CIRCUMPOLAR BIODIVERSITY MONITORING PROGRAM (CBMP)
COORDINATION MEETING
AKUREYRI, ICELAND, APRIL 11-12, 2002

Technical report no. 12

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I. Welcome

Aevar Petersen welcomed participants to the meeting, introduced the Agenda (Appendix I) and called for roundtable introductions of participants (Appendix II). He noted that the purpose of the meeting was to coordinate the biodiversity monitoring work of CAFF and obtain the views of individual network coordinators in terms of necessary tasks and needs. The meeting should, therefore, be seen as a step in the process of establishing a circumpolar biodiversity monitoring program. A second purpose of the meeting is to finalize, as far as possible, a funding proposal to the EU, aimed at strengthening the infrastructure of and further scope the program.

II. Introductory Section

Presentation of the CBMP (Aevar Petersen)

Aevar Petersen provided the history of the CBMP. CAFF had previously been interested in monitoring topic and during 1995-1996 initiated work on compiling an overview of circumpolar monitoring activities – a task that was not completed. The second wave of work began formally in early 1999 after adoption oft the CAFF Strategic Plan for the Conservation of Biological Diversity (1998). The Strategic Plan includes *monitoring of Arctic biodiversity* as one of five objectives.

The main challenges for a CBMP is to keep it focussed and to select representative parameters, which build on existing monitoring programs. The CBMP is intended to: detect changes in the natural environment; provide an early warning system; contribute to development and evaluation of national monitoring plans; and provide for timely and cost-effective sharing of information to Arctic and non-Arctic users.

A CAFF/AMAP Biodiversity Monitoring Workshop, held in Reykjavik, February 2000, decided to launch the program with 9 individual expert networks. Eight networks have been established, i.e for reindeer/caribou, Arctic plants, Arctic char, seabirds, waders/shorebirds, geese, polar bear, and ringed seal. A planned network on wetlands has not been established yet. Therefore the existing networks are species-based rather than site-based.

Common Terms of References were drawn up for the networks. Participation in the networks is voluntary, with Network Coordinators responsible for soliciting network members. Each network is requested to provide suggestions for its monitoring program.

CAFF continues to develop the general scope of the program. Funding has been and is a continuing issue. The program needs to be formulated so that Arctic Council ministers will accept it. It needs to be well defined and pragmatic, yet scientifically sound. Its value as a management tool for conservation and economic work, both on circumpolar level and nationally, needs to be explained.

Discussion:

John Crump asked if there is a role for indigenous and local people in the program. Aevar Petersen responded that not only scientific experts but others with topical knowledge were invited to participate in the networks. Snorri Baldursson added that the Reykjavik Workshop had discussed a separate community-based monitoring component, and that he had unsuccessfully tried to find a coordinator for this from

indigenous organisations. A community-based network would be very relevant to monitor parameters related to e.g. seasonal markers, such as time of snow melt and arrival of nesting birds.

Conceptual Framework for the CBMP (Kevin McCormick)
Kevin McCormick reviewed the conceptual framework for CBMP – initially presented at the Reykjavik Workshop (CAFF 2000). The conceptual framework represents an attempt to focus thoughts around the initiative. The goal of CBMP is to improve understanding of biodiversity through harmonisation and/or expansion of existing programs and networks. The venue is the Arctic region as defined by CAFF (see Figure 1 in Appendix II). The proposed approach focuses on the three large ecosystems (terrestrial, freshwater, marine) and selected criteria include ecological importance, socio-economic importance, and feasibility. The CBMP, as is the entire Arctic Council cooperation, is based on voluntary cooperation, which implies limited centralised control or direction over financial resources. However, this also means that the program must be implemented in cost-effective manner. As an initial focuser for the networks, the key question posed was what are the ecological impacts of climate change in the circumpolar Arctic? Next steps involve a revision of the framework to provide a clear statement of objectives, coordination and implementation of networks.

AMAP – Effects Monitoring (Helgi Jensson)
Helgi Jensson introduced the AMAP effects monitoring program. This program will be implement only in areas where effects are expected. The effects program complements contaminants monitoring by AMAP and includes POPs, heavy metals, radionucleides, PCBs, and organochlorines. Current information does not demonstrate many clear ecological effects from these contaminants. However, effects have been demonstrated in local areas, including on humans (see AMAP web site: www.amap.no).

Discussion:
Don Russel asked how AMAP funds its monitoring activities. Helgi Jensson noted that AMAP does not have any core funding and has to rely on national funding as well as external funding agencies such as the Global Environment Facility (GEF).

Christoph Zöckler asked if AMAP focuses its monitoring efforts in certain areas or tries to get a circumpolar coverage. Helgi Jensson replied that the goal is circumpolar coverage, while in practice AMAP has had to rely extensively on areas with high monitoring activities. This, however, depends on species. As an example, polar bears are rather unevenly distributed while Arctic char has a truly circumpolar distribution. AMAP also relies on specimen banks available in some Arctic countries but not all, as they are very expensive to maintain.

Bill Heal asked how AMAP deals with multiple stresses - e.g. when looking at biodiversity and climate change, what is the connection? Helgi Jensson replied that studying multiple stresses is difficult and that AMAP has only limited experience with this kind of work. With respect to biodiversity and climate change, it is possible e.g. to look at how shifting species distribution affects contaminant loads in the system.

Global Biodiversity Monitoring (Christoph Zockler)
Christoph Zöckler provided an overview of some globally-based observation systems relevant for biodiversity. The three big UN monitoring networks (Global Terrestrial Observation System - GTOS; Global Ocean Observation System –GOOS, and Global Climate Observation System - GCOS) all may have relevance, but the FAO run GTOS network, based in Rome, is probably most relevant as it includes a definitive biodiversity focus. The UNESCO-run DIVERSITAS network is site-based, with ambitions to monitor biodiversity in World Heritage Sites. The International Waterbird Count (IWC) of Wetlands International, which includes at least 20,000 sites globally, has a huge database built on counts by a network of volunteers. Also, the Important Bird Areas (IBA) of Bird Life International provide site-based information of relevance to the Arctic – 10% of 700 sites are in the Arctic. These sites do not include monitoring yet but this is being discussed. A benefit would be that e.g. songbirds and raptors are also included in overall monitoring data. The Living Planet Index (LPI) of WWF/UNEP-WCMC is built on population numbers over years, starting in 1970. The LPI currently covers some 400 species representing a wide range of taxa. However, there is some bias because species of concern tend to be better monitored than common species. The LPI has been sub-divided into thematic areas, e.g., marine, forest, freshwater, but an Arctic LPI has yet to be done.

Christoph Zöckler further proposed that a common CBMP interface, in the form of a web-based meta-database, was established for analyses. Under such scheme, species networks can have individual web sites that are integrated into this meta-database using new technology. Other data sources (e.g. AMAP) could provide physiochemical and other data and scenarios, which could be combined with biodiversity data for analyses and modelling.

Discussion:
Don Russell asked how similar different databases have to be in order to be integrated in a common meta-database? Christoph Zöckler responded that this is not fully clear yet and that the technology is rapidly evolving.

Community-based monitoring – Nunavut General Monitoring Program (John Crump)
John Crump noted that the Arctic Council Permanent Participants have identified 4 main focus areas for the Indigenous Peoples Secretariat (IPS), all of which can involve monitoring. He then introduced a community-based monitoring study in West Kitikmeot Region of Nunavut, which might serve as a partial model for CBMP.

The West Kitikmeot Community Based Monitoring System is one of several regional planning exercises underway. The system aspires to be an early warning system with a focus on biodiversity and human health. The first community workshop was held in 1996 in Cambridge Bay. Already then there was a sense of local ownership because of community involvement. The workshop discussed what monitoring is and what land-claim agreements need in terms of monitoring. The workshop came up with a huge list of parameters (e.g., climate change, health of caribou). The community focussed on social and cultural indicators but tied this back to the natural environment. A categorising exercise divided the environment into 4 components: natural, social, cultural, and economic. A technical workshop in Yellowknife in 1998 attempted to mesh scientific knowledge with traditional knowledge. After reporting back to the

communities a new set of indicators was developed, focusing on indicators that were easy and doable. As an example, indicators for natural environment include caribou, greenhouse gas, and global temperature. Biodiversity indicators tend to focus on what people use. All members of the West Kitikmeot Region - largely Inuit (90%+) - are involved.

If CAFF is interested in a community monitoring component and learning from the West Kitikmeot, John Crump recommended contacting the Nunavut Planning Commission.

Discussion:
Don Russell noted that Canada has many community-based volunteer monitoring networks (e.g., birds, frogs), also involving indigenous communities. Russia is also trying to launch community-based monitoring. Snorri Baldursson asked whether there should be a community-based monitoring element in the CBMP and, if so, an overview of existing programs should be build into the EU application package. Christoph Zöckler asked if this would be a separate network, or if a community-based monitoring component should be built into each of the eight networks. Kevin McCormick noted that a scoping paper would be an important first step before making decision on this. Bill Heal asked if participants were aware of any experts or publications on this topic that could be cited in the EU application? As a general observation, Bill Heal noted that intensive studies should be done by experts and extensive studies by amateurs/volunteers.

III. Overview of Networks

Arctic Char (Johan Hammar)

For several reasons, Arctic char is an ideal species to include in a circumpolar monitoring program. Reasons include:

- → circumpolar distribution;
- → diverse life history features – anadromous, resident, and/or landlocked.
- → a number of existing long-term (15-20 years) monitoring sites for char in the Arctic;
- → a good circumpolar coverage of char experts;
- → biological markers sensitive for climate change, including a temperature sensitive allele (warmer climate favours the “fast type” of that allele, e.g. warm springs in Spitsbergen produce larger year-class of the “fast type”), and temperature sensitive sex ratio.

Currently, there are 27 members in the Arctic char network. Long-term operational difficulties relate to finding “patient funding” for long time-series (university studies tend to be short term, while government studies focus on economic aspects). Short-term difficulties involve: raising money for a kick-off workshop to identify, harmonise and initiate sampling programs (what populations to sample, what sites, what gear, what variables, whether kill or catch-and-release); coordinating the network and sampling; and providing standard data management and early identification of trends. Desirable links to other networks include national watch programs and international research groups such as the Long Term Ecological Research Network (LTER), ILTER (International LTER), Zackenberg Ecological

Research Operations (ZERO), and Department of Fisheries and Oceans (DFO) Canada.

Discussion:
Participants noted that it would be more important to use the range that is relevant to the species and not be bound by artificial boundaries of CAFF, AMAP, etc.

Caribou/Reindeer (Don Russell)
Herds for monitoring have not been selected yet, but important to include all ecotypes, i.e.: marine type (e.g., Peary Caribou); large migratory mainland herds (esp. in NA), forest herds (e.g., woodland caribou in Canada). There are four main components to monitoring: herd assessment (what do we know about herds), remote sensing to look at how range is changing; community monitoring to look at what users see through the year; and communication.

A meeting in 2001 identified 70 biological, climate, range, social and economic indicators. A North American database for *Rangifer* information has been initiated. A Russian scientist (Konstantin Klokov) has been contracted to prepare "profile of Russian herds", and to translate a Russian thesis on Taimyr herds, which provides good comparison to North American herds.

Climate information is needed to assess impacts of climate change on herds. This information needs to be detailed as different herds adapted to different climate conditions. Remote sensing has proved its applicability to *Rangifer* studies e.g. in retrospective habitat analysis for a number of NA herds. Information routinely obtained includes maximum greenness, total greenness, etc. A problem is that prices of satellite imagery can be very high and variable among providers (e.g., $30 for an image in U.S., but $240 in Canada). A paper is available on remote sensing (D. Griffiths), including cost analysis and institutional problems on collecting data.

Don Russell asked if CAFF: a) could pull basic climate data together for all of the networks, and b) if CAFF could negotiate signed agreements with appropriate agencies in their respective countries to get reasonably priced satellite products for remote sensing.

With respect to community monitoring, a number of projects have been launched across North America. Examples include: an on-going project involving the Western Arctic herd in Alaska, in which hunters collect information on body condition using special protocol; the Arctic Borderlands Project engages local people to interview community experts about what they have observed, what would be good indicators, etc. - his project is not restricted to caribou but also berries, fish, new bird species; and a similar project on the Beverly-Qaminuriaq herd, with interviews initiated in 2001.

Don Russell noted that there is a need to raise the profile of the caribou/reindeer monitoring network to help with funding. For that purpose he has prepared a *Rangifer* Monitoring Poster shown at a number of fora. Also, a *Rangifer* website is presently being updated.

Discussion:
Snorri Baldursson invited other network coordinators to comment on the need for centralised mechanism for obtaining satellite images and basic climate data. Ingibjörg

S. Jónsdóttir noted that this would certainly be useful for ITEX. Chistoph Zöckler noted that this would be one of the potential services of the proposed CBMP meta-database, which could be linked to a platform providing a suite of physical data from which networks can choose. Ongoing work by e.g. UNEP focuses on ways to make such data available to users in easy and cost-effective way. Gillian Bunting added that if the platform could not provide all the needed data for a specific monitoring network, it could be used to negotiate the purchase of additional data from data holders. Bill Heal suggested that network coordinators specify what their data needs are in order to determine common needs.

ITEX (Ingibjorg S. Jonsdottir)

The International Tundra Experiment is basically a common experiment with a strong monitoring component. ITEX began in 1990. Currently, there are 12 active Arctic sites, and additional 4 Alpine and Antarctic sites. Initially ITEX included 26 sites, but many have been abandoned because of lack of funds. However, the abandoned sites can easily be re-instated should funding become available. Initially, ITEX had great success in attracting funds, especially in Europe, but this has become increasingly difficult as most research funds have a bias towards novelties. Financial problems are most extreme in Russia, whereas U.S. funding agencies seem to be the most patient with respect to long-term research.

The idea behind ITEX was to focus on individual tundra species with broad distribution, using a simple approach designed to encourage broad international participation. ITEX uses manipulation (glass chambers to raise temperature), monitoring and modelling. The approach has been bottom-up - starting with individual species, which are then grouped into functional types. ITEX has been "plot-based" but is increasingly scaling up to higher biological complexity (communities, ecosystems and landscapes). ITEX attempts to relate plant responses to physical and chemical characteristics and climate change. ITEX has resulted in numerous publications and has been a catalyst for international projects.

ITEX experiments have confirmed a general sensitivity of cold region vegetation. Geography is important, i.e. different responses in high vs. low arctic vs. alpine. Phenological shifts, however, are consistent and growth forms have predictive value regardless of sites.

At the 10th workshop in 2001, ITEX agreed to maintain the OTC (open top chamber) warming treatments, while also scaling up to levels of increasing biological complexity. They want to distinguish between inter-annual variability and longer-term changes, and are considering the establishment of long-term, low-dose N-deposition experiment. ITEX is further interested in exploring linkages to other monitoring programs (e.g., CAFF, ACIA) and to investigate how ITEX can serve the trace gas- and global climate change modelling communities.

The 11th ITEX workshop in Finse, Norway, October 2002, plans to design a biodiversity monitoring methodology for ITEX. Also an IASC-ITEX Arctic Biodiversity Initiative is to be launched at this meeting, with the ITEX part of CAFF participating.

Discussion:
Aevar Petersen noted that one important part of CBMP is to look at how the impacts of climate change and other pressors at one tropic levels affects others, and that this may require experimentation similar to ITEX's in addition to monitoring. How do changes in flora impact fauna and vice versa? What do changes in climate or contaminants, for example, mean to populations? Also, CBMP needs to consider not only species diversity but also genetic diversity at a large scale.

Polar Bear (Stanislav Belikov)
There are about 20 discreet populations and subpopulations of polar bear and 15 of them are subject to hunting. Some populations are threatened by both natural and human-related factors. For example, polar bears in the western Hudson Bay area are starving because of late ice formation/early break-up of ice in Hudson Bay, which in turn is caused by climate warming. In other areas, the climate is showing evidence of cooling.
Ship traffic, creating pollution, waste, noise, and physical disturbance, also affects polar bears either directly or indirectly, e.g. through the prey (seals).

