Circumpolar Murre Conservation Strategy

IMPLEMENTATION PLAN 2004–2008 – ICELAND

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SUMMARY

The International Murre Conservation Strategy and Action Plan (CMCS) was finalised in 1996 by the Circumpolar Seabird Group (CBird) on behalf of the Conservation of Arctic Flora and Fauna Working Group (CAFF 1996). Prior to that and since, the CAFF countries have been implementing various aspects of the strategy most relevant to them. Iceland has worked on several aspects of the strategy, although a consorted plan has not been developed until now. The strategy covers the two murre species, Common Murre *Uria aalge* and Thick-billed Murre *U. lomvia*.

An overview of the present status of various strategy actions is given. Also presented are various suggestions for actions to implement the different strategy items in future years. Guidelines are provided in the CMCS on how to implement the strategy. These fall under three headings, i.e. Priorities, Collaboration and Cooperation, and Reporting. The most important initial recommendations for future work are collected under each heading, including some general recommendations, which are important for full implementation of the strategy.

Many aspects of murre management and conservation need further work in Iceland, both research and compilations of status. These include, among others, harvesting and tourism practices at colonies, distribution of murres at sea, effects of incidental takes in fishing gear, monitoring of a representative set of breeding colonies, effect of winter hunting on Thick-billed Murres, murre banding, and production of educational materials.

Supporting material is assembled in the appendices. These include a status report, which was produced as a baseline document on the status of murre conservation, research, and management issues in Iceland (Appendix 1). Also included are five matrices, which track the progress of national implementation of various action items (for years 1998, 1999, 2000, 2001 and 2002). This task was given to CBird on behalf of CAFF. Lastly, an appendix contains figures for the numbers of murres killed in Iceland 1995-2001, as indicated in the national hunting statistics.

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APPENDICES

1 DEVELOPMENT OF THE CONSERVATION PLAN

Since the start of the Conservation of Arctic Flora and Fauna (CAFF) co-operation in 1992, seabirds - and not the least murres - have been recognized as being of important conservation value, which would benefit from coordinated circumpolar conservation. The countries agreed to develop a Circumpolar International Murre Conservation Strategy and Action Plan (CMCS). This was accomplished through CAFF´s standing group on seabirds, the Circumpolar Seabird Group (acronym is now CBird, previously CSWG). The strategy (CAFF 1996) was endorsed by the environmental ministers of the eight Arctic countries in Inuvik, Canada, in 1996. CBird was charged with implementing the CMCS on behalf of CAFF and keep track of its development in each country.

In the beginning CBird decided to plan the implementation of the strategy in two steps. During the first phase an overview was produced of the status of murre populations in Iceland, their management, research and primary actions needed (Appendix 1). This document formed the basis for the second step, as a 5-year implementation plan, which for Iceland is now recommended for 2004–2008. Although a fully integrated implementation plan has not been produced for Iceland until now, nonetheless important aspects of murre conservation have been dealt with. However, an integrated plan is needed for a more concerted effort to implement the strategy and address all relevant conservation needs of murres, both nationally and internationally. It is also quite clear that important conservation issues, monitoring and research have not been dealt with to date in the way needed.

References are not cited in the text of this document, but towards the end (section 5) is a list of publications, which is relevant to this plan.

2 BACKGROUND TO THE PLAN

The two murre species, the Common Murre (Common Guillemot in the UK) *Uria aalge* and the Thick-billed Murre (Brünnich´s Guillemot in the UK) *U. lomvia*, are among the most common of Icelandic birds. Ecologically they are important elements of the marine ecosystem and they are core members of some of the most spectacular seabird colonies in the world. Traditionally murres are an important food resource of Icelanders. More recently tourists are increasingly looking to the seabird cliffs for inspiration through their beauty and grandeur. Murres are hence of great conservation value. They are also potentially threatened by various man-induced activities, such as over-hunting, incidental take in fishing gear, disturbance, oil and gas exploration, and climate change, besides coping with the rigors of the many natural factors with which these species have evolved through the ages.

Although closely related and often nesting on the same cliffs, the life-history of the two murre species differs in many respects, including their behavior, distribution on the cliff face, distribution at sea in summer, their food spectrum, and dispersal out of the breeding season. In addition the two species have different global breeding distributions, which renders them highly suitable as indicators of climate change. The Thick-billed Murre is a truly High Arctic species, spending all its time in the region covered by the CAFF co-operation. Although also widely distributed in the Arctic, a substantial part of the world population of Common Murres breeds south of the Arctic border. Birds breeding in the temperate region are nonetheless subject to factors operating in the Arctic, since they regularly travel northwards into Arctic waters in search of food.

3 THE CONSERVATION PLAN

The CMCS consists of 31 action items, grouped into six management issues. At the CAFF VI meeting in Nuuk 1997 a matrix was developed against which the action items were weighted. The matrix took into account the relevance of the 31 action items to each country, whether actions had been completed or not, if items were in progress, etc. The matrix also included priority rankings for each item, as designed by CBird members. The matrix was further revised in May 1998 (Appendix 2). The progress of the action items was again monitored by means of a matrix at the CBird VI meeting in Ottawa 1999 (Appendix 3), at CBird VII in Helsinki 2000 (Appendix 4), at the Anchorage meeting of CBird VIII in 2002 (Appendix 5), and at CBird IX in Tromsö 2003 (Appendix 6).

It is recognized that 27 of the 31 action items may be of relevance to Iceland. The present implementation plan is based on that assumption.

3.1 Consumptive Use

3.1.1 Background

The present legislation on bird hunting (no. 64/1994) and its associated regulations (no. 456/1994 and 506/1998) call for sustainable use of birds. This legislation overarches the conservation of murres in Iceland, while general habitat conservation is also addressed in the law on nature conservation (no. 93/1999).

Hunting is only allowed for specific purposes, such as for the use for food, while hunting just for the sake of killing birds is illegal. Murres can be hunted at sea between 1 September and 10 May. Eggs can also be collected and full-grown birds taken in pole nets at colonies between 1 July and 15 August, where this has been a tradition. While egging takes place at all the larger colonies, pole-netting of full-growns is rare and at present takes place regularly at only two colonies (Grímsey, Skrúður) as far as known. Shooting must not take place nearer to seabird colonies than 500 m at sea and 200 m on land. Unnecessary disturbance by noise, such as aeroplanes or high-frequency whistles, is illegal at seabird colonies. On the other hand there are no limits at what distance fishing gear can be placed to seabird colonies (except 250 m to Common Eider *Somateria mollissima* colonies).

One of the most important aspects of CAFF is the willingness to co-operate on the conservation of migratory animals where one country may be impacting another country's animal population. Murres provide excellent examples where the conservation of the species need to be carried out through co-operation, since they migrate between countries and are subject to considerable hunting pressures. On the Red List for birds in Iceland, published by the Icelandic Institute of Natural History, attention is drawn to the possible impact of hunting on Icelandic Thick-billed Murres wintering in Greenland waters.

3.1.2 Strategy Actions

Action 1: Ensure that consumptive uses of murres are sustainable.
Action 2: Monitor harvest levels and assess their impacts on populations.
Action 3: Harmonize management and harvest regimes for shared populations.
Action 4: Involve local indigenous people in the management of consumptive uses.

3.1.3 Requirements and Status

Requirements to implement actions:	Status:
Determine the harvest level in comparison to population size, to be able to model the harvest impact.	The number of birds shot is known from hunting statistics, and a reasonable estimate is available for the size of the Icelandic population and its distribution.
More needs to be known about which birds are harvested, both the age classes and the proportions from different populations.	Little is known about the proportions of birds, which belong to different populations, from within Iceland as well as foreign countries. No age class determinations have been carried out.
Egging is one form of impact, yet much less likely to influence population size than hunting, especially if birds are allowed to re-lay.	In contrast to number of birds taken, little is known about the number of eggs taken, the distribution of the harvest, and the impact on different colonies.
At the appropriate time, models should be developed on the harvest regime of shared populations.	More information is needed from banding and telemetry studies to determine the proportions of different populations in winter flocks.
Local management of consumptive uses.	Landowner traditionally controls the number of eggs or birds taken. Information on birds killed finds its way into the general harvest figures, but not on the regional scale needed and not separated from numbers killed out of the breeding season away from colonies.

3.1.4 Recommended Actions:

- A report on the numbers of eggs collected and birds killed at individual bird-cliffs need to be compiled.
- Modelling the impacts of hunting on populations (Appendix 7 contains hunting statistics for 1995-2001).
- A co-operative project on the movements, over-wintering areas, and levels of harvests of Thick-billed Murres should be initiated between Greenland, Canada, Norway, Russia, and Iceland.
- A co-operative project on the movements, over-wintering areas, and proportional levels of harvests of Common Murres should be initiated between Norway, Russia, Iceland, and Faeroes, with possible co-operation from UK and Germany.

3.2 Non-Consumptive Use

3.2.1 Background

Contrary to harvesting, seabird colonies in Iceland have relatively recently become significant targets by the eco-tourism industry. This form of utilization of seabird colonies has without any doubt increased simultaneously with an increase in general tourism.

3.2.2 Strategy Actions

Action 5*:* Ensure that non-consumptive uses of murres are sustainable.

Action 6: Implement management plans for areas of eco-tourism activity.

