengen, O., Hokstad, S. & Strømngren, T. 1994. Vannfugl og marin bunndyrfauna i Ramsarområdet på Tautra. Nord-Trøndelag. Konsekvenser av steinmoloen over Svaet. UNIT Vitenskapsmuseet. Rapport Zoologisk serie 1994 - 8.
- Thingstad, P.G., Hokstad, S. & Strømngren, T. 1995. Undersøkelser av bunnfaunaen i Tautrasvaet 1995. Mulige konsekvenser for vannfugl av endrete næringsbetingelser. Notat: 1995-6.
- Tingstad, A. 1988. Forvaltningen av verneområdene på Tautra. Frosta kommune. Fylkesmannen i Nord-Trøndelag. Miljøvernavdelingen. MVA Rapport 10-1988.

Froan - an intact archipelago



Figure 3.24 The thousands of islets, skerries and rocks that make up the Froan Nature Reserve, situated on the outermost coast of central Norway on the edge of the open ocean, have become a unique sanctuary from terrestrial predators like mink. In contrast to the situation along much of the Norwegian coast, sea birds are therefore able to nest here undisturbed. Froan is the only comparatively large protected area in Norway that is large enough to be able to be termed a marine reference area and is partly protected as a nature reserve. The photograph was taken looking south, with Halten in the foreground.

PHOTO: MORTEN EKKER



National protection: 14th December 1979 as a nature reserve (404 km², 400 km² of which are sea) and an area of protected landscape (80 km², 60 km² of which are sea). The fauna in a radius of 2 km around this has also been protected, resulting in the total area of sea that is protected being 120 km².

International status: Designated a Ramsar site on 19th March 1996.

Description of the area

The Froan archipelago (Fig. 3.24) is situated on the edge of the open ocean in the county of Sør-Trøndelag, some 40 km from the mainland. Because of a need to live close to the fishing grounds, Froan has periodically had several hundred inhabitants. The area became gradually depopulated in the latter part of the 20th century and is now relatively isolated and has only a handful of residents. However, the scattered houses and ruins that remain in many parts of the archipelago show that the population was once much larger. Nature did not endow Froan with many opportunities for farming, and trees do not thrive under the severe weather conditions. However, the grazing pressure was much greater when the settle-

ments were maintained, and probably provided better conditions for grazing geese and some other wildlife. The turf-dominated land is now largely overgrown by heather *Calluna vulgaris* or, in wetter parts, cotton-grass *Eriophorum* spp., and offers little grazing for geese. The areas of shallow water are the main reason why Froan is so important as a habitat for large numbers of sea birds and seals. The absence of predators like American mink *Mustela vison* is a particular bonus for the sea birds. Froan is not least noted for its large numbers of breeding great cormorants *Phalacrocorax carbo* and European shags *P. aristotelis*, having the southernmost colonies of great cormorants (about 2000 pairs) and numerous European shags (about 1000 pairs). Greylag geese *Anser anser*, common eiders and white-tailed eagles *Haliaeetus albicilla* are among other birds that breed in large numbers. Tens of thousands of greylags, eiders and red-breasted mergansers *Mergus serrator* congregate here to moult. Numerous sea birds, including little auks *Alle alle*, common eiders and long-tailed ducks *Clangula hyemalis*, visit Froan on their spring and autumn migrations, or winter here. Froan is the most important pupping locality for grey seals *Halichoerus grypus* in Norway and between 100 and 200 are born here each year in September-November. Froan also has a stationary population of common harbour seals *Phoca vitulina*, numbering approximately 250-300. Otters *Lutra lutra* are common, but members of the whale family, like common porpoises *Phocaena phocaena* and killer whales *Orcinus orca*, appear more sporadically. Since Froan is located in the midst of the Norwegian Coastal Current, the archipelago functions as a sieve to water-borne rubbish and diffuse oil pollution. Investigations around 1990 showed that approximately half the new-born grey seal pups had patches of oil on their coats within the first three weeks of their life. Studies show that the nature reserve contains approximately 30 % of the cuvie *Laminaria hyperborea* in Sør-Trøndelag. Our knowledge of the flora (270 species of vascular plants, 175 species of bryophytes and 43 species of lichens), fauna (199 species of birds and 16 species of mammals) and geology can be considered comparatively good.

Management problems

Revision of the protection provisions Froan was designated a nature reserve quite early and the form of protection chosen then and the current provisions no longer satisfactorily secure the qualities of the area against new commercial interests.

Fish farming and marine ranching Commercial activity concerned with marine ranching and, particularly, fish farming has grown dramatically in Norway in the past 10-20 years. The demand for suitable sites for fish farming is great and often creates conflicts because these sites are frequently the most valuable localities for biological diversity and other interests like outdoor recreation. A trend towards political liberalisation in the use of protected marine areas for commercial activities has been laid down in the Government White Paper on the Protection and Use of the Coastal Zone (St. meld. no. 43 (1998-1999)). There is also a growing interest in Norway for harvesting kelp and other seaweeds, and this area contains large kelp resources.

Recommendations 1) Complete the management plan, 2) Revise and improve the protection provisions, 3) Establish permanent monitoring of a selection of wildlife species and acquire more knowledge about the biological diversity in general, 4) Improve supervision.

Bibliography

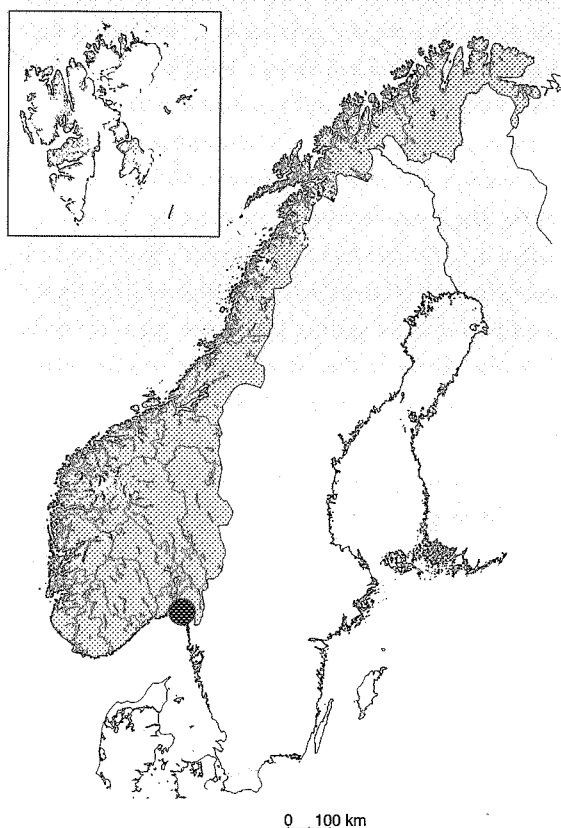
- Abildsnes, J. 1998. Vern av biologisk mangfold. Tema: Våtmarksverneområdene II. Verneområdene i Froan - Oversikt over naturfaglig kunnskap. Fylkesmannen i Sør-Trøndelag Rapport 2:1-70. Fylkesmannen i Sør-Trøndelag 1997. Forvaltningsplan og vernebestemmelser for verneområdene i Froan. Frøya kommune. Høringsforslag. 32 pp. + appendix. Sjøfugl, hekkeregistreringer.

Øra – a brackish-water area at the mouth of the largest river in Norway



Figure 3.25 A large area of brackish water with an unusually rich flora and fauna has formed where the River Glomma enters the sea. Its name is Øra and it has for a long time been known as one of the classical sites for birds in Norway and for having an unusually large variety of fish. This is one reason why a sub-species (*Phalacrocorax carbo sinensis*) of the great cormorant, normally found in continental Europe, began breeding here in 1997, for the first time in Norway. Physical disturbances in the vicinity have led to a shift in the natural currents that supplied fresh water and hence an increase in salinity in parts of the area. This has, in turn, had a negative impact on the plant and animal life.

PHOTO: OLA M. WERGELAND KROG



National protection: 28th September 1979 as a nature reserve covering 15.6 km² (inc. 13.3 km² of sea and brackish water).

International status: Designated a Ramsar site on 24th July 1985.

Description of the area

Øra is the name of the area at the mouth of the longest river in Norway, the Glomma (Fig. 3.25). It is the only large soft-bottom estuary in Norway and its brackish water is unusually rich in nutrients. Both freshwater and salt-water fish live here, but their proportions vary through the year due to changes in salinity. Freshwater fish dominate in summer when the salinity is low, but in winter it is mostly salt-water fish that are found. A few species, such as the common goby *Pomatoschistus microps* and the common eel *Anguilla anguilla*, are specially well adapted to brackish water and large numbers are found here throughout the year. This is one of the most important eel-fishing areas in Norway. The diversity of invertebrates is comparatively low, as is usual in brackish water, but some species occur in large numbers. There used to be a lush growth of water plants, particularly the brackish-water perfoliate pondweed *Potamogeton perfoliatus*, which gave ample food for large flocks of swans. This species has now declined greatly. The protected area includes a number of small islands and anthropogenous grasslands which are extremely important for breeding birds. The great cormorant colony that was established in 1997 has had an explosive growth and there were almost 500 nests in 2000. Several first-time records of species nesting in Norway stem from the Øra area, which is also an important site for migrating and wintering birds. The Øra area is a well-known site for studying birds, and was recognised as one of the most important wetlands in the country at an early date.

A plan put forward in the 1960s for an extensive landfill in the Øra area to acquire land for a port and industry was partially implemented and large areas of valuable wetland north-west of the present reserve were destroyed. However, a proposal to protect the rest of the area was put forward in the 1970s, and the reserve was set up in 1979 following years of tug and war between the developers and the conservationists.

A breakwater had already been built far into the area concerned, but this was removed. This was one of the most important victories for nature conservation at that time. The reserve now has a large waste dump and industrial plants as its closest neighbours.

Management problems

Changes in salinity The landfill schemes implemented north and west of the present reserve led to the mouth of the Glomma being moved 1.5 km southwards in 1971, resulting in the natural supply of fresh water east and south of the estuary to Gansrødbukta being blocked. This in turn led to increased salinity and consequent changes in the freshwater flora and fauna. It was therefore soon believed that the characteristic brackish-water environment in the area was at risk. The construction of a channel to increase the supply of fresh water has been partially successful, but over time this has changed the sedimentation conditions and erosive processes have once more brought a negative trend. A programme to monitor the brackish-water environment in the reserve is now about to start.

The cultural landscape becomes overgrown Former settlement had a great deal to say for the maintenance of the cultural landscape. When people moved from the area and grazing was less intensive, the grassland became overgrown and several species of birds disappeared or their breeding declined substantially. This includes two of the most endangered species in the country, the blue-headed wagtail *Motacilla flava flava* and the southern sub-species of the dunlin *Calidris alpina schinzii*. Moist grasslands require regular mowing and grazing to maintain their value as breeding and residential sites for birds and other creatures that are attached to wetlands.

Recommendations: 1) Complete the management plan. 2) Monitor and ensure that the low salinity is maintained. 3) Establish permanent monitoring of a selection of wildlife and acquire more knowledge about the biological diversity in general. 4) Continue restoring the cultural landscape. 5) Continue combating mink and other predators in the bird colonies.

Bibliography

- Zoological Museum, Oslo 1973-1976.
Øraundersøkelsene. Annual reports.
- Viker, M. & Bosy, R.G. (eds.) 1986. Fuglelivet i Øra-området. Østfold-Natur no. 25 (with a complete list of references).
- Fylkesmannen i Østfold 1987. Fisken på Øra. Rapport 2-87.
- Krohn, O. (ed.) 1990. Fuglelivet i Øra-området 1985-88. Østfold-Natur no. 29.
- Fylkesmannen i Østfold 1993. Utkast til forvaltningsplan for Øra.
- Fylkesmannen i Østfold 1995a. J.A. Thomes ornitologiske notater fra Østfold 1875 - 1910. Rapport 1-95.
- Fylkesmannen i Østfold 1995b. Ornitologiske registreringer i Øraområdet 1989-1992. Rapport 10-95.
- Fylkesmannen i Østfold 1997. Øra - våtmark og havn. Rapport 2-97.
- Verneplanutvalget for Oslofjorden 1999: Vern av viktige naturområder rundt Oslofjorden og Telemarkskysten. Utredning for DN 1999. No. 8:1-274 (p. 102).
- Fylkesmannen i Østfold 2001. Ornitologiske registreringer i Øraområdet 1993-1997 (in prep.).

3.5.7 SWEDEN

Sweden abounds in wetlands of one kind or another. The Fennoscandian Ice Sheet and its retreat were primarily responsible for this, creating a great abundance of lakes, rivers, mires and swamp woodlands. Depending on how wetland as a concept is defined, and what degree of human impact (mainly through ditching) can be accepted, the country can be considered to have approximately 12.8 billion ha of land with a wetland character. Hence, just over 25 % of Sweden can be classified as freshwater wetland, about half that in the whole of Fennoscandia. Probably few countries in the world have such a high proportion of wetland as Sweden. Considerable tracts of shallow water along the long coast, especially in the many archipelagos, can be added to this. Sweden is estimated to have 221 800 islands, 98 400 of which are in the sea.

Important types of wetland

Mires of various kind are the most common type of wetland in Sweden. It is estimated that there are about 6.0 billion ha of mire, i.e. peat bogs, fens and mixtures of these. In addition, numerous mosaics of mire and woodland occur. Peat bogs dominate in southern Sweden and fens principally occur in the north. Sweden ranks number seven in the world as regards the abundance of mire, and therefore has an international responsibility to preserve various types of mire.

Swamp woodland and wetland woodland - the area taken up by these kinds of woodland was mapped in 1990-98 by the National Board of Forestry and 264 000 sites were recorded, covering approximately 1.2 billion ha. Such woodlands mainly occur in northern Sweden. They often form part of a wetland mosaic, in which mires form an important part. The inventory showed that most of the surviving woodlands of this kind are small, about 80 % covering less than 10 ha. Their total area is estimated to be some 2.5 billion ha.

Lakes and rivers - Sweden has about 95 700 lakes that are larger than 1 ha. Altogether they take up just over 9 % of the country, corresponding to rather more than 4 billion ha. The largest lakes are Vänern, Vättern, Mälaren, Hjälmaren and Storsjön. Since a large proportion of Swedish lakes are very deep and consist of open water lacking surface or underwater vegetation, the concept of wetland scarcely applies. It

is estimated that areas of lake with aquatic vegetation, along with rivers, amount to almost 0.5 billion ha. The adjacent land area is also reckoned as part of lake and river wetlands. More or less frequently recurring floods create river meadows and grassy river banks, which form transitional zones to drier ground.

The majority of Swedish lakes can be classified as oligotrophic, i.e. poor in nutrients. Naturally eutrophic water is chiefly found on the plains of southern Sweden. Since numerous lakes have had their water level lowered or have suffered other forms of human impact, principally the discharge of nutritive substances, a great many lakes have gradually become overgrown or eutrophied. Many thousands of lakes have also been acidified by air-borne substances.

A large number of rivers of various type and size are found in Sweden. The three largest, reckoned by the discharge at their mouths, are the Göta, Lule and Ångerman. The longest are the Göta with its tributary the Klar (760 km), the Dal (540 km) and the Torne (520 km). In terms of hydrology, Sweden is divided into 119 runoff areas, which in turn are divided into 10 700 sub-runoff areas.

Coasts and shallow marine areas - Sweden has a long coast, some of which has numerous narrow inlets which lengthen the coastline. In addition, there are extensive archipelagos on both the Baltic and west coasts. The Stockholm archipelago alone has close on 25 000 islands and islets. All this helps to create a large area of shallow sea. The total length of the coastline is 43 200 km. The ecological conditions vary appreciably between different stretches of coast, depending upon factors such as the bottom substrate and topography, currents and prevailing winds. The salinity in the sea varies from almost 0 % in the northern part of the Baltic Sea to just over 2.5 % in the Skagerrak. Soft bottoms provide the most productive shallow-water areas, which are of great importance, partly because fish grow up there. The ongoing uplift of the land means that the coastline is slowly changing. At present, the uplift is a maximum of 8 mm per year in northern Sweden, but the coast of southern Sweden is sinking about 1 mm per year. The availability of digital charts has meant that the area of shallow sea (defined as less than 6 m deep) can now be calculated. It is reckoned to be 0.6 billion ha.

Protection of wetlands in Sweden

History

Regulations existed as early as 1734 stating how water was to be used and under what circumstances ditching might take place. A special Act on Ditching and other Ways of Diverting Water reached the statute book in 1879. In 1919, related statutes and provisions were brought together in a Water Act, to which many clauses were added in the next few decades. Following many years of debate, a new Water Act was approved in 1983 which took greater consideration than the former one for the interests of the general public and the importance of using the water resources in an economical manner.

The basis for Swedish legislation relating to nature conservation was laid in 1909 when the Act concerning the Protection of Natural Monuments and the Act concerning National Parks were approved. In the same year, Sweden designated nine national parks. However, the level of protection was so low that the Parliament soon decided to exploit the water bodies in the Stora Sjöfallet National Park to produce hydro-electricity. In 1952, these two Acts were replaced by the Nature Conservation Act. Interim provisions had been introduced some years prior to that prohibiting building taking place in the vicinity of some shores. However, the reason for this ban was not concern for nature conservation interests, but rather to secure access to beaches for bathing and outdoor recreation. These provisions became permanent in 1952.

In 1964, the Swedish Parliament approved a new Nature Conservation Act which, in principle, was to be valid until 1999. According to its provisions, land that was particularly valuable from a nature conservation viewpoint could be designated as a national park, nature reserve or sanctuary. Sanctuaries were designated where bird life, in particular, was sensitive to disturbance. Endangered species of plants and some forms of animal life could be specifically protected, but not fish, mammals or birds, which were protected under the terms of legislation relating to fishing and hunting, respectively. The National Environment Protection Board was set up in 1965 to improve the national nature conservation effort in Sweden.