The proposed approach to monitoring polar bears, includes to select different parts of the Arctic that represent a varied threats to polar bear in terms of intensity of climate change, pollution, hunting, etc. Priority populations include those that already show responses to climate change, those already monitored, and those most exposed or potentially exposed to pollution. Based on this, the recommendation is to monitor the western Hudson Bay population; the sub-population of Svalbard and the pelagic zone of the Barents Sea (not subject to hunting for 30-50 years but have highest PCB burden of all polar bears); the southern Beaufort Sea population; and the populations of Chukchi and Bering Seas. Only a few of these or other polar bear populations have been subject to long-term monitoring. The parameters of the program need to include observations on habitats, prey species dynamics, and the most important abiotic factors.

The core network will be the Polar Bear Specialist Group of the IUCN, which need to be expanded to incorporate traditional knowledge; this is already used in Russia. It is possible to monitor polar bears by tagging or by aerial surveys, but this is very expensive. In general, funding polar bear monitoring is a great challenge.

Discussion:
Kevin McCormick noted that perhaps the network should start by focussing on one or two well-studied populations and doing comparative work. For example, all Canadian data on polar bears is in a single database. Snorri Baldursson noted that there have been some experiments with using heat sensing to locate bears and dens and asked what the status of this work was. Stanislav Belikov answered the U.S. researchers had been experimenting with this, but that the technology currently was prohibitively expensive.

Shorebirds/waders (Hans Meltofte)
Hans Meltofte set out by noting that shorebirds are imminent birds to monitor in the Arctic. They represent the most diverse and common group of all birds and are sensitive to climate change (e.g., timing of snow melt). Shorebirds are migratory and thus also exposed to effects in their wintering grounds. Although this creates a

challenge in terms of separating climate effects inside and outside of the Arctic, many shorebirds concentrate in few wintering areas where they can be easily counted.

Currently, data and trends are available only for a relatively few species, mostly based on counts in wintering areas. Inside the Arctic, the most extensive current program is the Arctic Birds Breeding Condition Survey – running in Russian Arctic since the 1980s, and now expanded to the entire Arctic. This program is still mainly concerned with very basic monitoring of general breeding conditions, such as population densities, timing of snowmelt, predation pressure, rodent abundance, breeding success etc.

There are approximately 50 members of the shorebird network, mainly European and North American, but also key players in Russia. The shorebird network prepared an application to Nordic Arctic Research Program and succeeded in obtaining funds for a workshop in 2003 that will focus on creating and publishing consensus analyses of existing time-series data and discussing future monitoring needs and standards.

In Zackenberg (NE Greenland) Hans Meltofte and colleagues have conducted integrated monitoring – CO2 flux, habitat monitoring, species monitoring, etc. – for a number of years. This is now a part of the SCANNET consortium – a cooperation of research stations around the north Atlantic. Preliminary analysis of the Zackenberg data has confirmed that time of snowmelt is a key factor in just about everything (flowering, muskox habitat use, etc.) in the high Arctic. Therefore, under climate change scenario, serious effects on shorebirds may be expected in high Arctic.

Discussion:
Bill Heal noted that there already exists powerful data on shorebirds, but that seemingly researchers collecting it have not had time or will to analyse it all – do the shorebirds represent an opportunity to get out an early product for the CBMP? Hans Meltofte agreed and noted that the planned workshop is meant to be a "working" workshop – with researchers bringing their data for analysis and eventual publication under joint authorship, like ITEX has done. Regarding the potential problem of too many people writing a paper, Helgi Jensson noted that the AMAP and ACIA assessments could provide a model - with lead authors in overall charge, assisted by several contributing authors.

Seabirds (David Irons)
David Irons informed that the Circumpolar Seabird Group (CBird) of CAFF will be implementing the seabird monitoring network. The network will be administered by CBird and members will meet in conjunction with CBird. The goal of the network is to promote and coordinate seabird monitoring in order to detect trends and integrate with other networks. Objectives are to establish priority species and monitoring parameters, develop protocols, establish a database, and promote exchange of information. The plan is to monitor seabirds mainly at colonies, but also at sea using transects. Seabird harvest will also continue to be monitored. The monitoring locations and species are to be determined. The monitoring parameters will include population change, productivity (breeding success), diet, and adult survival. A draft charter is available for CBird.

David Irons then presented a preliminary analysis of circumpolar murre (Common Murre and Thick-billed Murre) population trends against climate variability

represented by the North-Atlantic and Pacific Oscillations. The preliminary analysis suggests significant correlations, although different for the two species in question. This study will be developed further and submitted to a scientific journal for publication later this year.

Discussion:
Christoph Zöckler noted that the "seabird case" demonstrated well the opportunities available when there is access to good circumpolar data.

Ringed Seal (Snorri Baldursson on behalf of Kit Kovacs)
Snorri Baldursson informed that Kit Kovacs, coordinator of this network, had not been able to attend the meeting. He then presented a brief update based on written submission from Dr. Kovacs. The network idea was presented at a meeting held in November 2001 in Vancouver, Canada, in association with the Society for Marine Mammalogy. The participants were interested but expressed concern about funding. An informal network was established, but it lacks representatives from Russia or Iceland yet.

Geese (Aevar Petersen for Bart Ebbinge)
Aevar Petersen informed that Bart Ebbinge (Chair of the Goose Specialist Network of Wetlands International) had very recently agreed to act as a coordinator, but was unable to attend the meeting. Overall, geese are probably the Arctic species group best covered in terms of monitoring and there exist extensive data (e.g., Wetlands International database for Europe). The main question is how to organise work on a circumpolar basis. Currently, there is insufficient interaction between North American and Eurasian researchers. Russia goose specialists are well organised and linked to the Wetlands International work. However, there may be a need to add a co-lead of this network from North America.

Discussion:
Christop Zöckler informed that the Alaska Department of Fish and Game oversees the North American Goose Specialist Group. Kevin McCormick noted that there are a number of goose databases available in North America, but that they are probably not consolidated, at least not in Canada. He further offered to look into the possibility of engaging someone from the Canadian Wildlife Service as a co-lead for the network. Ingibjörg S. Jonsdottir noted that there seems to be lots of information available from wintering grounds of geese, while it had proved difficult for ITEX to obtain reliable information from their summer breeding grounds. Christoph Zöckler noted that banding of geese on their wintering grounds gives a good idea of regions where geese breed in the Arctic; this information, however, cannot pinpoint specific locations. Aevar Petersen agreed that there is a need for more information on the breeding grounds, also to explore better links between different populations. Kevin McCormick noted that, on the contrary, most banding of geese in North America is done on the breeding grounds.

General Discussion on Network Reports
Tiina Kurvits summarised observations from the network reports. Common points were *inter alia*: the need for funding; need for access to physical data (e.g., meteorological); better linkages between networks (e.g., polar bears and seals) to learn about what is happening in other networks and to better understand effects observed in their own; access to remote sensing information (i.e., what can be

obtained without prohibitive costs; negotiating deals with remote sensing agencies); and continued harmonisation of databases.

A discussion ensued on how to respond to common data needs, which is not a unique problem for CAFF, but common for the monitoring and assessment community including AMAP. While it seems possible to organise access to general meteorological data through ongoing global and regional initiatives (e.g. WCMC, UNEP GRID-Arendal, ACIA), access to the specific fine scale data needed for some of the networks may prove more difficult and costly. Again, this was seen as a potential function of the proposed web-based CBMP meta-database.

It was recommended, in order to define common versus special needs, that network coordinators compiled an initial list of physical data required for their work, and that this would be addressed at the proposed workshop in 2003 (see below).

IV. CAFF/AMAP Collaboration and Deliverables (Helgi Jensson/Sune Sohlberg)

Sune Sohlberg introduced this topic. Based on the report "Arctic Flora and Fauna: Status and Conservation" (2001), CAFF is preparing recommendations for future conservation work in the Arctic. Two of the recommendations are relevant for monitoring. These are:

- Promote activities that identify and classify Arctic species and ecological processes to better understand Arctic ecosystems.
- Build on national and international work to implement a program to monitor biodiversity at the circumpolar level that will allow for regional assessments, integration with other environmental monitoring programs, and comparison of the Arctic with other regions of the globe.

As AMAP's mandate also includes environmental monitoring (contaminants and climate change), there have been discussions at the SAO level regarding how to better ensure synergies between the efforts of the two working groups. At the last SAO meeting, therefore, it was agreed that AMAP and CAFF should aim to integrate their monitoring activities as feasible and prepare a joint paper on this for submission in 2003. CAFF has already agreed to use the AMAP Project Directory for listing CAFF relevant projects.

Under the Arctic Climate Impact Assessment project, CAFF and AMAP have an overall responsibility to draft an ACIA Policy Document, which will relate the scientific findings of the assessment to policy relevant issues and provide recommendations to the Arctic countries for follow-up actions. A plan for developing this document has been submitted to the SAOs. Accordingly, drafting work will begin in early 2003.

CAFF and AMAP collaborated on an application to the Global Environment Facility that aims to support data collection and analysis for ACIA in Russia. A decision by GEF is awaited.

Invited Lecture: Integrated information database on Icelandic national resources
(Agust Ulfar Sigurdsson, Icelandic Institute of Natural History)
Agust U. Sigurdsson presented a prototype information database that is currently being developed. The objective is to develop an integrated information system for natural resource-, history-, and science data, which gives a unified view into multiple data collections. The primary data collections are of different origins and non-homogeneous, but can be put into GIS. The developers aim for easy scalable access. A two-tiered internet system is being developed: front-end or users' end, driven by web browser technology; and a back end, which is a web server and a database that may be either real or virtual. The prototype can be observed at: http://nvs.hnit.is and http://mercator.hnit.is/website/nvs.

V. Funding of the CBMP – Application to the EU

Introduction (Snorri Baldursson/Bill Heal)
Snorri Baldursson informed that the EU application was due in only six days, i.e on April 17, 2002. A draft had been prepared by him, Bill Heal, Aevar Petersen and Christoph Zöckler and the task of the present meeting was to improve and finalise to the extend possible this draft.

Bill Heal provided general overview of the funding application by bringing together threads from yesterday's discussion and moving forward from there. The questions that must be focused on in the application include:

- What is the problem/issue?
- What are the main approaches?
- What are the observations that we need to address?
- What do we learn from these observations?
- Where should we observe?
- When should we observe?

It must be explained why we have selected the current species networks as a basis for the program? The DPSIR (Driver-Pressure-State-Impact-Response) model is an important way of looking at how the selected species fit in and it gives the context for the observation: trophic system; biogeographic region (range); social/economic context; ecosystem structure/function. The species currently selected all represent links in the Arctic trophic system but do we have the right species and sufficient number of species to represent the system?

There is a need to think about how to present this in a political context in addition to an ecological context. Brussels wants know how this can help implement conservation policies in Europe as a whole. The 6th Environmental Action Programme (2001-2010) of EU has 4 priorities: climate change, nature and biodiversity, environment and health (human health), natural resources and waste. The CBMP fits in well with the first two.

The 5th Framework Programme RTD (1997-2001/2) - to which this application will be submitted - focuses on energy, environment and sustainable development. The application fits well with Action 2: Global Change, climate, and biodiversity. The 5th Framework does include options for working with non-European partners and this link is strengthened in the upcoming 6th Framework Programme RTD (2002-2006).

Therefore, there is no reason to believe that we only need to focus at the European part – can look at what can be learned from Europe and what can be brought back to Europe. The ideas of CBMP are right for Europe because they are waking up to the "northern dimension". The fact that Denmark is taking the chair in June 2002, should help with this northern focus.

Discussion:
Christoph Zöckler noted that the European Environment Agency (EEA) in Copenhagen is working on a European monitoring program and asked how this will affect the CBMP. Aevar Petersen informed that the EEA is at the moment very much focusing on collecting basic environmental information from the countries (e.g., species, endangered species, protected areas) for their ENVINET database. Bill Heal noted that there is a need to present credibility by emphasising links to other programs such as those held by EEA.

VI. Working Session

Participants worked on improving and finalizing the draft application – the final product is presented in Appendix III.

VII. Close of meeting

Snorri Baldursson and Aevar Petersen gave some closing remarks. Thanks were extended to the University of Akureyri for facilities, and to Niels Einarsson of the Vilhjálmur Stefánsson Institute for organizing. Financial support for holding the meeting was received from the Nordic Council of Ministers and was gratefully acknowledged.

Appendix 1: Agenda

Conservation of Arctic Flora and Fauna

Circumpolar Biodiversity Monitoring Program (CBMP)

Coordination Meeting in Akureyri, Iceland
April 11-12 2002

Revised agenda

Meeting venue: CAFF International Secretariat
Hotel: Hotel Nordurland, Geislagata 7, 600 Akureyri

April 10: Wednesday

Arrival in Akureyri, Hotel Nordurland

April 11: Thursday		Facilitator
0900-0905	Welcome	Petersen
0905-0920	Introduction to the CBMN	Petersen
0920-0940	Conceptual Framework	McCormick
0940-1000	AMAP – Effects Monitoring	Jensson
1000-1030	Coffee	
1030-1050	Global Biodversity Monitoring Network	Zöckler
1050-1110	Community based monitoring	Crump
1100-1200	Discussion	All
1200-1300	Lunch	
1300-1500	Overview of networks:	
1300-1320	- Arctic Char	Hammar
1320-1340	- Carabou/Reindeer	Russell
1340-1400	- Geese	Wetlands Int. (?)
1400-1420	- ITEX	Jonsdottir
1420-1440	- Polar Bear	Belikov
1440-1500	- Ringed Seal	Kovacs
1500-1520	Coffee	
1520-1700	Overview of networks (cont.):	
1520-1540	- Shorebirds	Pierce/Meltofte
1540-1600	- Seabirds	Irons
1600-1700	Discussion	All

April 12: Friday		
0900-0910	Review of discussion	NN
0910-10	Discussion on CAFF/AMAP	

	collaboration and deliverables to Arctic Council Ministerial	Jensson/Sohlberg
1000-1030	Coffee	
1030-1100	Introduction to Funding	Baldursson
1100-1200	Discussion	All
1200-1300	Lunch	
1300-1500	Funding application	Baldursson/Heal
1500-1520	Coffee	
1500-1700	Funding application (cont.)	Baldursson/Heal

Appendix II: List of Participants

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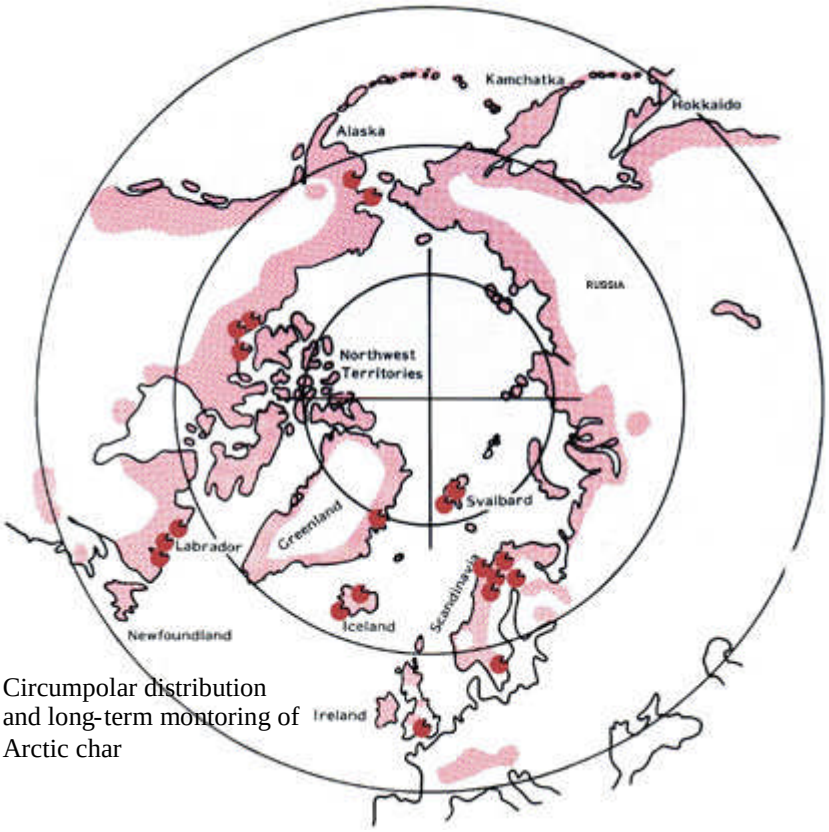
Appendix III: EU Application

Accompanying Measure
for the EU Environment and Sustainable Development Programme

CABNET

Circumpolar Arctic Biodiversity Monitoring Networks –
Strengthening the Infrastructure and Establishing Links to European and Global Observation Systems



Circumpolar distribution and long-term montoring of Arctic char

Submitted by

Icelandic Institute of Natural History

April 2002

Part A

Proposal submission forms for financial support from the EC for:

Accompaying measures

This part includes only the administrative overviews and signatures of participants and the proposal abstract.