Action 7: Implement standard guidelines to minimize the impact of disturbance at murre colonies.

3.2.3 Requirements and Status

Requirements to implement actions:	Status:
An overview of the use of seabird colonies for tourism needs to be compiled, describing the type of tourism taking place, the level of visits, how tours are operated, and determine their potential impact on the colonies.	CBird has compiled a preliminary overview of disturbance at Arctic seabird colonies, and this is reckoned to be negligible at present. However, no specific information is available on the subject in Iceland, while visits by tour operators to seabird colonies are increasing.
Work with tour operators, to establish a set of operating guidelines.	CBird has produced a brochure to help tourists avoid undue disturbance. The whale-watching and other marine tour-operators are the proper forum through which guidelines should be established.
WWF has developed a set of guidelines for Arctic eco-tourism.	These guidelines have been evaluated for at least one area in Iceland.
Further actions should be addressed in light of the results from an overview report.	No further activity at present.

3.2.4 Recommended Actions:

- Produce an overview of which seabird colonies are subject to organized and non-organized tourism with indications of the levels of exposure taking place through tourism.
- Evaluate WWF guidelines on eco-tourism and their recommendations as regards murres and seabirds at large.

3.3 Commercial Activities and Industries

3.3.1 Background

In Iceland fishery is the single most important commercial activity likely to affect seabirds, including murres. Fishing takes place both in the vicinity of seabird colonies and on the seabirds' feeding grounds, which overlap extensively with important fishing grounds. Fishing activities can affect seabirds in various ways, for instance through direct competition for the same fish resources, the birds getting entangled and killed in fishing gear, and through pollution. Oil and gas explorations with possible future drilling, which may take place as a result of extensions of the EEZ, call for concerted efforts to study the distribution and numbers of murres (actually seabirds in general) at sea. Such studies have already been carried out in most parts of the NE-Atlantic, with the exception of Icelandic waters.

3.3.2 Strategy Actions

Action 8: Identify, publicize and minimize impacts of commercial activities on murre breeding and foraging areas.

Action 9: Implement programs to reduce oil pollution in areas used by murres.

Action 10: Assess and reduce mortality of murres in commercial fishing gear.

Action 11: Ensure that management of commercial harvests of small fish species provide for their role in murre diets.

3.3.3 Requirements and Status

Requirements to implement actions:	Status:
Identify the levels of fishing activities in the vicinity of seabird colonies.	Might be possible to use data already available on reported fishing activities. A reporting scheme in conjunction with control flights by the Icelandic Coast Guard could potentially be designed.
Identify the levels of fishing activities on important seabird feeding grounds.	Use data already available on reported fishing activities. Also possible to design a reporting scheme in conjunction with control flights by the Icelandic Coast Guard. Surveys of important seabird concentrations need to be carried out.
Qualify and quantify the levels of bycatch.	A preliminary report by CBird shows that there are considerable levels of bycatch, not the least murres, but this is seasonal. A proper survey has never been carried out.
Competition with man for food.	Food studies have been carried out but need to be expanded, to include different seasons and annual variations, especially at colonies. Modelling will be helpful to evaluate possible impacts.
Identify the locations and importance of biological resources, in order to avoid and reduce dangers from pollution incidents.	Compilation, mapping, and research of biological resources of significant importance. A pilot study has been initiated through the Committee on Response to Catastrophic Pollution Incidences, in the region Vestmannaeyjar in the south to Snæfellsnes in the west.
Experiments with modifications of fishing gear and sharing devices to reduce bycatch.	No activity presently but monitor activities in other countries through CBird.

3.3.4 Recommended Actions:

- Identify levels of fishing activities in the vicinity of seabird colonies and important feeding grounds.
- Increase food studies and ecosystem modelling, among others in conjunction with climate change issues. One such project includes the types and quantity of foods brought to young in summer.
- Produce a status report, *vide* FAO, in order to identify the extent of incidental take (bycatch) as a human-induced mortality factor, and develop ideas for mitigation measures.
- Carry out a preliminary survey of and report on the spatial, temporal, and numerical extent of bycatch in fishing gear.

3.4 Murre Habitat Protection and Enhancement

3.4.1 Background

Murres nest at over 20 sites in Iceland (counting the Vestmannaeyjar islands group as a single unit). Both murre species are found at most colonies, while five small additional ones consists only of Common Murres. The distribution of breeding pairs is highly uneven, as the three largest colonies of Látrabjarg, Hælavíkurbjarg, and Hornbjarg, which are all on the Northwest peninsula, contained 74% of the Icelandic Common Murres and 89% of the Thick-billed Murres in 1983-85.

Protecting the breeding colonies is only one facet of murre conservation. Their pelagic marine habitat, where most of their time is spent, feeding, molting, migrating, etc., is of no less importance. The breeding colonies are located at strategic locations, which allow proper feeding regimes for the breeders.

3.4.2 Strategy Actions

Action 12: Identify important murre colonies and designate them under national and international systems of protected areas.

Action 13: Promote the establishment of marine protected areas in important pelagic habitats for murres.

Action 14: Contribute to the "Important Bird Areas" system to highlight important areas for murres.

Action 15: Explore the establishment of an international network to identify and protect key areas for murres.

Action 16: Ensure that conservation action will benefit population, by assessing causes of decline, from an ecosystem perspective.

Action 17: Undertake specific restoration activities to assist depressed populations to recover.

3.4.3 Requirements and Status

Requirements to implement actions:	**Status:**
Conservation status of each colony site, including reserve status.	Conservation status has been partially evaluated, including their Important Bird Area (IBA) status.
Evaluate what activities take place at each colony and their impact on individual colonies.	No work to date, but compilation of activities, incl. harvesting and tourism, needed for each colony, evaluation their impacts, such as egging and taking of birds. Impact of fisheries on individual colonies is unknown, but further data needed on feeding distribution of birds from individual colonies.
Identify the most important feeding concentrations at sea.	Some data available on distribution and density at sea, mainly off the SW, NE, and Látrabjarg (West).

3.4.4 Recommended Actions:

- Complete an evaluation of the conservation status of the largest seabird colonies, incl. murre colonies, using the methodology developed for the Important Bird Area program by BirdLife International.
- Compile what activities, incl. harvesting, take place at each of the large colonies and make an initial evaluation of the impact of egging and the taking of full-grown birds.
- Collect distributional and temporal data of seabirds at sea, concentrating initially on the areas where there is a known overlap with important fisheries and areas where the risk of pollution incidences is greatest.
- Emphasize research on the temporal and spatial distribution of sandeels, as the main food species of murres for which least is known.
- Continue studies into the feeding areas associated with individual seabird cliffs, using telemetry.
- Identify the most important feeding concentrations of murres in late winter.

3.5 Communication and Consultation

3.5.1 Background

No educational materials have been produced in Iceland aimed at murres specifically while they have been incorporated into broader accounts. Literature on birds exists for the general public and these can also be used in school curricula. Projects on seabirds for secondary school teachers have been produced. Children's books on seabirds have also been published. Some tour operators, not the least whale-watching operators, produce leaflets for their individual purposes with information on seabirds of their area. However, information directed at fishermen or the fishery industry at large is virtually non-existent, including that on murres specifically. The primary exceptions are information tables on hunting seasons and advertisements as regards bird banding, published occasionally in seafarer manuals.

3.5.2 Strategy Actions

Action 18: Determine appropriate communication approaches and produce materials to deliver specific messages.

Action 19: Emphasize communication to operators of ships at sea, the fishing industry and tour boat operators.

Action 20: Produce educational materials aimed specifically at children.

Action 21: Issue joint scientific reports of activities relating to murre conservation.

Action 22: Co-ordinate murre population monitoring and store data in standardized databases.

3.5.3 Requirements and Status

Requirements to implement actions:	Status:
Identify the target groups for which education materials are most needed.	No analysis available.
Take advantage of published educational materials.	CBird has produced two types of educational materials on murres, a brochure and a poster in English.
Publish results of scientific investigations.	A number of publications exist describing various aspects of murre biology, both general and specific.
Raise awareness of threats to, or serious developments of, murre populations.	The Icelandic Red List on birds includes the Thick-billed Murre and draws attention to the serious decline, which appears to have taken place in the population.

3.5.4 Recommended Actions:

- Produce educational material, such as brochures, papers, and posters on seabird colonies and potential disturbance by tourists and hunters, including translating the CBird brochure and murre poster into Icelandic.
- Produce a brochure on seabird colonies, on murre behavior at colony and out at sea, about the feeding areas, etc, which can be used in schools, by tour operators, fishermen, and the public at large.
- Report on different aspects of murre conservation, research results, and management issues, in popular media, scientific journals, and management reports.
- Distribute educational and scientific material on murre conservation to public libraries and other interested bodies.

- Produce brochures for fishermen, schools, and others on different aspects of seabirds and the threats to these, such as from oil spills, bycatch in fishing gear, etc.

3.6 Research and Monitoring

3.6.1 Background

Threats to Arctic wildlife are diverse, both of local and global nature. One of the latter is global warming, which could affect the whole Arctic ecosystem. The two murre species are potentially excellent indicators of the effects of climate change. The effects would presumably work in opposite directions for the two murre species in the same region, since one has a High Arctic distribution (Thick-billed Murre) while the other is temperate in distribution (Common Murre). In addition the latter has two colour morphs, which show a clinal change in proportion with increasing latitude and could constitute an independent indicator of climate change.

