CBD

UNEP

CONVENTION ON BIOLOGICAL DIVERSITY

Distr.
GENERAL

UNEP/CBD/SBSTTA/6/INF/15
1 March 2001

ENGLISH ONLY

SUBSIDIARY BODY ON SCIENTIFIC, TECHNICAL AND TECHNOLOGICAL ADVICE
Sixth meeting
Montreal, 12-16 March 2001
Item 5.4 of the provisional agenda*

MIGRATORY SPECIES AND COOPERATION WITH THE CONVENTION ON THE CONSERVATION OF MIGRATORY SPECIES OF WILD ANIMALS

Case-studies illustrating how the implementation of the Convention on Migratory Species complements the implementation of the Convention on Biological Diversity

Note by the Executive Secretary

1. At the request of the secretariat of the Convention on the Conservation of Migratory Species of Wild Animals, the Executive Secretary is circulating herewith, for the information of participants in the sixth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) a four case-studies that illustrate the interrelationship between the Convention on Migratory Species and the Convention on Biological Diversity and highlight how the implementation of the Convention on Migratory Species complements the work and the implementation of the Convention on Biological Diversity.

2. The case-studies are being circulated in the form and language in which they were received from the secretariat of the Convention on Migratory Species.

* UNEP/CBD/SBSTTA/6/1.

/…

PRESENTATION

The Secretariat of the Convention on Migratory Species (CMS) in order to assist the SBSTTA 6 participants in their discussions on substantive issues (agenda item 5.4 Migratory species and cooperation with the Convention on Migratory Species of Wild Animals) present for their consideration, 4 cases studies on migratory species and biodiversity. These cases studies address matters related to the conservation, sustainable use of migratory species, the ecosystem approach and the facilitation, exchange and dissemination of information on migratory species. In a simple and concise manner, they illustrate how the implementation of the CMS complements the implementation of the CBD.

The Secretariat of the Convention on Migratory Species would like to particularly acknowledge the contributions made by Mr. Gerard Boere (Wetlands International) who prepared the paper on an integrated flyway/ecosystem approach for water bird; Mr. William Perrin (NOAA Fisheries) who wrote the case study on cetaceans, their status and the agreements that deal with them; Mr. Klaus Riede (University of Bonn) who presents the results of the Global Registry of Migratory Species Project (GROMS) on the global exchange and dissemination of electronic information on migratory species and Mr. Roberto Schlatter (Universidad Austral of Chile) who focused on the conservation and sustainable use of the Andean flamingos of South America.

GLOBAL ACTIVITIES ON THE CONSERVATION, MANAGEMENT AND SUSTAINABLE USE OF MIGRATORY WATERBIRDS: AN INTEGRATED FLYWAY/ECOSYSTEM APPROACH

Gerard Boere[1]

General Introduction[2]

Bird migration in general and, in particular, north-south migration, is a massive, mainly annual movement of biodiversity around the globe. It involves every country. It also includes the Earth's most remote areas such as Antarctica. Migratory birds link continents and countries. Range states share responsibilities to conserve specific species.

Bird migration has always attracted great attention from the public at large, from researchers and from those using the resource for subsistence hunting or sport. The migration strategies of species, such as storks, raptors and several wader species are well known, concentrating along a relatively small flyway or at certain geographical areas where large numbers can be observed. Several areas in Europe are famous places to observe concentrated migration of large numbers of birds, such as Falsterbö (Sweden) and Bosporus (Turkey). Outside of Europe places like Eilat in southern Israel, and Point Pelee in Canada are also worth mentioning. Many more such places are located around the globe.

Besides humans there are several examples of predators adapting their whole reproductive cycle to migratory birds as a food source such as the Eleanora's Falcon (breeding in the Mediterranean Area) and the famous viper of Milos (Greece) both feeding on the millions of passerine birds crossing the Mediterranean Sea. Generally migratory birds are also preyed upon in their wintering quarters by the resident predators. On the other hand the tens of millions of migratory birds are also often seen as the best "pesticide" in wintering areas in tropical countries.

After the breeding season water birds such as geese, ducks and waders migrate in large flocks using a relative small number of areas. These areas are often well known and frequently visited by large numbers of people to harvest or enjoy the views of the large flocks (eco-tourism). Research stations to study bird migration have been established in many places where large-scale bird migration takes place.

Many of these research and bird ringing stations have existed for a long time and are quite famous, such as Helgoland in Germany and Manomet in the USA. Bird ringing is a relatively young technique. In 1999 the technique is 100 years old.

Migration in spring to the Northern breeding areas and the arrival of large numbers has given birth to all kinds of festivals. These festivals often attract large numbers of people and are economically important for the region in which they occur. Examples include Point Pelee; the Spring festival at the Copper River Delta in Alaska when several million shorebirds arrive; and, the Eilat Spring Festival in particular to see the hundreds of thousands raptors returning from Africa to Europe and Asia.

In the whole of the Russian Arctic the first birds arriving in the far north in late May, can be hunted for a limited time and in small bags. These birds are the first living creatures people encounter after the long and dark winter and the spring hunting is a small bonus.

---

[1] International Programme Co-ordinator, Wetlands International; <Boere@Wetlands.agro.nl>

[2] NB: The information presented does not give a complete picture of every activity or initiative in this field. Instead this study provides an overview of the major projects and programmes presently in place.

During their migrations, migratory birds are fully dependent on the availability of habitats used as wintering, breeding or stopover sites. Any changes in the quantity and quality of these habitats will have an impact on the species. Therefore migratory water birds are important indicators for environmental changes.

Water birds

Water birds together with raptors and seabirds, among migratory birds, always have been a major field of interest for several groups of people such as researchers, subsistence and sports hunting and for the general public to enjoy (bird watching). There are very good reasons why this is the case:

- Many of them breed in large colonies with good access for research, observation and sustainable use (eggs, young and adult birds);
- Their relatively large size helps in observing them in the field; thus facilitating monitoring of populations and numbers; and to be used as a food source (sports and subsistence hunting);
- Most all species concentrate in large flocks outside the breeding season and at a relative small number of areas thus facilitating census-taking, catching and ringing;
- Many species are large enough to apply individual marking systems (colour banding with individual numbers, wing tags, neck collars, small radio sets and, in recent years, satellite tracking) and have been of great importance for more fundamentally oriented migration research. The classic method of using metal rings has a number of limitations when it comes to interpreting the results; and
- Many water bird species (ducks, geese, large waders) are also considered to be pest species for mussel farming (Eider ducks); agricultural crops (geese, swans and ducks, some waders in Africa feeding on rice); grasslands (geese); and, fish farming (cormorants, herons, pelicans, sawbills). This has stimulated research, monitoring and other efforts.

Because of these factors migration routes and water bird numbers are relatively well known, including those of the more rare and endangered species.

Trends in Water bird Populations

Several co-ordinated census programmes are in place for migratory water birds. These include:

- International Water bird Census (IWC). This was originally restricted to Europe and the Mediterranean area. The IWC started in 1967 and is the longest running internationally co-ordinated biodiversity monitoring programme in the world. The census each year takes place during a weekend in mid-January in the wintering areas. About 10,000-15,000 volunteer counters are involved.
- More recently, in the 1980s and 1990s, water bird census programmes under IWC have been developed and co-ordinated for the Asia Pacific region, Africa and the Neotropics area (e.g., South America).
- Many national and regional water bird censuses are carried out or focus on a single species or groups of species.

Wetlands International and its regional offices are co-ordinating several of these water bird censuses programmes by involving a network of national co-ordinators and members of the Specialist Groups network (shared by Wetlands International, BirdLife International and IUCN). When it comes to the active field surveys, close co-operation exists between the members of BirdLife International partners and the national agencies involved in managing protected areas,

The data from the IWC have played an important role in developing the tools for the Ramsar Convention on Wetlands to designate wetlands of international importance through the well known 1% criterion

whereby any site holding 1% of the population of a water bird species qualifies for inclusion in the list of wetlands of international importance. Databases are decentralised (by species groups and geographically).

At regular times all data available are summarised by Wetlands International in a publication presenting the world water bird population estimates of 840 water bird species with over 2000 subspecies or distinct biogeographical populations. Two volumes have been published so far: Water bird Population Estimates (WPE) 1 (1994) and WPE2 (1997). WPE3 will be published by the end of 2001 or in 2002 in time for the eighth meeting of the Conference of Parties of the Ramsar Convention.

The data are also published by regions. Examples include the International Water bird Census Western Palearctic and Southwest Asia 1995 and 1996 (published in 1999). Annual reports with the results of the African census and several reports with the results of the Asian Water bird censuses have been published. The results of surveys in the Neo-tropical regions will soon be published. Recently also a number of overview reports, in particularly one on shorebirds, have been published for the North American Region and annual reports on population trends in quarry species are produced by the Canadian Wildlife Service and the US Fish and Wildlife Service. These differ per species groups and from region to region.