Protection processes and protection categories

The protection and management of valuable areas of countryside has largely taken place through the designation of national parks and nature reserves. In

2001, there were 27 of the former and almost 2200 of the latter. The statistics for different kinds of habitat show that nearly 700 000 ha of water are present as lakes and watercourses in these parks and reserves.

Sweden may be said to have a special responsibility to protect mires of various kinds since few nations have such a large percentage of mire within their borders. Finland, admittedly, has a larger area of mire than Sweden, but Finnish mires are drained to a much greater extent. A nationwide plan to protect Swedish mires was put forward in 1994, the mires that had been registered being grouped in various protection classes and the need to protect the various kinds of mire being analysed. According to this mire

protection plan, 146 areas of mire were already protected and the objective was to protect almost 500 by the time the plan was fulfilled. In 1999, 226 000 ha of mire had been protected, but the full accomplishment of the plan would entail the protection of almost 400 000 ha. The Swedish Parliament has determined that the plan must be fulfilled in 2010.

Sweden ratified the Ramsar Convention in 1974, which meant assuming a greater responsibility to preserve wetlands and seek a wise utilisation of their resources. By the beginning of 2001, 30 Ramsar sites totalling 382 000 ha had been designated in Sweden and proposals lay on the table for a further 21 sites (Table 3.30).

Table 3.30 Ramsar sites in Sweden and their status.

Site	Area (ha)	Formal status	Threats	Recommendations
Falsterbo - Foteviken	7530	NR		
River Klingaväls - Lake Kranke	3970	NR	5	5, 7
River Helge	8050	(NR)	4	4
Ottenby	1610	NR		
Öland's east coast	8460	--	4, 5	4, 5
Åsnen	16 800	(NR)	4	4
Träslövsläge - Morups Tånge	1990	(NR)	4, 5	4, 5
Getterön	450	NR	9	7
Lake Käv - Store Mosse	7580	NP		
Gotland's east coast	4900	(NR)	4	4
Stigfjord	6940	NR		
Dättern	4010	(NR)	4, 5	4, 5
Lake Hornborga	6510	NR		
Östen	1010	NR	5, 9	5, 7
Tåkern	5650	NR		
Kilsviken	9090	(NR)		
Kvismaren	780	NR	4	4
Hjälstaviken	770	NR		
Stockholm's outer archipelago	15 000	(NR)	4	4
Svartå	2230	(NR)		
Hovran	4860	(NR)	4, 5	4, 5
Ännsjön	11 000	(NR)	4	4
River Ume delta	1040	(NR)	4, 9	4
Lake Tärna	11 800	NR		
Gammelstadsviken	430	NR		
Persöfjärd	3320	-	4	4
Lake Tjälme & Laisdalen	21 400	(NR)		
Laidaure	4150	(NP)	4	4
Sjaunja	188 600	NR		
Tavvavuoma	28 700	--	4	4

Site	Area (ha)	Formal status	Threats	Recommendations
Västra Roxen	4170	(NR)	4	4
Södra Bråviken	3610	(NR)		
Dumme mosse	3350	(NR)		
Komosse	4070	NR		
Emån	1580	--	3, 4, 9	2, 4
Kallgate - Hejnum	1650	(NR)	4	4
Mörrumsån - Pukavik Bay	2740	(NR)	4, 9	4, 7
Blekinge archipelago	12 500	(NR)	4	4
Lundåkra Bay	1980	(NR)	4	4
Skälderviken	1350	(NR)	4	4
Tönnersjöheden - Årshultsmyren	12 300	(NR)	4	4
Fylleån	910	(NR)	4	4
Sulsjön - Sulån	350	NR	6	6
Mossaträsk - Stormyran	950	(NR)	4	4
Nordre estuary	7210	--	4	4
Asköviken - Sörfjärden	12 200	NR	5	5
Dalälven - Färnebofjärd	17 300	NP, NR		
Storkölen	7040	NR		
Tysjöarna	410	--	4	4
Oldflån - Flån	10 100	(NR)	4	4
Aloppkölen	19 100	(NR)	4	4
Total area	527 990			

Key:

NP, NR = > 50 % of the site protected as a national park or nature reserve

(NP), (NR) = < 50 % of the site protected as a national park or nature reserve

Threats: 1. Traffic, wear and tear, and disturbance (hunting, shooting, fishing, etc.), 2. Waste dumps, 3. Pollution from agriculture, industry, housing, boat traffic, etc., 4. Inadequate protection provisions, 5. Insufficiently looked after, 6. Sand extraction, aquaculture, 7. Becoming overgrown, 8. Erosion, 9. Encroachment, landfills, road building, watercourse regulation.

Recommendations: 1. Limit traffic, hunting, shooting, fishing, etc., 2. Limit pollution, 3. Establish buffer zones, 4. Extend the protected area, change the protection provisions, 5. Look after the site better, 6. Halt ongoing encroachments, 7. Other special measures.

Several major revisions of the environmental conservation legislation took place in 1991, including the introduction of more stringent regulations regarding ditching and draining (land drainage) and better opportunities for protecting small biotopes, including some types of wetland. 1999 saw a major change in Swedish environmental legislation when 15 Acts were incorporated into an Environmental Code. These included statutes and ordinances regulating the premises for nature conservation work, among them the Water Act.

Changes to the landscape resulting from human disturbance have been considerable during the last 150 years. Some of the encroachments on the aquatic environment will be taken up here.

During the latter part of the 19th century and the first half of the 20th century, a large number of Swedish lakes had their water level lowered. In many cases, the reduction was so great that the lake ceased to be a functioning ecosystem. Lakes, other wetlands and rivers on the plains of southern Sweden were particularly seriously hit by the intensification of agriculture. It is estimated that maybe 80 - 90 % of the original wetlands there disappeared or were seriously affected. Around 3 billion ha of wetland are thought to have been drained since the beginning of the 19th century. Even though the lowering of lake levels almost completely ceased during the 1950s and 1960s, drainage of waterlogged land continued for another couple of decades, both on farmland and in forests. It is estimated that the hydrology of $\frac{3}{4}$ of the

total area of freshwater wetland in the country has been disturbed. However, the figures vary considerably from one region to another.

The realisation that substantial environmental assets are lost through land drainage has led to increasingly stringent regulations during the 1980s and 1990s that have affected more and more of the country. Since 1991, the Government can ban all land drainage with the aim of completely halting ditching activities in those parts of the country that have the fewest surviving wetlands. By the end of 2000, such a ban existed in 188 of the nation's 288 urban and rural boroughs. The Government is considering a proposal to extend this ban to cover a further 20 or so boroughs (see Fig. 3.26). The ban also applies in every area in Sweden that figures on the list of internationally important wetlands (the Ramsar List). Applications to drain land in forested areas have dropped significantly in recent years, from about 900 in 1991 to fewer than 50 in 1999. Barely 400 ha of wooded land were expected to be directly affected by ditching in 1999. At the end of the 1990s, it was estimated that almost 60 % of the swamp woodland in south-west Sweden had been ditched, the corresponding figure for the northern part of the country being 20 %.

1991 also saw the protection of some kinds of small biotopes throughout the country. Activities that damage the natural environment are forbidden in such areas. Biotopes that are protected in this manner include springs and their surrounding wetland as well as other small lakes and wetlands in farmland, but none may exceed 1 ha. The National Board for Forestry Protection has the right to define and protect certain kinds of small biotopes in wooded countryside. Such biotopes include several aquatic environments, such as swamp woodlands of various kinds, alder fens and springs. The County Administrative Boards are, moreover, able to designate rich and calcareous fens, as well as stream beds, as biotope protection areas. All these regulations have been embodied in the Environmental Code since 1999.

The Environmental Code also gives the Government the right to forbid the discharge of pollutants, or the storage of substances that may cause pollution, within some aquatic areas. So far, decisions have been taken to protect 11 aquatic areas, mainly lakes. In sensitive

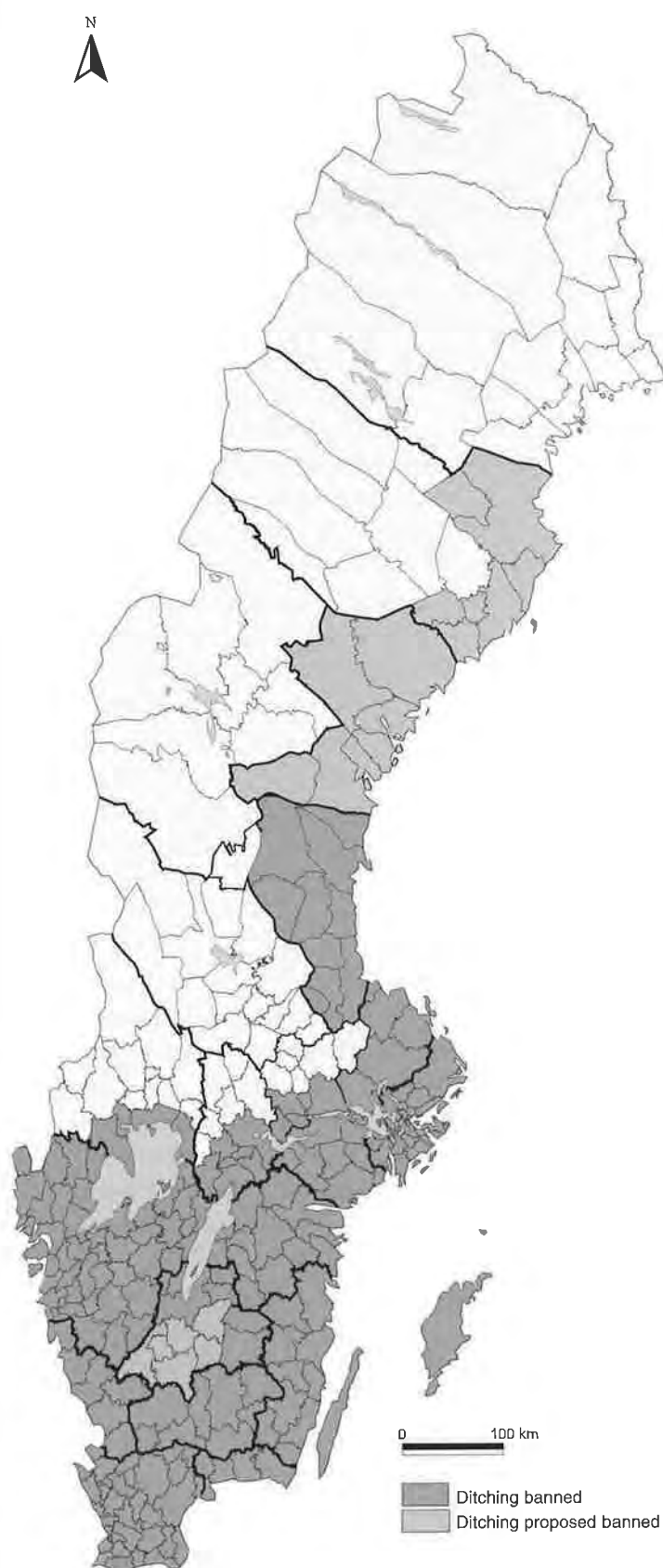


Figure 3.26 Areas where ditching has been banned or is proposed to be banned.

DRAWN BY: MARIE-LOUISE MODEER

areas, such restrictions can also apply to the use of fertilisers and the amount of grazing permitted.

A nationwide inventory of freshwater wetlands has been taking place in Sweden since 1981. The objectives of this work include mapping the distribution of wetlands throughout the country and studying their environmental assets and the extent to which they have been affected by human activity. All large wetlands have been studied on aerial photographs and allocated an identification number based on the land-use map sheet. Their size, geographical location and certain key words describing their environmental value and disturbance have been recorded. The areas have been placed in different categories on the basis of their morphology, hydrotopography, vegetation, tree layer, wetness and type of landform. Approximately 10 % of the identified objects have been visited in the field. A lower size limit has been set to make the inventory feasible. In most of the country, only wetlands larger than 10 ha have been considered. However, the limit in the county of Norrbotten is set at 50 ha, and in Skåne (Scania) and on the islands of Gotland and Öland it is 5 ha. Only Norrbotten, furthest north in the country, remains to be investigated, and this is expected to be completed in 2003. When the mapping is accomplished, the database will contain information on 25 000-30 000 freshwater wetlands.

The knowledge available about the environmental qualities to be found in Swedish lakes is very limited and the protection of limnic habitats has therefore taken second place to work on other environments. It is true that a great deal of data exists on water quality, but far less is known about animals and plants, and the way the lakes function ecologically is neglected. Little experience has been gained about how to administratively protect different kinds of lakes and watercourses. For this reason, the National Environment Protection Board in 1999 began a project (Aquatic environments in the landscape) aimed at finding out how to put priority on different limnic objects, how to protect them and how to impart knowledge about the qualities related to aquatic environments.

Marine areas have not achieved the same attention as regards conservation work as terrestrial environments. Several years work put into setting up marine reserves has given few results. Only five protected areas in the marine environment can be said to fulfil all the requirements required for them to be called marine reserves, i.e. to have provisions that regulate the utilisation of the marine resources and an established monitoring programme. Many nature reserves have been established in the archipelagos and elsewhere along the coast, but the regulations laid down for their management normally only aim to protect the qualities they have above water level. Moreover, the Baltic Sea Protected Areas (BSPA) project run by HELCOM (Helsinki Commission - Baltic Marine Environment Protection Commission) is seeking valuable coastal sites in the Baltic Sea to improve their protection, and some ten such areas are relevant on the Swedish side.

As a member of the European Union, Sweden is required to apply the Birds and Habitat Directives. Both require the selection of valuable areas of countryside to form part of the European network of protected areas (Natura 2000). By the end of 2000, Sweden had singled out 395 Special Protection Areas (SPAs) under the terms of the Birds Directive. A large number of these sites were chosen because of the occurrence of wetland birds and the consequent need to ensure the long-term protection of the wetland environment. Table 3.31 shows the proportions of marine and limnic environments within the areas that contain large tracts of wetland.

Table 3.31 The area taken up by EU Birds Directive Special Protection Areas that contain >50 % of wetland, and their relationship to Ramsar sites (January 2001).

SPAs of wetland type	Marine	Inland	Marine + Inland	TOTAL
Number of km ²	1719	6623	88	8430
Number of SPAs	88	173	5	266
Number of SPAs that are part of Ramsar sites	15	35	1	51
Number of SPAs that are part of proposed Ramsar sites	9	12	2	23

Sweden has also proposed that nearly 2500 areas should become Natura 2000 sites under the terms of the Habitat Directive. A large number of these contain various kinds of wetland, which must be classified according to the system agreed by the EU

in connection with the Natura 2000 Network. These are shown in Table 3.32. Oligotrophic lakes, aapa mires and some kinds of swamp woodland are among the types that, in terms of area, dominate the Swedish part of the network.

Table 3.32 The area of various kinds of wetland in sites in Sweden that were part of the EU Habitat Directive Natura 2000 Network in January 2001.

Type of habitat	Natura 2000 habitat code	Area (in thousands of hectares)
COASTAL AND HALOPHYTIC HABITATS		
Sandbanks just covered by sea water at all times	1110	50
Estuaries	1130	9
Mudflats and sandflats above water level at low tide	1140	5
Coastal lagoons	1150	2
Large, shallow inlets and bays	1160	23
Reefs	1170	6
Glassworts <i>Salicornia</i> spp. and other annuals colonising mud and sand	1310	<1
SALT MARSHES AND NARROW INLETS		
Atlantic salt marshes	1330	1
Boreal Baltic coastal salt marshes	1630	3
Boreal Baltic sandy beaches with perennial vegetation	1640	1
Boreal Baltic narrow inlets	1650	<1
Humid dune slacks (wet depressions in sand dunes)	2190	<1
FRESHWATER HABITATS - STANDING WATER		
Oligotrophic water containing few minerals, on sandy plains	3110	2
Oligotrophic to mesotrophic standing water with vegetation of the <i>Littorelletea uniflorae</i> and/or <i>Isoete-Nanojuncetea</i> alliances	3130	302
Hard oligo-mesotrophic waters with benthic stoneworts <i>Chara</i> spp.	3140	23
Naturally eutrophic lakes with <i>Magnopotamion</i> or <i>Hydrochariton</i> -type vegetation	3150	35
Natural dystrophic lakes and ponds	3160	18
FRESHWATER HABITATS - RUNNING WATER		
Fennoscandian natural rivers	3210	25
Alpine rivers and the herbaceous vegetation on their banks	3220	27
		+ 12 000 km
Watercourses of plain to montane levels with <i>Ranunculon fluitans</i> and <i>Calliticho</i> - <i>Batrachion</i> vegetation	3260	2

Type of habitat	Natura 2000 habitat code	Area (in thousands of hectares)
HEATHS		
Northern Atlantic wet heaths with cross-leaved heath <i>Erica tetralix</i>	4010	<1
Purple moor-grass <i>Molinia</i> grassland on peaty or clay-silt soils	6410	13
Northern boreal alluvial meadows	6450	1
MIRES		
Active raised bogs	7110	24
Degraded raised bogs, still capable of natural regeneration	7120	<1
Blanket bog (active)	7130	<1
Transition mires and quaking bogs	7140	71
Fennoscandian mineral-rich springs and spring fens	7160	2
Calcareous fens with great fen-sedge <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> alliance	7210	1
Petrifying springs with tufa formation	7220	<1
Alkaline fens	7230	20
Alpine pioneer formations of the <i>Caricion bicoloris-atrofuscae</i> alliance	7240	4
Aapa mires	7310	470
Palsa mires	7320	27
WET FORESTS		
Fennoscandian deciduous swamp woodland	9080	3
Bog woodland	91D0	52
Residual alluvial forests	91E0	8
Mixed oak-elm-ash forests along large rivers	91F0	<1

Restoring lakes and watercourses

The first attempts to restore Swedish lakes and rivers were made in the 1960s. Until the beginning of the 1980s, the work largely concerned improving the quality of the water in areas polluted by industrial or municipal effluent. Some 25 such projects were carried out between 1969 and 1982. Since then, the work has mostly centred around restoring lakes overgrown by vegetation, the objective in most cases being to return the wetland to a state favouring birds. Some 15 major wetland restoration schemes have been completed or begun in this period. Some of the largest have concerned Swedish Ramsar sites, such as Hjälsaviken, Kvismaren, Lake Hornborga and Getterön.