Information gathering through research and monitoring constitutes the foundation for a solid management and conservation of the species involved. This is therefore paramount to a profitable execution of most of the tasks included in other sections, and to implementation of the strategy as a whole.

3.6.2 Strategy Actions

Action 23: Conduct research on demography at circumpolar monitoring sites.
Action 24: Develop a co-ordinated circumpolar murre-banding program.
Action 25: Monitor murre feeding ecology and food availability.
Action 26: Monitor murre mortality due to oil pollution, fisheries, and hunting.
Action 27: Conduct research to develop techniques to reduce entrapment in fishing nets.
Action 28: Develop management techniques to restore habitats and populations.
Action 29: Consider the effects of global warming and local eutrophication on murre populations.
Action 30: Assess the need to conduct research into the genetics of murre populations.
Action 31: Conduct research to define at-sea distribution of murres and factors affecting this.

3.6.3 Requirements and Status

Requirements to implement actions:	**Status:**
General knowledge of various aspects of murre biology is a prerequisite for effective conservation of the species, such as the effects of climate change.	Many general aspects of murre biology are known, while others have been little researched. Some 20 scientific publications exist specifically on murres in Iceland, while various aspects of their life history are found in more general publications. Considerable foreign literature can also be drawn upon. Good information exists on distribution and general population size, while meagre data exist for population trends and causes of changes.
Monitoring the trends in the populations.	Monitoring takes places at two colonies, but none at the three major colonies, of greatest importance to the well-being of the Icelandic murre populations.

3.6.4 Recommended Actions:

- Initiate a monitoring program, using two corresponding methods, a countrywide aerial survey and study plots at selected colonies, at regular intervals.
- Continue analyses and reporting of the present knowledge of the winter distribution of murres and relevant mortality factors from banding returns.
- Implement a Circumpolar Murre Banding Plan, in co-operation with the other Arctic countries, including the possibilities of receiving experienced banders/climbers from other countries to help in banding operations.
- Continue efforts to start a project on the winter distribution of murres using satellite-tracking or other relevant techniques, in co-operation with other Arctic countries.
- Continue to work with foreign workers interested in the genetics, phylogeny, and structure of murre populations.
- Work with CAFF/CBird, AMAP and other interested parties on climate change issues and their relations to the changes in murre populations.

4 IMPLEMENTATION GUIDELINES

The CMCS provides three main guidelines for each country in order to implement the strategy. These are further separated into nine actions. Based on these guidelines a number of actions, which are recommended under the previous six management issues, are selected as initially recommended priorities for Iceland. These are listed below. Some further issues, not mentioned in section 3.0 The Conservation Plan, are brought up below in section 4.2 Collaboration and Co-operation and 4.3 Reporting.

4.1 Priorities

4.1.1 Actions

Action 1: Give high priority to actions addressing significant levels of murre mortality.
Action 2: Give high priority to habitat protection for key colonies and foraging areas.
Action 3: Give additional priority to research and monitoring needed to address murre conservation issues.
Action 4: Give additional priority to actions supporting obligations of treaties and agreements.

4.1.2 Initial Recommended Actions

Actions listed here are not placed in any particular priority order. It should be noted that two or more of these recommendations could be carried out together:

- Produce an overview of which activities take place at each of the large colonies and make an initial evaluation of the impact of these. These activities include harvesting (egging and the taking of full-grown birds), organized and non-organized tourism with indications of the levels of exposure, and near-colony fishing operations.
- Collect distributional and temporal data of seabirds at sea, concentrating initially on the areas where there is a known overlap with important fisheries and areas where the risk of pollution incidences is greatest.
- Identify the most important feeding concentrations of murres in late winter.
- Continue analyses and reporting of the present knowledge of the winter distribution of murres and relevant mortality factors from banding returns
- Produce a status report, *vide* FAO concentrating both on both long-line and gill-net fisheries, in order to identify the spatial, temporal, and numerical extent of incidental take

(bycatch) as a human-induced mortality factor, and develop ideas for mitigation measures.

4.2 Collaboration and Cooperation

4.2.1 Actions

Action 5: Encourage and assist the development of national murre conservation plans.

Action 6: Coordinate initiatives among circumpolar countries to address shaded murre conservation issues.

Action 7: Ensure the involvement of other jurisdictions and groups necessary to effectively implement this action plan.

4.2.2 Initial Recommended Actions

Actions listed here are not placed in any particular priority order. It should be noted that two or more of these recommendations could be carried out as one project:

- Co-operative projects on the movements, over-wintering areas, and levels of harvests of Thick-billed Murres should be initiated between Greenland, Canada, Norway, Russia, and Iceland.
- Increase food studies and ecosystem modelling, among others in conjunction with climate change issues. One such project includes the types and quantity of foods brought to young in summer.
- Complete an evaluation of the conservation status of the largest seabird colonies, using the methodology developed for the Important Bird Area program by BirdLife International.
- Emphasize research on the temporal and spatial distribution of sandeels, as the main food species of murres for which least is known.
- Produce educational material, such as brochures, papers, and posters on seabird colonies and potential disturbance by tourists and hunters, including translating the CBird brochure and murre poster into Icelandic.
- Initiate a monitoring program, using two corresponding methods, a countrywide aerial survey and study plots at selected colonies at regular intervals.
- Implement a Circumpolar Murre Banding Plan, in co-operation with the other Arctic countries, including the possibilities of receiving experienced banders/climbers from other countries to help in banding operations.
- Continue efforts to start a project on the winter distribution of murres using satellite-tracking or other relevant techniques, with other Arctic countries.
- Work with CAFF/CBird, AMAP and other interested parties on climate change issues and their relations to the changes in murre populations.

4.3 Reporting

4.3.1 Actions

Action 8: Report annually to CAFF on each nation's progress in implementing this action plan.

Action 9: Meet regularly to revise objectives and actions on the basis of shared information.

4.3.2 Initial Recommended Actions

Actions listed here are not placed in any particular priority order, except the first, which is a prerequisite for the implementation of this plan. It should be noted that two or more of these recommendations could be carried out as one project:

- One full-time researcher is needed to oversee in sufficient details the implementation of the Circumpolar Murre Conservation Strategy in Iceland, carry out some of the research, monitoring, or other activities, and forge links with other workers in this field, nationally and internationally.
- Report on aspects of murre conservation, research results, and management issues, in popular media, scientific journals, and management reports.
- Distribute educational and scientific material on murre conservation to libraries and other interested bodies.
- Continue to participate in the Circumpolar Seabird Group (CBird) together with the other seven Arctic countries.

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Appendix 1:
Circumpolar Murre Conservation Strategy and Action Plan: ICELAND

Compiled by Gudmundur A. Gudmundsson, Aevar Petersen and Arnþór Garðarsson

1. Introduction

Research activity on seabirds, esp. alcids, in Iceland has greatly increased since 1993. Several events led to these developments. First, a special emphasis was placed on seabirds, Common Murre *Uria aalge* and Thick-billed Murre *U. lomvia* in particular, by CAFF (*Conservation of Arctic Flora and Fauna*), a working group under the ministerial Rovaniemi Declaration (or *Arctic Environmental Protection Strategy*, AEPS), already at its inaugural meeting in Ottawa 1992. To fulfil that requirement the Circumpolar Seabird Working Group (CSWG) was established at CAFF's second annual meeting in Fairbanks in 1993. Second, a workshop sponsored by the Nordic Council of Ministers, in Trondheim, Norway, in autumn 1992, emphasized the need for increased research on alcids. In both cases the needs for increased co-operation between countries which share common alcid populations as well as added national commitments was emphasized. Furthermore, a new research program, led by the Marine Research Institute, on the relationship of different marine species was initiated with emphasis on food selection of several seabird species, including murres.

2. Present status

2.1 Murre populations

2.1.1. Breeding populations and habitats

Murres are numerous in Iceland. Common and Thick-billed Murres are found at over 20 breeding colonies around the country. A survey was carried out in 1983-85 (Table 1) but since then three small Common Murre colonies have been located at Hafnarbjarg, Norðfjarðarnípa, and Stokksnes, in E- and SE-Iceland. These colonies vary much in size, from less than 100 breeding pairs to 800,000. The location and relative size of Icelandic murre colonies is shown in Fig. 1 (from Gardarsson 1995). Several colonies are known to have disappeared (Petersen 1982, Gardarsson 1995).

Table 1. Population estimates of Common and Thick-billed Murres in Iceland 1983-85, shown as number of breeding pairs (Gardarsson 1995).