At a general level the following trends are noticeable:

- Western Palearctic: increase of most populations of geese, swans and ducks; this is due, to a large extent, to less hunting pressures; waders are stable or slightly decreasing;
- Asia: decrease of most populations, certainly the resident species;
- Africa: decrease of many populations, particularly resident species;
- North America: duck populations decreasing, some geese, Snow Goose in particular increasing; shorebirds: not a clear picture; and
- South America: not a clear picture, but a number of species decreasing.

In the framework of the many flyway initiatives actions are foreseen to increase monitoring in areas that are less well surveyed such as large parts of Africa, Asia (Central Asia) and South America.

Special attention is given to globally endangered species using the recently published overview by BirdLife International and research published by the Threatened Waterbird Specialist Group.

A major initiative is being developed to organise a so-called “Gap-filling Water bird Census”. This means a one-time maximum effort to survey as many wetlands as possible in a certain region also aiming at sending survey teams to wetland areas never previously surveyed.
The purpose is to have a one-time check on the present population estimates and whether or not the selected areas within the present IWC do give reliable overall figures.

An Action Plan has been worked out for the area of the Western Palearctic and West Asia; funding is being sought to implement the Gap-filling Census in this region in January 2003. If successful, similar activities will be undertaken in other areas.

The Flyway Concept

Generally the definition of a flyway is understood to mean the entire range of a migratory water bird species (or groups of species or distinct populations of a single species) from the breeding ground to the wintering area, including the intermediate resting and feeding places and the relative small area within which the birds migrate. The concept was developed in North America and is widely used if it comes to clearly define what overall problems a migratory water bird encounters in its life cycle and which countries should co-operate to protect and sustainably manage the populations.

Flyways differ considerably in length. For instance: many geese species have relatively short and well-defined flyways (a few thousand kilometres), whereas many Arctic breeding waders migrate huge distances. A species like the Arctic Tern breeds in the Northern Arctic region and winters in the Southern Hemisphere, while circling around the Antarctic continent.

The concept fully supports the ecosystem approach proposed under the CBD, because a flyway is in fact the entire ecosystem needed by a migratory water bird in order to survive. However it may contain several different habitats used by the same species at different times of the year. For example many arctic waders breed in the Northern tundra, a relatively moist green area, but winter in coastal areas with only grey muddy soft substrates or even on the open sea (Phalaropes). On migration they may use for example, the shorelines of fresh water lakes. By taking action to protect an entire flyway many species and many habitats have to be and are protected at the same time.

Moreover the flyway concept, by definition, requires close co-operation between all the range states involved. It can strongly stimulate co-operation between states to build up networks of scientists, conservationists and reserve managers and stimulate a wealth of small-scale initiatives in all fields of biodiversity and habitat conservation.

Multilateral Flyway Initiatives

The following gives a brief overview of various multilateral initiatives at a flyway level (not in a particular order or priority) and in various stages of development or implementation. They also represent a mixture of legally binding and non-binding instruments. Governments initiated some. Others have their origin in science or in the activities of NGOs.

North American Waterfowl Management Plan (NAWMP): the "founding father" of the flyway concept, concentrates on the conservation and sustainable management of migratory waterfowl in Canada, USA and Mexico. It is managed by four flyway councils and involves many stakeholders with a special role for landowners. Originally signed in 1986 (after a long process of consultations) and updated in 1994 and 1998.

Western Hemisphere Shorebird Reserve Network (WHSRN): a network of large wetlands, coastal areas etc. (the areas are selected on the basis of supporting 5% of a flyway population and not a 1% level as usually used to identify areas of international importance for potential designation under the Ramsar Convention), aiming at conserving the most important sites for migratory shorebirds. New initiatives are under way such as within the US Shorebird Conservation Plan, Canadian Shorebird Plan and others. WHSRN has the potential to evolve into a full flyway agreement and strategy.

Partners in Flight (PIF, 1991) and the North American Bird Conservation Initiative (NABCI, 1999/2000): these are umbrella organisations/platforms to protect migratory birds in the whole of the Western Hemisphere involving a large number of stakeholders: governmental organisations and NGOs, private landowners and the corporate world. These initiatives include all migratory bird species, not only water birds. They include strong components to protect tropical forests in Central- and South America as wintering area for, among others, passerine birds and raptors (PIF) from North America.

African Eurasian Migratory Waterbird Agreement (AEWA, UNEP/CMS Bonn Convention): this is the largest Agreement under the Bonn Convention both in geographical coverage (about 117 countries) and species (about 175). The AEWA came into force in November 1999 at the time of the First Meeting of the Parties (MOP1) in South Africa. About 30 Range states have ratified. The Secretariat is based at UNEP/CMS in Bonn, Germany. An Action Plan is in place and a PDF B GEF project is being implemented. The latter will mainly focus on information exchange and capacity building in the whole AEWA Agreement area. Furthermore this project contains 12 demonstration projects to demonstrate and disseminate best practices on wetlands and water bird management.

Central Asian-Indian Flyway (CAIF): recent initiatives by UNEP/CMS, Russian and Dutch Governments; AEWA Secretariat and Wetlands International should lead to a co-ordinated effort to develop an Action Plan and, in the long term, an agreement, for this flyway. Here the lack of data about many species has to be addressed in the first place. The geographical area of the CAIF is also included in the APMWCS.

Asia-Pacific Migratory Waterbird Conservation Strategy (APMWCS): the strategy includes a large geographical area in which generally three flyways are identified: Central Asian-Indian Flyway; East Asian-Australasian Flyway and the West Pacific Flyway.

In October 2000, a new APMWCS was adopted by the Range states involved and the work is co-ordinated mainly by Wetlands International, with some other NGOs with substantial support from the Governments of Japan and Australia. Several site-based networks have been developed and expanded for cranes, shorebirds and Anatidae, stimulating many bilateral conservation actions on habitat and the wider countryside.

Migratory Birds Commission of the International Council for Wildlife Management (CIC): provides the framework for a number of national and international hunting organisations and their many activities involving among others harvesting water birds, co-ordinating applied research and monitoring.

Regional and Bilateral Flyway Initiatives

Many other arrangements are in place for migratory birds focussing on smaller areas or service bilateral co-operation between countries. The following is an overview of a number of important instruments and arrangements:

EU Bird Directive: with its strong legal protection for both species and their habitats also during migration in all Member States. The candidate member states, about 10 at the moment, have to comply with the EU Directive at the time of their accession to the EU.

Bern Convention: (Convention on the Protection of the European Fauna and Flora and their Habitat, 1979, administered by the Council of Europe) has a specific annex for the protection of migratory species that is the basis for a few African countries to ratify the Bern Convention.

Migratory Birds Convention Canada-USA (1906) and with Mexico (1936): one of the oldest legal instruments includes substantive arrangements for sustainable harvest of water bird populations. A system of Flyway Councils is in place and facilitates many research projects on migratory species. Amended in 1978.

Siberian Crane MoU (UNEP/CMS Bonn Convention): aiming at the conservation of the various small populations of this globally endangered species, each with its distinctive flyway and staging and wintering areas. The MoU provides the basis for active co-operation between governments involved, the NGOs (e.g., the International Crane Foundation) and UNEP/CMS. The MoU is supported by funds from GEF.

Slender billed Curlew MoU (UNEP/CMS Bonn Convention): flyway agreement also for a single species, which is one of the world's rarest birds. Facilitating a number of conservation activities in wetlands in the former wintering area and surveys of supposed last strongholds in the Middle East.

Bilateral agreements on migratory birds: there are quite a number such as: China-Australia (CAMBA); Russia-India; Australia-Japan (JAMBA); Russia-Japan; USA-Russia; Korea D.P.R-Russia; Japan-USA etc. Canada has agreements on migratory species with Ireland, Russia and the UK.

National legislation: many countries do protect bird species on their territory, including migratory species. However some countries have developed specific legislation concerning the protection of migratory species; examples are the USA and Australia.

Other Initiatives Important for Migratory Water birds

A very large number of other international conventions, treaties and regional co-operating bodies can help protect migratory water birds: the Convention of Algiers, OSPAR, Western Hemisphere Convention, regional treaties in Africa, Asia and North America (NAFTA). Many such bodies have structures in place, such as environmental committees, that can address water bird conservation as an integral part of biodiversity and habitat conservation.

A good example is the **Working Group on the Conservation of Arctic Fauna and Flora (CAFF).** The CAFF Working Group plays an important role co-ordinating conservation, research and sustainable use efforts at a circumpolar level.

