

Policy options

This section aims to identify feasible policy options that target key components identified in the Causal chain analysis in order to minimise future impacts on the transboundary aquatic environment. Recommended policy options were identified through a pragmatic process that evaluated a wide range of potential policy options proposed by regional experts and key political actors according to a number of criteria that were appropriate for the institutional context, such as political and social acceptability, costs and benefits and capacity for implementation. The policy options presented in the report require additional detailed analysis that is beyond the scope of the GIWA and, as a consequence, they are not formal recommendations to governments but rather contributions to broader policy processes in the region.

Key issues and causes

The assessments and the causal chain analysis identified the following key issues:

- West Greenland (GIWA region 16) suffers from overexploitation of the marine resources, due to climatic changes, inadequate knowledge about the resource dynamics and productivity of the ecosystems, inappropriate management frameworks, and a lack of population awareness and ability on how to best adapt to the changes.
- East Greenland (GIWA region 15) - and to a certain degree West Greenland - suffers from the impacts of chemical pollution, transported by the air and ocean currents from Europe, Asia and North America, and building up in the food webs of the arctic marine ecosystems. There is a need to further improve the understanding of the transport processes and to improve the international cooperation to reduce emission of hazardous chemicals.

- North Greenland (GIWA region 1) is presently fairly undisturbed, but it is expected that global climatic changes related to emission of greenhouse gases may cause significant threats to the arctic ecosystems, in particular the unique arctic mammals (polar bears, walrus, etc.). There is a need to further understand these impacts, and to use this information in the international climate negotiations.

Options for policy intervention

The politicians and the administration in Greenland are fully aware of the issues and the threats they pose to the socio-economic development. Accordingly, a large number of policy initiatives – both nationally and internationally have been initiated. The following sections will highlight some of particular importance to the issues identified above, and also point out some additional options for intervention.

Addressing Overexploitation of marine resources in West Greenland

In 1987 the “Brundtland Report” (World Commission on Sustainable Development 1987), also known as Our Common Future, alerted the world to the urgency of making progress toward economic development that could be sustained without depleting natural resources or harming the environment. The report provided a key statement on sustainable development, defining it as: development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

There is great awareness in Greenland about the urgency of sustainable development in the society (see www.nanoq.gl/sustainability). Quoting Jonathan Motzfeldt, former Premier, Greenland Home Rule Government (Greenland Institute for Natural Resources 2002: Foreword):

"The marine ecosystem is the life-blood of Greenland. There is a tight connection culturally, socially, and economically, and mankind is, more significantly than anywhere else, integrated into the ecosystem.

The wide-spread realms of the Arctic marine region have, through the centuries, drawn fishermen and hunters from far and wide. But human influence, and rapid climatic change, have induced marked shifts in the ecosystem, and the focal points of exploitation have changed through time.

Rapid climatic shifts and a low level of complexity make the Greenland marine ecosystem uniquely suitable for the study of the effects of climate change. At the same time, the situation of the ecosystem within a single economic zone gives good possibilities for studying the interactions between it and society. Together, these factors make this a unique study area, of international interest for investigating the effects and interactions between mankind, climate, and ecosystem."

Improved knowledge

In their discussion of the concept of sustainability in fisheries, Steele and Hoagland (2003) argue that one of the main difficulties in fisheries management is the "ratchet" effect (Ludwig et al., 1993). When the abundance of a stock increases, the fishing capacity goes up. But when later the stock decreases – often by natural causes – , the effort stays the same, usually with disastrous consequences for the stock and the economy. This general sequence occurs on top of a trend for "improved" gear technology. The critical scientific problem is to distinguish between these two causes: natural environmental variability and changes in effort, fishing boats and gear. According to Steele and Hoagland (2003) the time scale of natural changes in the sea - a few decades - is comparable to the economic scales of human adaptation; specifically the "lifetime" of a fishing vessel. It is this resonance in time scales that makes the attribution of cause to the quasi-cycles in stock abundance more than a purely scientific problem. There is a need to understand the natural physical and ecological causes of these "cycles" in marine ecosystems and subsequently devise sufficiently long-term management to ameliorate rather than amplify the economic consequences (Steele and Hoagland, 2003).