This part, like the whole application form, was obtained from the EU through the internet.

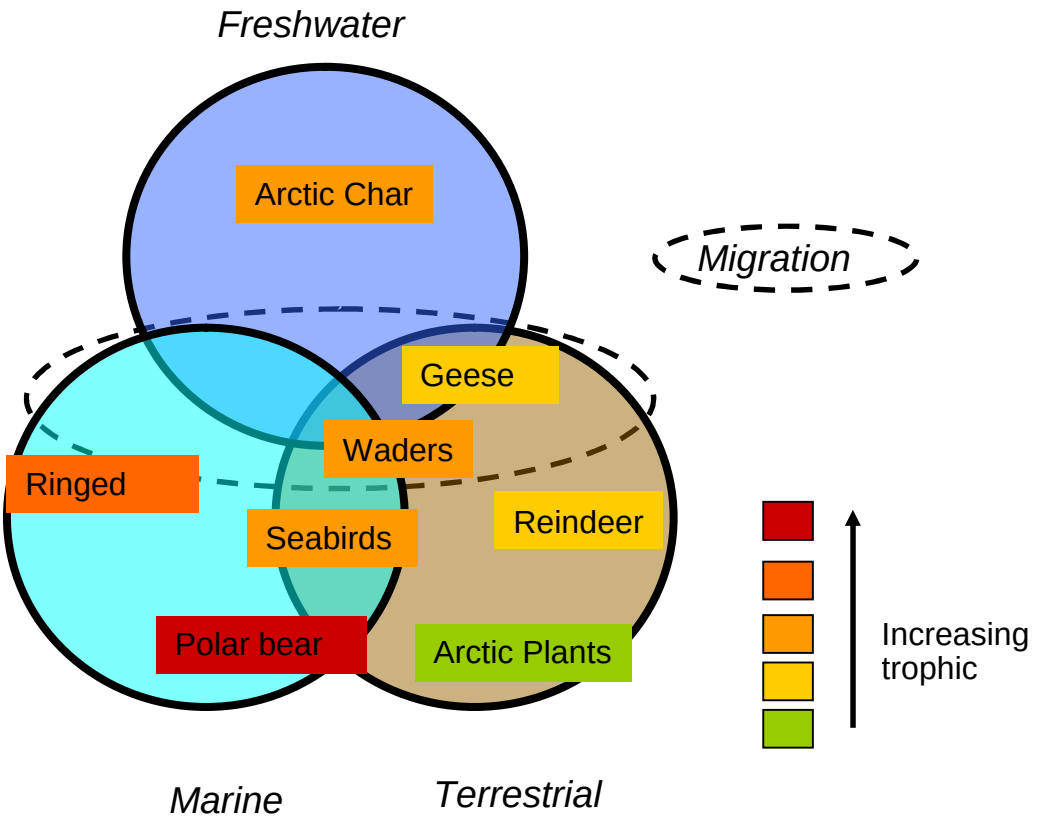
For some reason could Part A not be saved after completion and hence is not included here. Photocopies can be provided if needed.

Part B

Description of scientific/technological objectives and work plan.

Circumpolar Arctic Biodiversity Monitoring Networks –
Strengthening the Infrastructure and Establishing Links to European and Global Observation Systems

CABNET



April 2002

Key action 2: Global change, climate and biodiversity

RTD Action 2.2. To foster better understanding of terrestrial (including freshwater) and marine ecosystems, their species and interactions.

RTD Action 2.4. European component of the global observing systems, including (2.4.1) better exploitation of existing data and adaptation of existing observing systems, and (2.4.2) development of new long-term observing capacity.

B2. Content list

B3. Objectives

The Arctic

The circumpolar Arctic region (Figure 1) covers some 14.8 million km^2 on land, and 13 million km^2 of ocean. The region, marked by extreme climate, encompasses an array of landscapes, seascapes, plants, animals, and people. All parts are linked as water, nutrients, and energy flow through the system. The Arctic itself is connected to the rest of the world, through air and water currents, plant dispersal and animal migrations, and movements of people and natural resources.

The Arctic makes several unique contributions to global biodiversity, including:

- The Arctic environment has created many species and types of flora, fauna and habitats not found elsewhere.
- The northern circumpolar continuity of terrestrial and marine environments has resulted in many regional taxa in common — a unique spatial feature.
- The comparatively low Arctic species richness is compensated by generally large niche breadth and high biomass.
- Low species diversity, wide spatial features, relatively young biota and low competition pressures in the Arctic have generated high phenotypic and genetic diversity within species, creating a 'Theatre of Evolution' (Skulason, 2001).
- Arctic species are adapted to extreme and highly fluctuating environments, with potential for exploitation of extremophiles in biotechnology.
- Arctic biota provides important conservation interests at lower latitudes through migratory links to every region and virtually all habitats of the world, and through genetic continuity with southern populations.
- Arctic biota provides important source of subsistence for local and indigenous peoples.
- Human impacts on biota are generally low and/or localised in the Arctic compared to other regions of the globe, while global changes pose significant threats.

Changes in biota

Although, many Arctic species, especially invertebrates and lower plants, are still not adequately described, Arctic species richness has been reasonably studied, including the major continental areas of Russia and North America (CAFF 2001). In fact, many vital ecological processes have been better studied and understood in the simpler Arctic ecosystem than elsewhere. The results of scientific research and traditional ecological knowledge (TEK) are increasingly documenting climatic changes that are more pronounced in the Arctic region than in other regions of the world (IPCC 2001), and indicating that the physical environment, as well as flora and fauna, are undergoing changes in abundance and behaviour as a result of these changes (McDonald et. al. 1997). Resource exploitation, habitat fragmentation and pollution have also caused various biotic changes in the Arctic (CAFF 2001). There is a reason to believe that pressure on Arctic biodiversity will remain high for decades to come (UNEP 2001, UNEP 2002), creating an incentive for a reliable biological observation system.

The circumpolar linkage

Conservation of biodiversity is an important global issue and an essential element of the policies of the eight Arctic nations (Canada, Denmark (Greenland and Faroes),

Finland, Iceland, Norway, Sweden, Russia and USA) constituting the Arctic Council. Its working groups include CAFF (Conservation of Arctic Flora and Fauna) and AMAP (Arctic Monitoring and Assessment Programme). AMAP runs a major inter-governmental monitoring programme for contaminants in the Arctic (AMAP 1997, 1998). Within CAFF, a Circumpolar Protected Areas Network (CPAN) has been established, covering 2.5 million km² of Arctic habitats (CAFF 2001). A comprehensive review of the state of the Arctic flora and fauna highlighted the value of long-term data. However, it also reinforced the current lack of coordinated circumpolar biodiversity information and the general scarcity of species trends data (CAFF 2001). To resolve this lack of coordinated species-based monitoring and to complement circumpolar contaminants monitoring and habitat-based conservation, CAFF is currently developing and establishing a circumpolar program to monitor key elements of Arctic biodiversity. Initial considerations (CAFF 2000), highlighted the need and practical opportunity to initiate the program development through a series of circumpolar expert networks (Table 1), focusing on species and species groups of key ecological and socio-economic importance. The initial species networks were selected based on circumpolar coverage, ecological and socio-economic importance, and national interest. The approach was pragmatic in selecting species and species groups for which there already existed significant national data, but limited circumpolar harmonisation and integration.

Long-term objectives of CAFF biodiversity monitoring

The overall goal of CAFF biodiversity monitoring activities in the Arctic is to provide an information basis for sound decision-making regarding conservation and sustainable use of Arctic flora and fauna. Long-term objectives are:

- To detect change and its causes amongst flora and fauna of the circumpolar Arctic region.
- To strengthen the infrastructure for and harmonisation of long-term monitoring of Arctic flora and fauna.
- To provide an early warning system and strengthen the capacity of Arctic countries to respond to environmental events.
- To ensure the participation of Arctic residents, including indigenous peoples, and to incorporate their knowledge into monitoring.
- To establish a circumpolar database of biodiversity monitoring information and contribute to existing European and global database systems.
- To contribute to national, circumpolar, European, and global policies concerned with conservation of biodiversity and related environmental change.
- To integrate circumpolar biodiversity monitoring information with physical and chemical monitoring information of AMAP and others.

Objectives of the present proposal

The current CABNET research infrastructure proposal is designed to assist CAFF as a primary user with this task and at the same time ensure that CAFF monitoring efforts are fully integrated and linked to European and Global users of biodiversity monitoring information. CABNET aims to:

- develop the infrastructure, strengthen ecological representation, and create data management systems for circumpolar Arctic species biodiversity monitoring networks;
- establish functional links between these Arctic networks and European and global biodiversity observation systems and programs.

To achieve these objectives, a **Workshop** will be held among Arctic experts, representatives from relevant national, regional and global biodiversity monitoring agencies and organisations, indigenous peoples representatives, other stakeholders and users. The Workshop is intended to: provide a solid baseline of available biodiversity information, sources and infrastructures; plan the scope and implementation mechanism of comprehensive circumpolar biodiversity monitoring programme; define data management and access requirements; and to prepare a presentation to the European and global biodiversity community.

Preparations for the Workshop include: identification and collation of information and monitoring parameters for each expert network (identified in Table 1); a scoping paper to evaluate gaps of monitoring needs and additional networks required for a comprehensive circumpolar programme; a scoping paper on options for community-based monitoring; an analysis on the interrelationship of the circumpolar Arctic to European and global monitoring programmes; and a prototype of a GIS-interactive meta-database. Follow-up measures will include consultations with main regional and global users of biodiversity information.

Figure 1. The Circumpolar Arctic region as delineated by the Arctic Council programme for the Conservation of Arctic Flora and Fauna.

Table 1. Arctic species networks selected for development by CABNET based on a range of criteria.

Network/Main attributes	Biogeography	Ecosystem/ habitat	Trophic level	Threat	Socio-economic importance	Other characteristics
Arctic char	Circumpolar Migratory Resident or Landlocked	Freshwater (lakes, rivers) Anadromous	Carnivore (primary/secondary)	Climate change, Exploitation Introduced competition Hydropower development Pollution	Subsistence Commercial Sport fishing	High phenotypic diversity (ecotypes) Catch data Genetic markers High scientific interest
Reindeer/caribou	Circumpolar Migratory resident	Terrestrial/Tundra, Forest tundra	Herbivore	Climate change Development activities	Subsistence (herding, hunting) Commercial Indigenous culture	Distinct populations Extensive population information International networks
Geese	Regional spp. Migratory Arctic breeding	Terrestrial-Freshwater/ Tundra, Lakes	Herbivore	Climate change Hunting Southern land-use and hunting	Subsistence Sport hunting	Extensive population and species information High scientific interest International networks
Polar bear	Circumpolar Arctic Migratory Resident	Marine-terrestrial/ice-edge	Carnivore (top predator)	Climate change Pollution (POPs) Hunting	Subsistence, Tourism	Discrete populations Polar Bear Treaty from 1974 Extensive information on most populations
Ringed seal	Circumpolar	Marine/ice edge	Carnivore (top predator)	Climate change Pollution (POPs) Hunting	Subsistence Cultural	Discrete populations Relatively good information
Shorebirds (waders)	Arctic breeding Circumpolar/ Regional spp.	Multiple/Coastal, Estuarine, Tundra	Multiple trophic levels	Climate change (including rising sea-level) and land-use	Cultural	International networks High public interest
Seabirds	Circumpolar Migratory (east-west)	Marine/Coastal	Multiple trophic levels	Hunting Climate change Pollution Bycatch Human disturbance	Subsistence Commercial Cultural	Extensive population Information Ten-years of circumpolar cooperation
Flora (ITEX) -selected plant species	Circumpolar Regional	Terrestrial/Tundra, Polar desert	Primary producer	Climate change Nitrogen deposition	Subsistence (grazing, food and fuel sources)	Extensive information Ten-year circumpolar/alpine cooperation

B4. Contribution to programme/key action objectives

The current project is designed to link principal stakeholders of the circumpolar Arctic region through a series of expert networks in order to find a solution to the strategic problem of coordinating and harmonising species trends data. These data are relevant for the conservation, management and sustainable use of the region's living resources, and to provide a meaningful input to European and global observation systems.

While the proposal has cross-cutting relevance to Key Actions 1 (Sustainable Management and Quality of Water) and 3 (Sustainable Marine Ecosystems), its major contribution is to Key Action 2 (Global Change, Climate and Biodiversity). In particular it will strengthen the scientific basis and provide tools necessary for the study and understanding of changes to Arctic species diversity. It will also ensure integration and synthesis of data across scientific regimes of the circumpolar region, which is shared by 6 European (including Russia) and 2 North-American nations.

The proposal contributes especially to the following generic activities of Key Action 2:

- It will aid the understanding and assessment of interactions and effects of anthropogenic pressure and global change on the Arctic ecosystem and its biodiversity (2.2).
- It will assist in the development of a tool to provide input to support the Convention on Biological Diversity, the Convention on the Conservation of Migratory Species (CMS), the Pan-European Biological and Landscape Diversity Strategy and other regional and global conservation mechanisms (2.2.3).
- It will assist the development of Arctic regional standards for monitoring, quantifying and understanding status and trends in biodiversity (2.2.3).
- It will strengthen the Arctic input to European and Global observing systems for biodiversity including identifying and filling key gaps to ensure coordinated input of long-term consolidated circumpolar data (2.4).
- It will support the further development of European and Global observing systems for biodiversity (where Arctic and biodiversity input is currently weak), including identifying and filling key gaps to ensure that the necessary long term consolidated circumpolar data sets are collected in a co-ordinated manner, and that such data are quality-assessed and made available to predict, assess the impact and to formulate response options to global change (2.4).
- It will contribute to a better exploitation of existing Arctic national and circumpolar data (2.4.1).
- It will assist in identifying the need for, and to help deploy where necessary, new cost-effective observation systems, based on both in-situ and remote sensing technologies (2.4.2).

Many monitoring systems are site or habitat-based. Such systems are not always appropriate where migratory or widely distributed taxa frequently transcend boundaries between nations and between habitats.

Finally, through participation of local and indigenous peoples in the Arctic, and enhancing access to databases, the proposal will contribute to capacity building and the wider social objectives of the EC Environment Programme.

B5. Innovation

State of the Art

Biodiversity: General reviews of species richness in the European and circumpolar Arctic have clearly documented the diversity and distribution of the flora and fauna (Matveyeva & Chernov, 2000). Comprehensive surveys in the Russian, North American and Scandinavian Arctic highlight the small numbers of terrestrial species relative to temperate and tropical biomes - 9000 plants including 5000 fungi; 6000-7000 fauna species including 55 mammals, 200 birds, 3000 insects. Although the Arctic biota as a whole is estimated to represent less than 1% of the world's species, taxa such as lichens, Diptera, Collembola, mites and enchytraeids are represented by 1-8% of species worldwide. Other groups e.g. geese and waders are predominantly Arctic and together with other migratory birds link the circumpolar region to all other parts of the world (CAFF 2001). The Arctic biota is further distinctive in that many species are widespread, forming large populations with high biomass and high phenotypic and genetic diversity.