The Arctic is in fact the main "source" for many of the water bird species populating the various flyways around the world. CAFF initiated the publication of a comprehensive overview report on the conservation of Migratory Arctic Breeding Birds outside the Arctic. Of about 250 species analysed, a large percentage is water bird species.

For the Arctic breeding grounds of so many water bird species, the possible effect of climate change is important and may influence, in a negative way, distribution and populations. (WCMC report).

There are other groups of birds, with a close link to water birds, for which major initiatives on a flyway level are in place. This is particularly the case for groups of species or single species of seabirds. For instance:

Albatross work has led to the development of a UNEP/CMS agreement. This has been a high priority given the sharp population declines of these birds as a result of thousands being killed by-catch in the long line fisheries in the Southern Oceans.

Conclusions

- Migratory water birds constitute a biological resource shared by all countries of the world; conserving and sustainably using migratory water birds also helps the protection of biodiversity of many countries at the same time.
- Most species are highly migratory covering large distances, concentrating in large numbers at often a small number of places, making them vulnerable to external influences; but attractive for bird watching and ecological tourism at the same time.
- The flyway concept supports the ecosystem approach by protecting several habitat types at the same time in order to provide breeding, resting and wintering areas during the whole annual cycle.
- Migratory species really force range states to work together because of shared interest in conserving each other's biodiversity and assuring that use of species in one country is co-ordinated with other countries to avoid unsustainable use of populations.
- Monitoring and research of migratory water birds is relatively well developed and is providing models for population ecology, fundamental research on ecology and migration of species and it involves large numbers of volunteers.
- The Convention on the Conservation of Migratory Wild Animals is involved in many of the migratory water bird initiatives and can provide the legal framework for necessary international co-operation.

CETACEANS AND THE CONVENTION ON MIGRATORY SPECIES

William F. Perrin[3]

The Convention on Migratory Species has addressed cetaceans since its inception. Very early additions to its Appendix I (migratory species that are endangered) included the blue, humpback, bowhead and right whales. As of February 2001, Appendix I includes six cetacean species and Appendix II (species that have an unfavorable conservation status and/or would benefit from international cooperation through an inter-governmental regional agreement) contains 33 species.

One of the first regional agreements to be completed under the CMS umbrella was ASCOBANS (the Agreement on Small Cetaceans of the Baltic and North Seas; came into force in 1994). The second major agreement, ACCOBAMS (Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area) has not entered into force but it is expected to do so shortly. Activities are underway to promote similar agreements in other regions, including Southeast Asia, southern South America, and West Africa.

Cetaceans as Migratory Animals

Many people are familiar with the migrations of the great whales, e.g., the annual trek of gray whales from feeding grounds in the Bering Sea to calving grounds in Mexico, and the movements of blue, fin, sei, minke, humpback and right whales from low latitudes to the Southern Ocean to feed on summer blooms of plankton. However, we know less about migration in the small cetaceans (some 70 species, all the cetaceans other than the baleen whales and the sperm whale), which have been the main emphasis in the CMS agreements. This is mainly because they have not been the targets of large-scale commercial exploitation as the great whales have been.

There have been a few exceptions. For example, we know that harbor porpoises once migrated *en masse* seasonally in and out of the Baltic Sea, because large numbers of them were harvested during their autumn migrations (likely to the point of depletion of the population) in the early to mid 20th Century.

Small cetaceans are difficult to observe in the wild and difficult to tag, and it is only recently that progress in tracking telemetry has begun to enable us to follow the movements of individual animals. For the most part, our knowledge of small cetacean migrations is limited to observations of their seasonal presence or absence in certain areas.

In other cases, populations of wide-ranging pelagic small cetaceans exist in waters shared by several nations (e.g., the Black Sea). It appears certain that they must frequently move in and out of the jurisdictional waters of any one of the nations.

For these reasons, the cetacean agreements developed under CMS to date have not stipulated that the cetacean species included be known to be migratory in the sense of the CMS definition ("the entire population or any separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries"). The assumption is that all or most of them will eventually be proven to be migratory, wholly or in part.

For example, ACCOBAMS applies to "all cetaceans that have a range which lies entirely or partly within the Agreement area or that accidentally or occasionally frequents the Agreement area." ASCOBANS

[3] Senior Scientist, NOAA Fisheries, Department of Commerce, Southwest Fisheries Science Center, PO Box 271, La Jolla, CA 92038 USA; <william.perrin@noaa.gov>

covers all small cetaceans in the Agreement area. Similarly, Appendix II of CMS has been expanded to include a number of regional populations of small-cetacean species (e.g., spinner, spotted, Fraser's and bottlenose dolphins in Southeast Asia) not yet documented to be migratory but under threat and thought to likely be shared by two or more nations. The United Nations Convention on the Law of the Sea (UNCLOS) also recognized that most whales, dolphins and porpoises are presumably migratory in specifically naming (in Annex I) seven families of cetaceans as highly migratory and needing greater international attention and management. The CMS COP recognized the dearth of critical information on migration in small cetaceans and recommended in 1994 that the Parties to the Convention carry out and report on the necessary research to obtain such information, giving priority to species and populations of threatened or uncertain status. The CMS Secretariat is currently undertaking a review of available information on small cetaceans migration.

ASCOBANS also has recognized the need and in 2000 asked that parties and range states support further work to elucidate temporal and spatial aspects of distribution of small cetaceans in the ASCOBANS area. Whether these recommendations will be followed by adequate research to delineate migrations remains to be seen. Such research is extremely expensive, involving vessel charters and satellite-based radio tracking, and in general is not high on the lists of national research priorities. Beyond the doubt more research is needed to assess and reduce immediate population threats, such as by-catch in fisheries and effects of pollution (discussed below). However, that should not preclude the full compliance of the precautionary approach.

Cetacean Diversity

Approximately 85 species of whales, dolphins and porpoises are currently recognized (see Table 1). Some occur nearly from pole to pole, and others are restricted to small seas or single river drainages. This number does not fully reflect diversity in the group, however, because most of the species exhibit geographic differentiation into races and subspecies (named and unnamed).

The world cetacean landscape is a complex mosaic of forms morphologically and behaviorally adapted to local ecological conditions. For example, in the eastern tropical Pacific, coastal spotted dolphins are larger and have proportionately larger teeth than their conspecifics offshore that feed on smaller, more elusive pelagic prey. Genetically distinct groups of killer whales in the U.S. Pacific Northwest feed on different kinds of prey, some only on fish and others only on marine mammals.

Given the fine-grained nature of this diversity, it is likely that the number of recognized *evolutionarily significant units* (ESUs) globally would eventually run into the thousands. In addition, undifferentiated local populations contribute to the structure and diversity of ecosystems, and the conservation of these is also important. Unrecognized until recently has been the role of learning and culture in such cases; an extirpated local population of migratory whales may not be replaced simply because there are no longer any adult animals who know about the particular breeding or feeding ground.

The Status of Cetaceans

The stocks of great whales were depleted by commercial whaling. Some populations were driven to extinction; others were almost wiped out and even now although under full protection for decades have only begun to recover. At present there is a moratorium on commercial whaling by the parties to the International Convention for the Regulation of Whaling (implemented by the International Whaling Commission), although one member, Norway, is taking whales under a legal objection to the moratorium, and another, Japan, harvests hundreds of whales annually under a scientific research permit.

The status of whales worldwide is under review by the IWC, and a revised management scheme to ensure conservation when exploitation resumes is nearly completed. It is unlikely that any future exploitation under this scheme will adversely affect the stocks or prevent their further recovery.

For the small cetaceans, however, it is another story completely. Like the great whales, their status ranges from critically endangered (the baiji or Chinese river dolphin and the vaquita or Gulf of California harbor porpoise) to unknown but presumably healthy (many of the pelagic dolphins and small toothed whales).

What is different is that the threats are more numerous and diverse and far from under control. Small cetaceans are harvested directly and unsustainably, killed incidentally in fisheries in huge numbers, and greatly affected by habitat degradation. There is no single international body dedicated to their global conservation.

As compared with the great whales, small cetaceans are particularly vulnerable to threat for a number of reasons. They are highly vulnerable to hunting because of their small size and, in some species, their habit of riding the bow wave of vessels. They can be captured with small-scale equipment and are more easily killed in fishing nets because they do not have the strength to break loose. Their habitats can be easily damaged; rivers can be dammed, rivers and estuaries are easily polluted, and coastal development can degrade adjacent habitats. By-catch in fisheries can be converted to deliberate take as markets develop. Incidental kills and small directed takes are difficult to monitor and regulate, because the animals are often killed or caught by a large number of small vessels (thousands in some cases, e.g., China) that operate independently and land their catches in a large number of places, including undeveloped beaches. All of these factors have operated to lead to adverse conservation status, often cryptic, of many small-cetacean populations.

