



# Protecting the environment of the Arctic ecosystem

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## Outline

- What is the Arctic?
- The Arctic marine environment
- Key environmental challenges

### Integrated Management Plan for the Barents Sea

- Integrated management through collaboration and co-management
- Management by areas
- The integrated management planning process



# Current and potential threats

- **Biological resource exploitation**
  - Pelagic fisheries
  - Bottom trawling/dredging (fish + clam)
  - Hunting (marine mammals)
- **Pollution**
  - Persistent organic pollutants
  - Radioactivity
  - Petroleum activity
- **Shipping**
  - Oil from Russia
  - The northern Sea Route
- **Climate change**

B. Gulliksen

Generally, food chains in the Arctic are relatively short, with few, but robust species. Because short food chains can be relatively unstable, the effects of variations in the volume of Atlantic water inflow and anthropogenic impacts could be pronounced. Moreover, many Arctic species have special adaptations (with respect to food availability, fat storage, life cycle, behaviour, etc.) which could make them vulnerable in certain situations. Seabird colonies could be affected by environmental changes in feeding areas because many seabirds travel great distances from their colonies in search of food.

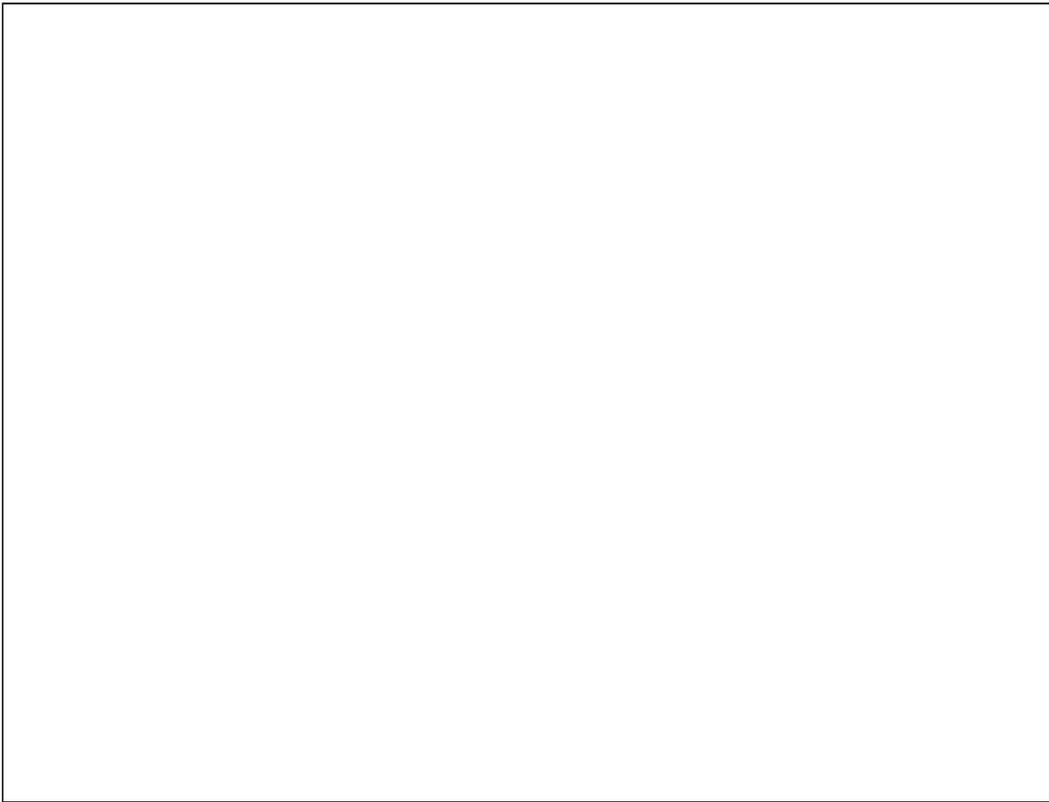
Factors which potentially affect the environment in the marine areas around Svalbard include the harvest of biological resources, various kinds of pollution (persistent organic pollutants, heavy metals, radioactivity, hydrocarbons), tourism and other kinds of human activity in vulnerable areas, the introduction of new species and climate change (including global warming and thinning of the ozone layer).

Since the area encompasses historical, aesthetic, scientific and educational values with significance for both national and international society, it is crucial to maintain an overview of and to continually monitor the impact factors in the area. Also consider that fish caught in the Barents Sea are marketed as among the purest in the world. For economic reasons, this reputation should be protected.

Of the marine mammals, the minke whale is the only species hunted in the analysis area, apart from some seal (bearded and ringed) individuals taken by local hunters and residents in the settlements of Svalbard. (The commercial hunting grounds for harp and hooded seals lie outside the analysis area.) In 2001 the total quota for minke whale was 549 animals. 40 % of the hunting quota is allocated to the Barents Sea and just under 20 % go to Svalbard.