Given the extreme difficulties in routine surveying of the Arctic biota, detection of changes in biodiversity have concentrated on individual species that are visible, readily identified, and socio-economically important. Thus, in order to obtain quantitative information on the status and trends in Arctic biodiversity, reviews have relied heavily on commercial statistics and data on a few key vertebrates (Kristensen & Hansen, 1994; Chapin & Korner, 1995; the Dobris Assessment, 1995; Hansen, et al, 1996; Europe's Environment: The Second Assessment, 1998; Nuttall & Callaghan, 2000).

The most recent, more systematic synthesis of information (CAFF, 2001), highlights the still fragmented national data on Arctic terrestrial and marine vertebrates, and the much more limited information on changes in invertebrates and plants. In compiling the report, however, it became apparent that there is a lack of structural framework for interpreting available quantitative species information in a circumpolar context, *inter alia* as a result of: spatially and temporarily inconsistent, imprecise, and uneven data; gaps in taxa and time series; wide natural population fluctuations that complicate interpretation of trends; lack complementary data collection in both breeding and wintering areas of migratory species; different data sampling techniques between years and sites; and lack of statistical trend analyses. A key feature of the Arctic biota is that many species are migratory or with wide geographic ranges, transcending national and even continental boundaries. Thus strengthening of internationally coordinated monitoring schemes is essential to determine trends and causes of change (CAFF 1998).

Environment: In contrast to the data on species status, information on the physical and chemical environment is relatively strong. Reasonably long-term information on climate, derived from various sources, indicates both warming and cooling trends in different areas of the Arctic. Climate change predictions indicate that the Arctic will experience greater changes than in other parts of the World and an assessment of their impacts has been initiated recently (ACIA 2001). Similarly, the Arctic Monitoring and Assessment Programme (AMAP, 1998) has established baseline information and some trends in environmental pollutants, including in some target biota.

Thus there is a reasonable general view of the main biodiversity features and threats, combined with some large-scale national and international monitoring programmes. What is lacking is fine scale and co-ordinated understanding of the trends and dynamics of Arctic species, with improved spatial and functional representation of species and sites. The breadth and depth of such data requires improved access for synthesis and interpretation, which can generate basic comparative ecology as well as understanding for management and policy.

Innovation.

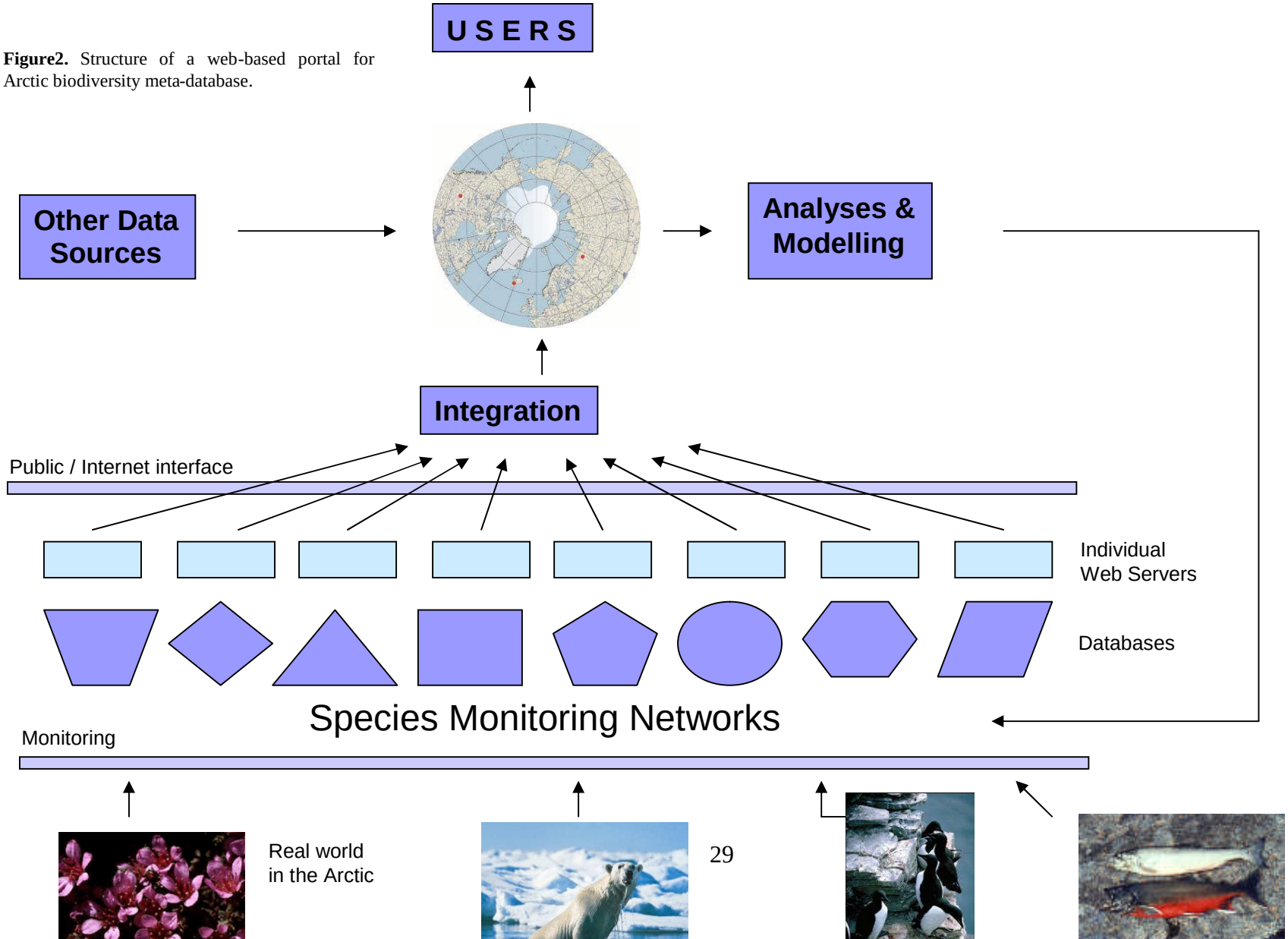
The proposal adopts an approach that establishes as a first step a range of species rather than site networks - an infrastructure of species-networks. The plan will:

- Build on existing studies of individual species or species groups (guilds).
- Select target species that fulfil particular taxonomic, trophic, functional, habitat, social and economic criteria.
- Expand these through additional networks and local people to improve ecological and geographical representation and involve those close to the data in analysis and interpretation.
- Design a common database platform to integrate and synthesise information from the species networks and other sources.
- Establish access to additional environmental information, which can be spatially related to the species databases.

The innovation of this project is primarily related to the combination of activities proposed and the resulting potential for integrating a variety of biological information on a large geographic scale. For the first time biologists from across the circumpolar Arctic region propose to integrate monitoring data for various taxa in a circumpolar context. The initiative provides the capacity a) to rapidly expand and exploit the enthusiasm and expertise of a diversity of specialists across national boundaries and b) to integrate the information through recent developments in web technology, GIS and database interoperability. It also provides a series of networks of experts who can be rapidly contacted when advice or action is urgently needed in case of environmental or ecological emergency - a Rapid Response System.

Table 1 illustrates the 8 species networks that have been selected for preliminary assessment against a series of criteria identified by the key user organisation (CAFF 2000). Fig 2 illustrates the structure of a web-based portal that would allow an inter-operational and geo-referenced data management system.

Figure2. Structure of a web-based portal for Arctic biodiversity meta-database.



B6. Project Work Plan:

Introduction

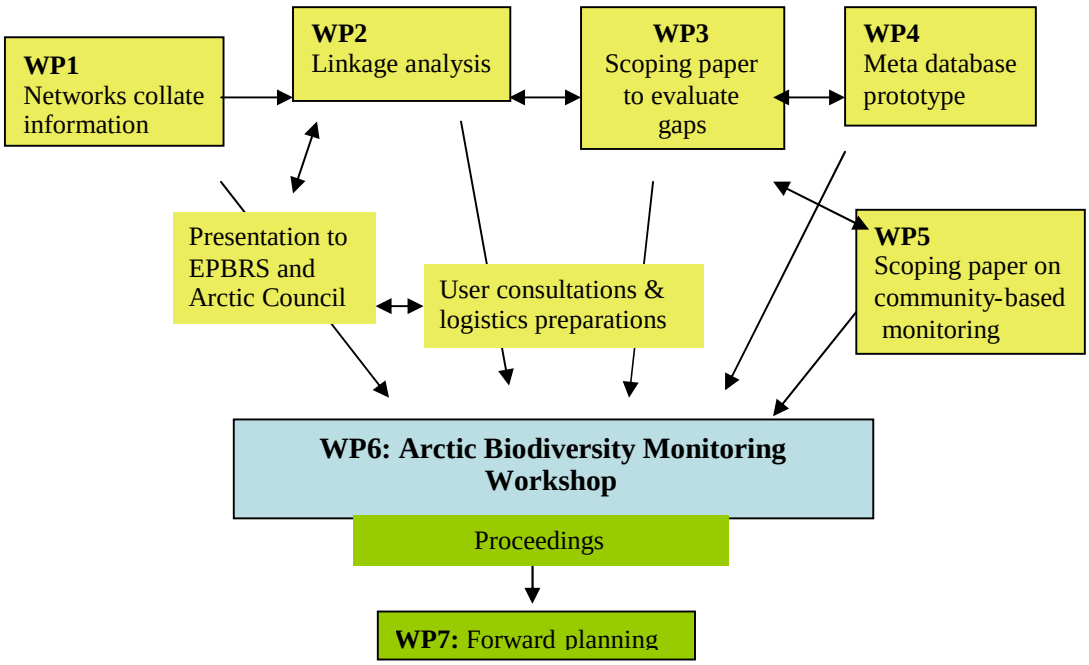
The Project Work plan follows the series of activities identified in B3 and is illustrated in the timetable, workflow chart and WP descriptions below. While an Arctic Biodiversity Monitoring Workshop is the central activity proposed, the project can bee seen as consisting of three phases: workshop preparation phase; conduct of the workshop; and workshop follow-up.

Project planning and time table; (time-work flow-chart)

The project is planned to run for 9 months, with an estimated start 1 October 2002.

Activity	Timeline (months)									
	0[1]	1	2	3	4	5	6	7	8	9[2]
1. Presentation to 2nd meeting in 2002 of EPBRS[3]	X[4]									
2. Presentation to Arctic Council Ministerial meeting	X[5]									
3. Preparations for an Arctic Workshop										
2a. Existing networks collate relevant information										
2b. Analysis of links to other observation systems										
2c. Scoping paper for a comprehensive programme										
2d. Prototype of a GIS-based meta-database.										
2e. Scoping paper on community-based monitoring										
4. Conduct of Arctic Monitoring Workshop						X				
5. Preparation and publication of Workshop Proceedings										
6. Presentation of Workshop results to 1st meeting of EPBRS in 2003[6]										
7. Communications with key stakeholders, including Arctic Council programs and member states, EEA, GTOS, etc..										
8. Preparation and submission of proposals for next phase										

Graphical presentation of the project's components; (interconnection diagram)



[1] October 1, 2002, is set as the approximate start date of the project.
[2] June 30, 2003, set as approximate end date of the project. Actual date will be contingent upon timing of first call to the 6th Framework and announced deadline.
[3] European Platform for Biodiversity Research Strategy
[4] The EPBRS will meet in Copenhagen, 5-8 October 2002.
[5] The Third Arctic Council Ministerial will be held in Inari, Finland, 9-10 October 2002
[6] Contingent upon date of 1st EPBRS meeting in 2003

Detailed project description broken down into work packages:

WPL Workpackage list						
Work-package No	Workpackage title	Lead Participant No[7]	Person-months	Start month	End month	Deliv-erable No
1	Networks collate information	1	8.5	0	4	1-9
2	Linkage analysis	3	1.5	2	4	10
3	Scoping paper to evaluate gaps	2	2	2	5	11
4	Meta-database prototype	4	2	2	4	12
5	Scoping paper on community-based monitoring	5	2	2	4	13
6	Arctic Biodiversity Monitoring Workshop	1	4	6	5	14
7	Forward planning	2	1	5	8	15
	TOTAL		21			

[7] Numbers refer to Partners identified in Section C

Deliverable list

DL	Deliverable list[8]			
Deliverable No[9]	**Deliverable title[10]**	**Delivery date (rel. month)[11]**	**Nature**	**Dissemination level**
D1	Arctic Flora Monitoring Network: Status, Challenges and Opportunities	20.02.03 (4)	Re	PU
D2	Arctic Seabird Monitoring Network: Status, Challenges and Opportunities	20.02.03 (4)	Re	PU
D3	Arctic Shorebird Monitoring Network: Status, Challenges and Opportunities	20.02.03 (4)	Re	PU
D4	Arctic Char Monitoring Network: Status, Challenges and Opportunities	20.02.03 (4)	Re	PU
D5	Reindeer/Caribou Monitoring Network: Status, Challenges and Opportunities	20.02.03 (4)	Re	PU
D6	Arctic Goose Monitoring Network: Status, Challenges and Opportunities	20.02.03 (4)	Re	PU
D7	Polar Bear Monitoring Network: Status, Challenges and Opportunities	20.02.03 (4)	Re	PU
D8	Ringed Seal Monitoring Network: Status, Challenges and Opportunities	20.02.03 (4)	Re	PU
D9	Synthesis of Established Arctic Monitoring Networks	20.02.03 (6)	Re	PU
D10	Circumpolar Biodiversity Monitoring Program: Scope of a Comprehensive Programme	31.04.03 (6)	Re	PU
D11	Circumpolar Biodiversity Monitoring Programme: Linkages to Regional and Global Biodiversity Observation Systems	20.02.03 (4)	Re	PU
D12	Circumpolar Biodiversity Monitoring Programme: Opportunities for Community-based Monitoring	20.02.03 (4)	Re	PU
D13	Prototype Meta-database for a Circumpolar Biodiversity Monitoring Programme	20.02.03 (4)	Pr	PU
D14	Proceedings from Circumpolar Biodiversity Monitoring Workshop	31.04.03 (6)	Re	PU
D15	Circumpolar Biodiversity Monitoring Program: Forward Planning	31.07.03 (9)	Re	PU

[8] Note: Papers will be published in CAFF Technical Report Series electronically (www.caff.is) and in hard copy format. An effort will be made to publish the more technical/scientific aspects of papers 1-9 in special issue of peer reviewed periodicals such as Ambio.

[10] Note: titles are provisional

[11] Note: actual dates are contingent upon funding decision by the EC.

Workpackages

DWP 1 Networks collate information	
Workpackage number :	1
Start date or starting event:	1 October 2002 (contingent upon funding decision by EC)
Participant codes :	1 3-10
Person-months per participant:	0.5 1
1	Objectives; To collate information on data characteristics and sources for each species network, identify gaps in data coverage and harmonisation, and recommend needed improvements.
2	Methodology / work description; Each Network Coordinator will be contracted for one person-month to prepare a paper in advance of the Workshop, describing the status of available data and data sources for their respective species/species group, gaps in coverage, and suggestions for improving circumpolar coverage and data harmonisation. The Project Coordinator will lead this work and prepare a synthesis paper.
3	Deliverables including cost of deliverable as percentage of total cost of the proposed project; D1-D8 (24%): Eight individual reports on the status of the species networks (Table 1). D9 (1.5%). Synthesis paper.
4	Milestones including cost of the Milestone as percentage of total cost of the proposed project 1. Delivery of reports by Network Coordinators (24%) 2. Delivery of synthesis paper by Project Coordinator (1.5%)

DWP 2 Linkage analysis	
Workpackage number :	2
Start date or starting event:	Presentation to EPBRS, October 5-9 2002
Participant codes :	1
Person-months per participant:	1,5
1	Objectives; To analyse linkages among regional and global biodiversity monitoring programmes and observation systems and consult with providers and users of monitoring information.
2	Methodology/work description; Work will consist of consultations with national and regional providers of information as well as potential regional and global users of monitoring data. A report will be prepared in advance of the Workshop, providing analysis of potential linkages to and role of CAFF in regional and global biodiversity observation systems. Consultant for one and half person-month, two international travels.