These schemes have given significantly greater insight into restoration methods, techniques and the machinery needed, and many people have now acquired this knowledge. In general terms, it may be said that the administrative and technical preparations leading up to a restoration effort are often substantial and the time and costs involved then are easily underestimated. However, restoring wetlands into sites suitable for birds has generally proved very successful.

Government funding has often been provided for the larger schemes. However, in several cases, the work has been funded jointly by the Government and various organisations. The Swedish branch of the World Wildlife Fund (WWF) has been involved in restoring wetlands for a long time. In addition to annually supporting several wetland restoration schemes, the association has built up a fund amounting to several million SEK to support work taking place at Tåkern, one of the foremost lakes for birds in the country. The Swedish Hunting Association has, moreover, set up a special wetland fund, the aim of which is to support smaller projects which favour species associated with wetlands, or significantly improve the landscape. This fund has helped to create 162 new wetlands covering approximately 26 km².

Two important new sources of funding have appeared in recent years. Since 1998, the Government has allocated approximately 5.0 billion SEK to 125 municipal authorities in the form of local investment programmes aimed at improving the state of ecosystems within their boundaries. Some of this money has gone to various aquatic environments. In

1998-2000, 156 million SEK went to 88 schemes aimed at improving the biological diversity of wetlands, the sea, lakes and rivers. In the same period, 31 schemes shared 54 million SEK to establish wetlands, primarily with the aim of cleansing sewage and surface runoff water. The local authorities concerned are required to invest an equivalent sum in the scheme.

The second source of funding is the EU. Through measures to improve the environment related to farming, landowners and tenants may obtain grants to restore or create new wetlands on land taken out of cultivation on a long-term basis. These grants are administered by the Swedish agricultural authorities and the County Administrative Boards. So far, however, this scheme has proved less attractive than expected. During 1996-2000, it has funded work on about 1600 hectares of wetland on around 450 farms. Funding from a variety of other sources, principally Life-Nature, is also channelled through the EU. Such projects have concerned several Swedish Ramsar sites (Klingavälsån, Getterön, Lake Hornborga and Östen) and substantial sums have been spent improving wetlands or providing information about them. EU grants generally cover 50 % of the total cost.

Restoration of watercourses has only taken place on a small scale. Some stretches of numerous small rivers and streams have been cleaned to make them more attractive for fish and fishing, largely through efforts by non-profit making organisations. Parts of the River Klingaväl in Scania, which runs through a Ramsar site, were restored in 2001, the aim being to return the river to its former meandering course.

Examples of threats to wetlands

Peat has been utilised for a long time, chiefly as a source of energy, but recently also to improve soil. In 1995, 2.6 million cubic metres of peat were cut to provide power, and just over 1 million cubic metres for soil improvement. Partly due to shifting weather conditions, the volume of peat cut varies greatly from year to year. Since peat cutting totally destroys the original environment, the location of such activities is important.

A great deal of peat is available in Sweden and it is often possible to cut peat without creating conflicts with other interests. Nevertheless, some major conflicts have arisen in recent years when the peat

industry has set its sights on areas that are highly rated in a nature conservation context. As long as achieving a balance between exploitation and conservation interests does not mean that the most valuable areas of mire are left undisturbed, peat cutting must be considered a local threat to the environmental value of the mires. The Act concerning certain Peat Deposits regulates peat cutting. Compared with most other countries, a relatively small percentage, roughly 12 %, of the total area of mire has been disturbed through such exploitation. The annual increase is about 300 ha. Insignificant areas of exploited mires have so far been restored.

No reliable figures exist indicating the rate at which areas of wetland are being changed. Even though some wetlands are restored and others created, the total area is likely to be still decreasing. One reason is that ditching (land drainage) is still being permitted, chiefly in the north of the country. However, there have been far fewer applications to carry out such work for forestry purposes in recent years. At the beginning of the 1990s, there were nearly 1000 such applications annually, but this figure dropped to 25 by 1999. Some ditching still takes place illegally.

Swedish rivers have been exploited as a source of energy for a long time. Particularly rivers in northern Sweden have been regulated to produce hydroelectricity and large land areas have been inundated. In mountainous areas alone, 12 000 km of rivers have been affected by regulation schemes. Approximately 70 % of Swedish rivers are estimated to have been affected by such disturbances.

Only four of the large rivers remain unexploited, the Torne, Kalix, Pite and Vindel. These have been termed national rivers and their protection assets are very high, also from an international perspective. Future exploitation of a further 50 to 60 smaller watercourses or stretches of river has been forbidden. However, provided certain conditions are fulfilled, it is still possible to obtain Government grants to exploit small watercourses for energy purposes. Hydroelectric schemes may thus still locally pose a threat to the natural merits of running water.

A well-known, serious environmental problem in Sweden is the acidification of lakes and rivers. Even though natural acidification takes place, acid preci-

pitiation has been a great problem in recent decades. The impact is greatest in south-west Sweden, where the bedrock in many areas is incapable of compensating for the acid fallout. The acidification results, among other things, in changes to plant communities and the absence of rejuvenation among fish. Heavily acidified lakes have clear water, but few species of plants and animals. Some 17 000 Swedish lakes are now considered to be acidified. In the first instance, the problem has to be tackled through international agreements to reduce the discharge of acidifying substances. Such a reduction has indeed taken place in recent years, but large-scale liming is needed to counter the acidification while waiting for this improvement to show itself in the lakes and rivers. A national plan for liming over the next 10 years was presented in 2000. Each year, some 200 million SEK are being spent on liming, spread over 7000 acidified lakes and rivers. Liming of surrounding wetlands has, however, proved to be potentially very damaging to various peat mosses *Sphagnum* spp. and other organisms.

Through transport via rivers, streams and other watercourses, many lakes and Swedish coastal waters receive enhanced concentrations of various substances, some of which result in negative changes to the environment. The runoff of nutritive substances has received most attention, particularly that from farmland in southern Sweden. Many lakes and associated rivers show enhanced levels of phosphorous. In southern Sweden, the mean concentrations of total phosphorous is around 25 - 50 µg/l in many places, but some lakes and rivers have values close to 100 µg/l.

Wetlands and lakes are more rapidly overgrown and their lifetime shortens; moreover, great changes take place in the plant and animal life in the water and on the shores. Some shallow areas of sea have periodically been hit by lack of oxygen and the total destruction of biological life on the bottom. Excessive fertilisation is a result of deposition of airborne nitrogen oxides and other substances from distant sources, but domestic discharges from traffic, cattle farming and the use of artificial fertilisers add to the problem.

There has recently been a deliberate swing towards the use of renewable sources of energy, including wind power. Government grants have helped to increase interest in the construction of windparks to

produce electricity, these naturally being placed in windy districts, for example on the coast. Conflicts with other interests increase in pace with the growing demand for new locations. As energy policy deliberately favours the development of wind power, conflicts will probably also arise in relation to some coastal wetlands in the years ahead, even though developers are focusing their interest more and more on suitable sites out at sea, especially for large-scale developments.

The problem of oil spills at sea remains, despite attempts over many years to find a solution. Even though oil disasters seldom take place, repeated and deliberate discharges of oil, or of water mixed with oil, take place during transport, especially in the Baltic Sea. The oil residues are often mixed with detergents or solvents, thus damaging the marine environment still more. In the last 30 years, the number of recorded oil spills in Swedish waters has stood at around 300 a year.

In 1999, 326 were confirmed, but none resulted in any measures being taken. Several of the spills resulted in large numbers of sea birds, often several thousand, coming into contact with the oil and dying. Long-tailed ducks *Clangula hyemalis*, occurring in large concentrations in some shallow waters in winter, are particularly seriously hit. The long-term consequences of these recurrent spills on animal and plant life on the sea bed remain largely unclarified. Depending on the wind and currents, the oil may disperse out to sea or be carried to land where it can also damage shore vegetation.

Caring for protected areas

There are almost 2200 nature reserves in Sweden. Many of them require care and attention if their assets are to last. This applies especially to wetlands in cultivated areas and where preservation depends on the presence of grazing livestock. As the numbers of farms and grazing animals have dropped appreciably in recent decades, those who administer the reserves are faced with major challenges when it comes to maintaining the natural merits attached to the areas. On the whole, the increase in the extent of protected areas (chiefly nature reserves) has not resulted in a corresponding growth in funding to take care of them.

Approximately 80 million SEK of the budget of the National Environment Protection Board are allocated annually to the County Administrative Boards to pay for looking after protected areas. As the labour market has been good in recent years, the nature conservation authorities have had fewer opportunities to use cheap manpower derived from measures to generate temporary employment. When all these factors are taken into account, it has often been impossible to maintain the level of aspiration stated in care and maintenance plans. However, in the most recent budget proposal, the Government is providing more funding for looking after nature reserves. Another shortcoming is that around 360 reserves (about 15 %) still lack approved plans for care and maintenance, and a number of these contain wetland.

The task of putting the EU Habitat Directive into practice will gradually enter a phase where it is necessary to secure the qualities that formed the basis for the selection of the areas. It is then a matter of maintaining the favourable conservation status of the habitats and species found in the area. Substantially more resources will be needed if this is to function and if monitoring is to proceed in accordance with the intentions of the directive.

The shooting pressure exerted on wetland birds is significantly less in Sweden than in many countries in central and southern Europe. However, such shooting is an important source of disturbance and means that wetland birds that are resting in autumn are scared away from many sites where they would otherwise have stayed longer. Several nature reserves have limitations on shooting; in some it is entirely forbidden, in others only in parts of the area. There are also regulations permitting shooting except on some closed days. The use of lead shot when shooting in wetlands was banned in 2002.

See Chap. 7 for relevant references.

Examples of wetlands in Sweden

Lake Hornborga - a wetland that was given a new lease of life



Restoration work: The decisive restoration work was performed in 1992-1995, but the immense task of clearing reeds and scrub began much earlier. The final stage of restoration was the stepwise raising of the water level, amounting to about 0.8 m in the northern part of the lake and 1.4 m in the southern part. The cost of the experimental work, the reports and the restoration work itself, undertaken between 1965 and 1995, amounted to approximately 116 billion SEK.

National protection: Since 1997, the area has been a nature reserve measuring 4124 ha.

International status: The lake is listed as a wetland of international importance (a Ramsar site) and also forms part of the EU Natura 2000 Network as an SPA under the terms of the Birds Directive.



Figure 3.27 The black-necked grebe is uncommon and Lake Hornborga has the largest colony in the Nordic countries.

PHOTO: PEDER HEDBERG-FÄLT

Description of the area

Lake Hornborga is one of the best-known wetland and birdwatching sites in Sweden. It has won its fame for two main reasons. For many years, large numbers of common cranes *Grus grus* have used the banks and immediate surroundings of this shallow lake to rest on their spring migration. Close on 10 000 can be seen here at any one time during their journey to their northern nesting sites. The other reason this area has won considerable attention is the large-scale restoration scheme carried out during the 1990s. The large surfaces of open water that used to exist had become choked with vegetation and the ecological function of the lake had collapsed as a consequence of the water level having been lowered on several occasions during the past 150 years to create more and better farmland. The extensive reed beds and scrub spread more and more, partly resulting in a gradual deterioration in the bird life on the lake. In the latter part of the 20th century, this trend resulted in growing public pressure to have the lake restored as a breeding and resting site for wetland birds. Nonetheless, 30 years were to pass from the preparation of the first reports to the restoration plan being implemented. The size of the lake, more than 3000 ha, the ecological, technical and legal difficulties, and the large sums of money required to fulfil the scheme mean that this project probably lacks its counterpart in Europe.

The immense tasks of clearing reeds and scrub and raising the water level by almost a metre have meant that the bird life associated with the lake can flourish again. More and more birds are now using the area for breeding and resting. Ducks and grebes have multiplied and some species that disappeared during the period when the lake level was reduced have now returned (Fig. 3.27). Approximately 125 species nest regularly in the area, and about 275 have been recorded here.

Nowadays, the Hornborga area boasts a considerable range of wetland biotopes, but also some small areas of woodland and cultivated fields. The latter are grazed by various kinds of livestock. The numerous visitors, including many school classes, who come to the lake are well catered for. Few protected sites are able to offer the kind of service given at Lake Hornborga. There are two information centres and several bird-watching towers, hides and nature trails, and those who do not want to roam on their own may book a guided walk.

Bibliography

Hertzman, T. & Larsson, T. 1997. Hornborgasjön – från vasshav till fågelrike. Naturvårdsverket. Rapport 4694.

Sjaunja - one of the largest mires in Europe



Figure 3.28 Sjaunja is probably the largest area of mire in Europe outside Russia. The presence of several uncommon species, large areas that remain undisturbed by people and beautiful scenery give it high conservation value.

PHOTO: STURE WESTERBERG



National protection: The Sjaunja Nature Reserve covers 285 000 ha and was established in 1986.

The reserve is zoned, the most stringent regulations applying in the central part, with the surrounding area acting as a buffer zone.

International status: Sjaunja is listed as an internationally valuable wetland under the jurisdiction of the Ramsar Convention. It is also part of the Lapland World Heritage Area (Laponia) administered by the World Heritage Convention, and belongs to the EU Natura 2000 Network.

Description of the area

Sjaunja (Fig. 3.28) is in the county of Norrbotten, north of a large lake, Stora Lulevattnet. The area boasts a mixture of different kinds of mire, but also has considerable areas of woodland, chiefly coniferous. The eastern part is dominated by low-lying mire, but towards the west the land rises and goes over to dry ground and rocky knolls. The large, flat mires are outstanding and very interesting, not least from an ornithological viewpoint. The area also contains moraines, glaciofluvial deposits, palsa mires and patterned ground.

The animal life is comparatively rich, and some 25 species of mammals have been recorded. Brown bears, lynx and wolverines live in the area most of the time, but wolves are seldom seen nowadays. More than 150 species of birds have been observed. The Sjaunja area has been used for reindeer grazing for a very long time, and also for hunting and fishing. Non-commercial fishing is permitted in some lakes. Since the area lacks organised facilities for tourism and outdoor recreation, relatively few people visit it in summer, when canoes are the best means of transport. In winter, snowmobiles may be used on a few marked trails.

In the 1960s and 1970s, the feasibility of various watercourse regulation schemes in the vicinity of Sjaunja was discussed, and these would have had a significant impact on the pristine character of the area. After many years of debate, the Swedish Parliament approved the regulation of Satishaure, a lake near the south-west border of the area. The amplitude of the present regulation is nearly 20 m, which makes a considerable impact on the original

shores. The River Kaitum, which forms the northern boundary of the Sjaunja area, has figured in several development schemes, but remains unregulated and now enjoys more stringent protection.

The area is now a nature reserve and the Parliament and Government have decided to afford some neighbouring lakes and rivers long-term protection. The principal threat to the area nowadays is disturbance caused by people in connection with the use of snowmobiles and canoes, fishing and reindeer husbandry. Illegal hunting of large predators and birds of prey has also been recorded in the area.

Bibliography

Landell, N.-E. & Holmåsen, I. 1973. Sjaunja. Bonniers.

Lonnstad, J. & Löfroth, M. (eds.) 1994.

Myrskyddsplan för Sverige. Naturvårdsverket.

Löfgren, R. (ed.) 1984. Urskogar. Naturvårdsverket PM 1511.

Naturvårdsverket 1989. Svenska våtmarker av internationell betydelse.

Naturvårdsverket 1996. Lapplands världsarv. Naturvårdsverket.

Färnebofjärden - an alluvial landscape in a transitional area



Figure 3.29 The lower reaches of the River Dal widen to form shallow lakes surrounded by woodland, much of which is regularly flooded. Rapids, alluvial meadows and associated marshes are other important habitats. A great many species, both northern and southern ones, can be found on land and in the water.

PHOTO: ROLF LÖFGREN



National protection: A large part of Färnebofjärden, 10 100 ha, was set aside as a national park in 1998, the 26th national park in Sweden. Just less than half of the park is water. Several adjoining areas have been designated as nature reserves.

International status: In 2001, the area was singled out as a wetland of international importance under the terms of the Ramsar Convention (the Government has not yet approved this). Färnebofjärden and its adjoining area, approximately 14,000 ha in all, is classed as a Special Protection Area (SPA) under the terms of the EU Birds Directive and therefore forms part of the Natura 2000 Network.

Description of the area

Färnebofjärden is on the lowest stretch of the River Dal, one of the largest rivers in Sweden (Fig. 3.29). Because of the flat surroundings, the river spreads out in a series of lakes, called fjärd in Swedish. Färnebofjärden is the uppermost and has rapids at its upstream and downstream ends that are in their natural state. Large parts of the surrounding land are inundated during the spring flood. This lake has more than 200 islets and rocks. The regular floods leave their mark on large parts of the area surrounding Färnebofjärden. They are essential for maintaining the alluvial meadows and deciduous woods, which stand under water for parts of the year and therefore have a special character. Birch and alder swamps are found along the shores, and groves of large, old aspens on slightly higher ground. Several large marshes dotted with old, virgin or little disturbed woods are present around Färnebofjärden. The lower reaches of the River Dal, and hence Färnebofjärden, are situated on the border between the county of Norrland and the rest of Sweden. This boundary, called Limes Norrlandicus, marks a clear shift in the animal and plant life. The mixture of northerly and southerly faunal and floral elements in this area is thus very evident, and has been recognised for hundreds of years.