Direct harvests of small cetaceans are generally declining as marine mammals come under increasing legal protection but continue around the world. Belugas are taken in Greenland, Canada, Russia and the U.S.; in some cases the takes have been unsustainable or of unknown impact.

A seasonal hunt in Greenland took roughly 1000 harbor porpoises annually between 1950 and 1970 and continues today, but its present magnitude and impacts are unknown. A large-scale seasonal drive fishery for pilot whales continues in the Faeroe Islands. In Japan, a wide variety of directed fisheries harvest dolphins, porpoises and small whales. In some cases, e.g., for the Baird's beaked whale, an effective management scheme is in place, but in others, the impact of harvest has been adverse or is unknown. For example, the population of the striped dolphin is thought to have declined significantly under exploitation, but takes continue. Other directed fisheries, legal and illegal, of various sizes and impacts exist in Indonesia, the Caribbean, the Philippines, Peru, Chile, Sri Lanka, India and elsewhere.

The greatest threat to the status of small cetaceans is incidental kill in fisheries. By-catch in purse seines, bottom set nets, drift gillnets and trawls has led and is leading to depletion of many populations. In the eastern tropical Pacific, incidental kill in tuna purse seines of millions of dolphins since the early 1960s, mainly pantropical spotted dolphins and spinner dolphins, has reduced two populations to a third or less of their original size. In recent years the kills have been reduced greatly, but the populations have not shown signs of recovering. Potentially unsustainable kills of porpoises and dolphins of several species in pelagic salmon and squid driftnets in the North Pacific largely ceased when a U.N. resolution banned the large-scale fisheries in the 1990s, but significant by-catch of small cetaceans continues in smaller-scale national driftnet fisheries around the world.

In many places, the data on fishing effort and cetacean by-catch that would allow assessment of the impacts of the by-catch do not exist; this is true for even some of the more developed regions, e.g., the North Atlantic and Baltic Seas, where by-catch is thought to have led to decrease in abundance of harbor porpoises but assessments are difficult and incomplete.

For the less-developed countries, of course, the difficulties are the greatest; the resources for research and monitoring are scanty. For example, in Southeast Asia, virtually nothing is known of the involvement and status of small cetaceans in the many industrial fisheries that have developed there in recent decades.

The very few studies that have been carried out do not lead to optimism about the situation; e.g., incidental kill of spinner dolphins in tuna driftnets in the central Philippines has been shown to be unsustainable. Thus many small-cetacean populations around the world may be in trouble due to by-catch without our knowing about it.

CMS recognized the importance of dealing with incidental kill in the conservation of cetaceans and other marine animals in a 1999 resolution calling on member nations to assess by-catch and minimize it to the maximum extent possible through technological research and mitigation measures.

Pollution is also a threat to cetaceans, although the evidence is less direct and harder to come by. Cetaceans are top predators and thus subject to bioaccumulation of contaminants, particularly organochlorines. Levels of these pollutants in whales and dolphins are some of the highest that have been recorded for mammals. The effects are sub-lethal, but most of the evidence is circumstantial, as it is difficult or impossible to conduct controlled physiological experiments with these animals.

One of the most important suspected effects is immuno suppression. High correlation has been found between organochlorine burden and morbidity during epizootics, such as in a recent mass die-off of striped dolphins in the Mediterranean. Other possible and likely effects include chemical/hormonal interference with reproduction and early development, direct induction of cancer and other pathology, and alteration of behavior.

Acoustic disturbance is yet another issue of serious concern, as more acoustic disturbance is being observed and some empirical evidence is showing its effects on whales. Likewise low frequency sonars appear to be used more now and they may be an issue with potential serious impacts[4].

The Role of CMS

Beyond listing some species in Appendix I early on, CMS has not given much attention to the great whales but rather (like CITES) deferred to the IWC as a more specialized international organization with broad responsibility for them. A recent review of the Appendices by the World Conservation Monitoring Centre (of IUCN and UNEP) recommended that the fin and sei whales be considered for addition to Appendix I, but the CMS Scientific Council recommended against this, and no action was taken. In its recent workings, the CMS has effectively limited its active consideration to the small cetaceans. ACCOBAMS applies to all cetaceans, but it is expected that its attentions too will focus on the small cetaceans.

At present, only one small cetacean, the franciscana or La Plata river dolphin, is included in Appendix I. This dolphin is thought to migrate between the waters of Brazil, Uruguay and Argentina and is threatened by incidental capture in a number of fisheries. CMS has supported regional consultations to develop joint research to assess the population(s) and the impacts of the fisheries.

Most of the activities of CMS on small cetaceans has consisted of identifying and listing on Appendix II those species and populations that could benefit from international cooperation in research and management in particular regions. This is followed up by efforts to establish regional agreements. Proposals for listing are submitted by the parties.

Following a global review of the conservation of small cetaceans mandated by the CMS COP in 1990, 22 species recommended by the review for listing were added to Appendix II. For some of these species, only particular geographic populations were listed. Subsequent additions as geographical areas suitable for regional agreements were identified brought the total to the present 33 (Table 2).

[4] Comment added by the CMS and ASCOBANS Secretariats

The geographic areas thus considered have been four: the North and Baltic Seas, the Mediterranean and Black Seas, southern South America, and, most recently, Southeast Asia. Of these areas, two, the North and Baltic Seas and the Mediterranean and Black Seas, have since become the focus of regional agreements. The CMS Secretariat played a major role in drafting these agreements and bringing them into fruition.

In addition to identifying and listing species and populations that would benefit from regional cooperation, the CMS has promoted the concept of regional cooperation by funding small "seed-money" projects involving two or more nations in a region ripe for such cooperative conservation research and action. These have included a cooperative training workshop and census survey of the Sulu Sea involving Malaysia and the Philippines, an international workshop on cetacean conservation and management in West Africa, and fieldwork to assess small-cetacean abundance and fisheries involvement in Senegal, the Gambia and Guinea-Bissau. A cooperative workshop and survey of dolphin populations shared by Indonesia and Australia in the Timor and Arafura Seas is underway. Upcoming initiatives include training/survey activities in the Celebes Sea (Philippines and Indonesia) and in Ghana and Togo.

ASCOBANS

ASCOBANS came into force in 1994 and has been ratified by Belgium, Denmark, European Community, Finland, Germany, the Netherlands, Poland, Sweden and the United Kingdom. (Remaining non-members in the area are Norway, Russia, Estonia, Latvia, Lithuania, and France). The Secretariat is located in Bonn. There have been three meetings of the parties, the most recent in 2000 in Bristol, UK. The Advisory Committee has met seven times.

An early major accomplishment of ASCOBANS was participation by members in SCANS (Small Cetacean Abundance in the North Sea), the first coordinated survey of small cetaceans in the region. This resulted in estimates of 353,000 harbor porpoises (CI 267,000-465,000) and 7,900 (CI 4,000-13,300) white-beaked dolphins in the North Sea and adjacent waters. Accurate population estimates are essential to assessment of the impacts of by-catches. Further surveys are planned for coming years.

In the current Work Plan, the highest priority is given to by-catch assessment and mitigation, with focus on the harbor porpoise. In this area Denmark has taken the lead among the members, in developing and implementing a program to reduce by-catch, including mandatory acoustic alarms in some fisheries. The U.K. has also put a program into place, the UK Conservation Strategy for the Harbour Porpoise. An ASCOBANS-commissioned study on possible mitigation measures and related case studies has been produced. Attention is also being given to integrating ASCOBANS by-catch objectives into fishery policies, through discussions with national fishery agencies, NGOs and the European Commission. A recovery plan for the harbor porpoise in the Baltic Sea is in development.

It is hoped that the area of the agreement will be extended to the west and south to include the waters of Ireland, Spain and Portugal.

ACCOBAMS

The Agreement on Conservation of Cetaceans of the Black and Mediterranean Seas and Contiguous Atlantic Area has been ratified by the European Community, Monaco, Morocco, Spain, Croatia, Romania, Bulgaria and Malta. The agreement will enter into force shortly. Remaining nations in the agreement area who are not yet members include Portugal, France, Corsica, Italy, Slovenia, Bosnia-Herzegovina, Yugoslavia (Montenegro), Albania, Greece, Turkey, Ukraine, Russia, Georgia, Syria, Israel, Cyprus, Egypt, Libya, Tunisia, and Algeria. Of these, Albania, Cyprus, France, Greece, Israel, Italy, Portugal, Tunisia, and Ukraine signed the original agreement in 1996.

One project that is making progress deals with the creation of a Franco-Italo-Monegasque marine mammal sanctuary in the Ligurian Sea; Monaco and France have already ratified the agreement on the sanctuary. Development of a work plan for ACCOBAMS will proceed upon entry into force and establishment of a scientific committee. It is expected that heavy emphasis will be placed on assessment and reduction of by-catch in fisheries.