3	Deliverables including cost of deliverable as percentage of total cost of the proposed project; D10 (6%): Report on linkages among regional and global biodiversity observation systems.
4	Milestones including cost of the Milestone as percentage of total cost of the proposed project 1. Attendance and reporting at EPBRS meeting 5-9 October 2002 (1%) 2. Delivery of report including necessary travel (5%)

DWP 3	**Scoping paper to evaluate gaps**
Workpackage number :	3
Start date or starting event:	December 2002 (approximately)
Participant codes :	2
Person-months per participant:	2
1	Objectives; To plan the scope of a representative biodiversity monitoring programme for the Arctic.
2	Methodology / work description; Work will consist of preparing a scoping paper, including suggestions for establishment of additional networks to improve ecological coverage, opportunities for remote sensing technologies, linkages to national monitoring programs, data management and reporting. A draft will be prepared in advance of the Workshop and a final report will be prepared based on discussions at the Workshop. Consultant/researcher for two person-months
3	Deliverables including cost of deliverable as percentage of total cost of the proposed project; D10 (6%): Report on the scope of a comprehensive biodiversity monitoring programme for the circumpolar Arctic.
4	Milestones including cost of the Milestone as percentage of total cost of the proposed project 1. Delivery of draft before Arctic Biodiversity Monitoring Workshop (4%) 2. Final report/scoping paper by May 2003 (2%)

DWP 4	**Meta-database prototype**
Workpackage number :	4
Start date or starting event:	Nov-December 2002 (approximate)
Participant codes :	12
Person-months per participant:	2
1	Objectives; To produce a prototype of a web-based graphical user interface (web portal) for Arctic biodiversity monitoring information.
2	Methodology / work description; Work will consist of preparing a prototype (web portal) of a GIS interactive database that will use available information from selected networks. In addition, a report outlining requirements for establishing a fully operational database will be prepared. A web-based demonstration will be ready in advance of the Workshop (see Figure 2) Consultant/researcher for two person-months, GIS computer facilities.
3	Deliverables including cost of deliverable as percentage of total cost of the

	proposed project; D11 (13%): Web portal plus a report.
4	Milestones including cost of the Milestone as percentage of total cost of the proposed project 1. Delivery of prototype Web portal (11%) 2. Delivery of report (2%)

DWP 5	**Scoping paper on community-based monitoring**
Workpackage number :	5
Start date or starting event:	October 2002
Participant codes :	11
Person-months per participant:	2
1	Objectives; To provide an overview of community-based monitoring programmes in the circumpolar region and identify potential linkages and opportunities.
2	Methodology / work description; A person with competence and experience in community- and volunteer based environmental monitoring will be hired for two months to prepare a scoping paper, based on consultations with key players and literature review. Consultant/researcher for two person months, two international travels.
3	Deliverables including cost of deliverable as percentage of total cost of the proposed project; D12 (8%): Scoping paper outlining possibilities for community-based monitoring in a circumpolar context and its integration into biodiversity monitoring programmes.
4	Milestones including cost of the Milestone as percentage of total cost of the proposed project Delivery of report/scooping paper.

DWP 6	**Workpackage description: Workshop**	
Workpackage number :	6	
Start date or starting event:	October 2002	
Participant codes :	1	Admin
Person-months per participant:	1,5	2,5
1	Objectives; To hold a Workshop (approximately 60 participants) to: consolidate stakeholders; provide a baseline of accessible biodiversity information, and information infrastructures for the Arctic; plan the scope and implementation mechanism of a comprehensive circumpolar biodiversity monitoring programme; define data management and access requirements for a comprehensive programme; and to prepare a presentation to the circumpolar, European and Global communities.	
2	Methodology / work description; Project Coordinator, in consultations with the project steering committee and the network coordinators, will organise the workshop and be responsible for the preparation of the proceedings. Work of administrative personnel will consist of overseeing registration and logistical preparations, including setting up a Workshop web-page, and assisting with preparation of workshop proceedings.	

	Project Coordinator for one and half person month, Administrator for two and half person months, travel and subsistence support for up to 40 workshop participants**.**
3	Deliverables including cost of deliverable as percentage of total cost of the proposed project; D13 (37%) : Workshop and Proceedings.
4	Milestones including cost of the Milestone as percentage of total cost of the proposed project 1. Web-page (in kind) 2. Workshop (33%) 3. Proceedings (4%)

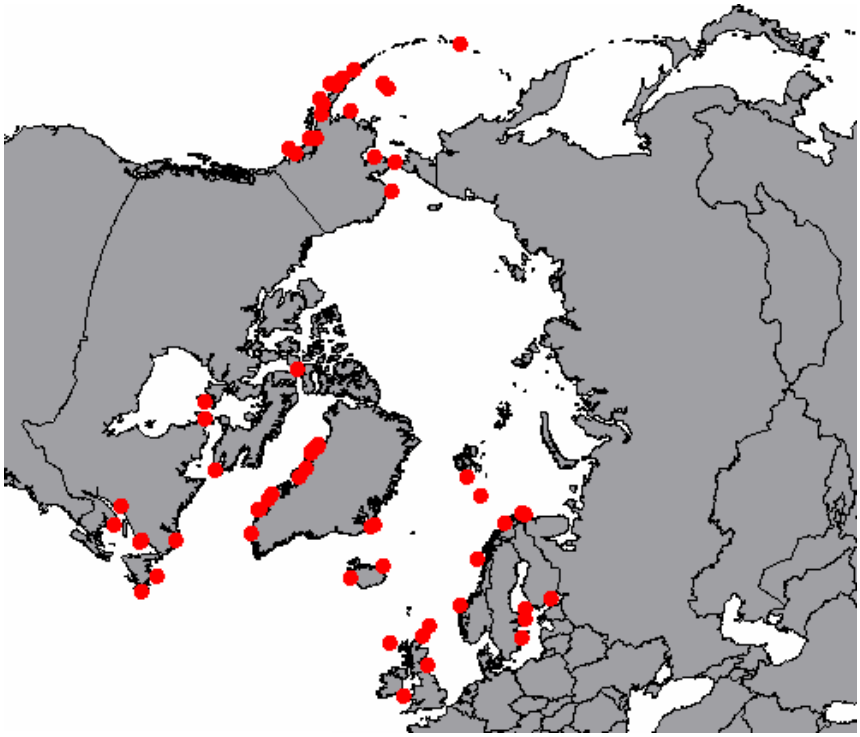
DWP 7 Workpackage description. Forward planning	
Workpackage number : Start date or starting event: Participant codes : Person-months per participant:	7 March 2003 2 1
1	Objectives; To follow-up Workshop results through consultations with data providers and users, and plan further development and implementation of a comprehensive monitoring programme for Arctic biodiversity.
2	Methodology / work description; Work will consist of reporting workshop results to major regional and global biodiversity initiatives, including the first meeting of the EPBRS in 2003, consulting with other stakeholders and users.
3	Deliverables including cost of deliverable as percentage of total cost of the proposed project; D14 (5%): Report on forward planning.
4	Milestones including cost of the Milestone as percentage of total cost of the proposed project 1. Attendance and reporting at 1st EPBRS meeting in 2003 (2%) 2. Delivery of report on forward planning (3%)

Part C

Description of contribution to EU policies etc.

Circumpolar Arctic Biodiversity Monitoring Networks – Strengthening the Infrastructure and Establishing Links to European and Global Observation Systems

CABNET



Monitored seabird colonies in the circumpolar Arctic region

April 2002

Key action 2: Global change, climate and biodiversity

RTD Action 2.2. To foster better understanding of terrestrial (including freshwater) and marine ecosystems, their species and interactions.

RTD Action 2.4. European component of the global observing systems, including (2.4.1) better exploitation of existing data and adaptation of existing observing systems, and (2.4.2) development of new long-term observing capacity.

C2. Content list (part C only)

C3. Community added value and contribution to EU policies.

What problems does the proposal address? It is only a decade since the 8 nations of the circumpolar Arctic combined forces to initiate the **Arctic Environment Protection Strategy** (1991). This has subsequently been adopted by the Arctic Council (1996), including the specific conservation programme of CAFF - the main stakeholder, along with the EU, in the present proposal. CAFF has developed a habitat-based Circumpolar Protected Areas Network (CPAN) and is now focussing attention on development of a species-based network to monitoring status and trends. The general difficulties in the subject of Arctic ecology and conservation are:

- The tiny human population in relation to the vast terrestrial, freshwater and marine environments limits availability of economic and human resources.
- The extreme difficulty in field observation due to climatic and topographic conditions, especially in winter.
- The vast spatial scales over which ecology and conservation have to be practised, especially for the many migratory species and the flora and fauna with large geographic distributions. Such species require major international and often intercontinental collaboration.
- The importance of the Arctic has only recently been recognised with awareness that it will be subject to a greater degree of climate change than other parts of the Globe. The change in climate is likely to have major consequences for society, environments and biodiversity in temperate and even tropical latitudes.
- Arctic concern within Europe has been increasingly focussed through the recent membership of Finland and Sweden, the acceptance of the 'Northern Dimension' by EU, and the recognition that policies must extend beyond Europe to ensure coordinated conservation.
- Although Arctic species richness may be small, the biota has many distinctive characteristics, which may have future technological application.

This unusual combination of circumstances has highlighted the weaknesses in data and information on Arctic biodiversity, as reviewed by CAFF (2001). Thus the circumpolar, European and Global requirements related to CBD, the Habitats and Species Directives, the Bonn, Berne and Ramsar Conventions, OSPAR and many other policies, require improved quantitative information on the status and trends in Arctic species for their implementation. Such improvements are a necessary contribution of the **EU 6th Environment Action Plan 2001-2010** with its 4 priority key areas including Climate Change, and Nature and Diversity. The 5 key approaches include:

- 'ensuring implementation of existing environmental legislation' and
- 'ensuring better and more accessible information on the environment for citizens'

Similarly, the **6th EC Framework Programme 2002-2006** aims to strengthen a **European Research Area**, including Global Change and Ecosystems, with emphasis on assessing and forecasting change, observations necessary for global change research and management strategies, and for extreme and large events. The strategies include enhanced observing, monitoring and modelling networks. These issues build on the 5th EC Framework Programme and require integration of results from the projects nearing

completion, including those covering Arctic sites, species and systems. Such integration is essential to ensure continuity between FP5 and 6.

How will the proposal contribute to EU policy implementation? The proposal will focus on assessing mechanisms and planning actions that can be implemented, through the circumpolar biodiversity monitoring programme of CAFF. In particular it will focus on adding value through integration of currently isolated activities through:

- Development of a conceptual framework to cover the various species networks and to define criteria for selection of further representative species and expert networks.
- Identifying comparable attributes for different taxa that can be applied to enhance the detection of change and the causes of change.
- Assessing the potential of species networks as Early Warning and/or Rapid Response Systems that can be utilised particularly for extreme accidental or natural events.
- Establishment of an accessible meta-database, now feasible as a result of various IT developments, to enhance interaction with indigenous and local people.
- Identifying gaps in information and connection between the Arctic and lower latitudes for species of common conservation concern.

Why should this project be carried out at European rather than national level? As already emphasised, whilst species are often identified as being 'Arctic species', in reality many of them migrate or have distributions extending across the whole of Europe. Detection of change, identifying the causes of change and determining appropriate actions are the responsibility of a disparate and dispersed group of nations.

Within Europe the project will contribute to the **European Platform for Biodiversity Research Strategy** and especially assist the **European Environment Agency** in fulfilling EEC Council Regulations related to: recording, collating, assessing data; providing expert opinion on the state of the environment; harmonisation of measurements; contributing to international monitoring programmes; taking account of socio-economic dimensions; covering trans-frontier, pluri-national and global phenomena.

The project will further contribute to policies of the Nordic Council, outlined in *Sustainable Development: New Bearings for the Nordic Countries* (TemaNord 2001:507), and the *Nordic Action Plan to Protect the Natural Environment and Cultural Heritage of the Arctic – Greenland, Iceland and Svalbard* (Nord 1999:29). A working meeting of the consortium (Akureyri, Iceland, April 11-12, 2002) to prepare this project was supported by the Nordic Council of Ministers.

Within the circumpolar region the project will assist **CAFF and AMA**P in addressing ministerial requests that "acknowledge the establishment of circumpolar monitoring networks for key elements of Arctic biodiversity and encourage efforts of CAFF and AMAP towards integrating their monitoring activities" (Barrow Declaration on the Occasion of the Second Ministerial Meeting of the Arctic Council 2000).

Globally, the **Global Terrestrial Observing System (GTOS)** — "a dedicated long-term, integrated, user-driven observing system for monitoring the extent, form and function of

terrestrial ecosystems" (GTOS 1998) — and its sister programme Global Ocean Observing System GOOS would be major user of information from the current project.

C4. Contribution to Community social objectives.

The proposal will contribute to the social objectives of the EU in 4 distinctive ways:

Distributed Monitoring and Education. Phenological observations such as arrival or departure of species or timing of laying or flowering are particularly sensitive indicators of the climate change. Such indicators are also particularly suitable for observation by local people and students, thus providing options for distributed community participation in monitoring. Planning and development of appropriate protocols will identify opportunities for contribution to environmental education and potential for participation of the newly established University of the Arctic and in the Globe 2000 Program for learning and observations to benefit the environment.

Species Resource exploitation. The African-Eurasian Migratory Waterbird Agreement is one example of the policies that influence local exploitation of wildlife in the diverse social contexts encountered by migratory Arctic species. The proposal will identify exploitation activities that may influence target species throughout their geographic range and indicate options for monitoring. Participation of Wetlands International on the Netherlands will ensure extensive coverage of information on migratory species (Scott, 1998).

Indigenous Peoples and Traditional Knowledge. Involvement of Indigenous Peoples in development of biodiversity networks will provide opportunity to incorporate traditional indigenous knowledge into understanding of the dynamics of target species the Arctic, especially in winter when western studies are particularly weak. Participation of Indigenous Peoples is a central part of Arctic Council and CAFF policy and representation in the management and implementation on the proposal is ensured.

Access to data and information. The web based metadatabase with clear geographic relevance will be designed and developed to provide opportunities for public access to information on biodiversity, climate change, pollution and resource exploitation in the Arctic region. It will also be structured for use by those directly involved in the collection of the data. This will be a particular responsibility of the UNEP-WCMC and will be linked to the UNEP GRID-Arendal both of which have wide experience both inside and outside the Arctic.

C5. Project management

The project will have its main administration at the Icelandic Institute of Natural History – Reykjavik Branch, where the Project Coordinator, Dr. Aevar Petersen, is Director. He will have a part-time administrator financed by the project.

A Project Steering Committee, consisting of Dr. Snorri Baldursson Executive Secretary CAFF, Dr. Christoph Zöckler Senior Researcher WCMC, and Mr. John Crump Executive Secretary IPS, will assist the Project Coordinator in day to day management and planning, in addition to their professional roles in the project. Professor O.W. Heal will be subcontracted as an independent Scientific Advisor to the Steering Committee, and responsible for quality assurance alongside the Project Coordinator.

Network Coordinators will serve as an Advisory Group to the Project Steering Committee.

Communication among Steering Committee and Advisory Group members will primarily be through email correspondence and telephone meetings.

The Workpackages will be coordinated by members of the Steering Committee who will subcontract consultants/researchers/administrators as needed to carry out the assigned tasks in individual packages.

Project information dissemination will be through:

1. Project home page, maintained by the CAFF Secretariat (Participant 2)
2. Reports from the individual Workpackages will, as a minimum, be published online at the CAFF website (www.caff.is) and as CAFF Technical Reports. Publications in peer reviewed international journals will be encouraged and the Steering Committee will explore the possibility of collective publication of relevant project reports.
3. Public information in local newspapers and television will be encouraged.