Much of this and related discussion was taken up by the Food and Agriculture Organisation (FAO) of the United Nations in discussions related to the Convention relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UN, 1994) and the Code of Conduct for Responsible Fishing (FAO, 2001), and recently resulted in Technical Guidelines for an Ecosystem Approach to Fisheries Management (FAO, 2003). These guidelines have been adopted to reflect

the merging of two different but related and – it is hoped – converging paradigms. The first is that of ecosystem management, which aims to meet its goal of conserving the structure, diversity and functioning of ecosystems through management actions that focus on the biophysical components of ecosystems (e.g. introduction of protected areas). The second is that of fisheries management, which aims to meet the goals of satisfying social and human needs for food and economic benefits through management actions that focus on the fishing activity and the target resource. Up until recently, these two paradigms have tended to diverge into two different perspectives, but the concept of sustainable development (World Commission on Environmental and Development, 1987) requires them to converge towards a more holistic approach that balances both human well-being and ecological well-being. Ecosystem Approach to Fisheries (EAF) is, in effect, a way to implement sustainable development in a fisheries context (FAO, 2003).

The Greenland Institute of Natural Resources is the Greenland Home Rule Government's centre for research on living natural resources. It advises the government on sustainable use of resources, including conservation of the environment and biological diversity. The Institute's vision is to understand the interrelationship between ecosystem, climate and human impact.

The Greenland Institute for Natural Resources wishes to initiate a long-term research programme towards its vision, in order to meet the increasing interest in ecosystem-based advice for management (Jarre, 2002). The focus will be the marine ecosystem off West Greenland, both economically and socially most important to Greenland's society.

The goal of the "Ecosystem West Greenland" (ECOGREEN) research programme is to establish a scientific basis for a long-term ecosystem-based management of natural resources in West Greenland waters"

Through the research programme ' ECOGREEN', Greenland expects to attract international expertise within the natural- and social-science research communities, which in fellowship with Greenlandic institutions can create a scientific basis for holistic management of a marine ecosystem.

The results from ECOGREEN could well become the basis for developments in more complex systems, and its perspective therefore extends far beyond Greenland.

Improved management

Key questions concerning management of human use of natural resources and the need for socio-economic research in the West

Greenland ecosystem were discussed during a workshop at Greenland Institute of Natural Resources in 2001. The following is quoted from the workshop report (Jarre, 2002, p77-78):

The need for communication on management issues: "In the end it is the person with the finger on the trigger or the person setting the net, who decides whether their action is complying with, or violating the law." said Paviaraq Heilman, then member of the Home Rule Government, during the seminar on Greenland's living resources conducted by the Greenland Institute of Natural Resources in 1998. In a country where it is practically impossible to control compliance with hunting and fishing regulations, it is the people's knowledge, understanding and acceptance of management measures that leads to compliance with regulations. In connection with strategies for sustainable exploitation, experts and practitioners have been analysing for a number of years how the needed change of behaviour can be achieved. Consensus is growing that active participation in the management process is one of the necessary conditions.

Solution co-management: In International Union for Conservation of Nature (IUCN), World Wildlife Fund (WWF) and the Arctic Council, co-management is propagated as the best solution to management issues. In the report "Arctic Flora and Fauna. Status and conservation" (CAFF (ed.) 2001, Edita, Helsinki. 272 p.- free online version: www.caff.is it is concluded that "One of the most notable recent innovations is the involvement of hunters and fishers in wildlife management. In theory, hunters and fishers who help develop the regulations will better understand the rationale for them and be more willing to abide by them. In practice this approach has enjoyed success in North America, where support for co-management has grown widely, although difficulties remain."

However, efforts like "better communication" by themselves may not solve the problems. There are genuine divergence of interests and a major problem in fishery management is lack of organisation among fishers and lack of confidence among them: If an individual fisher restrict himself in his fishing he will not receive the benefits himself. Thus the individual fisher has little incentive to restrict himself.

There are genuine conflicts of interests among stakeholders. Shrimp and cod fishers might have different interests. Environmentalists and fishers clearly have different interests as well. Thus, only a socio-political realistic approach to "comanagement" will be efficient.