The bird life is very rich here; more than 100 species of birds regularly nest in the area, and the great variety of habitats means that a large number of species are attached to the woodland, mire and aquatic ecosystems. Many Red List species are

present. All the seven species of woodpecker found in Sweden occur here, as do several owls. Among the birds that can be observed in or close to the aquatic habitats are white-tailed eagles *Haliaeetus albicilla*, ospreys *Pandion haliaetus* (more than 25 pairs) and black-throated divers *Gavia arctica*. Early in spring, when the ice melts, nearly 1000 whooper swans can be seen on the lake. Elk, roe deer and pine martens are common, but lynx, beavers and otters are less common. Brown bears are occasionally seen.

Investigations have shown that Färnebofjärden has an unusually large number of lichens and fungi, and also numerous species of insects, several of them figuring on the Red List. The lake and its surroundings are well known for their huge production of mosquitos which, while providing a rich source of food for many creatures, cause considerable problems for people living in the area. Finally, it should be added that some 20 species of fish can be found in Färnebofjärden, among the highest number recorded in any lake in this part of Sweden.

Bibliography

Föreskrifter och skötselplan för Färnebofjärdens nationalpark.

Lonnstad, J. & Löfroth, M. (eds.) 1994.

Myrskyddsplan för Sverige. Naturvårdsverket.

Naturvårdsverket 1989. Nationalparksplan för Sverige.



Following its restoration, Lake Hornborga has regained its wetland character and contains many different biotopes. It has become one of the most important breeding and resting areas for birds in the Nordic countries.

PHOTO: TORSTEN LARSSON

4 Summary and evaluation of wetland conservation in the Nordic countries

When threats facing wetlands in general and wetland conservation in particular are summarised, data on formal instruments (statutes and regulations) are compiled and follow-ups of EU directives and the Ramsar Convention are assessed, the Nordic nations reveal several similarities, but also great dissimilarities, as the tables below show. As regards the dissimilarities, there proves to be a significant difference in the amount of effort put into certain fields. The individual countries therefore seem to have various kinds of problems to tackle.

A. Threats and analysis of problems

Tables 4.1 and 4.2 outline in general terms the threats to wetlands in the individual countries and particularly within established Ramsar sites, as indicated by the situation described for each country in Chapter 3.

Types and categories of threats:

1. Traffic, wear and tear, disturbance (the buffer zone problem)
2. Refuse dumps and the like
3. Agricultural pollution (eutrophication)
4. Poor conservation provisions, conservation categories
5. Need for care and maintenance, or other measures
6. Sand and gravel extraction, aquaculture and kelp trawling
7. Land becomes naturally overgrown
8. Erosion
9. Encroachments: landfills, road building, watercourse regulations, drainage, etc.

Table 4.1 The most serious threats to wetlands in general in the Nordic countries (the numbers refer to the above summary of threats).

DK	GL	FI	IC	NO	SW
2, 4, 6	1	1, 3, 4, 5, 7	4, 7	1, 3, 4, 7	2, 4, 6

Table 4.2 The most serious threats to Ramsar sites in the Nordic countries (the numbers refer to the above summary of threats).

DK	GL	FI	IC	NO	SW
1, 2, 4, 6	1	1, 4, 5, 7	7	3, 4, 5	3, 4, 6

B. Acts and Regulations

Nature conservation legislation

The first nature conservation legislation in the Nordic countries was introduced at the beginning of the 20th century, and was updated in several stages up to the end of the 1960s. New revisions have taken place since, and during the 1990s almost all the Nordic nations have improved and modernised their nature conservation legislation, at the same time as the general planning tools have been improved with regard to looking after green assets (see Table 4.3). Norway, with its more than 30-year-old legislation, home-ruled Greenland and the Faeroes are lagging behind. It is essential that these countries come abreast with the other Nordic nations and acquire an improved, modernised nature conservation legislation.

Table 4.3 National nature conservation legislation and the last year it was revised.

DK	GL	FI	IC	NO	SW
1994	1981*	1997	1999	1970	2001

* No possibility for regulating traffic or hunting and trapping

General biotope protection

General biotope and habitat protection and a general ban on the destruction of, for example, wetlands, are formal measures that most Nordic nations have introduced during the past 30 years. Here, too,

Norway, Greenland and the Faeroes are at the bottom of the league, as they have not introduced such measures (Table 4.4). It is vital that this shortcoming is rectified.

Table 4.4 National legislation for general biotope conservation.

Country	DK	GL	FI	IC	NO	SW
Regulations for general biotope and habitat conservation	1972	0	1997	0*	0	1991
Regulations for individual biotopes and habitats	1972-1992	0	1981	1999	0	1991

* Authorisation to protect biotopes since 1996.

Shore protection

Most Nordic countries have been trying for a long time to prevent the shore zone along their coasts, lakes and rivers from being ruined by development. The need has been most clearly expressed in the vicinity of cities, towns and other built-up areas, but also in typical holiday areas. Consequently, a ban has been introduced on erecting buildings within a 100 m zone or more of the water. This has functioned excellently in many places, but elsewhere traditions for readily granting exemptions have undermined the intentions of the ban. Even though the protection of shorelines has mostly been motivated by a concern for

the needs of the public for open-air recreation and for aesthetic reasons, it has indirectly also had a positive effect in relation to the wetlands and their flora and fauna. Nowadays, all the Nordic countries except Greenland and the Faeroes have statutes and regulations that take care of shore protection through Special Acts or general planning legislation (Table 4.5).

Shore protection is, moreover, covered by the new EU Water Directive, which will also have consequences for those Nordic countries which are not EU members.

Table 4.5 Situation with regard to statutes and regulations concerning the protection of shores, lakes and rivers.

Country	DK	GL	FI	IC	NO	SW
Shore protection provisions	Nature Protection & Planning and Building Acts	0	Special Act	Nature Conservation & Planning and Building Acts	Planning and Building Act	Part of the Environmental Code
Protection of lakes and rivers	Nature Protection Act	0	Nature Conservation Act	Nature Conservation, Planning and Building & Special Acts	Planning and Building Act & Watercourse Conservation Plans	Part of the Environmental Code

Wetland restoration

Some Nordic nations have come far in their restoration efforts and spend considerable sums of money on restoring wetlands; others are lagging well behind (see Table 3.8). The need for an increased effort is very obvious. The present financial and legal premises for restoration measures vary greatly in the five Nordic countries. Advantage should therefore be

taken of the knowledge gained by others and, to encourage restoration efforts, new funding schemes should be introduced, or existing economic support and cooperation arrangements should be better utilised. Wherever possible, one or preferably more of the following support schemes should be accommodated or, if need be, introduced:

*Recommended measures for wetland restoration***1. Government funds reserved for restoration projects, in line with a long-term plan**

Sums of money to be set aside annually in the National Budget earmarked for restoration of wetlands, including watercourses, based on a systematic selection of alternative sites which pave the way for more long-term involvement. New opportunities to support major schemes requiring longer-term investment must also be made available.

2. Environmental support within the framework of the EU Common Agriculture Policy (CAP) (Denmark, Finland and Sweden)

Subject to certain conditions, landowners and users of land in the European Union may obtain grants from the EU and their own country to construct wetlands and small lakes on land that has been removed from production on a long-term basis. The grants may be used to cover both the construction costs and compensate for the loss of cultivated land. So far, few people in the Nordic countries have availed themselves of this opportunity and efforts should be made to redress this situation.

3. Local investment programmes to improve the ecological durability of society

Local authorities can obtain government grants to enable them to implement various environmental conservation projects in fresh water, salt water or watercourses, in part to create or restore wetlands for the sake of biological diversity, or (as a complement to traditional waste-water cleansing works) as nutrient traps to prevent nitrogen, in particular, from being carried away. Government grants will probably make local authorities more willing to invest in such projects, among elsewhere in agricultural administration. Moreover, joint funding may also make it easier to implement projects they could not tackle alone.

4. More cooperation between authorities and non-profit-making organisations

Several organisations, such as hunting and angling associations, ornithological societies, nature conservation associations and the World Wildlife Fund are heavily involved in matters that relate to the protection of wetlands. In some cases, cooperation has already been established between these and public nature conservation authorities, sometimes with local authorities, too. Closer cooperation should be established with non-profit-making organisations, in part to enhance skills and increase the involvement of local enthusiasts.

C. Nordic cooperation**The Nordic Environmental Action Programme for 2001-2004**

Since the first half of the 1990s, a number of strategic documents have been prepared dealing with the environmental effort being made by the Nordic Council of Ministers, first a Nordic environmental strategy for 1994-1996, which was followed by a second generation strategy for 1996-2000. This report is viewed as a direct follow-up of the Nordic Environmental Action Programme for 2001-2004.

The Nordic Council is simultaneously publishing a brochure on the status of Ramsar work in the Nordic countries (see section F, below). The overriding objective of the 'Biological diversity and genetic resources' project is to "preserve the diversity of plant and animal species and their genetic resources in the Nordic region and neighbouring areas." The wording of this general objective, and that of the specific objectives, covers the problems related with wetland conservation in the Nordic countries.

D. EU directives**Natura 2000 Network**

Within the EU, the implementation of the Birds Directive and the Habitat Directive has been taking place for several years. These two directives form the background for a great deal of effort being made to select sites that form, or will form, the network of protected areas referred to as Natura 2000. This is of great importance for, among other things, wetland conservation in these countries.

The Nordic nations which are not EU members are not taking part in this effort and are therefore lagging far behind their neighbours with respect to evaluating and implementing the demands placed by these directives (see Table 4.6).

In 1996, the EU published a policy for the "wise use of wetlands", but this has still not achieved formal status on a line with similar EU Directives.

E. Bern Convention

Emerald Network

Another international network of important sites is the Emerald Network, overseen by the Bern Convention. This is a voluntary offer to European nations which are not members of the EU, in contrast to the mandatory and legally binding Natura 2000 Network. In the Nordic region, only Iceland has so far begun to implement the Emerald Network. Norway, Greenland and the Faeroes have still not taken steps to include sites in this network (see Table 4.6).

Table 4.6 Implementation of EUs Natura 2000 and Emerald Networks.

Country	DK	GL	FI	IC	NO	SW
Birds Directive	Completed	0	Underway	0	0	Underway
Habitat Directive	Underway	0	Underway	0	0	Underway
Emerald Network	-	0	-	Underway	0	-

F. Ramsar Convention

All the Nordic nations have ratified the international nature conservation agreements, such as the Biodiversity Convention, the Ramsar Convention, the Bonn Convention and the Bern Convention. However, Åland, the Faeroes and Greenland have been granted exemption from some of these agreements. All three are, nevertheless, committed to the Ramsar Convention, although the Faeroes have still not designated any Ramsar sites.

Specific following-up of the Ramsar Convention varies from country to country, particularly as regards the designation of new Ramsar sites, the establishment of monitoring to ensure that the ecological state of designated Ramsar sites is preserved, and not least as regards the following-up of decisions taken by parties to the Convention.

Table 4.7 shows the situation regarding the follow-up of the Ramsar Convention and decisions taken by the parties since the Convention came into force. Several aspects on which the Nordic nations have lagged behind regard measures described under the recently initiated "Outreach programme" run by the Convention, which aims to raise awareness and spread information. Under the "Outreach programme", it is intended that each nation will set up a national working group to continue work on a number of already selected and described measures. The first report on the national follow-up of this programme was presented at the meeting of the parties in 2002. The publication in 2003 of a joint Nordic brochure on Ramsar sites is an example of the follow-up of this programme (see section C, above).

Table 4.7 National follow-up of the Ramsar Convention and other work to protect wetlands.

Measures	DK	GL	FI	IC	NO	SW
Formalised cooperation with non-governmental organisations	Yes	No	Yes	Yes	No	Yes
National Wetland Committee	No	No	No	No	No	Yes
- Official national wetland policy	Partly	Partly	Partly	Partly	No	No
- Regular monitoring of Ramsar sites	Yes	No	Yes	No	No	No
- <u>National plan for restoration work</u>	Partly	No	Partly	Partly	Partly	Partly
- Care and maintenance plans for Ramsar sites (see Table 3.8)	Yes	No	Yes	Yes?	Yes	Yes
National wetland register, incl. area covered	Yes	No	Yes	No	No	Yes
Sectoral integration of Ramsar "wise use" principles						
- Agriculture and forestry	Partly		Yes	No	Partly	Yes
- Fisheries	No		Partly	No	No	Partly
- Petroleum sector	Partly	Yes	Partly	-	Partly	No
- Other industry	Partly		Partly	No	No	Partly
"Perverse incentives" - <u>national grants that lead to the destruction of wetlands</u>	No?	Yes	No	Yes	Yes	No
General nature protection legislation						
- Evaluation & revision	Yes	Started	Yes	Yes	No	Yes
- General biotope protection & automatic "conservation"	Yes	No	Yes	Yes	No	Partly
- General ban on drainage	No	No	No	No	No	Partly
- EIA requirements	Yes	No	Yes	(Yes)	(Yes)	Partly
- Ban on lead shot	Yes	Yes	Yes	No	(Yes)	Yes
Public grants for wetlands						
- International grants ("Small Grants Fund")	No	-	No	?	?	Yes
- General aid	Yes	-	Yes	?	Yes	Yes
- National programmes	Yes	-	Yes	Yes	No	Yes
Outreach programme						
- Skill-improvement programme for nature management	No	No	Yes	No	No	No
- Public training programmes	No	No	No	No	No	No
- Information strategy	No	No	No	No	No	No
Ramsar sites						
- Revise Ramsar Information Sheets	Yes	Yes	Underway	Yes	No	Underway

Montreux Record

The Ramsar Convention has established a voluntary system whereby nations can go to court over matters concerning existing Ramsar sites that are exposed to, or threatened by, potential ecological changes of a negative character. When sites are reported to the Montreux Record, the Ramsar Bureau will set up an international reference group to pursue the matter and seek solutions with the object of securing or re-establishing the ecological conditions as they were when the area became a Ramsar site. Even though significant measures of a technical character have been undertaken and there exist clear threats to designated Ramsar sites, also in the Nordic countries, this system has so far been little applied. This is

probably because the scheme is voluntary and not one which allows, for example, other parties than national authorities to use the Montreux Record as an aid to self-help; for instance, it would have been advantageous if voluntary organisations could have acted.

It seems that national authorities in the Nordic region should have made more effort to use the Montreux Record as a tool to find optimal solutions to secure conservation assets within designated Ramsar sites. The Ramsar Bureau has also realised that the Montreux Record is largely overlooked and far too little used even though there are many Ramsar sites around the world that would have been clear candidates.

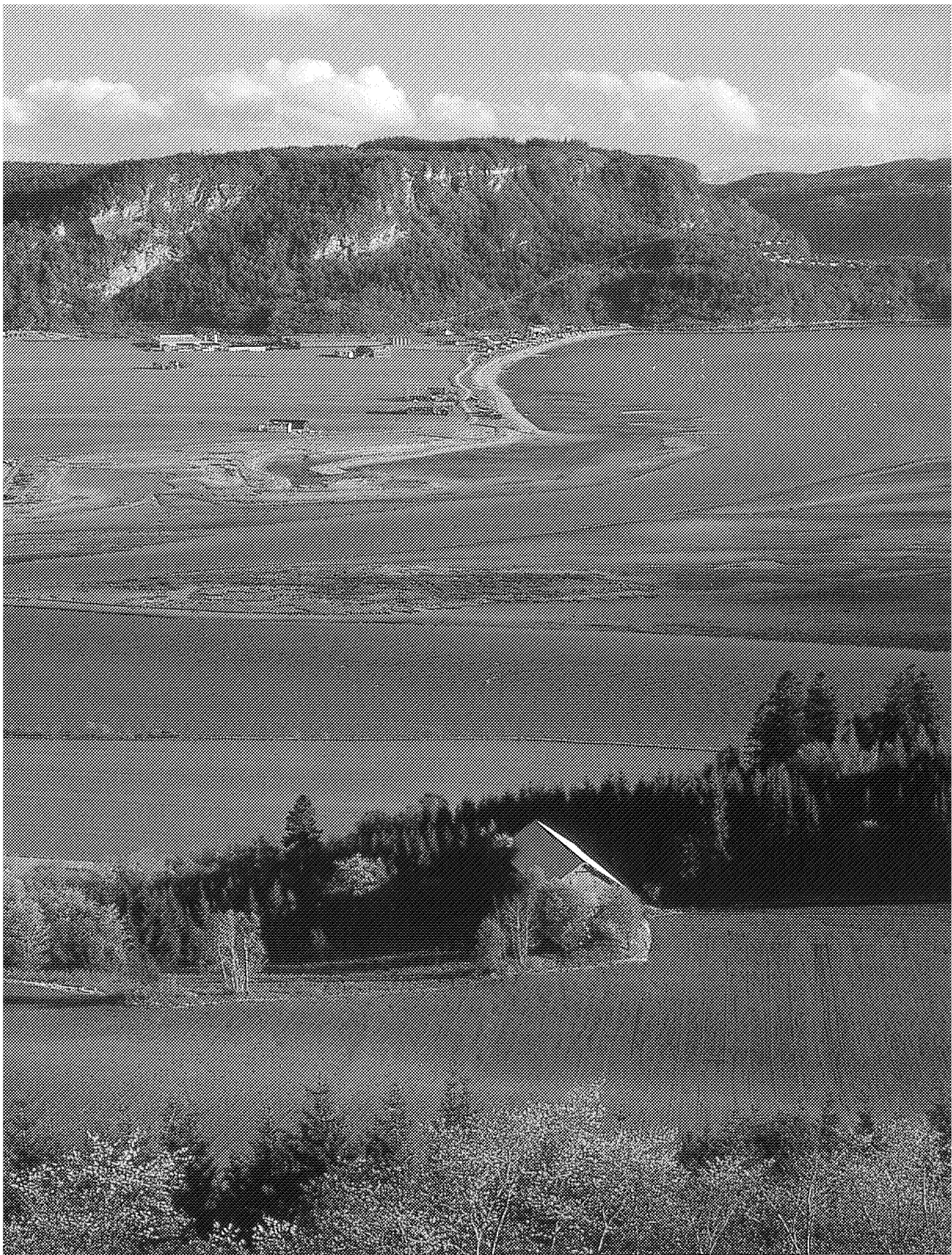
Table 4.8 The use of the Montreux Record in the Nordic countries.