C6. Description of the consortium

The consortium consists of altogether 10 research institutes from seven Arctic countries (Canada, Denmark, Iceland, Norway, Sweden, Russia, and USA) and two non-Arctic countries (The Netherlands and UK) with long-standing interests in Arctic research. In addition, two administrative bodies of the Arctic Council (the CAFF International Secretariat and the Indigenous Peoples Secretariat) are part of the consortium. CAFF represent the main potential user for species monitoring information in the Arctic. From these institutions and organisations, department heads and/or senior researchers with long and successful records of Arctic research, monitoring and administration serve as natural key persons. Most partners, including the eight Arctic species network coordinators, represent sub-networks comprised of 16-25 network members and institutions from the eight Arctic- and adjacent countries.

The 10 research institutes and two administrative bodies have overlapping interests in terms of data sets and monitoring programmes, but each with its own particular expertise. Most of the partners have collaborated earlier in various circumpolar (e.g. CAFF) and/or Nordic projects and programs and all have the necessary experience, expertise and facilities to carry out the objectives of this proposal as evident from Section C 7.

The project coordinator and Lead Participant for WP1 and 6, Dr. Aevar Petersen, has over 25 years of experience in Arctic research and has published extensively. He has served as the National Representative for Iceland in the Arctic Council Conservation of Arctic Flora and Fauna (CAFF) working group. Within CAFF he has been leading the development of a circumpolar program to monitor biodiversity and has been a key person in initiating implementing other CAFF programs and projects, including the Circumpolar Seabird Working Group and the Circumpolar Protected Areas Network. The Icelandic Institute of Natural History serves as a Clearing House for the European Environmental Agency's European Topic Centre for Nature Protection and Biodiversity. The institute furthermore participates in a multi-institutional project to develop a web-based met database of Icelandic environmental information, similar to the one proposed in this project (Figure2).

The Workpackages of the project will be coordinated by the following partners:

WP1: Partner #1 in collaboration with Partners 2-10 (subcontracts)

WP2: Partner #2

WP3: Partner #1 (Professor Bill Heal subcontractor)

WP4: Partner #12

WP5: Partner #11

WP6: Partner #1

WP7: Partner #2

It must be emphasised that although the specific partners above will take the lead role in particular workpackages, they will contribute to other WPs: all partners will have highly relevant expertise to contribute to most WPs. Some partners, including the coordinators for individual CAFF monitoring networks, will not lead WPs but will nevertheless provide essential contributions to them and the consortium as a whole.

C7. Description of the participants

Partner 1: Icelandic Institute of Natural History, Reykjavik, Iceland

The Icelandic Institute of Natural History was founded in 1889 by The Icelandic Natural History Society and managed by the Society until 1947 when it was acquired by the state. The Institute, with main branches in Reykjavik and Akureyri (northern Iceland): conducts basic and applied research on the nature of Iceland in the fields of botany, geology and zoology with emphasis in biology on taxonomy and ecology; maintains scientific specimen collections; holds data banks on Icelandic nature; assembles literature on the natural history of Iceland; operates the Icelandic Bird-Ringing Scheme, prepares distribution, vegetation and geological maps; assists in environmental impact assessments; advises on sustainable use of natural resources and landuse; and assesses the conservation value of species, habitats and ecosystems. The Institute has 35 full-time researchers in addition to part-time researchers and research-assistants, computer and GIS specialists, taxidermist, office staff, financial manager, publication officer and exhibit keepers. The total number of employees is about 70. Website: www.ni.is.

Key personnel:

Dr. Aevar Petersen, Project Coordinator & Lead for WPs 1 & 6

Education: 1971 Univ. of Aberdeen, Scotland, B.Sc. (Honours), 1st class Honours; 1981 Univ. of Oxford, England, D. Phil. (Oxon). Employment: Curator of Zoology and Head of Dept, Icelandic Institute of Natural History from July 1978; Dir. of institute 1984-86; Dir. Reykjavik Division from 1994. - Numerous committees, governmental and non-governmental, including: Icelandic Bird Protection Comm. 1978-94, chair 1980-94; Advisory Comm. on Bird and Terrestrial Mammal Protection, Conservation and Hunting 1994-98; Committee for Emergency Reactions against Disaster Pollution Incidents; National rep. Conservation of Arctic Flora and Fauna (CAFF) since inception 1992, chair 1993-94. - Extensive field and laboratory work, esp. on birds and mammals. Coordinator/organizer of many short- or long-term research projects. Contract work for town councils, planning commissions, etc. Reports for parliament, government, and state agencies. Numerous newspaper, radio and television interviews.

Recent references:

1998: [Icelandic Birds.] Vaka-Helgafell, Reykjavík. 312 pp. Incidental take of seabirds in Iceland. Pp. 23-27 *in*: V. Bakken & K. Falk (eds). Incidental Take of Seabirds in Commercial Fisheries in the Arctic Countries. CAFF Technical Report no. 1. v+50 pp. Breiðafjörður: West-Iceland. An Arctic marine protected area. Parks 8(2): 23-28. (With G. Þorvarðardóttir, J. Pagnan & S. Einarsson). **1999:** Adult survival of the Black Guillemot in Iceland. Condor 101(4): 589-597. (With M. Frederiksen). Philopatry and dispersal within a Black Guillemot colony. Waterbirds 22(2): 274-281. (With M. Frederiksen). The importance of natal dispersal in a colonial seabird, the Black Guillemot *Cepphus grylle.* Ibis 142(1): 48-57. (With M. Frederiksen). **2000:** [Monitoring of Icelandic seabirds.] Natturufraedingurinn 69(3-4): 189-200. (Icel., Engl. summ.). Kristín Ólafsdóttir, Ævar Petersen, Elín V. Magnúsdóttir, Þorvaldur Björnsson & Þorkell Jóhannesson 2000. Persistent organochlorine levels in six prey species of the Gyrfalcon *Falco rusticolus* in Iceland. Environ. Poll. 112: 245-251. (With Kristín Ólafsdóttir, Elín V. Magnúsdóttir, Þorvaldur Björnsson & Torkell Jóhannesson). **2001:** Black Guillemots in Iceland: A case-history of population changes (Box 70). Pp. 212-213 *in*: Arctic Flora and Fauna (Status and Conservation). CAFF/Edita, Helsinki. 272 pp.

Independent Scientific Adviser (subcontracted by artner 1)

Professor O.W.Heal, Scientific Adviser and subcontractor for WP3

A zoologist by training, Bill Heal completed his PhD at Durham University on protozoa in moorland soils (1959) and followed a research career in soil biology. He led the UK moorland site project in the International Biological Programme (IBP) and was active internationally in the Tundra Biome programme (Bliss, Heal and Moore 1981). He then developed a research career with the Institute of Terrestrial Ecology (ITE), becoming Director (North) in 1987 with responsibility for 3 research stations and 130 staff. Retiring in 1994 he renewed links with Arctic research, Chairing the UK Polar Committee of the Natural Environment Research Council (NERC) and representing UK on CAFF and AMAP. He led the EC Arctic Terrestrial Ecosystem Research Initiative (ARTERI) developing cooperation and synthesis across Arctic organisations (Heal 2001), initiating an EC North Atlantic network of field sites (SCANNET) and leading the initial Task Force of the University of the Arctic. He helped organise CAFF workshops on biodiversity and monitoring; is now an Elder of the University of the Arctic, a Senior Research Fellow of the Stefanson Institute in Iceland and Visiting Professor at Durham University.

Selected References:

1. Bliss, L.C., Heal, O.W. & Moore, J.J. (Eds) 1981. Tundra Ecosystems: A Comparative Analysis. IBP No 25. Cambridge University Press. 813pp.
2. Heal, O.W. 2001. Potential responses of natural terrestrial ecosystems to Arctic climate change. Icelandic Agricultural Sciences, 14, 3-16.
3. Turunen, M., Hukkinen, J., Heal, O.W., Saeltun, N.R. & Holten, J.L. (eds). 1999. A terrestrial transect for Scandinavia/Northern Europe: Proceedings of the International SCANTRAN Conference. Ecosystems Research Report No. 31. EC Brussels, 313pp.
4. Heal, O.W. 1999. Looking North: Current issues in Arctic soil ecology. Applied Soil Ecology 11. 107-109 (Guest Editor of the issue with 6 papers from Workshop on Global Change and Tundra Soil Biology, 11-188).
5. Heal, O.W, Callaghan, T.V., Cornelissen, J.H.C., Korner, C. & Lee, S.E. (eds). 1998. Global Change in Europes Cold Regions. Ecosystems Research Reports No. 27. EC Brussels, 137pp.

Partner 2: Conservation of Arctic Flora and Fauna (CAFF) International Secretariat, Akureyri, Iceland

Established in 1994 in Ottawa Canada, moved to Akureyri, Iceland in 1996. Serves as a focal point for the Arctic Council CAFF Working Group; assists the Chair in implementing the CAFF Work Plan; coordinates CAFF program activities; oversees preparation of CAFF publications; oversees meeting preparations and reporting; assists with fund raising for program work; reports to CAFF Management Board and Senior Arctic Officials of the Arctic Council; manages the CAFF website (www.caff.is). Three employees.

Key personnel:

Dr. Snorri Baldursson, Member of Project SC and Lead for WPs 2 & 7

Education: 1979 B Sc in biology (University of Iceland); 1997 Teachers Certificate (University of Iceland); 1983 MA in biology/plant ecology (University of Colorado);

1993 Ph D in applied plant genetics (Agricultural University of Copenhagen). Employment: 1983-1986 collage teacher in Reykjavik; 1986-1988 Researcher, Agricultural Research Institute of Iceland; 1990-1993 Researcher, Botanic Gardens, Univ. of Copenhagen; 1993-1996 Senior Researcher, Iceland Forest Research Station; 1997-2002 Executive Secretary for CAFF – member of various steering committees for CAFF and Arctic Council projects, including the Arctic Climate Impact Assessment (ACIA); UNEP/CAFF/GEF on Integrated Ecosystem Management of Arctic Russia (ECORA), and the CAFF Biodiversity Monitoring Group. Has published over 40 scientific articles in international and Icelandic journals.

Selected references:

1. Baldursson, S. 2002. [Arctic ecosystems]. IN: Grænskinna (Ingolfsdottir, A. ed), in press (in Icelandic).
2. CAFF (Conservation of Arctic Flora and Fauna). 2001. Arctic Flora and Fauna: Status and Conservation (**S. Baldursson**, H. Huntington, P. Kankaanpaa, A-L. Sippola, and C. Zöckler eds.). Helsinki: Edita. 272 p.
3. Baldursson, S. 2001. The Circumpolar Protected Areas Network (CPAN). IN: Proceedings Willem Barents Symposium (B. Ebbinge & Y. Mazarov eds.), February 18-20, 1998.
4. CAFF (Conservation of Arctic Flora and Fauna). 2000. CAFF Technical Report No 6: CAFF/AMAP Workshop on a Circumpolar Biodiversity Monitoring Program, Reykjavik, 7-9 February, 2000 (S. **Baldursson** ed.). Akureyri: CAFF, 68p.
5. CAFF (Conservation of Arctic Flora and Fauna). 1998. CAFF Technical Report no 5: AMAP/CAFF Workshop on Climate Change, Rovaniemi, 24-25 March 1998 (J. I Holten & S. **Baldursson** eds.).

Partner 3: The University Courses on Svalbard, UNIS, Longyearbyen, Norway

The University Courses on Svalbard (UNIS) is a private foundation established by the Norwegian government and owned by Norway's four universities. The objective of the foundation is to offer university-level courses and to perform research relevant to Svalbard's geographical location in the High Arctic. UNIS was established in 1993 and since then it has achieved a good international reputation in the academic world. UNIS is, or has been a partner in the following projects funded by the European Union: "Variability of Exchanges in the Northern Seas – VEINS" (1997-2000), Marie Curie Training Site Fellowship: "Aeronomy and Remote sensing in the high Arctic-Measurements and Modelling", Marie Curie Individual Fellowship: "Rock weathering in high latitude environments" and "FRAGILE (FRagility of Arctic Goose habitat: Impacts of and use, conservation and Elevated temperatures)", the Fifth framework programme (Energy, environment and sustainable development), Key action 2.2, starting in January 2003.

Key personnel:

Professor Ingibjörg S. Jónsdóttir, Coordinator of the CAFF plant monitoring network

Education: 1979 B.Sc. Biology (University of Iceland); 1981 'Diplome degree', Botany, University of Iceland; 1989 Ph.D., Plant Ecology, Lund University, Sweden. Employment: 1989-1993: Assistant Professor, Department of Ecology, Lund University, Sweden, 1993-2001: Associate Professor, Terrestrial Biology, Botanical Institute, Göteborg University, Sweden, promoted as Professor 2001; 2000-present: Professor, Terrestrial Biology, UNIS, Norway. Research details: plant population ecology, plant

animal interaction and the effect of climate change on Arctic vegetation. Extensive experience in ecological research in the Arctic, Sub-arctic, Sub-antarctic as well as in temperate areas, including participation in the International Tundra Experiment (ITEX) from its inception in 1991.

Selected references:

1. Stenström, A, Jónsdóttir, I.S. and Augner, M. (in press) Genetic and environmental effects on morphology in clonal sedges in the Eurasian Arctic. Journal of American Botany.
2. Stenström, A., Jonsson, O., Jónsdóttir, I.S., Augner, M. and Fagerström, T. (2001). Genetic variation and clonal diversity in four clonal sedges (*Carex)* along the arctic coast of Eurasia. – Molecular Ecology 10: 497-514.
3. Jónsdóttir, I.S., Virtanen, R. and Kärnefelt, I. 1999. Botanical report from Tundra Ecology -94: Large scale differentiation and population dynamics in tundra plants and vegetation. Ambio, 28:230-238.
4. Arft, A. M. ,Walker, M. D., Gurevitch, J., Alatolo, J. M., Bret-Harte, M. S., Dale, M. Diemer, M., Gugerli, F., Henry, G. H. R., Jones, M. H. Hollister, R. D., Jónsdóttir, I. S., Laine, K., Lévesque, E., Marion, G. M., Molau, U., Mølgaard, P., Nordenhäll, U., Raszhivin, V., Robinson, C. H., Starr, G., Stenström, A., Stenström, M., Totland, Ø., Turner, P. L., Walker, L. J., Webber, P. J., Welker, J. M. and Wookey, P.A. 1999. Responses of tundra plants to experimental warming: Meta-analysis of the International Tundra Experiment. – Ecological Monographs 69: 491-511.
5. Stenström, A. and Jónsdóttir, I.S. 1997. Responses of *Carex bigelowii*, a clonal sedge, to simulated climate change. - Global Change Biology 3: 89-96.
6. Jónsdóttir, I.S., Callaghan, T.V. and Headley, A. 1996. Resource dynamics in arctic clonal plants. - Ecological Bulletins 43: 53-64.

Partner 4: National Environmental Research Institute of Denmark, NERI, Roskilde, Denmark

The object of NERI's work is to help fulfil the Government's goal of an environmental policy based on knowledge. The total number of employees is around 450. NERI's Department on Arctic Environment conducts research on issues related to environmental management of mineral and petroleum exploration and exploitation in Greenland. Research also includes monitoring and assessment of contaminants in the environment, particularly related to AMAP and CAFF, and studies related to the impact of global climate change on Arctic ecosystems. Based on this research the department is environmental advisor to the Government of Greenland, Bureau of Minerals and Petroleum. The department has a staff of about 20, of which 13 has an academic background in biological, chemical and geographical science. Research has been conducted within the terrestrial, limnic, marine and atmospheric environments of Greenland during the past 25 years. The staff has significant experience in conducting field work, often in remote areas and harsh environments. The use of GIS has become an important tool in analysing and presenting data and remote sensing techniques become still more significant. In 2000 the Department is participating in 33 scientific Projects.