Site:	Common Murre	Thick-billed Murre	Methods:
Ingólfshöfði	7,000	110	Aerial photography/ground
Reynisfjall	1,540	0	Aerial photography/ground
Dyrhólaey	4,360	0	Aerial photography/ground
Vestmannaeyjar	57,000	210	Aerial photography/ground
Krísuvíkurberg	20,000	2,600	Transects/ground
Eldey	2,700	510	Aerial photography/ground
Hafnaberg	600	80	Total/ground
Þúfubjörg	1,370	240	Total/ground
Svörtuloft	1,110	840	Total/ground
Látrabjarg	298,000	118,000	Aerial transects/ground
Bjarnarnúpur	1,110	670	Aerial photography/ground
Ritur	18,000	12,000	Aerial transects/ground
Hornbjarg/Hælavíkurbjarg	438,000	397,000	Aerial transects/ground
Drangey	5,700	21,500	Aerial photography/ground
Grímsey	62,000	7,100	Transects/ground
Rauðinúpur	2,100	760	Aerial photography/ground
Skoruvíkurbjarg	30,000	12,000	Transects/ground
Langanesbjörg	30,000	3,500	Aerial photography/ground
Skrúður	9,700	2,280	Aerial photography/ground
Papey	2,050	50	Total/ground
	========	========	
Total (pairs):	992,340	579,450	

The estimated total Icelandic populations of these species in 1983-85 were about 990,000 pairs of Common Murre and about 580,000 pairs of Thick-billed Murre. These estimates correspond to about 27% of the North Atlantic total for Common Murre and 11% of the Thick-billed Murre.

The great majority of all three species in Iceland breed on the huge cliffs in the Northwest, including 76% of the Common Murre and 91% of the Thick-billed Murre. The species composition varies greatly from colony to colony. Common Murres dominate in the colonies on the south coast, whereas Thick-billed Murres are more

common in the north. The very uneven distribution is presumably related to feeding conditions at sea (Lilliendahl & Sólmundsson 1997).

Other seabird species which breed at murre colonies would also benefit from conservation efforts for murres, such as Razorbill and Puffin, substantial proportions of the world population of which breed in Iceland.

2.2.2. Pelagic populations and habitat

Aerial surveys of seabird distribution and numbers west of Iceland were made at different times of the year. Similar surveys off the north, east and south coasts are in progress and will be completed by 1998. As an example the mean density of large auks on the shelf west of Iceland (depth 20-200 m) in February was 20 per km^2 which is close to the density (22 km^2) indicated by the numbers breeding along the adjoining coasts (Gardarsson 1997). The density was highest over the shelf off north-west Iceland, reaching over 200 birds per km^2 in an extensive area at Hornbanki.

The limited ringing recovery data available indicate that most Icelandic Common Murres spend the winter in Icelandic waters, with a minor proportion migrating towards Europe. Some mixing of Common Murre populations also occurs in Icelandic waters during winter and spring, as birds from the Faeroes and the Scottish Isles migrate northwards. For Icelandic Thick-billed Murres the movements seem to be westerly since the recoveries outside the breeding season come from SW-Greenland and Newfoundland, except one recovery in early spring from Iceland. Conversely influx of birds from Svalbard and Bear Island into Icelandic waters in winter, has been shown.

2.3. Legislation

2.3.1. Act on Conservation, Protection and Hunting of Terrestrial Mammals and Wild Birds

A new wildlife act came into force in 1994 (no. 64/1994) replacing the former Act on Bird Hunting and Bird Protection of 1966. The law emphasises that all birds are protected unless a special regulation is issued allowing hunting, but indicates also the maximum extent of the hunting seasons. Regulation on Bird Hunting and Consumptive Use of Wild Bird Populations (no. 456/1994) gives the shooting seasons, which for murres are presently 1 September to 10 May (shortened from 19 May from the previous law). Landowners are also allowed to collect eggs and take birds at colonies in summer between 1 July and 15 August using a special pole net. Flying aeroplanes or by other means causing unnecessary disturbance at or near bird-cliffs, is prohibited. All shooting is forbidden at or near bird-cliffs, within 200 m on land and 500 m at sea. Enforcement of these laws is difficult in remote areas, but they seem to be generally observed. Former hunting methods, such as snare-rafts or nooses, are now forbidden.

2.3.2. Other relevant legislation

Other legislation are relevant to murre conservation. These include the general nature conservation law (no. 93/1996) which relate to habitat protection, law against marine pollution (no. 20/1972 and 14/1979), and utilization of marine resources (no. 81/1976)

2.3.3. International agreements

Iceland is member of several international conventions, treaties and co-operative efforts that could have bearing on murre conservation. These are the Ramsar, Berne, Biodiversity, Paris, and World Heritage Conventions, and various international efforts counteracting pollution of marine areas.

2.4. Protected areas

2.4.1. Protected colonies

Several areas, which include murre colonies, are protected. These include Eldey Island which was the first such area to be protected (in 1940), Ritur and Hælavíkur- and Hornbjarg which are included in the Hornstrandir Nature Reserve, part (called Bæjarbjarg) of the huge Látrabjarg, Skrúður Island, Ingólfshöfði and Dyrhólaey promontories, and the seacliff Krísuvíkurberg which is included in the Reykjanes Country Park.

2.4.2. Marine Protected Areas

The major marine protected area in Iceland is that of Breiðafjörður (W-Iceland), about 3000 km² in area. This does not include murre colonies but murres regularly disperse into this area for feeding. The Eldey and Skrúður nature reserves also include a radius of two kilometres of sea areas around them. Fishery authorities can close certain sea areas, both temporarily and permanently. Although primarily for fishery protection purposes murres may also benefit.

2.5. Consumptive use

2.5.1. Egging

Egg collection is a tradition which goes back centuries. A total assessment of murre eggs harvesting has never been made. Some harvesting data is available for individual colonies from different times, including the largest colonies, giving a general idea of the egg harvest in former times. Most colonies are owned by local farmers which harvested them in a traditional manner. It has therefore been in their own interest to protect and manage their use, so oddly, this activity may have been positive for the birds because of local protection. It seems the egging intensity has declined in past decades on the whole, although individual colonies may be visited just as much as formerly, some even more intensely. Certain changes have taken place, as most landowners have decreased or stopped utilising this resource, and rescue organisations or private contractors have taken over for fund raising or commercial purposes.

2.5.2. Hunting

Bag-statistics for the murre hunt are available since 1995, when new hunting regulations where adopted. Hunters need to register and report their annual harvest (to the Wildlife Management Unit). Based on the reports from hunters, a total of 52,400 and 57,800 Common Murres where shot in 1995 and 1996, respectively. Corresponding figures are 15,100 and 18,800 for Thick-billed Murres. Identification of the two murre species by hunters is questioned, and certain confusion is also takes place with the Razorbill. Note that figures for 1996 are preliminary, based on only over 70% report return.

2.5.3. Bycatch

Accidental drowning in fishing gear has never been quantified for murres but is considerable though probably highly variable. A preliminary estimate of the order of magnitude of the combined total annual bycatch could be about 70,000 individuals for both species of murres. No monitoring or registration of bycatch is ongoing. Gill-netting (for cod) is the primary source of bycatch mortality, especially at certain high-density areas or at Capelin spawning areas just prior to the breeding season. There is much seasonal change in bycatch. Bycatch is lowest during the summer period. Increase starts in the autumn and continues throughout the winter period, peaking in May. The use of incidental take has been banned in the Icelandic wild bird acts since 1954. This was originally put in so as to discourage intentional netting. Nonetheless, fishermen have utilised bycatch for home consumption. During the past 10-20 years some of these birds have found their way to fishmongers, and starting a few years ago bycatch has also been sold at fish auctions, without intervention from law enforcement authorities.

There are no available guidelines for counteracting bycatch in Iceland, and no preparations are in progress for such work. Although the utilization of birds drowned in fishing gear is illegal this does counteract another human-induced mortality factor. Since a substantial part of the bycatch reaches the market this goes some way to satisfy the demand for human consumption. The utilisation of bycatch therefore counteracts hunters´ incentive to satisfy the market by shooting.

Drift-nets are forbidden by law, and there is no Salmon fishing at sea within the Icelandic fishery zone.

2.6 Non-consumptive use

Tourism is limited to only a few colonies (primarily Látrabjarg, Ingólfshöfði, Vestmannaeyjar, Dyrhólaey, Drangey, and Papey). This is presently almost restricted to visits at the edges, but boat tours are also organized under the cliffs at certain colonies, notably in the Westman Islands (Vestmannaeyjar). Although increasing, tourism is believed to have little or no impact at present.

2.7. Previous research emphasis

2.7.1. Population assessment

A survey of numbers and distribution of Common and Thick-billed Murres (and Razorbill) breeding in Iceland was conducted in 1983-85 (Table 1, Fig. 1). Combined ground and aerial counts were applied at small and medium-sized colonies. At the huge inaccessible cliffs, such as Látrabjarg, Hælavíkurbjarg and Hornbjarg where most of the Icelandic populations breed, counts were made on vertical transects from aerial photographs. Species composition was estimated on the ground. Counts on the cliff yielded the relative abundance of the two species.

2.7.2. Monitoring

The new base-line results on the breeding population size of Icelandic murres (Gardarsson 1995) are difficult to compare with older estimates (Einarsson 1979, mainly from the 1950s), especially because of the difficulties of obtaining reliable and unbiased estimates at Látrabjarg, Hælavikurbjarg and Hornbjarg. The suggestion that numbers of murres have decreased at these northwestern colonies (Nettleship & Evans 1985) is not supported

by the available information. Prior to 1985, the Common Murre may have decreased in Vestmannaeyjar, but at other localities (Krísuvíkurberg, Snæfellsnes, Drangey, and east coast colonies) some increase or at least little change has been observed. Numbers of Thick-billed Murre probably did not change at Snæfellsnes peninsula colonies, and possibly other west coast localities. At Hafnaberg, Drangey and Papey decreases are suggested in Thick-billed Murre.