Country	Has been considered	Should be considered	Is or has been listed
Denmark	-	-	Ringkøbing fjord
Iceland	Lake Mývatn	Þjórsárver	-
Finland	-	-	-
Norway	-	Tautra and Øra	-
Sweden	Lake Hornborga	-	-

G. The Biodiversity Convention and PEBLDS Pan-European Biological and Landscape Diversity Strategy - PEBLDS

The Biodiversity Convention, which has some degree of supremacy relative to the Ramsar Convention, has entered into an agreement with the latter regarding mutual cooperation. This agreement stresses that the Ramsar Convention, which possesses special expertise on wetlands, will take the lead in this field. In the case of various international agreements, it will be possible to benefit from synergetic effects by improving the coordination of local or regional projects. The role of the Biodiversity Convention as a

coordinator should therefore be strengthened. The Pan-European Biological and Landscape Diversity Strategy (PEBLDS) has several action themes in which wetlands play a central role, such as the establishment of a Pan-European Ecological Network (cf. the Emerald and Natura 2000 Networks), river ecosystems and related wetlands, and endangered species. It also acts as a sort of coordinator for appropriate organisations which are given responsibility for following up various themes. These initiatives are important, but depend upon national interest for good follow-up and to ensure adequate resources.



Particularly productive areas are found where salt water and fresh water meet to form brackish water. These are vitally important for biological production, including mussels that can be harvested commercially. The protection of deltas is therefore one action theme on which the Pan-European Biological and Landscape Diversity Strategy is focusing. The photograph shows the Gaulosen Ramsar site in Norway.

PHOTO: JON ARNE SÆTER

5 Recommendations

Based on the contents of this document, and the benefit of insight gained from 30 years work on wetland conservation in the Nordic region, knowledge, threats, challenges and requirements are summed up here in the form of a number of recommendations. These are mainly directed at the authorities which have responsibility in this field in the various countries, but also at the Nordic Council of Ministers and institutions beyond the Nordic region. The intention is that the report and its conclusions will help to draw attention to relevant problems and be a positive contribution to discussions on the continued effort for wetland conservation in the Nordic countries.

Recommendations to responsible national authorities in the Nordic countries are:

General aims

* The countries that have achieved least in wetland conservation should support the general Nordic aim to strive after the countries that have achieved most. This also applies to the self-governing areas of Åland, the Faeroes and Greenland. It concerns, among other things, drawing up better formal means (national legislation, organisation and management tools).

* "Wise use" principles should be implemented in every relevant sector and the various sectors should be better coordinated, for instance as regards the use of grant schemes.

Accommodation to EU Directives

* Both Nordic nations which are EU members and those which are not should comply with the EU Birds and Habitat Directives, and the Nordic EU nations should aim to make better use of EU grants that are available for restoring wetlands under the CAP and LIFE schemes.

Follow-up of the Emerald Network

* Non-EU members among the Nordic nations should implement the Emerald Network, and a schedule for this should be agreed.

National follow-up of protected wetlands

* Protected wetlands, like other protected areas, should be managed in keeping with an overall national policy and the principle of equal treatment, and be assured adequate management by institutions possessing the required professional skills and practical experience on a level commensurate with any obligations that may be encountered in the individual site.

Follow-up of the Ramsar Convention

* Shortcomings in following up obligations stipulated by the Ramsar Convention should be attended to.

* Existing Ramsar sites in the Nordic region should be critically investigated every 5th year with regard to assessing their status, developmental trends, requirements for active management measures and, at worst, proposed listing on the Montreux Record.

* Management plans should be drawn up for all Ramsar sites.

* National wetland committees should be set up in all the Nordic countries, and relevant NGOs should be represented on them.

* Focus should be placed on acquiring more knowledge and improving training and information.

Greater effort to restore wetlands

* More wetlands should be restored in keeping with national plans where the scientific and management priorities are applied regionally. Wherever possible, the following grant schemes should be accommodated or, where necessary, introduced in countries where this has not already taken place:

- long-term plans and annual economic frameworks for restoration projects
- environmental grants within the framework of the EU common agricultural policy
- local investment programmes to improve biological diversity and government grants to local authorities to enable the implementation of a range of environmental projects.

Use of volunteers

* Scientifically oriented NGOs (non-governmental organisations, i.e. national, voluntary organisations of interested individuals) should be drawn into the follow-up effort to supervise, perform practical work, record species, etc., and cooperation with these should be improved. This particularly applies to organisations that are specially interested in matters relating to wetlands and their preservation.

Recommendations to the Nordic Council of Ministers are:

* Improving wetland conservation in the Nordic countries should become an integral part of the overriding and specific objectives in the "Biological diversity and genetic resources" project in the follow-up of the Nordic Environmental Action Programme for 2001-2004 and its continuation.

* Priority should be given to arranging a seminar to follow up this report, and international decisions should be taken in connection with the Ramsar Convention and, in that context, other relevant Conventions and EU Directives, etc. Relevant topics should include joint Nordic measures to improve information.

Recommendations to the EU Environmental Conservation Directorate are:

* The document "Wise use of wetlands" should be elaborated on with the aim of formalising its objectives, for instance by supplementing the Water Directive.

* The regulations pertaining to environmental grants available through the EU common agricultural policy should be worded in such a way that they encourage landowners to take care of wetlands and create or restore small wetlands in the agricultural landscape.

* Work concerned with Natura 2000 and the Emerald Network should be coordinated.

Recommendations to the Ramsar Bureau are:

* The Ramsar Bureau should continue to improve its follow-up and contact with the individual signatory nations with a view to ensuring a good follow-up of the Convention and the decisions taken by the signatories.

* The Ramsar Bureau and the nations which have signed the Ramsar Convention should put emphasis on coordinating and cooperating with other Conventions in relevant fields to achieve better attainment of objectives and utilisation of resources.

6 Appendix

Appendix 6.1 Definition of habitats with a wetland character that were covered by the Habitat Directive when Finland and Sweden became members of the European Union.

1610	Baltic esker islands with sandy, rocky and shingle beach vegetation and sublittoral vegetation
1620	Boreal Baltic islets and small islands
1630	Boreal Baltic coastal meadows
1640	Boreal Baltic sandy beaches with perennial vegetation
1650	Boreal Baltic narrow inlets
3210	Fennoscandian natural rivers
6450	Northern boreal alluvial meadows
7160	Fennoscandian mineral-rich springs and spring fens
7310	Aapa mires
7320	Palsa mires
9080	Fennoscandian deciduous swamp woodlands

See Swedish Nature Conservation Board (1997) for additional details.

Appendix 6.2 Red-listed vertebrates and vascular plants associated with Nordic wetlands, based on the categories Extinct to Vulnerable (cf. IUCN categories EW-VU) in the national Red Lists. Salt-water fish and birds entirely confined to marine habitats are not included, except for Iceland.

Birds

Denmark	Finland	Iceland	Norway	Sweden
Regionally extinct	Regionally extinct	Regionally extinct	Regionally extinct	Regionally extinct
<i>Acrocephalus arundinaceus</i>	<i>Gallinago media</i>	<i>Rallus aquaticus</i>	<i>Charadrius alexandrinus</i>	<i>Ciconia ciconia</i>
<i>Crex crex</i>	Critically endangered	Critically endangered	Endangered	<i>C. nigra</i>
<i>Gallinago media</i>	<i>Anser erythropus</i>	<i>Aythya ferina</i>	<i>Anser erythropus</i>	Critically endangered
<i>Larus minutus</i>	<i>Calidris alpina schinzii</i>	<i>Numenius arquata</i>	<i>Crex crex</i>	<i>Anser erythropus</i>
<i>Netta rufina</i>	<i>Xenus cinereus</i>	<i>Tadorna tadorna</i>	<i>Calidris alpina schinzii</i>	<i>Charadrius alexandrinus</i>
<i>Platalea leucorodia</i>	Endangered	Endangered	<i>Larus fuscus fuscus</i>	Seriously endangered
<i>Podiceps auritus</i>	<i>Falco peregrinus</i>	<i>Anas clypeata</i>	<i>Motacilla flava flava</i>	<i>Circus pygargus</i>
<i>Sterna caspia</i>	<i>Limosa limosa</i>	<i>Branta leucopsis</i>	<i>M. flava flavissima</i>	<i>Crex crex</i>
Critically endangered	<i>Sterna albifrons</i>	<i>Bucephala islandica</i>		<i>Larus fuscus fuscus</i>
<i>Asio flammeus</i>	Vulnerable	<i>Haliaeetus albicilla</i>		<i>Podiceps nigricollis</i>
<i>Charadrius alexandrinus</i>	<i>Acrocephalus arundinaceus</i>	<i>Phalaropus fulicarius</i>		<i>Sterna caspia</i>
<i>Chlidonias niger</i>	<i>Aythya marila</i>	Vulnerable		Vulnerable
<i>Ciconia ciconia</i>	<i>Calidris temminckii</i>	<i>Anas strepera</i>		<i>Botaurus stellaris</i>
<i>Cinclus cinclus</i>	<i>Chlidonias niger</i>	<i>Anser anser</i>		<i>Alcedo atthis</i>
<i>Pandion haliaetus</i>	<i>Gallinula chloropus</i>	<i>Asio flammeus</i>		<i>Anas querquedula</i>
<i>Pluvialis apricaria</i>	<i>Haliaeetus albicilla</i>	<i>Gavia immer</i>		<i>Aythya ferina</i>
Vulnerable	<i>Larus fuscus fuscus</i>	<i>Melanitta nigra</i>		<i>A. marila</i>
<i>Anas acuta</i>	<i>L. ridibundus</i>	<i>Mergus merganser</i>		<i>Calidris alpina schinzii</i>
<i>A. penelope</i>	<i>Sterna caspia</i>	<i>Podiceps auritus</i>		<i>Chlidonias nigra</i>
<i>A. querquedula</i>	<i>Uria aalge</i>			<i>Haliaeetus albicilla</i>
<i>Arenaria interpres</i>		Marine species:		<i>Limosa lapponica</i>
<i>Circus pygargus</i>		Extinct		<i>L. limosa</i>
<i>Philomachus pugnax</i>		<i>Pinguinus impennis</i>		<i>Podiceps auritus</i>
<i>Porzana porzana</i>		Regionally extinct		<i>Porzana porzana</i>
<i>Tringa glareola</i>		<i>Alle alle</i>		<i>Remiz pendulinus</i>
<i>T. ochropus</i>		Critically endangered		<i>Sterna albifrons</i>
		<i>Anthus petrosus</i>		<i>S. sandvicensis</i>
		Vulnerable		<i>Tachybaptus ruficollis</i>
		<i>Hydrobates pelagicus</i>		
		<i>Morus bassanus</i>		
		<i>Oceanodroma leucorhoa</i>		
		<i>Puffinus puffinus</i>		
		<i>Uria lomvia</i>		

Mammals

Denmark	Finland	Iceland	Norway	Sweden
Critically endangered	Regionally extinct	-	Conservation dependent	Critically endangered
<i>Halochoerus gryphus</i>	<i>Musteola lutreola</i>		<i>Lutra lutra</i>	<i>Myotis bechsteinii</i>
Vulnerable	Endangered			Seriously endangered
<i>Lutra lutra</i>	<i>Phoca hispida saimensis</i>			<i>Myotis dasycneme</i>
<i>Myotis dasycneme</i>				Vulnerable
				<i>Lutra lutra</i>
				<i>Myotis mystacinus</i>
				<i>M. natterei</i>

Amphibians

Denmark	Finland	Iceland	Norway	Sweden
Critically endangered	Vulnerable	-	Endangered	Critically endangered
<i>Bombina bombina</i>	<i>Triturus cristatus</i>		<i>Triturus cristatus</i>	<i>Bufo viridis</i>
<i>Rana ridibunda</i> / <i>R. esculenta</i>			<i>Rana lessonae</i>	Seriously endangered
Vulnerable			Vulnerable	<i>Bombina bombina</i>
<i>Bufo viridis</i>			<i>Triturus vulgaris</i>	<i>Bufo calamita</i>
<i>Pelobates fuscus</i>			Rare	<i>Pelobates fuscus</i>
<i>Rana ridibunda</i>			<i>Rana arvalis</i>	Vulnerable
				<i>Natrix natrix</i>
				<i>Rana dalmatina</i>
				<i>R. lessonae</i>

Fish

Denmark	Finland	Iceland	Norway	Sweden
Regionally extinct	Regionally extinct	-	Rare	Regionally extinct
<i>Acipenser sturio</i>	<i>Acipenser sturio</i>		<i>Aspius aspius</i>	<i>Acipenser sturio</i>
<i>Cottus gobio</i>	<i>Silurus glanis</i>		<i>Myoxocephalus</i>	Critically endangered
Critically endangered	Extinct in the wild		<i>quadricornis</i>	<i>Coregonus pelad</i>
<i>Alosa alosa</i>	<i>Salmo salar m. sebago</i>		<i>Cottus gobio</i>	<i>C. tryboni</i>
<i>A. fallax</i>	Critically endangered			<i>Silurus glanis</i>
<i>Misgurnus fossilis</i>	<i>Salvelinus alpinus</i> (Lake Saimaa stock)			Seriously endangered
<i>Noemacheilus barbatulus</i>	Endangered			<i>Lampræta fluviatilis</i>
<i>Salmo salar</i>	<i>Cobitis taenia</i>			<i>Petromyzon marinus</i>
Vulnerable	<i>Salmo salar</i>			Vulnerable
<i>Cobitis taenia</i>	<i>S. trutta</i> (anadromic)			<i>Aspius aspius</i>
	Vulnerable			<i>Leucaspisus delineatus</i>
	<i>Aspius aspius</i>			<i>Salmo salar</i> (wild stock)
	<i>Coregonus lavaretus</i> "lavaretus"			<i>Salvelinus umbla</i> (s.)
	<i>C. lavaretus</i> "pallasi"			