Key Personnel:

Dr. K. Hans Meltofte, Coordinator of the CAFF wader monitoring network

Education: D.Sc. at the University of Copenhagen. Profession: Ornithologist, research scientist. Key qualifications**:** Hans Meltofte has been involved with research and monitoring particularly on waders (shorebirds), waterfowl and seabirds in the Arctic and northern Europe for more than 30 years. Employment record: 1995-present: Manager of the BioBasis monitoring programme at the Zackenberg Research Station in Northeast Greenland (programme run by the Danish Polar Center 1995-1997 and by the National Environmental

Research Institute since 1998); 1979-1995: Researcher and author on a wide variety of projects, based at the Zoological Museum, University of Copenhagen; 1969-1979: Meteorological assistant on weather stations in Greenland and free lance field worker and researcher on projects in Greenland and Denmark; 1963-1968: Radio technician and field worker on Danish biological field stations.

Selected references:

1. Meltofte, H. 2000: Birds. Pp. 32-39 *in* Caning, K. & M. Rasch (eds): Zackenberg Ecological Research Operations, 5th Annual Report, 1999. - Danish Polar Center, Ministry of Research and Information Technology (86 pp).
2. Meltofte, H. & T.B. Berg 2000: Zackenberg Ecological Research Operations. BioBasis: Conceptual design and sampling procedures of the biological programme of Zackenberg Basic. 4th edition. - National Environmental Research Institute, Department of Arctic Environment (74 pp.).
3. Meltofte, H., J. Blew, J. Frikke, H.-U. Rösner & C.J. Smit 1994: Numbers and distribution of waterbirds in the Wadden Sea. Results and evaluation of 36 simultaneous counts in the Dutch-German-Danish Wadden Sea 1980-1991. - IWRB Publication 34 / Wader Study Group Bull. 74, Special issue. Common Secretariat for the Cooperation on the Protection of the Wadden Sea (192 pp).
4. Meltofte, H. 1993: Wader migration through Denmark. Populations involved, their migratory phenology and stategies. - Dansk Orn. Foren. Tidsskr. 87: 1-180 (thesis).
5. Boertmann, D., H. Meltofte & M. Forchhammer 1991: Population densities of birds in central Northeast Greenland. - Dansk Orn. Foren. Tidsskr. 85: 151-160.
6. Meltofte, H. 1985: Populations and breeding schedules of waders, Charadrii, in high arctic Greenland. - Meddr Grønland, Biosci. 16 (43 pp).
7. Meltofte, H. 1979: The population of waders Charadriidae at Danmarks Havn, Northeast Greenland, 1975. - Dansk Orn. Foren. Tidsskr. 73: 69-94.

Partner 5: Russian Research Institute for Nature Protection, Moscow, Russia

The Russian Research Institute for Nature Protection belongs to the Russian Federation Ministry of Natural Resources. Its role is conduct research in support of biodiversity conservation, including preparation of Red Books of the Russian Federation. It provides research advice and information to fulfil Russian Federation obligations in several international conventions and agreements concerned with nature conservation, including the Convention on Biological Diversity (CBD), the Ramsar Wetlands Convention, the Bern Convention, and Programs of the Arctic Council, including CAFF.

Key Personnel:

Dr. Stanislav Belikov Coordinator for the CAFF Polar bear monitoring network

Education/degrees: 1969 Candidate of Science (Moscow State University). Employment: 1970-present - Senior Researcher, Head, Laboratory of Arctic Problems, Russia Research Institute for Nature Protection. Field of Experience: biodiversity conservation and protected areas in Arctic regions, anthropogenic impact assessment, including pollution, sustainable use of animals (marine mammals, reindeer), protection and restoration of arctic animal species including for the Red Data Book. Memberships: Co-chair IUCN Polar Bear Specialist Group; member of IUCN Sustainable Use Specialist Group; member of Large Carnivore Commission of Teriological Society, RAS; member of CAFF/ CPAN Standing Committee. Projects: Co-leader Russian-Norwegian project on Polar Bear; Russian-US project on Polar Bear. Publications:

References:
140 publications, mostly in Russian, concerning marine mammals and polar bears.

Partner 6: Norwegian Polar Institute, Tromsö, Norway

The Norwegian Polar Institute has its headquarters in Tromsø, Norway, with an office in Longyearbyen, Svalbard, and a research station in NyÅlesund, Svalbard in addition to small outposts in various Arctic and Antarctic locations. NPI is one of five Directorates within the Ministry of the Environment. The Institute serves as a specialist, advisory body for he Norwegian Government on issues of policy, management and conservation in Polar Regions. The Institute operates an ice-strengthened research vessel R/V Lance that is equipped with modern marine science instrumentation and a helicopter deck. NP has a staff of 130 persons, and an annual budget that exceeds 13.5 M EUR. The Research Division included approximately 30 permanent and 20 contracts scientists that work in biology, geology and oceanography. NP's marine ecology program in the Arctic is focussed on upper trophic levels. Research programmes address the ecology, physiology, and population biology of polar bears, non-commerical species of seals and whales as well as seabirds that contribute scientific knowledge about the Arctic and provide data for national and international management decisions and monitoring. Studies of marine biodiversity and climate change effects also include studies of lower and intermediate trophic levels. NPs research efforts in the Arctic are geographically focussed within the Barents Sea and Svalbard area. NP also serves as a service institution, outfitting research expeditions via its logistics division. Finally, the Institute provides public information about the Polar Regions. NP works in close co-operations with the exhibition centre, Polaria - as part of its public education activities. (Http://www.npolar.no/)

Key personnel:

Dr. Kit Kovacs, Coordinator of the CAFF Ringed Seal Monitoring Network

Dr. Kit Kovacs heads the Marine Ecology Programme of the Norwegian Polar Institute, which is designed to provide sound scientific advice to Norwegian and international agencies responsible for resource management and conservation issues in the polar regions. It also strives to maintain a more general scientific expertise about polar marine systems, and contribute high quality scientific knowledge to the global knowledge base regarding Arctic and Antarctic marine fauna.

Note: CV for Kit Kovacs is not available at present due to the death of a close relative, but will be faxed to EU by Friday 19 April

Partner 7: Institute of Freshwater Research, Stockholm, Sweden

The Institute of Freshwater Research is a research laboratory within the National Swedish Board of Fisheries. The institute is responsible for the research, management and conservation of national freshwater fish populations conducted within the National Fishery Administration, and for supervising the long-term sustainable use of these natural resources. In addition to the central research facilities, which are located at Drottningholm in the vicinity of Stockholm, the institute also possesses an office in

Örebro, and two experimental research stations with new hatching facilities in Älvkarleby and Kälarne, further north. The institute thus has good experimental conditions, excellent sampling and processing facilities, well-equipped laboratories for microscopic work, allozyme and DNA analyses, and also an excellent library. Empirical field studies and monitoring programs are conducted throughout Sweden. The central staff comprises ca 40 people, including 10 administrators and technicians, and ca 30 research scientists and assistants. The Drottningholm Institute has a 70-year record of thorough scientific research into basic ecology and diversity of freshwater fish, intra- and interspecific interactions, salmonid systematics and speciation processes. The institute has also evaluated the environmental impact of impoundment, water level regulations, introductions of alien species of fish, crayfish and fish food organisms, acid rain problem, and pollution from e.g. radionuclides on northern fish communities. The direction of the research in evolutionary ecology has mainly reflected the pioneer work by earlier directors such as Gunnar Alm, Gunnar Svärdson and Lennart Nyman, whereas the applied research very much reflect present environmental changes caused by hydropower production, acid and radioactive depositions, and the impact of gillnetting.

Key Personnel:

Dr. Johan Hammar, Coordinator of the CAFF Arctic Char Monitoring Network

Academic degrees: 1974, B.Sc., Physical Geography, Genetics, Zoology, Limnology, (University of Lund); 1998 Ph. D., Animal Ecology (University of Uppsala). Employment: Senior Research Scientist at the National Swedish Board of Fisheries' Institute of Freshwater Research, Drottningholm, since February 1, 1976; visiting scientist at Department of Fisheries and Oceans, St. John's, Newfoundland, 1984-85. Research Profile: Basic research program: Speciation processes, and intra- and interspecific interactions in circumpolar populations of Arctic char (*Salvelinus alpinus*); Applied research program: The use of Arctic char as an indicator of environmental changes in northern lake ecosystems (e.g. water level regulation, gillnetting, pollution [heavy metals, organic contaminants, radionuclides], introductions of alien invertebrate and fish species, etc.). The position at the Drottningholm Institute during ca 25 years has also involved lecturing at numerous University Departments and Research Institutes throughout the northern hemisphere, participation in scientific symposiums, and international science expeditions such as Ymer-80 and TNW99 to the Arctic, as well as a series of commissions of trust.

Selected references:

1. Hammar, J. 2000. Cannibals and parasites - conflicting regulators of bimodality in high latitude Arctic char (*Salvelinus alpinus* (L.)). Oikos 88: 33-47.
2. Hammar, J. 1998. Evolutionary ecology of Arctic char (*Salvelinus alpinus* (L.)): intra- and interspecific interactions in circumpolar populations. Acta Universitatis Upsaliensis. Comprehensive Summaries of Uppsala Dissertations from the Faculty of Science and Technology 408. 31 p. Uppsala.
3. Hammar, J., J.B. Dempson & E. Verspoor. 1991. Natural hybridization between Arctic char (*Salvelinus alpinus*) and brook trout (*S. fontinalis*): evidence from northern Labrador. Can. J. Fish. Aquat. Sci. 48(8): 1437-1445.
4. Hammar, J. 1991. Speciation processes in the High Arctic: Hardly as simple as the environment might suggest. p. 73-88. In J. Hammar (Ed.) Proc. 6th ISACF workshop on Arctic char, 1990. ISACF Information Series 5, Inst. Freshw. Res., Drottningholm.
5. Hammar, J. 1989. Freshwater ecosystems of polar regions: Vulnerable resources. Ambio 18(1): 6-22.
6. Hammar, J., J.B. Dempson & E. Sköld. 1989. Natural hybridization between Arctic char (*Salvelinus alpinus*) and lake char (*S. namaycush*): Evidence from northern Labrador. Nord. J. Freshw. Res. 65:54-70.

Partner 8: Alterra, Green World Research, Wageningen, Netherlands

Alterra is the main Dutch centre of expertise on rural areas. The institute was founded 1 January 2000, as a result of a merger between the Winand Staring Centre for Integrated Land, Soil and Water Research (SC), the Institute for Forestry and Nature Research (IBN) and part of the Research Institute for Agrobiology and Soil Fertility (AB). This merger means that Alterra now combines all expertise on rural areas and their sustainable use, including aspects such as water, wildlife, forests, the environment, soils, landscape, climate and recreation, as well as various other aspects relevant to the development and management of the environment we live in. Alterra engages in strategic and applied research to support policymaking and management at the local, national and international level. This includes innovative and interdisciplinary research on complex problems relating to rural areas, but also the production of readily applicable knowledge and expertise enabling rapid and adequate solutions to practical problems. The many national and international themes of Alterra's research effort include relations between cities and their surrounding countryside, multiple uses of rural areas, economy and ecology, integrated water management, sustainable agricultural systems, planning for the future, expert systems and modelling, biodiversity, landscape planning and landscape perception, integrated forest management, geo-information and remote sensing, spatial planning of leisure activities, habitat creation in marine and estuarine waters, green belt development and ecological webs, pollution risk assessment, etcetera. Alterra is part of Wageningen University and Research Centre (Wageningen UR) and is located at two sites, one in Wageningen and one on the isle of Texel. The institute consists of seven departments, each of which is subdivided into teams focusing on a specific theme.

Key Personnel:

Dr. Bart Ebbinge, Coordinator of CAFF Goose Monitoring Network

Education: 1975 M.Sc. Biology (University of Groningen) animal ecology; 1992 Ph.D. in natural sciences (University of Groningen), population limitation in arctic-breeding geese. Key qualifications: Senior researcher with extensive experience in running long-term projects with both professional and volunteer co-workers. Key interest in population dynamics of long-lived migratory bird species, based on studies of marked individuals. Estimating Annual Survival rates. Predator-prey relationships (lemming/arctic fox/Brent Goose cycles). Applied research on the interactions between man and migratory birds (population management on an international level, recreation, hunting, agricultural damage by geese, integration of agricultural and nature conservation interests). From 1990-1995 led a 6-year international field research team studying the factors influencing breeding success in Brent Geese in northern Siberia. Has initiated two films for the general public about goose problems in managing goose populations in relation both to nature conservation and to agricultural damage. Has a written a textbook about the biology of migratory geese for a wide audience (in Dutch with summary in English). Has lectured widely on the biology and management of migratory goose populations on international symposia.

Selected references:

1. Ebbinge, B.S.1989. A multifactorial explanation for variation in breeding performance of Brent Geese. Ibis 131:196-204.
2. Ebbinge, B.S. 1991. The impact of hunting on mortality rates and spatial distribution of geese wintering in the western palearctic. Ardea 79:197-210.

3. Ebbinge, B.S. 1992. Regulation of numbers of Dark-bellied Brent Geese Branta b. bernicla on spring staging sites. Ardea 80:203-228.
4. Ebbinge, B.S. & B. Spaans 1995. The importance of body reserves accumulated in spring staging areas in the temperate zone for breeding in Dark-bellied Brent Geese Branta b. bernicla in the high Arctic. J.Avian Biol. 26: 105-113.
5. Ebbinge, B.S. & L.S. Buurma 2000. Mid-winter movements of geese in the Netherlands as a risk to aviation safety. In: J. van Nugteren (Ed.) 2000. IBSC 25 International Bird Strike Committee – Proceedings of the 25th Conference of the International Bird Strike Committee, Amsterdam, The Netherlands, 17-21 April 2000

Partner 9: Canadian Wildlife Service, Whitehorse, Canada

Environment Canada is the Federal Environment Department in Canada. Relevant to this application, Environment Canada is responsible for implementing the Convention on Biological Diversity (CBD) and assessing the impacts of Climate Change on species under their mandate. The Canadian Wildlife Service, within Environment Canada, is responsible for migratory international species. Primarily concerned with migratory birds, the Service has also had a strong history in research of migratory caribou populations in northern Canada.

Key Personnel:

Dr. Don Russell, Coordinator of the CAFF Reindeer/Caribou Monitoring Network

Research Manager, Circumpolar Global Change Program, Environment Canada, Canadian Wildlife Service, Yukon, Canada (2001-2002); Manager, Canadian Wildlife Service, Yukon (1988-2000). Primary research interest is the adaptation of *Rangifer* to arctic and sub-arctic ecosystems including behavioral, nutritional, physiological, compensatory and reproductive strategies. Computer simulation modeling as a tool to integrate ecosystem components to assess impacts of global change (climate, development and institutional) on reindeer/caribou systems. Use of modeling as a tool in cumulative impact assessment. Integration of social, economic, biological and cultural research in assessment of assessing health of natural and human systems. Use of monitoring as a tool to integrate aboriginal communities in research and management of their environment.

Selected references:

1. Russell, D., G. Kofinas, and B. Griffith. 2000. Need and opportunity for a North American caribou knowledge cooperative. *Polar Research* 19(1): 117-130.
2. Russell, D. E. and R.G. White. 2000. Surviving in the north- a conceptual model of reproductive strategies in arctic caribou. . Proc. 8th North American Caribou Workshop. 23-25 April 1998. Whitehorse, YT, Canada. Rangifer, Special Issue No. 12: 67.
3. Russell, D. E., R.D. Cameron, R.G. White and K.L. Gerhart. 1998. Mechanisms of summer weight gain in northern caribou herds. 2000. Proc. 8th North American Caribou Workshop. Rangifer Special Issue No. 12: 148.
4. Russell, D. E., K.L. Gerhart, R.G. White and D. Van De Wetering. 1998. Detection of early pregnancy in caribou: evidence for embryonic mortality. J. Wildl. Manage.62: 1066-1075.
5. Russell, D. E., and B. Griffith. 1995. The Porcupine Caribou Herd: a comprehensive study of ecosystem-level relationships. 2nd International Arctic Ungulate Conference, 13-17 August 1995. Fairbanks, AK. Invited Plenary Lecture.