Very little monitoring has yet been done, but some of the smaller colonies have been photographed several times from the early 1980's (Gardarsson 1995). Very few older comparable data sets on the sizes of Icelandic murre colonies are available, mainly due to methodological differences.

Transect data show a significant increase (4.3% per annum) of Common Murre at Skoruvíkurbjarg in 1986-94 but no change at Krísuvíkurberg in 1985-94. Significant declines of Thick-billed Murre have been observed at both places, 2.7% annually at Skoruvíkurbjarg but 4.1% at Krísuvíkurberg. Transect photographs have already been taken of the Látrabjarg colony but results are not available.

A methodological study for monitoring of breeding Common and Thick-billed Murres, based on Birkhead & Nettleship (1980), was initiated in 1993. Study plots were selected and photographed at Krísuvíkurberg on the southwest coast, at Skoruvíkurbjarg on the northeast coast and at the island Grímsey off the north coast. Krísuvíkurberg was visited six times between 9 June and 7 July 1993, and twice in the 1995 breeding season.

2.7.3. Colony attendance

Colony attendance of murres varies considerably between colonies, both diurnally and seasonally. Attendance was measured at two colonies, Hafnaberg and Latrabjarg, for two and three years respectively (Sigfusson 1985).

Presently data loggers are being used to monitor the movements and time utilization of murres breeding at Látrabjarg (Benvenuti *et al.* 1998). This method gives detailed time budgets of individual birds, among others their attendance in the colony. Comparisons with other colonies is being prepared.

2.7.4. Distribution at sea

Three methods have been used in the past to study the distribution of seabirds at sea, (1) censusing from ships and (2) using route recorders (Icelandic Institute of Natural History in co-operation with Univ. of Pisa, Italy) and (3) aerial surveys (Institute of Biology, University of Iceland).

In September 1987-1991, censuses were carried out along a fixed transect on the seas between Iceland, Jan Mayen and Greenland (Greenland Sea Project, Petersen & Petersen 1991, Petersen 1995).

Preparations for recording movements of breeding birds, using data loggers, began in 1993. These loggers (route-recorders, cf. Bramanti *et al.* 1988), which are glued on the birds´ back, register their compass bearings at pre-programmed intervals, enabling reconstruction of their flight paths and time budgets (Benvenuti *et al.* 1998).

Aerial surveys of seabird distribution and numbers west of Iceland were made in 1993-1995. Survey transects sampled an area of about 230,000 km², mostly between 63°N and 68°N, and 20°W and 26°W, and were conducted in February, May, July, September and November (Gardarsson 1997). Similar surveys off the north, east and south coasts are in progress and will be completed by 1998. Murres and Razorbill were generally lumped as one category ("svartfugl" or large auk) as these three species could only be identified to species when viewing conditions were exceptionally favourable (good light and small groups). In February the mean density of large auks on the shelf west of Iceland (depth 20-200 m) was about 20 per km² which is close to the density (22 km²) indicated by the numbers breeding along the adjoining coasts (Gardarsson 1997). The density was highest over the shelf off north-west Iceland, reaching over 200 birds per km² in an extensive area at Hornbanki north-east of Hornbjarg. In May and July densities at sea were much lower as expected from the attendance of the auks at the breeding colonies during the day. In September and November the overall density over the western shelf was only one third of the expected value as estimated from breeding numbers and it is seems likely that this was caused by dispersal of birds into deeper areas. In November high densities of auks, probably nearly all Thick-billed Murres, were found along the edge of the pack ice north of 66° and west of 26°W. A few Thick-billed Murres were found in the same general area in February and more observations along the edge would be interesting.

2.7.5. Ringing
Emphasis has been on murre ringing since 1993. By the end of 1992 only a total of 892 Common Murres and 425 Thick-billed Murres had been ringed, mainly as adults. Between 1993 and 1996 all together 5644 Common Murres and 728 Thick-billed Murres were ringed, bringing the grand total to 6536 and 1153, respectively.

Of Icelandic ringed murres only three Common Murres and four Thick-billed Murres have been recovered abroad during the non-breeding season. The Common Murres were recovered in the Faeroes. Two of the Thick-billed Murres were recovered in West Greenland and two in Newfoundland. Over 50 Common Murres have been found in Icelandic waters in the same season but only one Thick-billed Murre. Information is therefore meagre about migration routes and patterns of the Icelandic breeding populations as yet, although the material gives a certain indication. It seems that most Common Murres are resident but most of the Thick-billed Murres move out. Recoveries of foreign-ringed murres suggest some mingling of other populations. There are 27 recoveries in Iceland of Common Murres ringed abroad, five in the Faeroes, the remaining in Scotland, and primarily in winter and spring (December - May). Nine foreign-ringed Thick-billed Murres were ringed on Bear Island and Svalbard, N-Norway, demonstrating westerly movements of this species.

2.7.6. Food selection
Food selection of several seabird species, including murres, during winter (Lilliendahl 1990), and during summer (Lilliendahl & Sólmundsson 1997) has been studied. Assessment of their consumption of different prey species and role in the marine ecosystem may be of such importance to be included in models over fish stocks of commercial interest. This work is a part of a recent large research programme on the relationship of different marine organisms.

2.7.7. Taxonomic and genetic studies
Blood from both murre species has been collected from Icelandic breeders for analyses in Canada, as a comparative study of genetic structure of populations from different regions (V. Friesen). Results are likely to be available within not too long.

3. Future plans and needs
3.1. Research needed
A co-ordinated research plan is needed to address the most pressing research and management issues on murres in Iceland. In doing so it is important to stress questions which cannot be answered without international Cupertino as well as developing the basic background information for the conservation and management of Icelandic murre populations. Numbers in parentheses in the titles refer to numbered action items in the International Murre Conservation Strategy and Action Plan (CAFF 1996).

3.1.1. Monitoring of breeding population (1)
Total assessment should be undertaken every 10 years, using a combination of aerial and ground surveys, in the manner carried out by Gardarsson (1995). An annual monitoring program is needed to address population changes at selected colonies. For future monitoring of bird numbers colonies that are easy to count should be selected, e.g. Bjarnarey and Súlnasker in Vestmannaeyjar; Krísuvíkurberg, Hafnaberg, Þúfubjarg, Drangey, Skoruvíkurbjarg, and Papey. Despite the technical difficulties, it is also imperative to monitor Látrabjarg, Hælavíkurbjarg and Hornbjarg, because of the huge numbers breeding there. Associated with population monitoring, attendance (seasonal, annual, inter colony variation), needs to be addressed at selected colonies, and population parameters such as breeding success, adult survival, and recruitment.

Preparations are underway on establishing a Seabird Colony Register for Iceland, containing the available information on individual seabird colonies, their number of pairs of each breeding species, and monitoring data. Compatible databases are planned for all the CAFF-countries, and the preparatory work has been carried out by the Circumpolar Seabird Working Group (CSWG). Hopefully Icelandic ornithologists and other seabird enthusiasts which have seabird colony data will contribute to this database.

3.1.2. Non-breeding movements (3)
Research problems concerning Icelandic murres primarily centres on documenting the autumn movements of Icelandic populations and identifying their main wintering areas. Another scope for study is the influx of murres from elsewhere, identifying their origins, age structure, and timing.

Recovery percentage is very low for murres, and banding needs to be greatly intensified to work out the migration patterns, more so for the Thick-billed Murre. Colonies located in different parts of the country, and associated with different ocean water masses, need to be visited. Thick-billed Murres are primarily concentrated in colonies on the NW peninsula, so banding has to focused on Latrabjarg, Haelavikurbjarg, and Hornbjarg. These are also predominant colonies for Common Murres.

Banding will clearly need to be augmented with other techniques, esp. radio- and satellite-tracking, and route-recording (cf. above). Route-recording, using data-loggers, has been carried out during the breeding season, and satellite-tracking is in preparation. Commercial tracking devices are still somewhat large (20-25g) for murres (ca 950g) which have a rather unfavourable wing-loading ratio. A feasibility study is being carried for the development of ca 15g satellite-transmitters by an Icelandic electronics company.

3.1.3. Foraging grounds

For conservation purposes it is of major importance to locate the murres' main foraging grounds at different times of year. For that purpose, transect counts have been conducted both from ships and from air, as well as studying foraging flights of individual birds from the breeding colonies.

3.1.4. Impact of consumptive use (1, 2, 16, 26)

Information on the extent of egging and pole-netting is needed for further assessment of the situation, although neither are thought to be of the extent that is likely to endanger the populations.

The magnitude and impact of bycatch is presently unknown. Assessment and monitoring of the situation is severely needed.

3.1.5. Assessment of pollution (26)

Problems relate primarily to oil or liver oil pollution. The first is both chronic or from shipping incidences. The second is mainly from land-based factories, and is basically of chronic nature. One major incidence at least is of natural origin, i.e. mass death of *Calanus finmarchius* zooplankton (Sigfusson 1992). As a result of that incidence a committee was formed by the Ministry for the Environment to make recommendations on preventive measures against pollution. These are still being prepared but a report is in press which includes a compilation of various parameters of importance, *inter alia* information on main shipping lanes, spawning grounds of fish, fishing grounds, and seabird colonies at risk. Recommendations will be formed, based on this information.