Vascular plants

Denmark	Finland	Iceland	Norway	Sweden
Regionally extinct	Regionally extinct	Endangered in the wild	Regionally extinct	Regionally extinct
<i>Alisma gramineum</i>	<i>Carex maritima</i>	<i>Primula egalikensis</i>	<i>Ceratophyllum submersum</i>	<i>Alisma gramineum</i>
<i>Bidens radiata</i>	<i>Herminium monorchis</i>	Critically endangered	<i>Coleanthus subtilis</i>	<i>Bassia hirsuta</i>
<i>Corrigiola litoralis</i>	<i>Stellaria humifusa</i>	<i>Crassula aquatica</i>	<i>Groenlandia densa</i>	<i>Cirsium rivulare</i>
<i>Euphrasia rostkoviana</i>	Critically endangered	<i>Galium palustre</i>	<i>Lemna gibba</i>	<i>Cyperus fuscus</i>
<i>Helosciadium repens</i>	<i>Arctophila fulva pendulina</i>	<i>Juncus gerardii</i>	<i>Liparis loeselii</i>	<i>Euphrasia scotica</i>
<i>Leersia oryzoides</i>	<i>Najas flexilis</i>	Endangered	<i>Phleum arenarium</i>	<i>Groenlandia densa</i>
<i>Pedicularis sceptrumcarolinum</i>	<i>Polygonum oxyspermum</i>	<i>Carex flava</i>	<i>Tetragonolobus maritimus</i>	<i>Pyrola rotundiflora</i> ssp. <i>maritima</i>
<i>Polygonum viviparum</i>	<i>Salix pyrifolia</i>	<i>C. heleonastes</i>	Endangered	<i>Solanum villosum</i> ssp. <i>miniatum</i>
Critically endangered	<i>Stellaria crassifolia</i> var. <i>minor</i>	<i>Hippuris tetraphylla</i>	<i>Aster sibiricus</i>	<i>Trapa natans</i>
<i>Callitriche palustris</i>	<i>Sium latifolium</i>	<i>Hydrocotyle vulgaris</i>	<i>Baldellia repens</i>	Critically endangered
<i>Carex buxbaumi</i>	Endangered	<i>Isoetes lacustris</i>	<i>Berula erecta</i>	<i>Apium graveolens</i>
<i>C. maritima</i>	<i>Anagallis minima</i>	<i>Veronica anagallis-aquatica</i>	<i>Blysmus compressus</i>	<i>Arctophila fulva</i>
<i>C. pauciflora</i>	<i>Botrychium simplex</i>		<i>Botrychium simplex</i>	<i>Atriplex portulacoides</i>
<i>C. paleacea</i>	<i>Cardamine parviflora</i>		<i>Callitriche brutia</i>	<i>Carex atherodes</i>
<i>Crassula aquatica</i>	<i>Carex hartmanni</i>		<i>Epilobium obscurum</i>	<i>Chrysosplenium oppositifolium</i>
<i>Cyperus fuscus</i>	<i>C. lepidocarpa</i> ssp. <i>lepidocarpa</i>		<i>E. parviflorum</i>	<i>Equisetum telmateia</i>
<i>Dactylorhiza praetermissa</i>	<i>C. microglochin</i>		<i>Gentianella baltica</i>	<i>Hippuris tetraphylla</i>
<i>Eriophorum gracile</i>	<i>C. vulpina</i>		<i>Glyceria notata</i>	<i>Juncus anceps</i>
<i>Illecebrum verticillatum</i>	<i>Cladium mariscus</i>		<i>Herminium monorch.</i>	<i>Melilotus dentatus</i>
<i>Juncus alpinus</i> ssp. <i>alpinus</i>	<i>Epilobium laestadii</i>		<i>Hydrocharis morsus-ranae</i>	<i>Najas flexilis</i>
<i>Najas flexilis</i>	<i>Hippuris tetraphylla</i>		<i>Isolepis fluitans</i>	<i>Ranunculus cymbalaria</i>
<i>N. marina</i>	<i>Liparis loeselii</i>		<i>Juncus acutiflorus</i>	<i>R. ophioglossifolius</i>
<i>Potamogeton rutilus</i>	<i>Najas tenuissima</i>		<i>Luronium natans</i>	<i>Rorippa microphylla</i>
<i>Subularia aquatica</i>	<i>Primula nutans</i> var. <i>jokelae</i>		<i>Microstylis monop.</i>	<i>Scutellaria minor</i>
<i>Viola epipsila</i>	<i>Puccinella phryganodes</i>		<i>Najas flexilis</i>	<i>Stellaria fennica</i>
	<i>Rumex maritimus</i>		<i>Oenanthe aquatica</i>	<i>Taraxacum austrinum</i>
	<i>Salicornia europaea</i>		<i>Pilularia globulifera</i>	<i>Tephrosieris palustris</i>
	<i>Samolus valerandi</i>		<i>Polygonum oxyspermum</i>	
			ssp. <i>oxyspermum</i>	Seriously endangered
	<i>Suaeda maritima</i>		<i>Potamogeton compressus</i>	<i>Alisma wahlenbergii</i>
	<i>Viola uliginosa</i>		<i>Salicornia dolichostachya</i>	<i>Astragalus danicus</i> poja.
	Vulnerable		<i>Silene tatarica</i>	<i>Baldellia repens</i>
	<i>Alisma wahlenbergii</i>		<i>Stellaria fennica</i>	<i>Botrychium simplex</i>
	<i>Blysmus compressus</i>		Vulnerable	<i>Carex maritima</i>
	<i>Carex appropinquata</i>		<i>Arctophila fulva</i>	<i>Gentianella camp.</i> ssp. <i>baltica</i>
	<i>C. bohemia</i>		<i>Arenaria serp.</i> lloy.	<i>Hordeum secalina</i>
	<i>C. heleonastes</i>		<i>Beta vulgaris</i> marit.	<i>Luronium natans</i>
	<i>C. hostiana</i>		<i>Carex extensa</i>	<i>Nymphaea alba</i> ssp. <i>occidentalis</i>
	<i>C. lepidocarpa</i> ssp. <i>jemtlandica</i>		<i>C. punctata</i>	<i>Parapholis strigosajemtlandica</i>
	<i>C. paniculata</i>		<i>C. riparia</i>	<i>Polygonum avi.</i> ssp. <i>excelsius</i>
	<i>C. pulicaris</i>		<i>C. viridula</i> var. <i>bergrothii</i>	<i>P. oxyspermum</i>
	<i>C. viridula</i> var. <i>bergrothii</i>		<i>Cladium mariscus</i>	<i>Potamogeton rutilus</i>
	<i>Dactylorhiza incarnata</i>		<i>Dactylorhiza purpurella</i>	<i>P. trichoides</i> ssp. <i>cruenta</i>
	<i>D. lapponica</i>		<i>Deschampsia setacea</i>	<i>Ranunculus hederaceus</i>
	<i>D. traunsteineri</i>		<i>Elymus fibrosus</i>	<i>Rumex conglomeratus</i>
	<i>Elatine alsinastrum</i>		<i>E. macrourus</i>	<i>Sisyrinchium montanum</i>
	<i>Epipactis palustris</i>		<i>Epipactis palustris</i>	<i>Taraxacum lissocarpum</i>
	<i>Gentianella uliginosa</i>		<i>Euphrasia confusa</i>	<i>T. vestrogothium</i>
	<i>Leersia oryzoides</i>		<i>Gentianella uliginosa</i>	Vulnerable

Vascular plants

Denmark	Finland	Iceland	Norway	Sweden
	<i>Malaxis monophyllos</i>		<i>Glyceria declineata</i>	<i>Apium inundatum</i>
	<i>Primula stricta</i>		<i>Gymnadenia nigra</i>	<i>Atriplex pedunculata</i>
	<i>Ranunculus reptapundus</i>		<i>Isolepis setacea</i>	<i>Cardamine parviflora</i>
	<i>Sagina maritima</i>		<i>Juncus foliosus</i>	<i>Bidens parviflora</i>
	<i>Salix lanata glandulifera</i>		<i>Lythrum portula</i>	<i>Carex heleonastes</i>
	<i>Saxifraga hirculus</i>		<i>Najas marina</i>	<i>C. punctata</i>
	<i>Schoenus ferrugineus</i>		<i>Pedicularis sylvatica</i> ssp.	<i>Catabrosa aquatica</i>
	<i>Scirpus radicans</i>		<i>hibernica</i>	
	<i>Silene tatarica</i>		<i>Persicaria foliosa</i>	<i>Centaurium erythraea</i>
	<i>Viola persicifolia</i>		<i>Phippsia concinna</i>	<i>Elatine hexandra</i>
			<i>Potamogeton pusillus</i>	<i>E. orthosperma</i>
			<i>P. vaginatus</i>	<i>Gentiana pneumonante</i>
			<i>Puccinella finmarchia</i>	<i>G. purpurea</i>
			<i>Pyrola rotundifolia</i> ssp.	<i>Geranium palustre</i>
			<i>maritima</i>	
			<i>Ranunculus lingua</i>	<i>Hermineum monorchis</i>
			<i>Rumex maritimus</i>	<i>Microstylis monophyllos</i>
			<i>Silene furcatum</i> ssp.	<i>Montia arvensis</i>
			<i>angustiflorum.</i>	
			<i>Veronica anagalis-aquatica</i>	<i>Myricaria germanica</i>
			<i>Viola persicifolia</i>	<i>Isolepis setacea</i>
			<i>Zannichellia palustris</i> var	<i>Oenanthe lachenalli</i>
			<i>major</i>	
			<i>Zostera noltii</i>	<i>Orchis palustris</i>
				<i>Persicaria foliosa</i>
				<i>Pilularia globulifera</i>
				<i>Potamogeton acutifolius</i>
				<i>P. coloratus</i>
				<i>P. compressus</i>
				<i>P. friesii</i>
				<i>Primula natans</i>
				<i>Radiola linoides</i>
				<i>Ranunculus fluitans</i>
				<i>Rorippa nasturtium-aquaticum</i>
				<i>Rosa acicularis</i>
				<i>Salix hastata</i>
				<i>Senecio aquaticus</i>
				<i>S. paludosus</i>
				<i>Sparganium erectum</i> ssp. <i>occarpum.</i>
				<i>Taraxacum crocodes</i>
				<i>T. decolorans</i>
				<i>T. egregium</i>
				<i>T. praestans</i>
				<i>T. pseudosuecicum</i>
				<i>Trisetum subalpestre</i>
				<i>Zostera angustiflora</i>
				<i>Z. noltii</i>

Sources: Denmark: Stoltze, M. & Pihl, S. (eds). 1998. Red List 1997 of plants and animals in Denmark. Ministry of the Environment and Energy; Greenland: No Red Lists exist; Finland: Rassi, P., Alanen, A., Kanerva, T. & Mannerkoski, I. (eds.). 2000. The 2000 Red List of Finnish species. Ministry of the Environment. Helsinki. 432 pp. The II Committee for the Monitoring of Threatened Species in Finland, pre-print. Iceland: Náttúrufræðistofnun Ísland. 1996. Válisti 1. plöntur. Reykjavík & Náttúrufræðistofnun Ísland. 2000. Válisti 2. Birds, Reykjavík. Norway: Størksen, Ø.R. 1999. National Red List of endangered species in Norway 1998. Directorate for Nature Management, Trondheim. 161 pp.; Sweden: Gärdenfors, U. (ed.). 2000. Red-listed species in Sweden 2000. ArtDatabanken, SLU, Uppsala.

Appendix 6.3 Criteria (A, B, C) for identification of Important Bird Areas (IBAs), based on Heath & Evans (2000).

A - Global assessment*A1 Areas with globally endangered species*

Localities which regularly contain the following globally endangered species: lesser white-fronted goose, Steller's eider, white-tailed eagle, corn crane and great snipe.

A2 Areas containing species with a limited distribution

Localities that are important for species with a limited distribution, because they are either an "Endemic Bird Area" (EBA) or a "Secondary Area" (SA).

A3 Areas with species that are confined to one habitat region

Localities that contain a substantial number of species whose breeding population is largely confined to one habitat region. Only species attached to wetland are listed here. Arctic/tundra habitat: yellow-billed diver, tundra swan, pink-footed goose, tundra goose, white-fronted goose, brent goose, greater scaup, king eider, long-tailed duck, black scoter, grey plover, red knot, sanderling, little stint, Temminck's stint, purple sandpiper, bar-tailed godwit, spotted redshank, red-necked phalarope, pomarine skua, long-tailed skua, glaucous gull, ivory gull. Boreal habitat: slawonian grebe, smew, jack snipe, common greenshank, rustic bunting.

A4 Areas with larger aggregations

- i) Regular occurrence of at least 1 % of the global population
- ii) Regular occurrence of at least 20,000 aquatic birds or 10,000 pairs of sea birds

B - European regional assessment*B1 Areas with large aggregations*

Occurrence of at least 1 % of the 'flyway' population or some other limited population.

B2 Areas with species having poor conservation status in Europe

Areas in a country that are important for species with poor conservation status in Europe and where area conservation is thought to have a favourable effect (called SPEC 2 and 3 species), (countries that have >1 % of the known minimum European population and important areas must have >1 % of the known minimum national population).

B3 Areas with species having good conservation status and whose main distribution is in Europe

Areas in a country that are important for species with good conservation status in Europe, but which are distributed mainly in Europe (called SPEC 4 species) and area conservation is thought to have a favourable effect.

C - Assessments within the EU - Important Bird Areas qualifying under Article 4 of the Birds Directive*C1 Areas with globally endangered species**C2 Areas with concentrations of species that are endangered in the EU region*

Regular occurrence of at least 1 % of the 'flyway' population or the population is endangered in the EU (on List 1 in the Birds Directive).

C3 Areas with concentrations of migrating species that are not endangered in the EU region

Regular occurrence of at least 1 % of the 'flyway' population that is not thought to be endangered in the EU (not on List 1 in the Birds Directive).

C4 Areas with large occurrences

Areas which regularly contain at least 20,000 aquatic birds or 10,000 pairs of sea birds.

Appendix 6.4 Bird species attached to wetlands in the Nordic countries with the threshold for identification of important wetlands globally and in Europe. Nordic countries which fulfil the criteria are shown with the maximum number of individuals in winter or summer. Minimum figures are used (Heath & Evans 2000).

Species	A - Global level 1 % of population	B - European level (figures for N or NW Europe) 1 % of the flyway population	Responsibility species in the Nordic countries SPEC 1-4
<i>G. stellata</i>	750	750	X
<i>G. arctica</i>	1200	1200	X
<i>G. immer</i>	50	50	-
<i>T. ruficollis</i>	1000	1000	-
<i>P. cristatus</i>	3000	1500	-
<i>P. grisegena</i>	400	150	-
<i>P. auritus</i>	300	50	-
<i>P. nigricollis</i>	1000	1000	-
<i>P. carbo</i>	4200	1200	-
<i>P. aristotelis</i>	2700	2500	X
<i>B. stellaris</i>	-	Winter	X
<i>A. cinerea</i>	4500	4500	-
<i>C. nigra</i>	210	10	X
<i>C. ciconia</i>	4850	-	X
<i>C. olor</i>	2900	2100	-
<i>C. columbianus</i>	175	170	X
<i>C. cygnus</i>	730	400	X
<i>A. fabalis</i>	3800	800	-
<i>A. brach.</i>	2600	340	X
<i>A. albifrons</i>	12 800	6000	-
<i>A. erythropus</i>	250	250	X
<i>A. anser</i>	3500	2000	-
<i>B. leucopsis</i>	2200	50 Sv/1760-W. Europe	X
<i>B. bernicla</i>	3250	50 Sv/3000-W. Europe	X
<i>T. tadorna</i>	3750	3000	-
<i>A. penelope</i>	18 000	12 500	-
<i>A. strepera</i>	1300	300	X
<i>A. crecca</i>	14 000	4000	-
<i>A. plat.</i>	83 000	10 000	-
<i>A. acuta</i>	12 600	600	X
<i>A. querq.</i>	20 000	20 000	X
<i>A. clypeata</i>	4900	400	-
<i>A. ferina</i>	13 500	3500	X
<i>A. fuligula</i>	16 000	10 000	-
<i>A. marila</i>	4600	3100	X
<i>S. mollissima</i>	18 830	13 500 DK/3000NO 400 Sv/300GL 600IC	
<i>S. spectabilis</i>	3000	3000	-
<i>P. stelleri</i>	300	300	X

Species	A - Global level 1 % of population	B - European level (figures for N or NW Europe) 1 % of the flyway population	Responsibility species in the Nordic countries SPEC 1-4
<i>H. histrionicus</i>	90	75 IC/15GL	X
<i>C. hyemalis</i>	4750	1500 IC-GL 46000-N.Europe	-
<i>M. nigra</i>	16 000	16 000	-
<i>M. fusca</i>	10 000	10 000	X
<i>B. islandica</i>	-	-	X
<i>B. clangula</i>	4200	3000	-
<i>M. albellus</i>	900	250	X
<i>M. serrator</i>	1850	1250 -N.Europe 200GL-IC	-
<i>M. merganser</i>	2200	10 IC/2000-NW.Europe	-
<i>H. albicilla</i>	5p	?	X
<i>C. aeruginosus</i>	?	?	-
<i>C. cyaneus</i>	-	-	X
<i>P. haliaetus</i>	-	-	X
<i>R. aquaticus</i>	-	-	-
<i>P. porzana</i>	-	60p	X
<i>C. crex</i>	20p	20p	X
<i>G. chloropus</i>	10 000	10 000	-
<i>F. atra</i>	40 000	15 000	-
<i>G. grus</i>	1550	600	X
<i>H. ostralegus</i>			
<i>R. avosetta</i>	1100	700	-
<i>C. dubius</i>	3200	3200	-
<i>C. hiaticula</i>	2400	2400	-
<i>C. alexandrinus</i>	950	-	X
<i>C. morinellus</i>	1000	1000	-
<i>P. apricaria</i>	10 000	10 000	X
<i>P. squatarola</i>	1500	1500	-
<i>V. vanellus</i>	70 000	70 000	-
<i>C. canutus</i>	8500	3500	X
<i>C. alba</i>	1200	1200	-
<i>C. minuta</i>	2100	2100	-
<i>C. temminckii</i>	3000	3000	-
<i>C. ferruginea</i>	4500	4500	-
<i>C. maritima</i>	500	500	X
<i>C. alpina</i>	22 000	14 000 /8000 IC 150 GL	X
<i>L. falcinellus</i>	250	250	X
<i>P. pugnax</i>	33 000	33 000	X
<i>L. minimus</i>	660	660	X
<i>G. gallinago</i>	54 000	47 000 /7500 IC	-
<i>G. media</i>	300	75	X
<i>S. rusticola</i>	-	-	X
<i>L. limosa</i>	4200	3500 /700 IC	X
<i>L. lapponica</i>	1000	1000	X
<i>N. phaeopus</i>	6500	6500	X
<i>N. arquata</i>	3500	3500	X

Species	A - Global level 1 % of population	B - European level (figures for N or NW Europe) 1 % of the flyway population	Responsibility species in the Nordic countries SPEC 1-4
<i>T. erythropus</i>	720	720	-
<i>T. totanus</i>	3000	1500	X
<i>T. nebularia</i>	1800	1800	-
<i>T. ochropus</i>	10 000	10 000	-
<i>T. glareola</i>	11 000	11 000	X
<i>A. hypoleucos</i>	15 000	15 000	-
<i>A. interpres</i>	700	700	-
<i>P. lobatus</i>	-	-	-
<i>P. fulicarius</i>	-	-	-
<i>L. minutus</i>	680	680	X
<i>L. ridibundus</i>	65 000	60 000	-
<i>L. canus</i>	16 000	16 000	X
<i>L. fuscus</i>	6000	4000	X
<i>L. argentatus</i>	27 000	14 000/13 000IC	-
<i>L. hyperboreus</i>	2000	2000	-
<i>L. marinus</i>	4800	4800	X
<i>P. eburnea</i>	50	50	X
<i>G. nilotica</i>	270	120	X
<i>S. caspia</i>	150	50	X
<i>S. sandvicensis</i>	2800	1500	X
<i>S. hirundo</i>	7800	6000	-
<i>S. paradisaea</i>	13 000	13 000	-
<i>S. albifrons</i>	900	340	X
<i>C. niger</i>	1700	1700	X
<i>A. atthis</i>	-	-	X

Key: DK - Denmark F - Færoes FIN - Finland GR - Greenland IC- Iceland NO - Norway Sv - Svalbard SW - Sweden. p = pair "-" figures lacking SPEC:
Species of European Concern: 1-4

Appendix 6.5 Convention on Wetlands of International Importance especially as Waterfowl Habitat**Ramsar Convention text**

Ramsar, Iran, 2.2.1971 as amended by the Protocol of 3.12.1982 and the Amendments of 28.5.1987.