6. Russell, D. E., A. M. Martell, and W.A.C. Nixon. 1993. The range ecology of the Porcupine Caribou Herd in Canada. Rangifer Special Issue No. 8, 168 pp.

Partner 10: US Fish and Wildlife Service, Anchorage, Alaska

"The U.S. Fish and Wildlife Service's mission is, working with others, to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people." The Service helps protect a healthy environment for people, fish and wildlife, and helps Americans conserve and enjoy the outdoors and our living treasures. The Service's major responsibilities are for migratory birds, endangered species, certain marine mammals, and freshwater and anadromous fish. The Service's origins date back to 1871, when Congress established the U.S. Fish Commission to study the decrease of the nation's food fishes and recommend ways to reverse the decline. A series of reorganisations culminated in 1956 when the Fish and Wildlife Act created the United States Fish and Wildlife Service and established two bureaus, Sport Fish and Wildlife and Commercial Fisheries. For many years the Service was the principal federal wildlife and fisheries research agency. In the 1940's, Service research biologists conducted some of the first investigations into the effects of the pesticide DDT in wildlife. Service researchers also revealed the life cycle of the parasite that causes whirling disease in trout. In addition, Service biologists developed many of the captive breeding techniques that have benefitted such rare species as whooping cranes, California condors and black-footed ferrets. The Service's research function briefly became an independent agency and was eventually reorganized as part of the U.S. Geological Survey in 1996.

Key Personnel:

Dr. David Irons, Coordinator of the CAFF Seabird Monitoring Network

Education: . 1982 M. S. from Oregon State University on foraging behavior of glaucous-winged gulls in relation to the presence of sea otters; 1929 Ph. D. from the U. of CA, Irvine - dissertation on the foraging ecology and breeding biology of the black-legged kittiwake. Research profile: research on kittiwakes in Prince William Sound for 20 years; conducted or directed several seabird studies including: the effects of the Exxon Valdez Oil Spill on marine birds; seabird monitoring studies on Little Diomede Island, St. Lawrence Island, Kodiak Island and Prince William Sound; a cost of reproduction study on kittiwakes; a seabird/forage fish interactions study; and various population and reproductive studies on pigeon guillemots and marbled murrelets. Irons has authored and co-authored over 30 publications on seabirds and has made several presentations at scientific conferences on seabirds.

Selected References:

1. Suryan, R.M. and D.B. Irons. 2001. Black-legged Kittiwakes in Prince William Sound, Alaska: population dynamics in a heterogeneous environment. Auk
2. Golet, G. H., K. J. Kuletz, D. D. Roby**, D. B. Irons.** 2000. Adult prey choice affects chick growth and reproductive success of Pigeon Guillemots. The Auk 117:82-91.
3. Irons, D.B., S.J. Kendall, W.P. Erickson, L.L. McDonald, B.K. Lance. 2000. Nine years after the Exxon Valdez oil spill: effects on marine birds in Prince William Sound, Alaska. Condor 102:723-737.
4. Agler, B.A., Kendall, S.J., **Irons, D.B.,** and Klosiewski, S.P. 1999. Declines in Marine Bird Populations in Prince William Sound, Alaska Coincident with a Climatic regime Shift. Waterbirds 22:98-103.

5. Hunt, G.L., F. Mehlum, R.W. Russell, **D.B. Irons,** M.B. Decker, and P. Becker. 1999. Physical processes, prey abundance, and the foraging ecology of seabirds. In: Adams, N. and Slotow, R. (Eds.) 22 International Ornithological Congress, Durban, South Africa, University of Natal.
6. Golet, G.H., **D.B. Irons** and J.A. Estes. 1998. Survival costs of chick rearing in black-legged kittiwakes. J. Anim. Ecol. 67:827-841.
7. Irons, D. B. 1998. Foraging area fidelity of individual seabirds in relation to tidal cycles and flock feeding. Ecology 79:647-655.
8. Irons, D.B., R.G. Anthony, and J.A. Estes. 1986. Foraging strategies of Glaucous-winged Gulls in a rocky intertidal community. Ecology 67:1460-1474.

Partner 11: Arctic Council Indigenous Peoples Secretariat, Copenhagen, Denmark

The Indigenous Peoples' Secretariat (IPS) was established to strengthen the involvement of the Arctic Indigenous Peoples in the Arctic Environmental Protection Strategy (Rovaniemi, 1991). The Secretariat commenced operations in the fall of 1994. With the Declaration of the establishment of the Arctic Council, in 1996, it was decided that the Indigenous Peoples' Secretariat was to continue under the auspices of the Arctic Council. The IPS is located in Copenhagen, Denmark and is funded by the government of Denmark, Greenland, Norway, Canada and the United States. Its main task is to support the six Indigenous Peoples´ Organizations that hold the status of Permanent Participants in the Arctic Council and other relevant international fora. The Permanent Participants are:

- The Saami Council, representing the Saami People of Norway, Sweden, Finland and Russia.
- The Inuit Circumpolar Conference (ICC) representing the Inuit in Greenland/ Denmark, Canada, Alaska/USA and Chukotka/Russia.
- The Russian Association of the Indigenous Peoples of the North (RAIPON) representing more than 30 different peoples of the North, Far East and Siberia of the Russian Federation.
- The Aleut International Association representing Aleut from the Russian and US American Aleutian Islands.
- The Arctic Athabascan Council (AAC) representing the Athabascan people of Canada and Alaska.
- The Gwitch'in Council International (GCI) representing the Gwitch'in people of Canada and Alaska.

The main task of the IPS is to support the Permanent Participants under the auspices of the Arctic Council's work, particularly on issues of sustainable development, environmental protection and the maintenance of the biodiversity upon which their cultures depend. An important part of this work involves supporting continuing work with the traditional knowledge of the Indigenous Peoples.

Key Personnel:

John Crump Executive Secretary, Member of Project SC and Lead for WP 5

Academic Qualifications: 1988 Master of Arts, Northern and Indigenous Studies, Carleton University, Ottawa Canada. Professional experience: Executive Secretary, IPS (January 2002 -); Executive Director, Canadian Arctic Resources Committee, Ottawa, Canada (July 1999 – December 2001); Manager, Policy + Government Relations, Nunavut Planning Commission, Ottawa, Canada (Jan. 1995 – June 1999); Policy Analyst

– Senior Research Associate, Royal Commission on Aboriginal Peoples, Ottawa, Canada (Dec. 1992 – Jan. 1995); Cabinet Communications Advisor, Office of the Premier, Government of the Yukon, Whitehorse, Canada (Sept. 1990 – Dec. 1992).

Partner 12: UNEP World Conservation Monitoring Centre, Cambridge, UK

The UNEP World Conservation Monitoring Centre provides objective, scientifically rigorous products and services that include ecosystem assessments, support for implementation of environmental agreements, regional and global biodiversity information, research on threats and impacts, and development of future scenarios for the living world. The Centre became the biodiversity information and assessment arm of the United Nations Environment Programme in June 2000. It was founded in 1979 by IUCN and in 1988 was transformed into a joint activity of IUCN, WWF and UNEP. The financial support and guidance of these organisations in the Centre's formative years is gratefully acknowledged.

Key Personnel:

Dr. Cristoph Zöckler, Member of the Project SC and Lead for WP4

Professional experience: work with UNEP-WCMC since 1996 and is currently leading the Arctic programme at the Centre as well as co-leading the climate change and biodiversity programme. Has been co-operating with CAFF and WWF on Arctic issues since 1996 and has experience of managing various international research projects, participating in many expeditions into the Russian Arctic and has been experienced in compiling and analysing environmental data (for example: http://www.unep-wcmc.org/arctic/birds/ArcticBirdLibrary.htm). Previous work experience included project management with WWF Germany, and collaboration in a research project at the University of Bremen, Germany, totalling more than 17 years work experience. Over 50 research publications to date.

Selected references:

1. Zöckler , C. (2002): Declining Ruff *Philomachus pugnax* populations: response to global warming? Wader Study Group Bull. 97: 19-29.
2. CAFF (Conservation of Arctic Flora and Fauna) (2001): Arctic Flora and Fauna. Ecology, status and conservation. (eds. Baldursson, S., Huntington, H., Kaankapää, P., Sippola, A.L., Kaitala, S. & **C. Zöckler**) Edita. Helsinki. 272 pages.
3. Lugert, J. & **C. Zöckler** (2001): Between Taiga and Tundra. The Bird Fauna of the Yakut Horse Pastures in Northeast Siberia. In : Gerken, B & Görner, M.(eds.) Landscape Development with Large Herbivores Natur- und Kulturlandschaft, Höxter/Jena Vol. **4**: 458-461
4. Green, R.E., Harley, M., Spalding M. & **C. Zöckler** (eds.) (2001): Impacts of climate change on wildlife. Sandy.72 pages
5. Gilg, O., R. Sane, D. V. Solovieva, V. I. Pozdnyakov, B.Sarbard, D.Tsanaos, **C. Zöckler**, E. G. Lappo, E. E. Syroechkovski Jr. and G.Eichhorn (2000): Birds and Mammals of the Lena Delta Nature Reserve, Siberia. Arctic 53: 118 – 133.
6. Zöckler, C. & I. Lysenko (2000): Water birds on the edge. First circumpolar assessment of climate change impact on Arctic Breeding Water Birds. WCMC Biodiversity Series No.11. 20p plus Annex.

C8. Description of the resources

The combined expertise and facilities of the 13 Partners comprise the resources of the project. Partners will provide facilities comprising institutional overheads (housing, computers, telecommunications, etc.) free of charge to the project, with he exception of GIS facilities at Partner 12.

C9. Economic development and scientific and technological prospects

The exploitation of CABNET by the various user interests depends fundamentally on the generation of two key elements.

First, the establishment of the individual networks which have their basis in field observations of species by experts both professional and amateur. Currently, there are many experts in different Arctic countries with a limited degree of collaboration and geographical coverage which is not systematic or designed to address key issues. Thus the establishment of coherent networks will provide a more effective tool with which to determine changes and the causes of change. Further, the combination of species networks, if systematically structured as outlined in Figure 2, will strengthen assessment of the functioning of the Arctic system.

The second key element or tool will be the prototype web portal which will facilitate access to the basic data for analysis and synthesis combined with its integration with wider environmental data from other sources. This web portal will combine recent advances in web technology, GIS and database interoperability. Its application as a common platform for basic and applied data on biodiversity will be explored over a wide range of spatial scales.

Mechanisms for dissemination of information will vary between users and are designed to meet their particular interests.

- *Members of the networks are taxonomic and ecological experts*. They will benefit from receiving the detailed reports on scientific and technical information and the development of common standards for their own and other networks as well as access to wider data. As data accumulate, members of individual the networks will have the opportunity to analyse the data and compare results from across the networks. Technical network reports will be also made generally available through the CAFF web site.

- *Wider community.* Members of local and indigenous communities will be encouraged to participate in species monitoring through dissemination of the report on community monitoring and through access to the web site. It is anticipated that further practical information will become available to help communities to initiate monitoring programmes, possibly through schools and higher education establishments distributed throughout the Arctic.

- *National organisations*. The reports will identify opportunities for further development of national biodiversity monitoring. Subsequently, there is the prospect that as the networks develop and data become available, governmental organisations with responsibility for conservation and environmental protection will benefit by placing their national performance in the wider context. There will also be the opportunity to combine data to develop overall analyses and indices.

- *Regional users.* The diversity of organisations with interests in detection of changes in species populations and performance will be involved through consultation process and Workshop. They will also access to network reports providing an overall assessment of the state of monitoring for the Arctic with the prospect that the

networks can be enhanced to address their specific needs eg in EEA. A key mechanism for dissemination and follow up will be through the Arctic inter-governmental organisations of the Arctic Council, particularly via CAFF.

- *Global users.* The prospect of development of the species networks should provide the Global Observing Systems, particularly GTOS and GOOS, with monitoring systems that are appropriate for their needs. They will be involved in the consultation process and invited to the Workshop, but the long-term strength will be in the provision of established networks that can quality assured data and assessment of biodiversity change.

References.

ACIA 2001. www.acia.uaf.edu/

AMAP, 1997. *Arctic Pollution Issues: A State of the Arctic Environment Report*. Arctic Monitoring and Assessment Programme, Oslo. 188pp.

AMAP, 1998. *Assessment Report: Arctic Pollution Issues.* Arctic Monitoring and Assessment Programme, Oslo. 859pp.

CAFF, 2001. *Arctic Flora and Fauna: Status and Conservation.* Helsinki: Edita. 272pp.

CAFF, 2000. *CAFF/AMAP Workshop on a Circumpolar Biodivesity Monitoring Program. Summary Report.* CAFF Technical Report No 6. 21pp.

CAFF, 1998. Global Review of the Conservation of Migratory Arctic Breeding Birds Outside the Arctic (Scott, D. ed.). CAFF Technical Report No. 4, 132pp.

Chapin, F.S. & Korner, C. (Eds) 1995. *Arctic and Alpine Biodiversity. Patterns, Causes and Ecosystem Consequences.* Springer Verlag, Berlin. 332pp.

EEA 1995. *Europe's Environment: The Dobris Assessment.* European Environment Agency, Copenhagen.

EEA 1998. *Europe's Environment: The Second Assessment.* An Overview. European Environment Agency, Copenhagen.43pp.

GTOS, 1998. *GTOS Implementation Plan*. FAO, Rome.

Hansen, J.R., Hansson, R. & Norris, S. 1996. *The State of the European Arctic Environment*. EEA Environmental Monograph No. 3, 135pp. European Environment Agency, Copenhagen.

IPCC 2001. *Climate Change 2001: The Scientific Basis*. Cambridge University Press, Cambridge. 881pp.

Kristensen, P. & Hansen, H.O. 1994. *European Rivers and Lakes. Assessment of their Environmental State*. EEA Environmental Monographs No 1, 121pp. European Environment Agency, Copenhagen.

McDonald, M., Arragutainaq, L. & Novalinga, Z., 1997. *Voices from the Bay: Traditional Ecological Knowledge of Inuit and Cree in the Hudson Bay Bioregion.* Canadian Arctic Resources Committee, Ottawa. 98pp.

Matveyeva, N. & Chernov, Y., 2000. Biodiversity of terrestrial ecosystems. In: Nuttall, M & Callaghan, T.V. (Eds). *The Arctic. Environment, People, Policy*, p 233-273. Harwood Academic Publishers, Amsterdam.

Nuttall, M. & Callaghan, T.V., 2000. *The Arctic. Environment, People, Policy*. Harwood Academic Publishers, Amsterdam. 647pp.

Scott, 1998.

Skulason, S, 2001. *The Arctic as a Theater of Evolution.* In CAFF 2001, p44.

UNEP, 1999. *Global Environmental Outlook 2000.* Earthscan Publications, London.398pp.

UNEP 2001. *GLOBIO Global Methodology for Mapping Human Impacts on the Biosphere*, 55pp.

UNEP, 2002. *Global Environmental Outlook 2002 (in press)*.

Acronyms.

ACIA.	Arctic Climate Impact Assessment.
AMAP	Arctic Monitoring and Assessment Programme.
ARTERI	Arctic Terrestrial Ecosystem Research Initiative.
CAFF	Conservation of Arctic Flora and Fauna.
CBD	Convention on Biodiversity Directive.
CMS	Convention on the Conservation of Migratory Species.
CPAN	Circumpolar Protected Areas Network.
EEA	European Environment Agency.
EPBRS	European Platform for Biodiversity Research Strategy
GOOS	Global Ocean Observing System.
GTOS	Global Terrestrial Observing System.
IASC	International Arctic Science Committee.
ICC	Inuit Circumpolar Conference.
IPS	Indigenous Peoples Secretariat.
ITEX	International Tundra Experiment.
IUCN	International Union for the Conservation of Nature.
OSPAR	Oslo Paris Agreement.
RAIPON	Russian Association of the Indigenous Peoples of the North.
UNEP	United Nations Environment Protection.
UNIS	University Courses on Svalbard.
WCMC	World Conservation Monitoring Centre.
WWF	World Wide Fund for Nature.