3.1.6. Monitoring of food availability (25)

Only prey species of commercial interest, such as Capelin *Mallotus villosus* and Herring *Clupea harengus*, have been monitored in Icelandic waters. Other important prey species for murres (and for many commercially important fish species) like sandeel, especially *Ammodytes marinus,* ought to be monitored as well.

3.1.7. Genetic studies (3,30)

Blood from both murre species has been collected from Icelandic breeders for analyses in Canada, as a comparative study of genetic structure of populations from different regions. Results are likely to be available within very long. If population specific markers will be found new doors will be opened for investigation of origins of murres in different wintering quarters.

3.2. Legislation (1,8,10)

With new legislation the former hunting season (using shotgun) was shortened slightly, from 19 May to 10 May, starting on 1 September. Egging and hunting with pole-net continues to be possible at colonies. Egging takes place without any restrictions, as used to be for pole-netting, which is now restricted to the period 1 July - 15 August.

A few kilometre wide no-fishing zone at seabird cliffs (to curtail by-catch) has been recommended, but not accepted so far. These would also only be partially effective due to the extensive fishing range of the murres.

3.3. Proposed protected areas

3.3.1. Seabird colonies

Besides those murre colonies which are formally protected, all the other Icelandic murre colonies are registered as Sites of Special Interest (SSI) and listed on the national Nature Conservation Register. Although these areas do not enjoy full protection there are certain restrictions to changes in landuse. Many of these areas are either in the process of being formally protected or on the nature conservation authorities´ "wish-list". These areas (cf. Fig. 1) include Hafnaberg on the Reykjanes peninsula, Þúfubjörg and Svörtuloft on Snæfellsnes peninsula (where a national park is being planned), the rest of the huge Látrabjarg as well as Bjarnarnúpur, Drangey and Grímsey islands, Rauðinúpur on the Melrakkaslétta peninsula, the Langanes colonies, Hafnarbjarg in the Loðmundarfjörður region, Norðfjarðarnípa in the Neskaupstaður country park, Papey island, Stokksnes in the Skarðsfjörður region, and the Vestmannaeyjar islands.

3.3.2. Marine protected areas

A discussion paper on available options on the issue of marine protected areas, is being developed within CAFF. This work forms a part of the Circumpolar Protected Areas Network (CPAN), and is lead by Canada. Iceland participates in this work by contributing the relevant information.

3.4. Guidelines to minimise disturbance

CAFF is working on a first report on this subject, and Iceland has given an input to that report. The results of this work will be studied carefully, and any recommendations receive due consideration. Eco-tourism is increasing in Iceland, and guided tours such as on boats under seabird cliffs, traffic along cliff edges, are being organized to a greater extent in recent years. Activity such as egging, bird catching, or research need also to be considered.

3.5. Education (6,18)

3.5.1. Schools (20)

Recently an increased emphasis on birds has developed in biology teaching. A new textbook about seabirds, especially auks, has been published for upper classes of primary schools (Sigurjónsdóttir 1995). It is important to raise public awareness for murre conservation problems by teaching at all levels.

3.5.2. General public (20)

As television plays an important role in everyday life of modern man, it is a perfect media to bring information to the general public. Recently television films have been produced in Iceland about murres and other seabirds. More is needed.

3.5.3. Seamen and fishing industry (19)

Information about bycatch issues, marine pollution etc. needs to be prepared and included in the educational programme for seamen, especially those who are in charge of the vessels.

4. Summary of action items

A summary is provided here of the action items which are already underway in Iceland for implementing the murre conservation strategy. A listing is also provided of the most pressing issues which need to be addressed.

- Monitoring: Annual counts at selected plots in several colonies required, especially for measuring population parameters such as breeding success, adult survival, and recruitment.
- Feeding distribution from colony: Locate the most important foraging grounds.
- Relationship of murres to other parts of the marine ecosystem: Study food selection of murres and monitor the main prey species.
- Distribution outside breeding season: Locate wintering quarters.
- Seabird Colony Registry.
- Education: Increase public knowledge about biology of murres at all stages, both through the school system and media.
- Bycatch: A general survey needs to be carried out for Iceland, species, spatial and temporal distribution, and possible effects, country-wide or local.

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Appendix 2:
Progress of the implementation of the Circumpolar Murre Conservation Strategy 1998 (CAFF VI, May 1998).

Management Issue	Implementation of the International Murre Conservation Strategy Action Item	CANADA	FINLAND	GREENLAND	ICELAND	NORWAY	RUSSIA	USA ALASKA
I. Consumptive Use	1. Ensure that consumptive uses of murres are sustainable.	2	0	2	2	0	1	1
	2. Monitor harvest levels and assess their impacts on populations.	2	0	2	3	0	1	2
	3. Harmonize management and harvest regimes for shared populations.	1	0	1	1	0	1	1
	4. Involve local and indigenous people in the management of consumptive uses.	2	0	2	0	0	1	1
II. Non-Consumptive Use	5. Ensure that non-consumptive uses of murres are sustainable.	2	0	2	1	1	2	1
	6. Implement management plans for areas of eco-tourism activity.	2	0	1	1	2	2	2
	7. Implement standard guidelines to minimize the impact of disturbance at murre colonies.	2	0	2	1	1	2	2
III. Commercial Activities & Industries	8. Identify, publicize and minimize impacts of commercial activities on murre breeding and foraging areas.	2	1	3	1	2	2	2
	9. Implement programs to reduce oil pollution in areas used by murres.	2	1	2	2	2	2	2
	10. Assess and reduce mortality of murres in commercial fishing gear.	2	3	3	1	1	2	2
	11. Ensure that management of commercial harvests of small fish species provide for their role in murre diets.	1	0	0	2	1	2	2
IV. Habitat Protection & Enhancement	12. Identify important murre colonies and designate them under national and international systems of protected areas.	2	2	2	2	3	2	2
	13. Promote the establishment of marine protected areas in important pelagic habitats for murres.	1	2	2	1	1	2	2
	14. Contribute to the Important Bird Areas system to highlight important areas of murres.	3	3	3	3	2	2	2
	15. Explore the establishment of an international network to identify and protect key areas for murres.	1	2	1	2	1	2	2
	16. Ensure that conservation action will benefit populations, by assessing causes of populations, by assessing causes of population declines from an ecosystem perspective.	2	2	1	0	2	2	2
	17. Undertake specific restoration activities to assist depressed populations to recover.	1	1	2	0	1	1	2
V. Communic-ations & Consultation	18. Determine appropriate communication approaches and produce materials to deliver specific messages.	2	0	2	1	1	1	2
	19. Emphasize communication to operators of ships at sea, the fishing industry and tour boat operators and pilots.	2	0	1	1	2	1	2
	20. Produce educational materials aimed specifically at children.	1	0	1	2	1	2	3
	21. Issue joint scientific reports of activities relating to murre conservation.	2	2	2	2	3	2	1
VI. Research & Monitoring	22. Coordinate circumpolar murre population monitoring and store data in standardized databases.	2	2	2	2	2	2	2
	23. Conduct research on population demography at circumpolar monitoring sites.	2	2	2	1	2	2	2
	24. Develop a coordinated circumpolar murre banding program.	2	2	1	2	2	2	1
	25. Monitor murre feeding ecology and food availability.	2	2	1	2	2	2	2
	26. Monitor murre mortality due to oil pollution, commercial fisheries, and hunting.	2	2	2	1	2	2	2
	27. Conduct research to develop techniques to reduce entrapment in fishing nets.	1	1	0	1	1	1	1
	28. Develop management techniques to restore habitats and populations.	1	1	1	0	1	1	2
	29. Consider the effects of global warming and local eutrophication on murre populations.	2	2	1	1	2	1	2
	30. Assess the need to conduct research into the genetics of murre populations.	2	3	2	2	3	2	2
	31. Research on murre distribution/abundance at sea.	2	1	2	1	2	2	2

0 - not applicable 1 - no action 2 - in progress ongoing 3 - completed this year or in past years

Appendix 3:
Progress of the implementation of the Circumpolar Murre Conservation Strategy 1999 (CBird VI, Ottawa 1999).