Acknowledging that co-management in Greenland is only in its infancy, the Directorate for Environment and Nature of the Home Rule Government published a "programme proposal for local engagement

in management of natural resources in Greenland" (Greenland Home Rule, www.nanoq.gl). Quoting from the proposal:

"The programme's aim of seeking a broader basis for management principles - and letting the process of reaching agreement on the basic principles become a part of the programme, thereby creating local awareness of the consequences of a general natural resource policy - is new in Greenland".

"One of the conditions for solving these problems is that a real alternative is created to enable many of those who are today dependent on the very direct utilisation of our live resources to earn a living. Moreover, subsidies to the fishing industry and the hunting trade should be arranged so that they do not contribute to maintaining the existing pattern".

"In order to counter any negative development there is a distinct need for two concrete initiatives: 1. an information campaign and an open and honest dialogue about the problems in this country, and 2. the formulation of an overall policy for the solution of the problems, resulting in an actual strategy and action plan"

According to Greenland Home Rule (www.nanoq.gl), the purpose of the campaign is to ensure better dialogue between interest groups and to disseminate factual information about the status of living resources, the objective being to create a common understanding of what is needed to conserve the natural environment for future generations.

At the same time the campaign is hoped to enable Greenland to live up to its obligations in terms of information to the public about environmental issues and protection of the natural environment as required in two international conventions:

- The Biodiversity Convention, which Greenland has signed and according to which signatory countries are obliged to initiate public education and awareness programmes; and
- The Aarhus Convention on access to information about environmental matters, which Greenland stated it would endeavour to observe when Denmark ratified it. According to the Aarhus Convention citizens are not only entitled to information about environmental matters: public authorities have an obligation of pro-active dissemination of information. With the new nature conservation act which is expected to be adopted within the next twelve months. Greenland lives up to the spirit of the Aarhus Convention in a number of areas: the establishment of an environmental complaints board and the potential establishment of a nature protection council.

According to Sejersen (2003) the Greenland society should continue discussions and reevaluations of the terms optimal and sustainable use of the natural resources under the changing environment.

In relation to development of tourism in Greenland, Kaae (2003) suggests priority to projects integrating tourism, natural science, and sustainable use of nature. For example project cooperation between research institutions and the tourist business, and projects which better integrate and make use of local Greenlandic expertise.

Addressing chemical pollution in West and East Greenland

Environmental chemical contaminants are a global problem. Their presence and role in the Arctic reflects the physical, biological, and social characteristics of the region, as well as the way the Arctic interacts with the rest of the world.

The pollution stemming from the industrialised world is caused by a complex of causes and the solution is to stop/reduce the chemical pollution which leads to problems for the biota in Greenland. The latter needs international actions such as AMAP and the OSPAR Commission (see AMAP, 2002; OSPAR Commission, 2000). However, pollution from mining and hunting is mainly a “local Greenland” problem, as the use of lead shot contaminates bird’s meat, which subsequently is a significant lead source to bird eaters (Johansen et al., 2004). This problem may be solved by replacing lead with non-toxic alternatives.

Improved knowledge

Current concern about Arctic contaminants began with discoveries of high levels of persistent organic pollutants (POPs) in some indigenous inhabitants of the Arctic. Subsequent research confirmed that Arctic animals have elevated levels, posing a threat not only to the people who eat them but also to the animals themselves, and their ecosystems.

In 1991, the eight Arctic countries – Canada, Denmark, Finland, Iceland, Norway, Sweden, Russia, and the United States – initiated the Arctic Environmental Protection Strategy.

Under this framework, the countries pledged to work together on issues of common concern. Recognising the importance of the environment to the indigenous communities of the Arctic, the countries at that time included three indigenous organisations in their cooperative programs. In 1996, the eight Arctic countries created the Arctic Council, incorporating the Arctic Environmental Protection Strategy and expanding it to include sustainable development issues. They have also included three more indigenous organisations for a total of six permanent participants.

One of the programs created under the Arctic Environmental Protection Strategy and continued under the Arctic Council is the Arctic Monitoring and Assessment Programme. AMAP was designed to address environmental contaminants and related topics, such as climate change and ozone depletion, including their impacts on human health (AMAP, 2002). Its specific task in Phase I of its existence was to prepare a comprehensive scientific assessment on these matters.