The effects of persistent organic pollutants (POPs) in Arctic environments are not yet adequately understood, but these are considered to constitute a serious threat for animals at the top of the food chain. There is great variation among species with respect to the degree in which harmful substances are tolerated, biomagnified, broken down, etc. There are also synergistic effects to take into account, and the stage in the animal's life cycle plays a significant role. POP levels in glaucous gull and polar bear are several times higher in the Svalbard area than, for example, in the Canadian Arctic, and they are above the values which are expected to have harmful effects. This draws attention to the potential impacts of long-distance transported pollution on populations which inhabit otherwise apparently pristine areas. Furthermore, levels of new environmental toxins (brominated compounds and several pesticides) are on the rise in the environment. Although local pollution in the vicinity of the settlements is to be expected, results of a recent study showed relatively low values in the investigated benthos, compared to similar investigations on mainland Norway. Only PCBs show significantly raised levels.

Radioactive discharges (Sellafield, Dounreay and north-west Russia), in addition to potential discharges in connection with oil and gas prospecting and exploration in the Barents region, are potential threats in the area. There is currently little risk associated with radioactive pollution in the marine environment. With regard to petroleum activity, the possibility for severe leaks, as well as discharges from regular production, especially of processed water (which increases with the age of the field), must be evaluated. We know too little today about the long-term effects of processed water on biota. With acute discharges, the consequences for biota will vary depending on the time of year, the type of emission, affected organisms (e.g. alcids cannot fly during a 45–50 day moulting period and are therefore extra vulnerable to oil pollution), etc. The combination of low temperatures, long periods of darkness and the possibility for ice make oil and gas extraction in Arctic areas particularly risky. More activity is also associated with increased waste dumping from ships, as well as greater risk of wrecks. Moreover, oil and gas extraction can come into conflict with other economic activities, such as the potential exploitation of products (including ones as yet unknown) from marine organisms for medicine, research and industry.



Shipping is an important source of major oil spills via accidents and through illegal discharges. Major oil spills from shipping often occur close to land in vulnerable areas, and in the future tankers will be carrying large amounts of crude oil from North-western Russia and travelling close to the Norwegian coast. Together with increased interest in petroleum exploitation in the Barents Sea, this calls for preventive measures and preparedness for emergencies in order to limit damage. This demands close co-operation with the Russian authorities. But, in the Barents Sea region there is limited scope for effective protection against oil spills during the dark part of the year.

Though tourism has perhaps the greatest effects on land, marine systems can also be impacted by virtue of effects on important seabird nesting areas, moulting and birthing sites for seal, etc. Cultural remains associated with old hunting sites are often located right in these areas. According to the office of the Governor of Svalbard, the total number of landing sites outside the settlements and Isfjorden has been between 80–90 the last three years and between 20–25 000 persons have been on land. Ship traffic in connection with mining and settlement also present a challenge. Ships of a certain size and ice class, as well as comprehensive safety measures, are required, but these are expensive.

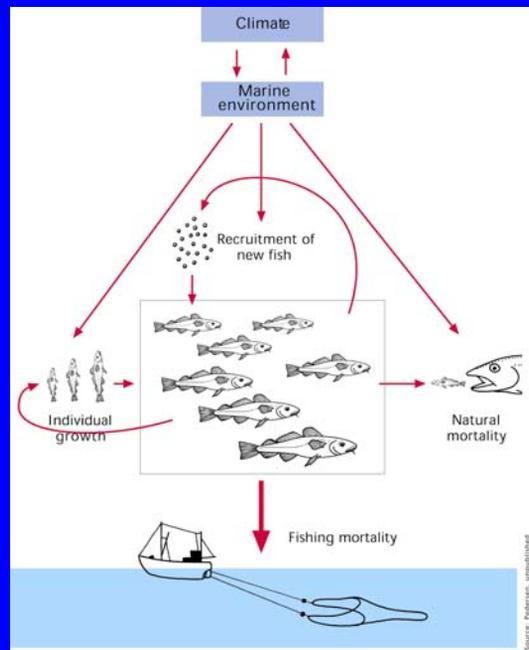
Today, introduced species in the Svalbard area hardly constitute a major threat to the marine environment, but as ship traffic increases so does the probability that new species can be introduced via released ballast water. The European Environmental Agency (EEA) lists 11 introduced species (macroalgae and benthic animals) to the Arctic. Four of these are registered in Svalbard.

# Relationships

A population of fish is a variable unit in which the size distribution and the biomass of the animals is constantly changing.

The rates of hatching, growth, and death in the population are influenced by changes in the marine environment.

Fishery is an additional source of mortality that affects the natural balance



Born & Böcher (2001)

About 150 fish species, of which only a few are commercially important (especially Northeast Arctic cod, Northeast Arctic haddock, capelin, Norwegian spring spawning herring, Northeast Arctic Greenland halibut and deep-sea redfish), are registered in the Barents Sea. Capelin and Polar cod are key species in the northern Barents Sea pelagic food web and the food web associated with the ice. South in the Barents Sea, cod and herring are considered key species. A fish population is especially influenced by cannibalism, competition for food resources, predation from organisms higher up in the food chain, various environmental factors (determining, among other things, larvae survival), the volume of water flowing into the Barents Sea and fisheries. The banks are important nursery and feeding areas for many species.