A CAUTION

Both ASCOBANS and ACCOBAMS prohibit deliberate take (of small cetaceans in the former and all cetaceans in the latter). This arguably limits the scope and effectiveness of the agreements, because not all the countries in the agreement areas agree with the concept of full protection.

For example, Norway commands a significant portion of the North Sea but is unlikely to join ASCOBANS while engaged in commercial whaling (albeit of great whales). Norway's position is that sustainable development includes responsible harvest of marine mammals. This sticking point may prevent other major players in the agreement regions from ratifying the agreements and should be carefully considered in any future agreements. However, it should be noted that Norway, though not a member of ASCOBANS, is a party to CMS and has been attending ASCOBANS meetings as an observer and participating in activities of the Advisory Committee dealing with the harbor porpoise).

SUMMING UP

The impact of CMS on the conservation of cetacean diversity is just beginning to be felt. One regional agreement is in place and its objectives are starting to be realized. A second agreement is on the verge of coming into force, and further potential agreements are being explored and promoted. The premise of a regional approach has proven its worth, and effective international cooperative research and conservation action on small cetaceans is now becoming a reality.

Table 1. List of cetacean species currently recognized by the International Whaling Commission.

	Scientific name	Common name
Suborder Mysticeti (baleen whales or mysticetes)		
Family Balaenidae		
	Eubalaena glacialis[1]	N. Atlantic right whale
	Eubalaena australis[1]	Southern right whale
	Eubalaena japonica[2]	N. Pacific right whale
	Balaena mysticetus	bowhead whale
Family Neobalaenidae		
	Caperea marginata	pygmy right whale
Family Eschrictiidae		
	Eschrichtius robustus	gray whale
Family Balaenopteridae		
	Balaenoptera acutorostrata	common minke whale
	Balaenoptera bonaerensis	Antarctic minke whale
	Balaenoptera borealis	sei whale
	Balaenoptera edeni[3]	Bryde's whale
	Balaenoptera musculus	blue whale
	Balaenoptera physalus	fin whale
	Megaptera novaeangliae	humpback whale
Suborder Odontoceti (toothed whales or odontocetes)		
Family Physeteridae		
	Physeter macrocephalus	sperm whale
Family Kogiidae		
	Kogia breviceps	pygmy sperm whale
	Kogia sima	dwarf sperm whale
Family Platanistidae		
	Platanista gangetica	South Asian river dolphin
Family Pontoporiidae		
	Pontoporia blainvillei	franciscana
Family Lipotidae		
	Lipotes vexillifer	baiji
Family Iniidae		
	Inia geoffrensis	boto
Family Montodontidae		
	Monodon monoceros	narwhal
	Delphinapterus leucas	white whale
Family Delphinidae		
	Steno bredanensis	rough-toothed dolphin
	Sousa chinensis	Indo-Pacific hump-backed dolphin
	Sousa teuszii	Atlantic hump-backed dolphin
	Sotalia fluviatilis	tucuxi
	Lagenorhynchus albirostris	white-beaked dolphin
	Lagenorhynchus acutus	Atlantic white-sided dolphin
	Lagenorhynchus obscurus	dusky dolphin
	Lagenorhynchus obliquidens	Pacific white-sided dolphin
	Lagenorhynchus cruciger	hourglass dolphin
	Lagenorhynchus australis	Peale's dolphin
	Grampus griseus	Risso's dolphin

	Tursiops truncatus	common bottlenose dolphin
	Tursiops aduncus	Indian Ocean bottlenose dolphin
	Stenella frontalis	Atlantic spotted dolphin
	Stenella attenuata	*p*antropical spotted dolphin
	Stenella longirostris	spinner dolphin
	Stenella clymene	Clymene dolphin
	Stenella coeruleoalba	striped dolphin
	Delphinus delphis	short-beaked common dolphin
	Delphinus capensis	long-beaked common dolphin
	Lagenodelphis hosei	*F*raser's dolphin
	Lissodelphis borealis	northern right whale dolphin
	Lissodelphis peronii	southern right whale dolphin
	Cephalorhynchus commersonii	Commerson's dolphin
	Cephalorhynchus eutropia	Chilean dolphin
	Cephalorhynchus heavisidii	Heaviside's dolphin
	Cephalorhynchus hectori	Hector's dolphin
	Peponocephala electra	melon-headed whale
	Feresa attenuata	pymy killer whale
	Pseudorca crassidens	false killer whale
	Orcinus orca	killer whale
	Globicephala melas	long-finned pilot whale
	Globicephala macrorhynchus	short-finned pilot whale
	Orcaella brevirostris	Irrawaddy dolphin
Family Ziphiidae		
	Tasmacetus shepherdi	Shepherd's beaked whale
	Berardius bairdii	Baird's beaked whale
	Berardius arnuxii	Arnoux's beaked whale
	Indopacetus pacificus	Longman's beaked whale
	Mesoplodon bidens	Sowerby's beaked whale
	Mesoplodon densirostris	Blainville's beaked whale
	Mesoplodon europaeus	Gervais' beaked whale
	Mesoplodon layardii	strap-toothed whale
	Mesoplodon hectori	Hector's beaked whale
	Mesoplodon grayi	Gray's beaked whale
	Mesoplodon stejnegeri	Stejneger's beaked whale
	Mesoplodon bowdoini	Andrew's beaked whale
	Mesoplodon mirus	True's beaked whale
	Mesoplodon gingkodens	gingko-toothed beaked whale
	Mesoplodon carlhubbsi	Hubbs' beaked whale
	Mesoplodon peruvianus	pygmy beaked whale
	Mesoplodon bahamondi	Bahamonde's beaked whale
	Ziphius cavirostris	Cuvier's beaked whale
	Hyperoodon ampullatus	northern bottlenose whale
	Hyperoodon planifrons	southern bottlenose whale

---

[1]Listed on CMS Appendix I as subspecies of *Balaena glacialis*; recent genetic work has indicated full species status is appropriate. *Eubalaena* is preferred over *Balaena* for the right whales.

[2]In CMS Appendix I, subsumed in *Balaena glacialis glacialis*. Recent genetic work indicated species-level separation from the North Atlantic right whale.
[3]May include more than one species, but taxonomy still unsettled.

Table 2. Cetacean species and populations on Appendix II of CMS.

Platanistidae	*Platanista gangetica gangetica*[1]
Pontorporiidae	*Pontoporia blainvillei* (also on Appendix I)
Iniidae	*Inia geoffrensis*
Monodontidae	*Delphinapterus leucas*
	Monodon monoceros
Phocoenidae	*Phocoena phocoena* (North and Baltic Sea, western North Atlantic and Black Sea only)
	Phocoena spinipinnis
	Phocoena dioptrica
	Neophocaena phocaenoides
	Phocoenoides dalli
Delphinidae	*Sousa chinensis*
	Sousa teuszii
	Sotalia fluviatilis
	Lagenorhynchus albirostris (North and Baltic Seas only)
	Lagenorhynchus acutus (North and Baltic Seas only)
	Lagenorhynchus obscurus
	Lagenorhynchus australis
	Grampus griseus (North and Baltic Seas only)
	Tursiops truncatus (North and Baltic Seas, western Mediterranean and Black Sea only)
	Tursiops aduncus (Timor and Arafura Seas only)
	Stenella attenuata (eastern tropical Pacific and Southeast Asia only)
	Stenella longirostris (eastern tropical Pacific and Southeast Asia only)
	Stenella coeruleoalba (eastern tropical Pacific and western Mediterranean only)
	Lagenodelphis hosei (Southeast Asia only)
	Delphinus delphis (North and Baltic Seas, western Mediterranean, Black Sea, and eastern tropical Pacific only)
	Orcaella brevirostris
	Cephalorhynchus commersonii (South America only)
	Cephalorhynchus eutropia
	Cephalorhynchus heavisidii
	Orcinus orca (North and Baltic Seas only)
	Globicephala melas (North and Baltic Seas only)
Ziphiidae	*Berardius bairdii*
	Hyperoodon ampullatus

---

[1]Formerly listed as *Platanista gangetica*

THE GLOBAL REGISTER OF MIGRATORY SPECIES (GROMS) <www.groms.de>. By Klaus Riede[5]

Overview

Depending on the taxonomic group, the knowledge about animal migration is heterogeneous and often insufficient. Migrations of most bird species are comparatively well known, while for mammals, fishes and insects, sufficient information is only available for economically important species. Most of this information is only available in printed format, and -if digitised at all - in different formats.

The aim of GROMS is to summarise our knowledge on migratory species in digital format within a database in combination with a geographical information system (GIS). Thereby, GROMS will reveal deficiencies of information and support the Convention on Migratory Species of Wild Animals and the Convention on Biological Diversity. It will be available on CD-ROM and on the WWW in the near future. GROMS is co-operating with the Zoological Museum at Bonn, Germany, and is supported by the Federal Agency for Nature Conservation with funds from the German Federal Environment Ministry.