The Contracting Parties,

RECOGNIZING the interdependence of Man and his environment;

CONSIDERING the fundamental ecological functions of wetlands as regulators of water regimes and as habitats supporting a characteristic flora and fauna, especially waterfowl;

BEING CONVINCED that wetlands constitute a resource of great economic, cultural, scientific, and recreational value, the loss of which would be irreparable;

DESIRING to stem the progressive encroachment on and loss of wetlands now and in the future;

RECOGNIZING that waterfowl in their seasonal migrations may transcend frontiers and so should be regarded as an international resource;

BEING CONFIDENT that the conservation of wetlands and their flora and fauna can be ensured by combining far-sighted national policies with co-ordinated international action;

Have agreed as follows:**Article 1**

1. For the purpose of this Convention wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.
2. For the purpose of this Convention waterfowl are birds ecologically dependent on wetlands.

Article 2

1. Each Contracting Party shall designate suitable wetlands within its territory for inclusion in a List of Wetlands of International Importance, hereinafter referred to as "the List" which is maintained by the bureau established under Article 8. The boundaries of each wetland shall be precisely described and also delimited on a map and they may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands, especially where these have importance as waterfowl habitat.
2. Wetlands should be selected for the List on account of their international significance in terms of ecology, botany, zoology, limnology or hydrology. In the first instance wetlands of international importance to waterfowl at any season should be included.
3. The inclusion of a wetland in the List does not prejudice the exclusive sovereign rights of the Contracting Party in whose territory the wetland is situated.
4. Each Contracting Party shall designate at least one wetland to be included in the List when signing this Convention or when depositing its instrument of ratification or accession, as provided in Article 9.
5. Any Contracting Party shall have the right to add to the List further wetlands situated within its territory, to extend the boundaries of those wetlands already included by it in the List, or, because of its

urgent national interests, to delete or restrict the boundaries of wetlands already included by it in the List and shall, at the earliest possible time, inform the organization or government responsible for the continuing bureau duties specified in Article 8 of any such changes.

6. Each Contracting Party shall consider its international responsibilities for the conservation, management and wise use of migratory stocks of waterfowl, both when designating entries for the List and when exercising its right to change entries in the List relating to wetlands within its territory.

Article 3

1. The Contracting Parties shall formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory.
2. Each Contracting Party shall arrange to be informed at the earliest possible time if the ecological character of any wetland in its territory and included in the List has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference. Information on such changes shall be passed without delay to the organization or government responsible for the continuing bureau duties specified in Article 8.

Article 4

1. Each Contracting Party shall promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands, whether they are included in the List or not, and provide adequately for their wardening.
2. Where a Contracting Party in its urgent national interest, deletes or restricts the boundaries of a wetland included in the List, it should as far as possible compensate for any loss of wetland resources, and in particular it should create additional nature reserves for waterfowl and for the protection, either in the same area or elsewhere, of an adequate portion of the original habitat.
3. The Contracting Parties shall encourage research and the exchange of data and publications regarding wetlands and their flora and fauna.
4. The Contracting Parties shall endeavour through management to increase waterfowl populations on appropriate wetlands.
5. The Contracting Parties shall promote the training of personnel competent in the fields of wetland research, management and wardening.

Article 5

1. The Contracting Parties shall consult with each other about implementing obligations arising from the Convention especially in the case of a wetland extending over the territories of more than one Contracting Party or where a water system is shared by Contracting Parties. They shall at the same time endeavour to coordinate and support present and future policies and regulations concerning the conservation of wetlands and their flora and fauna.

Article 6

1. There shall be established a Conference of the Contracting Parties to review and promote the implementation of this Convention. The Bureau referred to in Article 8, paragraph 1, shall convene ordinary meetings of the Conference of the Contracting Parties at intervals of not more than three years, unless the Conference decides otherwise, and extraordinary meetings at the written requests of at least one third of the Contracting Parties. Each ordinary meeting of the Conference of the Contracting Parties shall determine the time and venue of the next ordinary meeting.

2. The Conference of the Contracting Parties shall be competent:
 - a. to discuss the implementation of this Convention;
 - b. to discuss additions to and changes in the List;
 - c. to consider information regarding changes in the ecological character of wetlands included in the List provided in accordance with paragraph 2 of Article 3;
 - d. to make general or specific recommendations to the Contracting Parties regarding the conservation, management and wise use of wetlands and their flora and fauna;
 - e. to request relevant international bodies to prepare reports and statistics on matters which are essentially international in character affecting wetlands;
 - f. to adopt other recommendations, or resolutions, to promote the functioning of this Convention.
3. The Contracting Parties shall ensure that those responsible at all levels for wetlands management shall be informed of, and take into consideration, recommendations of such Conferences concerning the conservation, management and wise use of wetlands and their flora and fauna.
4. The Conference of the Contracting Parties shall adopt rules of procedure for each of its meetings.
5. The Conference of the Contracting Parties shall establish and keep under review the financial regulations of this Convention. At each of its ordinary meetings, it shall adopt the budget for the next financial period by a two-third majority of Contracting Parties present and voting.
6. Each Contracting Party shall contribute to the budget according to a scale of contributions adopted by unanimity of the Contracting Parties present and voting at a meeting of the ordinary Conference of the Contracting Parties.

Article 7

1. The representatives of the Contracting Parties at such Conferences should include persons who are experts on wetlands or waterfowl by reason of knowledge and experience gained in scientific, administrative or other appropriate capacities.
2. Each of the Contracting Parties represented at a Conference shall have one vote, recommendations, resolutions and decisions being adopted by a simple majority of the Contracting Parties present and voting, unless otherwise provided for in this Convention.

Article 8

1. The International Union for Conservation of Nature and Natural Resources shall perform the continuing bureau duties under this Convention until such time as another organization or government is appointed by a majority of two-thirds of all Contracting Parties.
2. The continuing bureau duties shall be, *inter alia*:
 - a. to assist in the convening and organizing of Conferences specified in Article 6;
 - b. to maintain the List of Wetlands of International Importance and to be informed by the Contracting Parties of any additions, extensions, deletions or restrictions concerning wetlands included in the List provided in accordance with paragraph 5 of Article 2;
 - c. to be informed by the Contracting Parties of any changes in the ecological character of wetlands included in the List provided in accordance with paragraph 2 of Article 3;
 - d. to forward notification of any alterations to the List, or changes in character of wetlands included therein, to all Contracting Parties and to arrange for these matters to be discussed at the next Conference;
 - e. to make known to the Contracting Party concerned, the recommendations of the Conferences in respect of such alterations to the List or of changes in the character of wetlands included therein.

Article 9

1. This Convention shall remain open for signature indefinitely.
2. Any member of the United Nations or of one of the Specialized Agencies or of the International Atomic Energy Agency or Party to the Statute of the International Court of Justice may become a Party to this Convention by:
 - a. signature without reservation as to ratification;
 - b. signature subject to ratification followed by ratification;
 - c. accession.
3. Ratification or accession shall be effected by the deposit of an instrument of ratification or accession with the Director-General of the United Nations Educational, Scientific and Cultural Organization (hereinafter referred to as "the Depositary").

Article 10

1. This Convention shall enter into force four months after seven States have become Parties to this Convention in accordance with paragraph 2 of Article 9.
2. Thereafter this Convention shall enter into force for each Contracting Party four months after the day of its signature without reservation as to ratification, or its deposit of an instrument of ratification or accession.

Article 10 bis

1. This Convention may be amended at a meeting of the Contracting Parties convened for that purpose in accordance with this article.
2. Proposals for amendment may be made by any Contracting Party.
3. The text of any proposed amendment and the reasons for it shall be communicated to the organization or government performing the continuing bureau duties under the Convention (hereinafter referred to as "the Bureau") and shall promptly be communicated by the Bureau to all Contracting Parties. Any comments on the text by the Contracting Parties shall be communicated to the Bureau within three months of the date on which the amendments were communicated to the Contracting Parties by the Bureau. The Bureau shall, immediately after the last day for submission of comments, communicate to the Contracting Parties all comments submitted by that day.
4. A meeting of Contracting Parties to consider an amendment communicated in accordance with paragraph 3 shall be convened by the Bureau upon the written request of one third of the Contracting Parties. The Bureau shall consult the Parties concerning the time and venue of the meeting.
5. Amendments shall be adopted by a two-thirds majority of the Contracting Parties present and voting.
6. An amendment adopted shall enter into force for the Contracting Parties which have accepted it on the first day of the fourth month following the date on which two thirds of the Contracting Parties have deposited an instrument of acceptance with the Depositary. For each Contracting Party which deposits an instrument of acceptance after the date on which two thirds of the Contracting Parties have deposited an instrument of acceptance, the amendment shall enter into force on the first day of the fourth month following the date of the deposit of its instrument of acceptance.

Article 11

1. This Convention shall continue in force for an indefinite period.
2. Any Contracting Party may denounce this Convention after a period of five years from the date on which it entered into force for that party by giving written notice thereof to the Depositary. Denunciation shall take effect four months after the day on which notice thereof is received by the Depositary.

Article 12

1. The Depositary shall inform all States that have signed and acceded to this Convention as soon as possible of:
 - a. signatures to the Convention;
 - b. deposits of instruments of ratification of this Convention;
 - c. deposits of instruments of accession to this Convention;
 - d. the date of entry into force of this Convention;
 - e. notifications of denunciation of this Convention.
2. When this Convention has entered into force, the Depositary shall have it registered with the Secretariat of the United Nations in accordance with Article 102 of the Charter.

IN WITNESS WHEREOF, the undersigned, being duly authorized to that effect, have signed this Convention.

DONE at Ramsar this 2nd day of February 1971, in a single original in the English, French, German and Russian languages, all texts being equally authentic* which shall be deposited with the Depositary which shall send true copies thereof to all Contracting Parties.

* Pursuant to the Final Act of the Conference to conclude the Protocol, the Depositary provided the second Conference of the Contracting Parties with official versions of the Convention in the Arabic, Chinese and Spanish languages, prepared in consultation with interested Governments and with the assistance of the Bureau.

Ramsar Convention Bureau
Rue Mauverney 28
CH-1196 Gland, Switzerland
Tel.: +41 22 999 0170
Fax: +41 22 999 0169
E-mail: ramsar@ramsar.org

7 Sources and bibliography

- Ahti, T., Hämet-Ahti, L. & Jalas, J. 1968. Vegetation zones and their sections in northwestern Europe. *Ann. Bot. Fennici* 5:169-211.
- Angell-Petersen, I. 1991. Flommarkskog i Trøndelag. Utkast til verneplan. *Direktoratet for naturforvaltning rapport* 2:1-45.
- BirdLife International/Bird Census Council 2000. European bird populations: Estimates and trends. *BirdLife Conservation Series No. 10*. BirdLife International, Cambridge, UK.
- BirdLife International 2001. *Important Bird Areas and potential Ramsar sites in Europe*. BirdLife International, Wageningen, The Netherlands. 126 pp.
- Boertmann, D. 1996. Seabird colonies in western Greenland. *National Environmental Research Institute (NERI) Technical Report no. 170*. Roskilde, Denmark. 148 pp.
- Boertmann, D. & Glahder, C. 1999. Grønlandske gåsebestande - en oversigt. *Danmarks Miljøundersøgelser (DMU) Teknisk rapport no. 276*. Copenhagen, Denmark. 59 pp.
- Brattgard, T. & Holthe, T. (eds.) 1995. Kartlegging av marine verneområder i Norge. Tilrådning fra rådgivende utvalg. *Utredning for DN* 3:1-179.
- Brix, B. et al. (eds.) 1999. *Naturforvaltning gennem 10 år/1989-1998*. Skov- og Naturstyrelsen. 179 pp.
- Cederberg, B. & Löfroth, M. (eds.) 2000. *Svenska djur och växter i det europeiske nätverket Natura 2000*. ArtDatabanken, Uppsala.
- Christensen, B. 1990. Vådområder. Pp. 201-210 in Barfod, L. et al. (eds.). *Landet og loven*. Miljøministeriet.
- Clausen, P., Madsen, J. et al. 1997. *Reservatnetværk for vandfugle*. Temarapport fra Danmarks Miljøundersøgelser. 52 pp.
- Clausen, P. et al. 2001. *Jagt- og forstyrrelsesfrie kerneområder for vandfugle: Status 1999*. Arbejdsrapport fra Danmarks Miljøundersøgelser. 84 pp.
- Common Wadden Sea Secretariat 1998. *Stade Declaration - Trilateral Wadden Sea Plan*. Ministerial declaration of the 8th trilateral governmental conference on the protection of the Wadden Sea, Stade, October 22, 1998.
- Delaney, S., Reyes, C., Hubert, E., Pihl, S., Rees, E., Haanstra, L. & van Strien, A. 1999. Results from the International Waterbird Census in the Western Palearctic and Southwest Asia 1995 and 1996. *Wetlands International Publication No. 54*, Wageningen, The Netherlands.
- Direktoratet for naturforvaltning. 1995. Naturvernområder i Norge 1911-1994. *DN-rapport* 1995-3. Trondheim.
- Direktoratet for naturforvaltning. 1996. Status for verneområde der verneverdiane er trua. *DN-rapport* 1996-1:1-73. Trondheim.
- Direktoratet for naturforvaltning. 1996. Plan for tiltak i verneområde 1997-2003. *DN-rapport* 1996-4:1-33. Trondheim.
- Egevang, C. & Boertmann, D. 2001a. The Greenland Ramsar sites. A status report. National Environmental Research Institute (NERI) *Technical Report no. 346*. National Environmental Research Institute. Roskilde,

- Denmark. 95 pp. (Available at <http://www.dmu.dk>).
- Egevang, C. & Boertmann, D. 2001b. The Ramsar sites of Disko, West Greenland. A survey in July 2001. National Environmental Research Institute (NERI) *Technical Report no. 368*. National Environmental Research Institute. Roskilde, Denmark. 68 pp.
- Eurola, S., Aapala, K. & Kokko, A. 1988. Ojitustilanne Etelä- ja Keski-Suomen sekä Pohjanmaan-Kainuun alueilla. *Suo* 39 (1-2):9-17.
- Fremstad, E. 1997. Vegetasjonstyper i Norge. *NINA Temabeftte* 12:1-279.
- Fremstad, E. & Moen, A. (eds.) 2001. Truete vegetasjonstyper i Norge. *NTNU Vitenskapsmuseet Rapp. bot. Ser. 2001-4*:1-231.
- Furman, E., Salemaa, H. & Välipakka, P. 1997. *Baltic Sea Environment & Ecology. Project by University of Helsinki*. Opasvihkonen + 20 monivärikalvoa. 18 pp.
- Garðarsson, A. 1975. Votlendi. *Rit Landverndar no. 4*. Reykjavík. 238 pp.
- Granö, O., Laurila, L. & Roto, M. 1995. *Suomen merenrannikon sulkeutuneisuus*. Ympäristöministeriö. 37 pp.
- Grimmet, R.F.A. & Jones, T.A. 1989. Important Bird Areas in Europe. Cambridge, U.K. International Council for Bird Preservation. *Technical Publication no. 9*.
- Grønlands Hjemmestyre 1989. *Hjemmestyrets bekendtgørelse nr. 29 af 19. september 1989 om fredning af fugle i Grønland*. Nuuk, Greenland.
- Grønlands Hjemmestyre 1992. *Hjemmestyrets bekendtgørelse nr. 7 af 17. juni 1992 om Nationalparken i Nord- og Østgrønland*. Nuuk, Greenland.
- Grønlands Hjemmestyre 1993 - 2000. *Piniarneq. Jagtinformation og fangstregistrering*. Direktoratet for Erhverv. Nuuk, Greenland.
- Grønlands Hjemmestyre 2001. *Hjemmestyrets bekendtgørelse nr. 38 af 6. december 2001 om beskyttelse af fugle*. Nuuk, Greenland.
- Grønlands Naturinstitut 2001: *Status 2000 - en oversigt over vigtige levende ressourcer i Grønland*. Grønlands Naturinstitut. Nuuk, Greenland.
- Heath, M.F. & Evans, M.I. (eds.) 2000. Important Bird Areas in Europe. Priority sites for conservation. Vol. 1: Northern Europe. *BirdLife Conservation Series no. 8*, Cambridge, UK.
- Henrikson, L. & Brodin, Y.W. (eds.) 1995. *Limning of acidified surface waters*. Springer. 458 pp.
- Hildén, O. & Hario, M. 1993. *Muuttuva saaristolinnusto*. Forssa. 317 pp.
- Hotanen, J.-P. & Tonteri, T. 1990. Soiden luokit- telun viimeaikainen kehitys Suomessa. *Luonnon Tutkija* 94:212-222.
- Höglund, J., Ollquist, S. & Molander, L.-L. 2000. Skötsel- och användningsplan för Lappören, Slåttskäret, Rönnskären och Kvicksund. Västra Finlands Miljöcentral. *Regionala miljöpublikationer no. 151*. 84 pp.
- Hågvar, S. 2001. *Naturarven*. Landbruksforlaget.
- Indergaard, M. & Jensen, A. 1991. *Utnyttelse av marin biomasse*. Institutt for bioteknologi, NTH, Universitetet i Trondheim. 123 pp.
- IUCN 1995. *Project Telma, Project Aqua. Project Mar*.
- Jensen, F.P. 1996. *EF-fuglebeskyttelsesområder og Ramsarområder - kort og beskrivelser, status 1995*. Skov- og Naturstyrelsen. 273 pp.
- Johnsen, I. 1994. Danmarks internationalt værdisfulde naturtyper. Pp. 60-65 in Asbirk, S. (ed.): *Natur uden grænser - dansk natur og globalt perspektiv*. Skov- og Naturstyrelsen.
- Kauppinen, J. 1995. Temporal variation in the wetland waterfowl communities of the Finnish lake district. *Ornis Fennica* 72:145-153.