Management Issue	Implementation of the International Murre Conservation Strategy Action Item	CANADA	FINLAND	GREENLAND	ICELAND	NORWAY	RUSSIA	USALASKA
I. Consumptive Use	1. Ensure that consumptive uses of murres are sustainable.	2	0	2	2	0	1	1
	2. Monitor harvest levels and assess their impacts on populations.	2	0	2	3	0	1	2
	3. Harmonize management and harvest regimes for shared populations.	1	0	1	1	0	1	1
	4. Involve local and indigenous people in the management of consumptive uses.	2	0	2	0	0	1	1
II. Non-Consumptive Use	5. Ensure that non-consumptive uses of murres are sustainable.	2	0	2	1	1	2	1
	6. Implement management plans for areas of eco-tourism activity.	2	0	1	1	2	2	2
	7. Implement standard guidelines to minimize the impact of disturbance at murre colonies.	2	0	2	1	1	2	2
III. Commercial Activities & Industries	8. Identify, publicize and minimize impacts of commercial activities on murre breeding and foraging areas.	2	1	3	1	2	2	2
	9. Implement programs to reduce oil pollution in areas used by murres.	2	1	2	2	2	2	2
	10. Assess and reduce mortality of murres in commercial fishing gear.	2	3	3	1	1	2	2
	11. Ensure that management of commercial harvests of small fish species provide for their role in murre diets.	1	0	0	2	1	2	2
IV. Habitat Protection & Enhancement	12. Identify important murre colonies and designate them under national and international systems of protected areas.	2	2	2	2	3	2	2
	13. Promote the establishment of marine protected areas in important pelagic habitats for murres.	1	2	2	1	1	2	2
	14. Contribute to the Important Bird Areas system to highlight important areas of murres.	3	3	3	3	2	2	2
	15. Explore the establishment of an international network to identify and protect key areas for murres.	1	2	1	2	1	2	2
	16. Ensure that conservation action will benefit populations, by assessing causes of populations, by assessing causes of population declines from an ecosystem perspective.	2	2	1	0	2	2	2
	17. Undertake specific restoration activities to assist depressed populations to recover.	1	1	2	0	1	1	2
V. Communic-ations & Consultation	18. Determine appropriate communication approaches and produce materials to deliver specific messages.	2	0	2	1	1	1	2
	19. Emphasize communication to operators of ships at sea, the fishing industry and tour boat operators and pilots.	2	0	1	1	2	1	2
	20. Produce educational materials aimed specifically at children.	1	0	1	2	1	2	3
	21. Issue joint scientific reports of activities relating to murre conservation.	2	2	2	2	3	2	1
VI. Research & Monitoring	22. Coordinate circumpolar murre population monitoring and store data in standardized databases.	2	2	2	2	2	2	2
	23. Conduct research on population demography at circumpolar monitoring sites.	2	2	2	1	2	2	2
	24. Develop a coordinated circumpolar murre banding program.	2	2	1	2	2	2	1
	25. Monitor murre feeding ecology and food availability.	2	2	1	2	2	2	2
	26. Monitor murre mortality due to oil pollution, commercial fisheries, and hunting.	2	2	2	1	2	2	2
	27. Conduct research to develop techniques to reduce entrapment in fishing nets.	1	1	0	1	1	1	1
	28. Develop management techniques to restore habitats and populations.	1	1	1	0	1	1	2
	29. Consider the effects of global warming and local eutrophication on murre populations.	2	2	1	1	2	1	2
	30. Assess the need to conduct research into the genetics of murre populations.	2	3	1	2	3	1	2
	31. Research on murre distribution/abundance at sea.	2	1	2	1	2	2	2

0 - not applicable 1 - no action 2 - in progress ongoing 3 - completed this year or in past years

Appendix 4:
Progress of the implementation of the Circumpolar Murre Conservation Strategy 2000 (CBird VII, Helsinki 2000).

Management Issue	Implementation of the International Murre Conservation Strategy Action Item	CANADA	FINLAND	GREENLAND	ICELAND	NORWAY	RUSSIA	USA ALASKA
I. Consumptive Use	1. Ensure that consumptive uses of murres are sustainable.	2	0	2	2	0	1	1
	2. Monitor harvest levels and assess their impacts on populations.	2	0	2	2	0	1	2
	3. Harmonize management and harvest regimes for shared populations.	1	0	1	1	0	1	1
	4. Involve local and indigenous people in the management of consumptive uses.	2	0	2	0	0	1	1
II. Non-Consumptive Use	5. Ensure that non-consumptive uses of murres are sustainable.	2	0	2	1	1	2	1
	6. Implement management plans for areas of eco-tourism activity.	2	0	1	1	2	2	2
	7. Implement standard guidelines to minimize the impact of disturbance at murre colonies.	2	0	2	1	1	2	2
III. Commercial Activities & Industries	8. Identify, publicize and minimize impacts of commercial activities on murre breeding and foraging areas.	2	1	3	1	2	2	2
	9. Implement programs to reduce oil pollution in areas used by murres.	2	1	2	2	2	2	2
	10. Assess and reduce mortality of murres in commercial fishing gear.	2	3	3	1	1	2	2
	11. Ensure that management of commercial harvests of small fish species provide for their role in murre diets.	1	0	0	2	1	2	2
IV. Habitat Protection & Enhancement	12. Identify important murre colonies and designate them under national and international systems of protected areas.	2	2	2	2	3	2	2
	13. Promote the establishment of marine protected areas in important pelagic habitats for murres.	1	2	2	1	1	2	2
	14. Contribute to the Important Bird Areas system to highlight important areas of murres.	3	3	3	3	2	2	2
	15. Explore the establishment of an international network to identify and protect key areas for murres.	1	2	1	1	1	2	2
	16. Ensure that conservation action will benefit populations, by assessing causes of populations, by assessing causes of population declines from an ecosystem perspective.	2	2	1	0	2	2	2
	17. Undertake specific restoration activities to assist depressed populations to recover.	1	1	2	0	1	1	2
V Communic-ations & Consultation	18. Determine appropriate communication approaches and produce materials to deliver specific messages.	2	0	2	1	1	1	2
	19. Emphasize communication to operators of ships at sea, the fishing industry and tour boat operators and pilots.	2	0	1	1	2	1	2
	20. Produce educational materials aimed specifically at children.	1	0	2	3	1	2	3
	21. Issue joint scientific reports of activities relating to murre conservation.	2	2	2	2	3	2	1
VI. Research & Monitoring	22. Coordinate circumpolar murre population monitoring and store data in standardized databases.	2	2	2	2	2	2	2
	23. Conduct research on population demography at circumpolar monitoring sites.	2	2	2	1	2	2	2
	24. Develop a coordinated circumpolar murre banding program.	2	2	1	2	2	2	1
	25. Monitor murre feeding ecology and food availability.	2	2	1	2	2	2	2
	26. Monitor murre mortality due to oil pollution, commercial fisheries, and hunting.	2	2	2	2	2	2	2
	27. Conduct research to develop techniques to reduce entrapment in fishing nets.	1	1	0	1	1	1	1
	28. Develop management techniques to restore habitats and populations.	1	1	1	0	1	1	2
	29. Consider the effects of global warming and local eutrophication on murre populations.	2	1	1	2	2	1	2
	30. Assess the need to conduct research into the genetics of murre populations.	2	3	1	2	3	1	2
	31. Research on murre distribution/abundance at sea.	2	1	2	2	2	2	2

0 - not applicable 1 - no action 2 - in progress ongoing 3 - completed this year or in past years

Appendix 5:
Progress of the implementation of the Circumpolar Murre Conservation Strategy 2001 in Iceland (CBird VIII, Anchorage 2002).

Murre Conservation Strategy Implementation:
ICELAND - PROGRESS REPORT 4

A general overview of the murre populations, their status, protection, utilization, and future needs, was compiled in 1997 (Gudmundsson, Petersen & Garðarsson 1997). At CAFF 6 (1997) a matrix was developed, against which the Murre Conservation Strategy action items were weighted. The matrix includes the relevance of the 31 action items for Iceland, whether actions have been completed or not, and if items are in progress. The matrix also included priority rankings for each of the items. The matrix has been revised annually to track the implementation of the Murre Conservation Strategy. Iceland can report the following changes in the implementation of the Murre Conservation Strategy since CSWG 7 (Helsinki 2000):

Action item	
1. Ensure that consumptive uses of murres are sustainable	2
2. Monitor harvest levels and assess their impacts on populations	3
3. Harmonize management and harvest regimes for shared populations	1
4. Involve local and indigenous people in the management of consumptive uses	0
5. Ensure that non-consumptive uses of murres are sustainable	1
6. Implement management plans for areas of eco-tourism activity	1
7. Implement standard guidelines to minimize the impact of disturbance at murre colonies	1
8. Identify, publicize and minimise impacts of commercial activities on murre breeding and foraging areas	1
9. Implement programs to reduce oil pollution in areas used by murres	2
10. Assess and reduce mortality of murres in commercial fishing gear	1
11. Ensure that management of commercial harvests of small fish species provide for their role in murre diets	2
12. Identify important murre colonies and designate them under national and international systems of protected areas	2
13. Promote the establishment of marine protected areas in important pelagic habitats for murres	1
14. Contribute to the “Important Bird Areas” system to highlight important areas of murr	3
15. Explore the establishment of an international network to identify and protect key areas for murres	2
16. Ensure that conservation action will benefit populations, by assessing causes of population declines from an ecosystem perspective	0
17. Undertake specific restoration activities to assist depressed populations to recover	0
18. Determine appropriate communication approaches and produce materials to deliver specific messages	1
19. Emphasize communication to operators of ships at sea, the fishing industry and tour boat operators	1
20. Produce educational materials aimed specifically at children	2
21. Issue joint scientific reports of activities relating to murre conservation	2
22. Coordinate circumpolar murre population monitoring and store data in standardized databases	2
23. Conduct research on population demography at circumpolar monitoring area	1
24. Develop a coordinated circumpolar murre banding program	2
25. Monitor murre feeding ecology and food availability	2
26. Monitor murre mortality due to oil pollution, commercial fisheries, and hunting	1
27. Conduct research to develop techniques to reduce entrapment in fishing nets	1
28. Develop management techniques to restore habitats and populations	0
29. Consider the effects of global warming and local eutrophication on murre populations	1