The GROMS liases with or even uses data extracts from several other bioinformatics initiatives, such as the CHM, GBIF, Species 2000 (in particular "Fishbase"), IUCN/SSC (2000 IUCN Red List of Threatened Species), UNEP-WCMC, BCIS, Wetlands International and the AMD (African Mammal Database). However, the idiosyncrasies of migratory species made it necessary to design a completely new information system from the ground up. For representing movements of migratory species in space and time maps are important tools. GROMS contains GIS maps for 545 species, which can be exported into any other GIS, covering further aspects relevant to conservation (e.g., land use). In addition, important aggregation areas have been linked with species lists. Where possible, geo-information has been provided with a time-code, to reflect the tremendous seasonal variation of migrants within certain areas. Time-codes and meta-information about maps are administered within the database.

The database provides basic information for 2880 migratory vertebrate species. It contains scientific names with authority and synonyms, common names (English, French, German, and Spanish), threat status according to the international Red List, and protection status as by listing through CMS with its agreements, and CITES appendices. The GROMS data model differentiates between "populations" of species, which are either defined taxonomically (subspecies) or geographically. This is necessary because of considerable differences in migration behaviour within a single species. All information is fully referenced by a literature module with more than 2000 entries, including a considerable number of full-text digital documents. Additional features include references to web sites and projects, addresses of organisations and experts, and species lists for countries or specific sites.

A JAVA-based interface connects the GIS maps with the database and allows searching for species within an area, or generation of species reports. Simple dropdown-menus for information retrieval are specially adapted to the needs of conservationists and policy makers. This completely new Graphical User Interface (GUI) has been designed for an inexpensive, user-friendly visualisation of interactive maps on the World-wide Web. The open-source software can easily be modified, and complies with the Open-GIS standard. The Geography Department of Bonn University developed GROMS; a pilot version can be tested under http://www.groms.de.

Results

[5] Centre for Development Research, Walter-Flex-Straße 3, D - 53113 Bonn, Germany; phone: int+228-731872; fax: +228-731869; k.riede.zfmk@uni-bonn.de

Though the first phase of the GROMS project had to concentrate on the development and functionality of the Geo-database, thus far several preliminary results have emerged.

- **Considerable knowledge gaps were discovered for migratory species**

Considerable knowledge gaps with respect to migratory behaviour were discovered for bats, Asian antelopes, small whales, tropical migratory fishes and insects.

- ***High numbers of migratory fish species were identified***

A surprisingly high number of 880 migratory fish species was identified in co-operation with Fishbase (www.fishbase.org). A total of 86 migratory fish species are red-listed, and the expansion of the CMS Appendices to include these is proposed. This list will probably increase after the evaluation of the scattered literature on fish migrations within tropical river systems. However, it is already evident that there are considerable knowledge gaps with respect to tropical fish migrations, and severe threats to all freshwater migrants must be expected from the high number of river dam projects in tropical and subtropical rivers.

- ***Harmonised terminologies were needed to produce GROMS and are needed for other biodiversity initiatives***

To guarantee the future compatibility of GROMS with the biodiversity initiatives mentioned above harmonised terminologies were needed. In particular for birds, major nomenclature differences between different species lists in use complicate co-operation between different database projects, as they require management of parallel taxonomies. To ensure future compatibility of digital data sets it is very important to agree on generally accepted taxonomic authority files.

- ***Huge data sets exist but digital access and analysis is difficult***

Huge species data sets exist, but digital access and analysis is difficult. Examples are bird and bat ringing data, or museum specimens, which could provide high-quality point data to improve maps. Bird lists for certain sites such as wetlands or Important Bird Areas (IBAs) are maintained by various agencies. This wealth of information could be integrated easily within a common GIS database. Satellite tracking data are published in many formats, but there is no custody for organised storage of these valuable data sets. Data holders should rapidly agree on common protocols if they are disposed to share their data, and digital data publication should be a pre-requisite for public funding (with the exception of sensitive data).

- ***Efficient conservation requires animal distribution data in GIS format***

In spite of the great potential, GIS analysis of species ranges is still in its infancy. Most distribution maps are still published in analogue format, thereby wasting chances of future analysis. Among the few examples for major GIS data sets are African mammals (AMD: http://www.gisbau.uniroma1.it/amd/homepage.html), arctic birds and turtles by WCMC (http://www.wcmc.org.uk/). These data were integrated into the GROMS without difficulties. For all other species, maps on a global scale were geo-referenced by GROMS. They allow a variety of analyses when intersected with other GIS data sets. For example, an intersection with political borders produced species lists for each country or even province, which can be queried by the database. This facilitates maintenance of range state lists, and allows comparison of different data sources. In case of contradictory results, clear research questions can be asked. There are numerous additional applications for biodiversity maps in GIS-format, among them:

- Comparison of maps from different sources and different projections
- Calculation of diversity hotspots

- Intersection with other GIS-layers such as ecoregions, land use, population pressure or climate change predictions, to name just a few.

One interesting result of a calculation of migratory birds and mammals for each administrative unit revealed a high species number in temperate regions (see map, figure 1). This simple analysis, based on available information, suggests that a great deal of responsibility for conserving migratory species lies with the range of industrialised and transition economy countries. One major implication of this analysis is that the present concentration of biodiversity conservation plans within tropical “hotspot areas“ will be completely insufficient to conserve most intercontinental migrants.

Many migratory species cover huge ranges, but sometimes concentrate temporarily within certain areas. This is a challenge for conservation policy, as it has to combine local approaches (e.g., protection of aggregation sites) with landscape approaches, protecting whole areas including different ecosystems, including vast areas of agroscapes. Many migrants have adapted successfully to extensively or sustainably managed agro-ecosystems, but suffer tremendously from agriculture intensification and industrialisation. Sometimes, even slight changes in management practice can have detrimental effects on migrants (e.g., change of shadow coffee/cacao practices to more intense, "pure" plantations).

The results outlined above are now published as an extensive report. The database will be available on CD-ROM and via the World-wide Web (www.groms.de). Beta-versions are available on request from the author (k.riede.zfmk@uni-bonn.de).

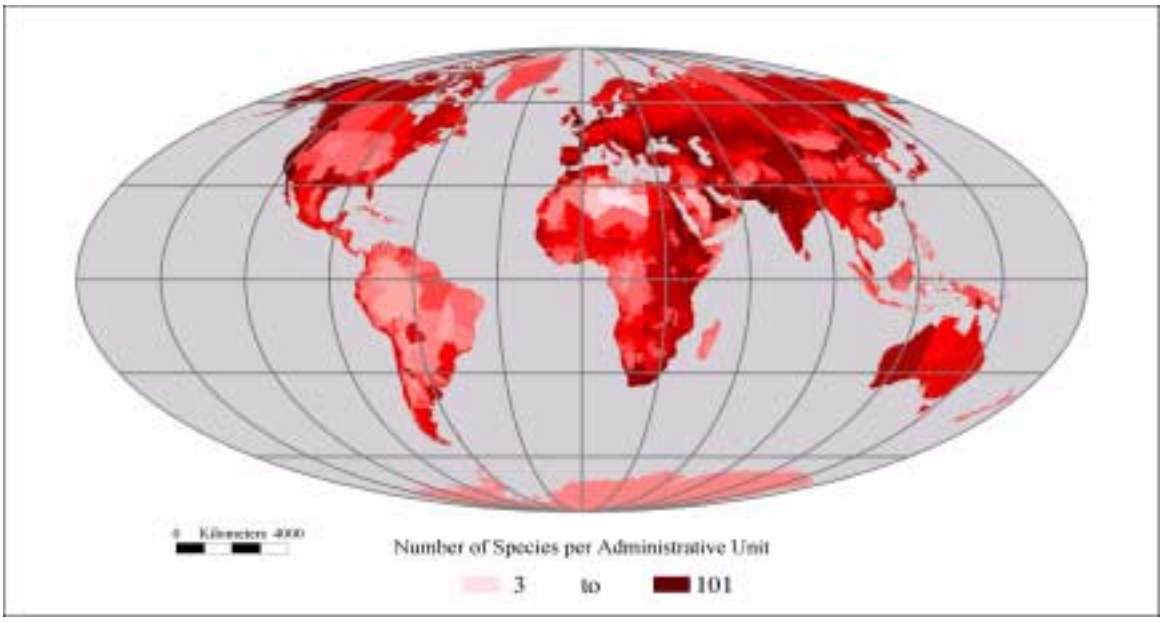

Figure 1:

Number of migratory bird and mammal species per administrative unit (provinces).
This map was produced by intersecting GIS range maps of 530 species with political boundaries.