- Kenttämies, K. & Saukkonen, S. 1996. Metsätalous ja vesistöt. *Maa- ja metsätalousministeriön julkaisu-ja no. 4/1996*.
- Lammi, E., Pöysä, H. & Väisänen, R.A. 1990. Suomen sisävesien pesimälinnusto 1986-1989. *Lintumies* 25:25-32.
- Lappalainen, I. (ed.) 1998. *Suomen Luonnon Monimuotoisuus*. Edita. Helsinki. 304 pp.
- Larsen, T. & Kjoberg, S. 1995. Status for verneverdige våtmarker i Norge Inngrep og trusler mot våtmarkene i 9 fylker i Sør-Norge. *Norsk Ornitologisk Forening Rapport 5:1-26* + appendix.
- Laubek, et al. 1999. Vedr. svaner.
- Líndal, P. 1984. Stríð og friður, Lesarkir Náttúruverndarráðs. Útgefandi Náttúruverndarráð.
- Löfroth, M. 1991. Våtmarkerna och deras betydelse. *Naturvårdsverket Rapport 3824*. 93 pp.
- Maa- ja metsätalousministeriö 1981. *Valtakunnallinen soidensuojelun perusohjelma. Maa- ja metsätalousministeriön julkaisuja*. 30 pp. + 169 pp. + Appendices.
- Maa- ja metsätalousministeriö 1982. *Valtakunnallinen lintuvesiensuojeluohjelma. Maa- ja metsätalousministeriön julkaisuja*. 15 pp. + 75 pp. + Appendices.
- Madsen, J., Cracknell, G. & Fox, T. (eds.) 1999. Goose populations of the Western Palaearctic. A review of status and distribution. *Wetlands International Publication No. 48*. Wetlands International, Wageningen, The Netherlands. National Environmental Institute, Rønde, Denmark.
- Maristo, L. 1941. Die Seetypen Finnlands auf floristischen und vegetation physiognomischer Grundlage. *Ann. Bot. Soc. Vanamo* 15 (5):1-314.
- Mikkola-Roos, M. 1995. Lintuvesien kunnostus ja hoito. Metsähallituksen luonnonsuojelujulkaisu-ja. *Sarja A no. 45*. 100 pp.
- Miljøstyrelsen 1998. Sørestaurering i Danmark – metoder, erfaringer og anbefalinger. *Miljønyt no. 28*, 1998.
- Miljøverndepartementet 1980. *NOU 1980:23*, Naturvern i Norge. Oslo.
- Miljøverndepartementet 1992. *Stortingsmelding no. 62 (1991-92) Ny landsplan for nasjonalparker og andre større verneområder i Norge*. Oslo.
- Miljøverndepartementet 1999. *NOU 1999:21*. Lov om miljøvern på Svalbard. Oslo.
- Ministry for the Environment & the Icelandic Institute of Natural History 2001. *Biological Diversity in Iceland*. National Report to the Convention on Biological Diversity.
- Moen, A. 1999. Vegetation. *National Atlas for Norway*. Statens Kartverk, Hønefoss. 200 pp.
- Muus, B., Salomonsen, F. & Vibe, C. 1990. *Grønlands Fauna. Fisk-Fugle-Pattedyr*. Gyldendal. 2nd ed. Copenhagen, Denmark.
- Náttúrufræðistofnun Ísland 1996. *Válisti 1, plöntur*. Reykjavík.
- Náttúrufræðistofnun Ísland 2000. *Válisti 2, fuglar*. Reykjavík.
- Naturvårdsverket 1997. *Svenska naturtyper i det europeiska nätverket Natura 2000*. Naturvårdsverkets förlag. Stockholm.
- Naturvårdsverket 2000. *Databasen N 2000*. Naturvårdsverkets förlag. Stockholm.
- Naturvårdsverket och Statistiska Centralbyrån 2000. *Naturmiljön i siffror 2000*. 296 pp.
- Nordic Council of Ministers 1997. Population sizes and trends of birds in the Nordic countries (1974-1994). *TemaNord Environment* 1997:614.
- Nordisk Ministerråd 1996. Nordisk naturvård – möjligheter och problem. *TemaNord* 1996:11. Copenhagen.

- Nordisk Ministerråd 1973. *Översikt över våda fugle-områden i Norden 1973*. Den nordiske arbejdsgruppe vedrørende beskyttelse af våde fugle-områder.
- NUTEK 1966: Torv 1995. Statistiska meddelanden. *Nr 25 SM 9601*.
- Ólafsson, J.S. 1988. *Íslensk votlendi, verndun og nýting greinasafn, artikelsamling*. Ritstjóri, Háskólaútgáfan. 283 pp.
- Olney, P.J.S. (ed.) 1965. Project MAR. The conservation and management of temperate marshes, bogs and other wetlands. Vol. 2: List of European and North African wetlands of international importance. *IUCN Publications New Series no. 5*.
- Perttula, H. 1990. Etelänsuosisirrin pesimäalueet ja niiden kunnostus Suomessa. *Lintumies* 25:11-15.
- Pessa, J. & Anttila, I. 2000. Conservation of habitats and species on wetlands. A case study of the Liminganlahti LIFE-Nature project in Finland. Northern Ostrobothnia Regional Environment Centre. *The Finnish Environment*, no. 389. 108 pp.
- Polunin, O. & Walters, M. 1985. *A guide to the vegetation of Britain and Europe*. Oxford University Press.
- Påhlsson, L. (ed.) 1994. Vegetationstyper i Norden. *TemaNord* 1994:665. Nordiska ministerrådet, Copenhagen.
- Raatikainen, M. & Kuusisto, E. 1990. Suomen järvien lukumäärä ja pinta-ala. *Terra* 102:97-110.
- Raeymaekers, G. 1999. *Conserving mires in the European Union*. Report to LIFE-Nature. Ecosystems Ltd, Luxembourg. Available on the internet: www.europa.eu.int/comm/environment/nature/bogs.pdf
- Rassi, P., Alanen, A., Kanerva, T. & Mannerkoski, I. 2001. *Suomen lajien uhanalaisuus 2000*. Uhanalaisten lajien II seurantatyöryhmä. The 2000 Red List of Finnish species. Ympäristöministeriö. Helsinki 432 pp. (Partly available on the Internet: <http://www.vyh.fi/eng/environ/naturcon/threat/2000/2000.htm>).
- Räike, A. 1994. Valtakunnallinen pienvesi-inventointi. Alustavat tulokset vuosilta 1989-1993. *Vesi- ja ympäristöhallituksen monistesarja no. 588*. 98 pp.
- Rudqvist, L. 2000. Sveriges sumpskogar. Resultat av sumpskogsinventeringen 1990-1998. *Skogsstyrelsens meddelande no. 3-1999*.
- Saarinen, H. 1993. Virheojitukset eri inventointien valossa. *Metsäntutkimuslaitoksen tiedonantoja* 495:8-14.
- Salomonsen, F. 1967. *The birds of Greenland* (Fuglene på Grønland). Rohdar, Copenhagen. 343 pp.
- Salonen, S. (ed.) 1999. *Yyterinniemen Natura 2000 -alueiden biodiversiteetin hallinta. Biodiversity management in Natura 2000 areas of the (Yyteri Peninsula)*. Turun Yliopisto, Satakunnan ympäristötutkimuskeskus. Pori. 71 pp.
- Scott, D. & Rose, P.A. 1996. Atlas of Anatidae populations in Africa and Western Eurasia. *Wetlands International Publication No. 41*. Wetlands International, Wageningen.
- Siira, J. & Eskelinen, O. 1983. Changes in the abundance of breeding waterfowl in the Liminka Bay 1954-81. *Finnish Game Res.* 40:105-121.
- Siira, J. & Pessa, J. 1992. Liminganlahden ranta-alueiden nykytila sekä suojelun ja hoidon tarve. *Perämeren tutkimusaseman monisteita* 21:1-161. Oulun yliopisto.
- Siira, J. 1994. Liminganlahden muuttuva linnusto. *Aureola* 19:95-103.
- Sjöfartsverkets digitala svenska djupkurvor.
- Skov, H., Vaitkus, G., Flensted, K.N., Grishanov, G., Kalamees, A., Kondratyev, A., Leivo, M., Luigujoe, L., Mayr, C., Rasmussen, J.F., Raudonikis, L., Scheller, W., Sidlo, P.O.,

- Stipniece, A., Struwe-Juhl, B. & Welander, B. 2000. *Inventory of coastal and marine Important Bird Areas in the Baltic Sea*. BirdLife International, Cambridge, UK.
- Skov- og Naturstyrelsen 1996. *Danish report 1996 on the Ramsar Convention*. Denmark and Greenland. 105 pp. Ministry of Environment and Energy. Copenhagen. Denmark.
- Solbakken, K.Aa. 2001. *Status for norske Ramsarområder*. Norsk Ornitologisk Forening Rapport in prep.
- Statistisk Sentralbyrå 1993. Myrareal.
- Statistiska centralbyrån 2001. *Statistiska meddelanden MI50SM0101*.
- Størkersen, Ø.R. 1996. Ni nye norske Ramsar-områder opprettet i 1996. *Vår Fuglefauna* 19:53-60.
- Størkersen, Ø.R. 1999. Nasjonal rødliste for truede arter i Norge 1998. Norwegian Red List 1998. *Direktoratet for naturforvaltning rapport 1999-3*.
- Sveriges Nationalatlas 1991. *Miljön*. 184 pp.
- Sveriges Nationalatlas 1995. *Klimat, sjöar och vattendrag*. 176 pp.
- Sævre, R. 1995. Naturvernområder i Norge 1911-1994. *Direktoratet for naturforvaltning rapport 1995-3*.
- Teeriaho, J. 1998. Ehdotus luonnon monimuotoisuuden indikaattoreiksi kunnissa. Luonto ja luonnonvarat. *Suomen Ympäristö* 221. 95 pp.
- Tolvanen, P., Øien, I.J. & Ruokolainen, K. (eds.). 1999. Fennoscandian Lesser White-fronted Goose conservation project. Annual report 1999. WWF Finland Report 12 & Norwegian Ornithological Society. *NOF Rapportserie Report No. 1-2000*: 1-66.
- Tolvanen, P., Øien, I.J. & Ruokolainen, K. (eds.). 2001. Fennoscandian Lesser White-fronted Goose conservation project. Annual report 2000. WWF Finland Report 13 & Norwegian Ornithological Society. *NOF Rapportserie Report No. 1-2001*: 1-52.
- Pórhallsdóttir, Þ.E. 1994. *Ábrif miðlunarlóns á gróður og jarðveg í Þjórsárverum*. Líffræðistofnun Háskólans, Reykjavík. 227 pp.
- Tucker, G.M. & Evans, M.I. 1997. Habitats for birds in Europe: A conservation strategy for the wider environment. Cambridge, U.K. BirdLife International. *BirdLife Conservation Series no. 6*: 1-464.
- Tucker, G.M. & Heath, M.F. 1994. Birds in Europe: Their conservation status. Cambridge, U.K. BirdLife International. *BirdLife Conservation series no. 3*:1-600.
- Útgefandi Náttúruverndarráð 1997. Skýrsla um störf Náttúruverndarráðs 1993 – 1996. *Fjölrit nr. 29*.
- Vasander, H. (ed.) 1996. *Peatlands in Finland*. Finnish Peatland Society. Gummerus. Helsinki. 168 pp.
- Väisänen, R.A. 1997. Pesimälinnusto suurten mullistusten ilmentäjänä. *Luonnon Tutkija* 100: 169-186.
- Väisänen, R.A., Lammi, E. & H. Koskimies, P. 1998. *Muuttuva pesimälinnusto*. Otava. Keuruu. 567 pp.
- Wahlström, E., Hallanaro, E.-L. & Manninen, S. 1996. *Suomen ympäristön tulevaisuus*. Edita. Suomen ympäristökeskus. 272 pp.
- World Resources Institute 2000. *World Resources 2000-2001. People and Ecosystems: The Fraying Web of Life*. United Nations Development and Environment Programme, World Bank, World Resources Institute, Washington.
- Ympäristöministeriö 1997. Suomen biologista monimuotoisuutta koskeva kansallinen toimintaohjelma 1997-2005. *Suomen ympäristö no. 137*. 171 pp.

Publications issued by the Nordic Council of Ministers and the Nordic Council can be ordered from:

BELGIUM & LUXEMBURG

Jean de Lannoy
Avenue du Roi, 202, 1190 Brussels
Tel +32 (0)2 538 5169 Fax +32 (0)2 538 0841
jean.de.lannoy@infoboard.be

CANADA

Renouf Publishing Company Ltd
5369 Canotek Road, Ottawa, Ontario K1J 9J3
Tel + 1 (613) 745 2665 Fax + 1 (613) 745 7660
order.dept@renoufbooks.com
www.renoufbooks.com

CHINA

C N P I E C

Europe Division 16 Gongti East Road, P.O. Box
88, Beijing
Tel +86 10 50 66 688-8 Fax +86 10 50 63 101

DENMARK

Svensk-Norsk Bogimport A/S
Esplanaden 8 B, 1263 København K
Tel +45 33 14 26 66 Fax +45 33 14 35 88
snb@bog.dk
www.snbog.dk

ESTONIA

Astro Raamatud AS
Pärnu mnt 142, 11317 Tallinn
Tel +372 654 8485 Fax +372 654 8475
book@astro.ee

FAROE ISLANDS

H.N. Jacobsens Bókahandil
Postboks 55, 110 Tórshavn
Tel +298 31 10 36 Fax +298 31 78 73
hnj-bokh@post.olivant.fo

FINLAND

Akademiska Bokhandeln
PB 128, Centralgatan 1, 00101 Helsingfors
Tel +358 9 12141
akatilaus@akateeminen.com
www.akateeminen.com

FRANCE

Librairie LAVOISIER
14, rue de Provigny, 94236 Cachan Cedex
Tel +33 (1) 4740 6700 Fax +33 (1) 4740 6702
group@lavoisier.fr
www.lavoisier.fr

GERMANY

UNO-Verlag GmbH
Am Hofgarten 10, 53113 Bonn
Tel +49 (0)228 949020 Fax +49 (0)228 9490 222
info@uno-verlag.de
www.uno-verlag.de

HUNGARY

Euro Info Service
PO Box 1039, 1245 Budapest
Tel +36 (1) 329 2487 Fax +36 (1) 349 2053
euroinfo@euroinfo.hu

ICELAND

Mál og Menning
Laugavegi 18, 101 Reykjavík
Tel +354 (9)515 2500 Fax +354 (9)515 2505
verslun@mm.is

LATVIA

Jana Rozes Gramātnica
Kr. Barona iela 5, 1011 Riga
Tel +371 (0)2 284288 Fax +371 7 370 922

LITHUANIA

Penki Kontinentai
A. Stulginskio 5, 2001 Vilnius
Tel +370 (5) 2664540 Fax +370 (5) 2664565
books@5ci.lt
www.books.lt

NORWAY

Akademika A/S
Postboks 84 Blindern, 0314 Oslo
Tel +47 22 85 30 30 Fax +47 22 85 30 80
bloken@sio.uio.no
www.akademika.no

ROMANIA

Euromedia s.r.l.

Str Dionisie Lupu nr 65, 70184 Bucuresti

Tel + 40 1 614 06 64 Fax + 40 1 312 96 46

SWEDEN

Fritzes

Kundservice, 106 47 Stockholm

Tel +46 (0)8 690 9190 Fax +46 (0)8 690 9191

order.fritzes@nj.se

www.fritzes.se

THE NETHERLANDS

De Lindeboom/INOR Publikaties b.v.

M.A. de Ruyterstraat 20A, 7482 BZ Haaksbergen

Tel +31 (0) 53 5740004 Fax +31 (0) 53 5729296

books@delindeboom.com

www.delindeboom.com

UNITED KINGDOM

The Stationery Office

P.O. Box 276, London SW8 5DT

Tel +44 870 600 5522 Fax +44 870 600 5533

customer.services@tso.co.uk

www.tso.co.uk/bookshop

USA

Bernan

4611-F Assembly Drive, Lanham MD 20706-4391

Tel +1 (301) 459 7666 Fax +1 (301) 459 0056

query@bernann.com

www.bernann.com

ÅLAND

Lisco bok- och pappershandel

Skarpansvägen 25, Box 8, 22101 Mariehamn

Tel +358 (0)18 17 177 Fax +358 (0)18 19 771

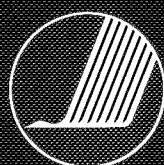
info@lisco.fi

Nordic wetland conservation

Conservation of wetlands has formed an important part of the Nordic nature conservation effort, particularly in the last 30 years. This work by the Nordic countries has been closely linked with the task of fulfilling their obligations as signatories of the Ramsar Convention and, as regards the nations that are EU members, the requirements of the more recent Birds and Habitat Directives. Nowadays, wetland conservation is also viewed in the context of the objectives of the Biodiversity Convention.

This report attempts to sum up the status of wetland conservation in the Nordic region after 30 years. It also points out a number of unfulfilled tasks and makes recommendations for how the work should proceed in the years ahead.

TemaNord 2003:506
ISBN 92-893-0987-3



Nordic

COUNCIL OF MINISTERS