30. Assess the need to conduct research into the genetics of murre populations	2
31. Conduct research to define murre distribution/abundance at sea	2

Legends: 0 = Not applicable; 1 = No Action to date but required; 2 = In progress and continuing; 3 = Completed

Various research and other activity has been carried out relevant to the Murre Conservation Strategy since CSWG 7. The major ones are summarized below, giving the action item number for which these are most relevant:

- In 2001 a draft national implementation plan was completed. This gives an overview of the status of action items, recommended actions to be taken, and priorities for research and management. The plan still awaits acceptance by authorities).
- Hunting statistics continue to be collected from hunters giving indications if the consumptive use in sustainable and monitors the harvest levels (action items 1,2).
- Paper has been submitted to the Circumpolar Seabird Bulletin on the hunting statistics and a preliminary analysis done on possible effects of hunting on murre populations (Petersen, in press) (action item 2).
- Work continues on a map for use in oil pollution emergencies and other such contamination cases by the Committee on Response to Pollution Incidences. This include *inter alia* the whereabouts of murre colonies and major feeding areas as known (action item 9).
- The illegal sales of seabird bycatch at fish-markets, the great majority of which is murres, have been taken to court and is pending trial.
- Work is proceeding on a nature conservation strategy for Iceland, and will include among others an overview of murre colonies, which have been designated as "Important Bird Areas" (action item 12).
- A paper on the monitoring of seabirds, including murres, was published in 2001 (Petersen 2001). New monitoring plots were established at a murre colony in E-Iceland (Skrúður) in 2000 and counts repeated in 2001 (action item 22).
- Small scale banding of murres continues (action item 24).
- Research continues into the feeding ecology of the two murre species, with the aim of identifying their role in the marine ecosystem and possible effects on fish stocks (Lilliendahl & Ásgeirsson 2001) (action item 25).
- Research has been carried out during the past few years on the distribution of seabirds, including murres, in sea-areas around Iceland, especially off the SW, W and NE coasts (action item 31).

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Appendix 6:
Progress of the implementation of the Circumpolar Murre Conservation Strategy 2002 in Iceland (CBird IX, Tromsö 2003).

Implementation of the International Murre Conservation Strategy: Iceland - Progress Report 5

Aevar Petersen, Icelandic Institute of Natural History **22.01.2003**

A general overview of the murre populations, their status, protection, utilization, and future needs, was compiled in 1997 (Gudmundsson, Petersen & Garðarsson 1997). At CAFF 6 (1997) a matrix was developed, against which the Murre Conservation Strategy action items were weighted. The matrix includes the relevance of the 31 action items for Iceland, whether actions have been completed or not, and if items are in progress. The matrix also included priority rankings for each of the items. The matrix has been revised annually to track the implementation of the Murre Conservation Strategy. Iceland can report the following changes in the implementation of the Murre Conservation Strategy since CBird 8 (Anchorage 2002):

Table xx. Implementation of the International Murre Conservation Strategy, Iceland 2001 and 2002.

Management Issue	Action Item	Status 2001	Status 2002	Initiatives
I. Consumptive Use	1. Ensure that consumptive uses of murres are sustainable.	3	3	B
	2. Monitor harvest levels and assess their impacts on populations.	4	4	B
	3. Harmonize management and harvest regimes for shared populations.	2	2	
	4. Involve local and indigenous people in the management of consumptive uses.	0	0	
II. Non-Consumptive Use	5. Ensure that non-consumptive uses of murres are sustainable.	2	2	
	6. Implement management plans for areas of eco-tourism activity.	2	2	
	7. Implement standard guidelines to minimize the impact of disturbance at murre colonies.	2	2	
III. Commercial Activities & Industries	8. Identify, publicize and minimize impacts of commercial activities on murre breeding and foraging areas.	2	2	
	9. Implement programs to reduce oil pollution in areas used by murres.	3	3	C
	10. Assess and reduce mortality of murres in commercial fishing gear.	2	2	D
	11. Ensure that management of commercial harvests of small fish species provide for their role in murre diets.	3	3	
Habitat Protection & Enhancement	12. Identify important murre colonies and designate them under national and international systems of protected areas.	3	3	E
	13. Identify important pelagic habitats for murres, and promote the establishment of marine protected areas in important pelagic habitats for murres.	2	2	
	14. Contribute to the "Important Bird Areas" system to highlight important areas of murres.	4	4	E
	15. Explore the establishment of an international network to identify and protect key areas for murres.	3	3	
	16. Ensure that conservation action will benefit populations, by assessing causes of population declines from an ecosystem perspective.	0	2	F
	17. Undertake specific restoration activities to assist depressed populations to recover.	0	0	
V. Communications & Consultation	18. Determine appropriate communication approaches and produce materials to deliver specific messages.	2	2	
	19. Emphasize communication to operators of ships at sea, the fishing industry and tour boat operators and pilots.	2	2	
	20. Produce educational materials aimed specifically at children.	3	3	
	21. Issue joint scientific reports of activities relating to murre conservation.	3	3	
VI. Research & Monitoring	22. Coordinate circumpolar murre population monitoring and store data in standardized databases.	3	3	F
	23. Conduct research on population demography at circumpolar monitoring sites.			
	24. Develop a coordinated circumpolar murre banding program.	2	2	
	25. Monitor murre feeding ecology and food availability.	3	3	G
	26. Monitor murre mortality due to oil pollution, commercial fisheries, and hunting.	3	3	H
	27. Conduct research to develop techniques to reduce entrapment in fishing nets.	2	2	D, I
	28. Develop management techniques to restore habitats and populations.	2	2	
	29. Consider the effects of global warming and local eutrophication on murre populations.	0	0	
	30. Assess the need to conduct research into the genetics of murre populations.	2	2	
	31. Research for sea distribution abundance of murres.	3	3	
		3	3	J

0 = not applicable
1 = no action considered required
2 = no action to date but required
3 = in progress and continuing
4 = completed in this year or past years

Various activities have been carried out relevant to the Murre Conservation Strategy, and calls for reporting since CBird 8. Mostly continued work is included. The major ones are summarized below, giving the action item number for which these are most relevant, as well as some important research needs.

Initiatives

A. ***National Implementation Plan***: In 2001 a draft national implementation plan was completed, giving an overview of the status of action items, recommended actions to be taken, and priorities for research and management. The plan has not been accepted for implementation by authorities, although implementing specific items are left to the discretion of the CAFF contact institute.

B. ***Hunting statistics***: Hunting statistics continue to be collected from hunters giving indications if the consumptive use in sustainable and monitors the harvest levels (action items 1, 2). A paper on the Icelandic hunting statistics and a preliminary analysis on possible effects of hunting on seabird (including murre) populations was submitted to the Circumpolar Seabird Bulletin in 2000 but still awaits publication (Petersen, in press) (action item 2).

C. ***Contaminants & Pollution***: Work continues by the Committee on Response to Pollution Incidences on a map for use in oil pollution emergencies and other catastrophic contamination cases. This includes *inter alia* the whereabouts of murre colonies and major feeding areas as known (action item 9).

D. ***Bycatch:*** The illegal sale of seabird bycatch at fish-markets, the great majority of which is murres, has been taken to court and is pending trial. A research plan has been under development since 2002 for gathering information on the scale of the bycatch problem in Icelandic waters at the request of Ministries of the Environment and Fisheries. The Common Murre is believed to be a major species involved (Petersen, in press) (action items 10 and 26).

E. ***Habitat Conservation***: Work is about to be finalized on a national nature conservation strategy. In a background document (Einarsson *et al.* 2002) murre colonies, among others, needing formal protection are identified and recommended for further protection action (action item 12). An "Important Bird Areas" analysis has been undertaken for Iceland (Einarsson 1997, 2000) (action item 14).

F. ***Monitoring:*** Monitoring of Thick-billed Murre colonies has indicated a serious decline and international action is needed to assess this decline and its causes (action item 16). Work continued on a national seabird colony database, which includes murre colonies. A Nordic project started in 2002 to further the harmonization of Nordic seabird databases. Further monitoring of Icelandic murre colonies is badly needed (action item 22).

G. ***Banding***: Small scale banding of murres continues (action item 24).

H. ***Feeding ecology***: Research continues into the feeding ecology of the two murre species, with the aim of identifying their role in the marine ecosystem and possible effects on fish stocks (action item 25).

I. ***Mortality***: A massive die-off of murres took place to the north of Iceland in winter 2001/2002. Dozens of thousands of birds are believed to have died, and starvation was considered the likely cause. The birds were considered unable to obtain food rather than the main food species had diminished (action item 26).

J. ***At-sea distribution***: Censuses have been carried out during the past few years on the distribution of seabirds, including murres, in sea-areas around Iceland, especially off the SW, W and NE coasts (action item 31).

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Appendix 7:
Official murre hunting statistics (numbers of birds killed) during 1995-2001 (Wildlife Management Institute).

	Thick-billed Murre *Uria lomvia*	Common Murre *Uria aalge*
1995	15,114	52,867
1996	20,479	65,099
1997	15,339	59,031
1998	18,294	65,378
1999	21,673	59,787
2000	16,404	66,353
2001	17,163	51,818
Average	17,781	60,048