ENDANGERED FLAMINGOS OF THE NEO-TROPICS: AN INTEGRATED PROJECT TO SAVE AND MAINTAIN THE SPECIES AND THEIR HIGH ANDES WETLAND ECOSYSTEM

Dr. Roberto P. Schlatter[6]

There are tremendous gaps in knowledge on the status and trends of many migratory species. This necessitates gathering basic information without which any conservation efforts to conserve and sustainably use migratory species and their habitats will likely fail.

This case study describes a multiyear research and conservation project (see Annex 1) on the flamingos of the High Andes plateau that has been supported with a variety of funding sources. It aims to facilitate the conservation and sustainable management of wetlands and adjacent upland areas of a region of the Andean Altiplano (plateau) to help conserve flamingo populations. The wetlands systems support the endangered neo-tropical flamingo populations as well as human settlements with unique economic and social development.

Overview of the Project Area

The project area is a crescent-shape area of the Central Dry Puna. The project area includes up to 200,000 square kilometres of territory, located from about 15º to 34º latitude South. It is centred on the tri-national border of Argentina, Bolivia and Chile with participation of Peru.

The Central Dry Puna of the Andes, is an ecoregion absolutely unique in the world. Its altitude ranges between 2300 and 4800 metres above sea level with the exception of Laguna Mar Chiquita in Argentina that is found at only 66 metres above sea level. It is characterised by breathtaking scenic beauty and geographic immensity and is populated by biota well adapted to high elevations and climatic extremes.

These High Andean wetlands are mostly saline in nature. They are home to several endemic and migratory, as well as nomadic, bird species and other wildlife dependent on these wetlands.

The Andean Puna is dry and cold. It has a limited capacity to support agriculture and classical cattle ranching, and therefore it can only sustain relatively low numbers of people. The endemic human populations have adapted to their environment and its limited resources even as a slow but persistent climatic drying period as progressed for the last 40 years. The indigenous groups located in the Puna - Aymara, Quechua, Atacameños and Coya peoples- have a cultural heritage that represents the oldest surviving traditional societies on the continent.

Threats to the Puna's Wetlands

In the last decades, the Puna's fragile wetlands and the biodiversity that they support have increasingly come under threat. The main threats are:

- **Industrial scale activities related to mining and energy development**

To date mining and energy development have resulted in direct wetland habitat alteration and contamination. Natural hydrological regimes have been altered and they continue to be threatened by water diversion, road building, urban development and associated activities.

---

[6] CMS Scientific Councilor for the Neotropics. Institute of Zoology, Universidad Austral de Chile, Valdivia, Chile; < rschlatt@uach.cl>.

- **Agricultural and cattle range management**

Several domestic livestock schemes and agricultural innovations have been developed with the local inhabitants. These have not considered the ecological limitations of this particular environment. Little is known about resource use and its sustainability. Issues related to disease transmission from domestic animals to wildlife populations should be addressed.

- **Unregulated tourism**

The unusual beauty of the area and its extreme environmental conditions are attractive to an increasing number of national and international visitors. Economic integration and free trade agreements between the Southern South American countries Brazil to Chile (with Argentina, Bolivia, Paraguay and Uruguay) are promoting trade and other commercial exchange across international borders. But little has been done to regulate economic development to ensure that it is compatible with environmental interests.

Any development will require more water. Supplies are fragile and mostly of endorreic nature. Increased water usage will further threaten the region's wetlands, which are also labile and are shrinking or have already dried up.

Even though the project area includes important protected areas, several key wetland habitats are not protected. Several pilot sites will be selected during the project development phase and the main threats to biodiversity will be evaluated. Biodiversity management principles in the regional land use and planning process will be considered by the project.

Migratory and Nomadic Flamingos as Flagship Species

Flamingos are the flagship species that characterise this unique landscape. The Andean and James flamingo are restricted to High Andean wetlands and are the rarest of all flamingo species. Internationally they have been classified by IUCN as vulnerable and have been included in Appendix I of the Convention on Migratory Species (CMS) and Appendix II of CITES.

Flamingos can be migratory and nomadic. They depend on wetland conditions that fluctuate seasonally and inter-annually. Securing enough habitats to ensure the long-term survival of the Puna's flamingo populations will require the protection of large wetland areas by the different countries involved. These habitats are patchily distributed and form a small portion of the area of interest (no more than the 12%) but the wetlands are essential for providing water to people and wildlife.

All the beauty, cultural heritage and wildlife associated with the Puna wetlands' heritage is threatened by industrial extraction of metallic and non-metallic minerals and other products, human encroachments and uncontrolled tourism, among others, because of the lack of proper physical landscape planning. Because of the transboundary nature of the Puna, conservation needs to take the form of a concerted effort among the flamingos' range countries in order to generate joint, integrated responses to common threats and opportunities.

Overview of the Project

The ultimate objective of the project is to develop and implement an integrated management strategy for the High Andean wetlands of Argentina, Bolivia, Chile and Peru to conserve flamingos and associated fauna.

There are two specific project objectives. The first is to develop and implement a research program that permits the standardisation of biological and ecological knowledge on the flamingos in their distributional

range.[7] The second is to develop and implement a management plan to conserve the flamingos and their habitat according to the environmental policies of each country.[8]

There are four expected results of the project. First will be improved co-operation between the range states to manage the flamingos and conserve their wetland habitat. Second, it is envisaged that co-operation will be materialised by developing specific legislation or agreements (e.g., a Memorandum of Understanding under CMS). Third, co-operation will be operationalised by a conservation and management plan for the concerted management of wintering sites and/or the design of international protected areas in the participating countries. Each one of the participating range states would implement this. Fourth and finally, the key wintering areas of the James and Andean Flamingos will be identified (especially those outside of the known breeding range). These will include lakes that support young individuals.

Research Methods

In 1996, an integrated task force, the Conservation Group for the High Andean Flamingos (GPCFA in Spanish), was organised under the auspices of the Convention on Migratory Species. The national participants from each country oversee their respective countries' wetlands.

In Chile, the participating groups included CONAF (Corporación Nacional Forestal, Chile) with initial support of the Wildlife Conservation Society. Funding was provided in part by mining companies like Doña Ines at Collahuasi, Escondida Ltda., Quiborax, SQM Salar and Arturo Prat University, Iquique, Chile. Fifty lagoons and wetlands were covered before 1996.

In Argentina the regional Northeast National Park System and the Faculty of Natural Sciences of the University of Salta took the responsibility over Argentinean wetlands. In Peru, INRENA was initially involved, and later Peru Verde conducted fieldwork. In Bolivia, the Biodiversity General Direction under the Sustainable Development and Environmental vice-Ministry, plus investigators from local universities, are involved and oversee the Bolivian component. The project started with more than 150 wetlands, most of them "islands" in an extreme arid region with mostly unpredictable rainfall.

Research Results

---

[7] *Objective 1* priority actions include: *Developing studies about species* (e.g., abundance and distribution; migratory pattern; description and characterisation of habitat types and their use; climatic background) and *Addressing Conservation Problems* (e.g., impact evaluation studies related to mining and industrial activities; tourism; water use; flamingos as resources including their feathers/plumage, eggs and others; pollution; and presence of human settlements).

[8] *Objective 2* priority actions include: (1) characterising levels of biological interactions between flamingos with *inter alia* other Altiplano species such as, vicuña, horned coot, shorebirds and Andean goose, as well as related socio-economic aspects; (2) reinforcing the wild protected area system by improving the established conditions of existing areas or creating new ones where they are necessary; (3) implementing a GIS that permits data gathering and storage to analyse flamingo abundance and distribution and the fluctuation in their numbers; (4) designing and applying legal and technical frameworks to regulate the use and exploitation of mineral resources as well as water in the High Andean wetlands; (5) extending and spreading information on the legal and technical frameworks to the political, administrative, public and private sector stakeholders involved with this ecosystems; (6) establishing an environmental educational program focused on local communities in relation to the High Andean lakes; and (7) preparing and implementing agreements between the range states in order to develop a common policy, to apply legal and technical elements and back up the establishment of a technical group that will oversee the multidisciplinary and integrated framework developed.

Research activity has been focused mainly on the flagship species: the flamingos. It was aimed at periodic control of their population in all of their ornithogeographical distribution.

Summer censuses 1997 and 1998 showed that the dominant species of flamingos in the Puna of Argentina, Bolivia, Chile and Peru was the James flamingo **(***Phoenicoparrus jamesi*). A total of 47,619 individuals were counted during 1997 while 64,101 individuals were counted during summer 1998. While 10,703 individuals were counted in the summer of 1999. A drop to 3,430 individuals was recorded during the summer of 2000. The winter census also fluctuated between 1,412 to 64,101 individuals during 1998 (probably due to effect of the El Niño event).