The conclusions and recommendations from the first scientific assessment led to substantial progress in addressing the problem of contaminants. They raised the profile of environmental contamination in the Arctic as a public policy issue, and helped in the preparation of dietary guidelines in several countries.

Improved international cooperation

At the time AMAP began its work, the United Nations Economic Commission for Europe (UN ECE) Convention on Long-range Transboundary Air Pollution was already considering whether it should take action on POPs and heavy metals. The data compiled by AMAP over the next several years established a strong case for restricting or eliminating several POPs.

Several important steps have already been taken to address the threats POPs pose to the Arctic environment, such as the Stockholm Convention and the UN ECE POPs Protocol. The AMAP (2002) assessment shows the continued need to bring Arctic concerns about POPs to the attention of these international policy fora to ensure continued emphasis on Arctic needs.

Conventions regulate some POPs

At a national level, the use and emissions of many POPs have been restricted since the 1970s. In 1998, the United Nations Economic Commission for Europe (UN ECE) negotiated a regional protocol on POPs under the Convention on Long-range Transboundary Air Pollution, the Aarhus POPs Protocol, which covers Europe, all states of the former Soviet Union, and North America. All AMAP countries except Russia are signatories to this convention. As of August 1, 2002, the following AMAP countries had ratified the POPs Protocol: Canada, Denmark, Norway, and Sweden. They were able to do so in part because they had learned much from AMAP concerning transboundary contaminants in the Arctic. Indeed, the preamble to the Stockholm Convention explicitly recognises the risks POPs pose to Arctic ecosystems and indigenous health and well-being.

The regional UN ECE agreement paved the way for global negotiations on banning POPs under the auspices of the United Nations Environment

Programme. The Stockholm Convention on Persistent Organic Pollutants was opened for signature in May 2001. All AMAP countries have signed the Stockholm Convention. As of July, 2002, Canada, Iceland, Norway, and Sweden had ratified it.

Both agreements identify a number of specific POPs to be banned or whose use or emissions are to be restricted. They include industrial chemicals and by-products, such as PCBs, dioxins, furans, and hexachlorobenzene. Also included are a number of organochlorine pesticides: aldrin, chlordane, dieldrin, DDT, endrin, heptachlor, mirex, and toxaphene. Together, these are often called the 'dirty dozen'. Some POPs, most notably the pesticide hexachlorocyclohexane (HCH), are covered in the UN ECE Protocol but not the Stockholm Convention. For several of the listed substances, some limited use is allowed, for example DDT for fighting malaria.

The conventions also define criteria for including new chemicals based on their persistence, bioaccumulation, potential for long-range transport, and adverse effects. The Arctic is well suited as an indicator region for long-range transport. Monitoring data that provide information about the fate of chemicals in the Arctic will therefore be critical in identifying new POPs to be considered under the agreements.

In addition to national regulations concerning emissions and use of heavy metals, some significant steps have recently been taken internationally to address the heavy metals. The United Nations Economic Commission for Europe (UN ECE) Convention on Long-Range Transboundary Air Pollution adopted a Protocol on Heavy Metals in 1998. The protocol targets mercury, lead, and cadmium. Countries that are party to the protocol will have to reduce total annual emissions to below the levels they emitted in 1990.

As of June 15th, 2002, there were 36 signatories to the protocol, including all the Arctic countries except Russia. Of these, 10 had ratified it, including Canada, Denmark, Finland, Norway, Sweden, and the United States. For the protocol to enter into force, sixteen countries must ratify it. At its meeting in 2000, the Arctic Council called on the United Nations Environment Programme (UNEP) to initiate a global assessment of mercury that could form the basis for appropriate international action. This request was based on the findings of AMAP's first assessment. In 2001, the UNEP Governing Council agreed to undertake such a study. At the same time, UNEP agreed to tackle the issue of lead in gasoline. The study on mercury will summarise available information on the health and environmental impacts of mercury, and compile information about prevention and control technologies and practices

and their associated costs and effectiveness. In addition, the UNEP Governing Council requested, for consideration at its next session in February 2003, an outline of options to address any significant global adverse impacts of mercury. These options may include reducing and or eliminating the use, emissions, discharges, and losses of mercury and its compounds; improving international cooperation; and enhancing risk communication.