This species is distributed in Bolivia where it nests in Colorada lagoon, a protected area of that country. Up to 3000 chicks are produced annually and the site is considered a major concentration point for the species. In Chile the breeding areas of importance are Salar de Pujsa (Antofagasta) and Salar de Surire in the Tarapacá region (Ramsar site). Both are part of the Chilean Natural System of Protected Areas.

The second species of major abundance is the Chilean flamingo (*Phoenicopterus chilensis*) with 39,089 individuals counted during summer 1995; 25,783 during 1998; 9,983 during 1999; and 10,268 individuals during summer 2000. The decline is due to the lack of information and census for the southern Peruvian wetlands for these years, which were affected by the El Niño event. Winter censuses varied between 4,155 to 43,340 individuals in winter 1998 (El Niño effect). The Surire saline lake increased its population of this species during those years, reaching 8000 individuals in January 1997 and a mixed colony of this and the Andean flamingo (*Phoenicoparrus andinus)* appeared. The Chilean flamingo population produced at least 5000 chicks.

The Andean flamingo is the species with fewest numbers of birds. Census showed 33,927 individuals during summer 1997; 27,803 during 1998; 16,351 in 1999; and 14,592 during summer 2000. Winter census figures showed between 2147 to 27,803 individuals during winter 1998 (also due to El Niño event).

The decline during the summer counts occurred due to probable movements of this species to saline lakes not covered by the simultaneous census activity of Argentina and Bolivia. Reproductive colonies of this species, historically established in the high Andes of Chile have not been as frequent and significant as before. Isolated breeding attempts have occurred in Surire, Huasco and Atacama saline lakes which are not comparable to the large breeding occurrences during 1989 when, for this species, 16,000 chicks hatched in Chile.

A conservation plan formulated for the species during 1995 by CONAF included the building of artificial nests and water-wave crashers to avoid nest destruction. This was agreed between CONAF and Minera Escondida Ltda. during 1998.

It is clear from the experience obtained in former studies and during this international co-ordinated effort, that in addition to their shrinking and fluctuating populations these flamingo species are vulnerable because:

- they are colonial breeders, which gather, in big numbers to breed only in selected wetlands and then not every year. Conserving these sites is essential: Salar de Atacama, Salar de Surire, Salar de Maricunga and Negro Francisco in Chile, Laguna Colorada in Bolivia;
- Flamingos migrate seasonally in altitude, using several wetlands in different countries throughout the year;
- Flamingos are concentrated in Altiplano wetlands during the summer;
- Flamingos are specialist feeders; and
- Eggs are an attractive and accessible food resource for the local people.

Currently, more than 207 sites are being monitored and surveyed: Argentina with 86 wetlands; Bolivia with 53; Chile with 47; and, Peru with 21 sites. This is quite an achievement considering the geography, limited access to the areas (road system) and high altitude. That the area covered is immense is also worth pointing out.

The interactions among countries' institutions have been very positive and this has contributed to achieving the results. The spirit of co-operation promises to continue as the results are subsequently directed towards addressing the main conservation issues of the international project.

Banding programmes results have not been yet published and evaluated for success in revealing how the flamingos move within habitats and countries and their probable causes. Thus far, only 3% of banded flamingos in a Chilean programme have been re-sighted and very few have been recovered in other countries.

This initiative could further implement bio-telemetric studies or the selective use of PTT and satellite tracking to increase knowledge of species population mobility in the realm of wetlands in the Altiplano. This would demand technical inputs, qualified personnel – researchers - and more financial support. Steps are being taken with private mining enterprises in Chile to address the technological needs.

It is necessary to resolve problems and dialogue (and negotiate) with mining enterprises in order to restrict water use, habitat alteration and pollution. Water demand is a key issue and it will become more difficult if other issues are not addressed. For example, how to save water during the surplus rainfalls that accompany El Niño events? Mining companies should conduct research on how to solve the problem of saving and using water.

Grazing seems to be another problem and solutions have to be studied for llamas, alpaca livestock, sheep and the wild stock of guanaco and vicuña which overgraze pastures and change the hydrological dynamics in the Altiplano's mostly endorreic watersheds. This has to be addressed also by state institutions in charge of such range management problems. Declining vegetation cover is a problem in arid and harsh climatic Altiplano conditions.

Tourism is increasing in Latin-American countries and the impacts of this activity need to be well studied and addressed.

Road building is a problem. It has to be restricted to a well-planned system in order to avoid habitat fragmentation and drainage alterations.

Most of these problems have been presented in Threat Identification Charts and Impact Indexes in the advance reports to CMS. Each country has their own scaled activities: Chile is vulnerable to mining, water demand and tourism; Argentina has more problems with grazing, mining, water demand and road building; mostly mining and tourism also affect Bolivia. The profits obtained by mining companies could be discussed and shared with conservation actions, like salaries for wardens and specific projects to solve mining pollution and their water demand problems in relation to habitat and wildlife.

Many questions still remain to be answered as the rest of the project is developed and implemented. For example, are there enough existing protected areas both in number and representation to cover flamingo movements and dispersal? What will it cost to create new ones? How well is each protected area's management plan implemented? What priority does the region or a country give to this ecosystem to be studied? How successful has the integrated Altiplano group been in addressing the objectives and hypothesis which were distributed to different institutions like the Wildlife Conservation Society, Wetlands for the Future (Ramsar Convention), CMS and the never ending support of local institutions?

Has the US $50,000 dollar investment been worth the effort and achieved its goals? What are the countries' political, technical and financial commitments to implement and support this type of project?

Workshops are needed at least once or twice a year to enable participants to interact, evaluate progress, share experiences and develop new techniques. More workshops would also help facilitate the participation of mining companies, state institutions related to ministries about water, road building, national park services and local communities. Once the main projects are finished scientific symposia should be organised to evaluate data and scientific progress and promote publication in known scientific journals. A good example is the *Waterbird Journal* Special Edition (2000) that was dedicated to neo-tropical flamingo studies.

With this project it is hoped that the flamingos which act as indicator/key/flag species of the High Andes Altiplano wetlands, and other biological resources which characterise the Puna biodiversity, can be saved and maintained. The area has been recognised by the Biodiversity Support Program as a vulnerable and high priority ecosystem for conservation.

Valdivia, Chile, 1st February 2001

Annex 1 - Integrated International Activities Performed in Relation to Flamingo Conservation Actions

1996

- Establishment of an international working group (called the Group for the Conservation of High Andean Flamingos)
- 1st International Workshop for Census Co-ordination. San Pedro de Atacama, Chile. (supported by the Wildlife Conservation Society (WCS) and CONAF)

1997

- 1st International Summer Census (WCS and national institutions)
- 1st Workshop on Flamingo Banding. Salar de Surire, Chile (CONAF)

1998

- 2nd International Summer Census, Chile, Argentina, Bolivia and Peru. (WCS and national support)
- Workshop on Management of Projects. La Paz, Bolivia. (Wetlands for the Future (Ramsar Office) and local institutions)
- 1st International Winter Census (financed mainly by local institutions)
- Capacity Building Workshop on Integrated Management of High Andean Wetlands, Monitoring Ecological Conditions and Key Species (All four countries) (Cieneguillas, Jujuy Province, Argentina. Wetlands for the Future, Universidad de Salta and National Park Administration from Argentina)
- Preliminary International Winter Census. Four countries ((WCS) and local institutions of these countries)
- International Flamingo Meeting, Miami, Florida, USA; Presentation of two abstracts

1999

- 3rd International Summer Census
- Training for the Integrated Management of Puna wetlands (Laguna Colorada, Bolivia. Wetlands for the Future and local institutions)
- 2nd International Winter Census (CMS and local institutions) (Suspended)
- Training Workshop for the Management of High Andean Wetlands. Evaluation of Industrial Impacts on these wetlands. Atacama and Surire, Chile (Wetlands for the Future and local institutions)
- Workshop on Conservation and Management Proposal: Concerted management among the 4 countries, Salta, Argentina (CMS funds and co-operation of local institutions)
- Memorandum of Understanding among countries' institutions in relation to the Conservation and Management of High Andean Flamingos; first approaches and discussions (CMS)

2000

- 4th International summer census.
- 2nd International Winter census (CMS Funds and local institutions)
- Memorandum of Understanding signed between Argentine, Bolivian and Chilean state conservation institutions
- GEF Project proposal: Priority Actions for the Conservation of the High-Andean Flamingos. UNEP/CMS; one of the aims of this is also to establish a three-country wide protected area to be managed in an integrated way; 1st step approved (PDF-A grant)

2001

- 5th International Summer Census
- GEF Project proposal, 2nd step (PDF-B grant) to be accomplished

---