The Arctic Council also decided to take cooperative actions to reduce pollution of the Arctic. In 1998, the Regional Programme of Action to Prevent Pollution of the Arctic Marine Environment from Land-Based Activities was adopted. As a direct follow-up of the AMAP scientific assessment, the Arctic Council Action Plan to Eliminate Pollution of the Arctic was created to address sources identified by AMAP. This plan was approved in 2000 and several projects have begun.

In addition to its recommendations on contaminants, the AMAP assessment recommended further work on climate change and ultraviolet radiation. In 2000, the Arctic Council approved the Arctic Climate Impact Assessment, overseen by AMAP, its sister working group on Conservation of Arctic Flora and Fauna (CAFF), and the International Arctic Science Committee. According to AMAP (2002), this impact assessment will deliver a report to the Arctic Council in 2004.

Addressing habitat modification in North Greenland

As described above

Addressing global climate change

Habitat modification due to climate change is a global problem, and climate change is dealt with by UN Intergovernmental Panel on Climate Change (IPCC) (e.g., Jørgensen et al., 2001; Anon., 2003a).

The Kingdom of Denmark comprises Denmark, Greenland and the Faroe Islands. The UN Framework Convention on Climate Changes has been ratified on behalf of all three parts of the Kingdom (Anon., 2003a).

The ultimate objective of international climate cooperation is described in Article 2 of the UN Framework Convention on Climate Change, namely to achieve a "stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system".

In September 2001, the UN Intergovernmental Panel on Climate Change (IPCC) presented its Third Assessment Report. The report shows that there is now stronger evidence for a human influence on the global climate than previously assumed, and that most of the observed warming at the Earth's surface over the last 50 years is likely to have been due to human activities.

The climate changed during the twentieth century, and larger changes are expected in the twenty-first century. No one knows the exact scope of future climate change. However, today no one can doubt the risk that climate change will affect humans and the environment in both the rich and the poor parts of the world. Taking climate change seriously has become a prerequisite for achieving sustainable development.

The Danish government takes global climate change seriously, within the framework of the Kyoto Protocol, under the auspices of the EU, Denmark is committed to reducing its emissions of greenhouse gases by 21% in 2008-12 compared to the level in 1990, taking into account the unusually high import of electricity in 1990 (Anon, 2003a). This is one of the hardest reduction targets in the world.

Since Denmark issued its First (1994) and Second (1997) National Communication under the UN Climate Convention, the Kyoto Protocol has been adopted, and the Conference of the Parties has taken the decisions necessary on realisation of the Protocol. Denmark ratified the Kyoto Protocol together with the other EU countries on 31 May 2002. The Danish government hopes that the Protocol will enter into force in 2003, policies and measures, including national action plans are described in Anon. (2003a).

As part of the national action plans for Greenland the GIWA-Greenland task team experts recommended that Greenland participate actively in the International Polar Year 2007. The year 2007-2008 will mark the 125th anniversary of the First International Polar Year (1882-1883), the 75th anniversary of the Second Polar Year (1932-1933), and the 50th anniversary of the International Geophysical Year (1957-1958). It will obviously be a good idea for Greenland to actively participate in the planning of the International Polar Year 2007 (<http://ipy.gsfc.nasa.gov>). The IPY-2007 will be a good opportunity for Greenland to inform the world of the severe changes for Arctic life caused by the predicted global warming.

to inform the UN and the world about the impact of climate change and chemical pollution and to take active part in solving the root causes to the problems. Through its memberships and active participation in international organisations e.g. Arctic Council, AMAP, ICES, NAFO, NEAFC, JCCM, NAMMCO, IWC, etc., Greenland is very aware of the threats to the habitats, biota, and human health of overexploitation, climate change and chemical pollution, and want to actively participate in the international discussions to address the external impacts on the marine ecosystems of Greenland.

Conclusions

Many of the root causes for overexploitation of Greenland's marine resources are to be solved within Greenland. However, climate change and chemical pollution from outside Greenland influence and have severe impact on the dynamics of natural resources and human health in Greenland. Both climate change and chemical pollution are caused by the industrialised world and they are global international problems to be solved in international cooperation. It is important for Greenland