# Petroleum hydrocarbons

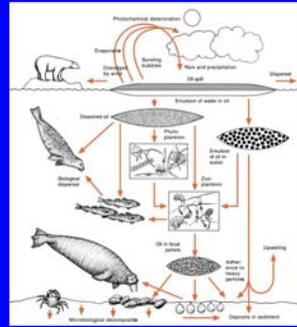
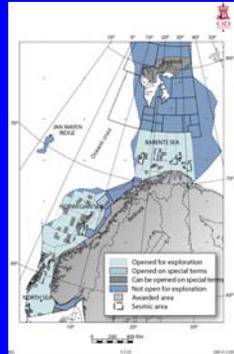
- Several components
- Types of spills
- Dispersal routes
- Environmental consequences
- Exploration Status on the Norwegian continental shelf



Ministry of Petroleum and Energy



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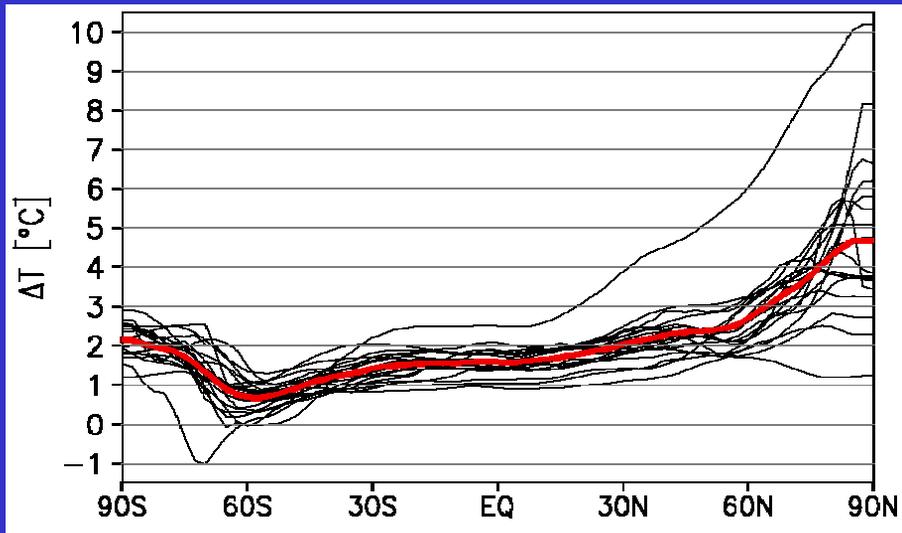


Born & Böcher (2001)

The southern part of the Barents Sea was opened up in 1989, cf. Parliamentary Report No. 40 (1988-89) on opening up the Barents Sea for oil prospection. Up to now 59 test wells have been drilled and according to the Norwegian Petroleum Directorate it is no more complicated to drill in the Barents Sea than in other parts of the Norwegian continental shelf. However, the areas around the Lofoten Islands and northwards from there contain some of the world's most important resources in terms of fish, sea birds and marine mammals. The physical and climatic conditions make the ecosystems very vulnerable to any impact, and the Government is therefore of the opinion that an impact assessment of year-round petroleum exploitation should be carried out for the areas stretching from the Lofoten Islands and northwards.

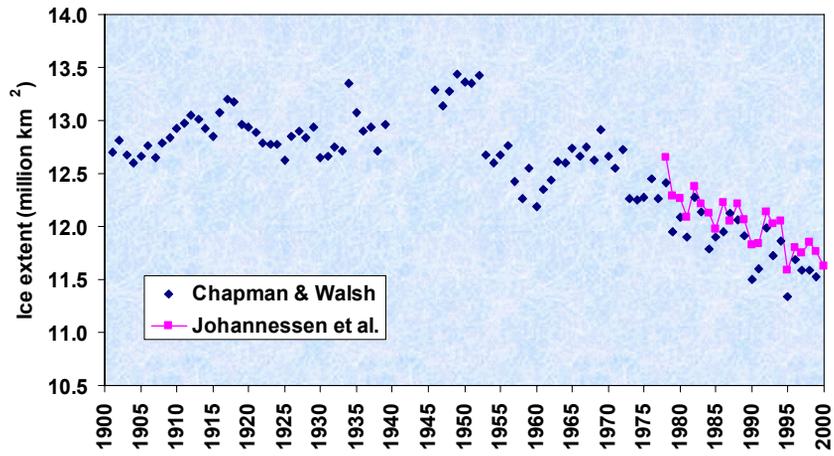
The Barents Sea (North of 74° 30') is not open for prospecting operations. An investigatory programme for the area was drawn up by the Ministry of Petroleum and Energy in 1991, but no impact assessment of the consequences of petroleum exploitation for the area has been undertaken. Many of the surveys planned pursuant to the investigatory programme were, however, carried out and the results of these are presented in a synthesis report.

## Zonal average of 19 climate models

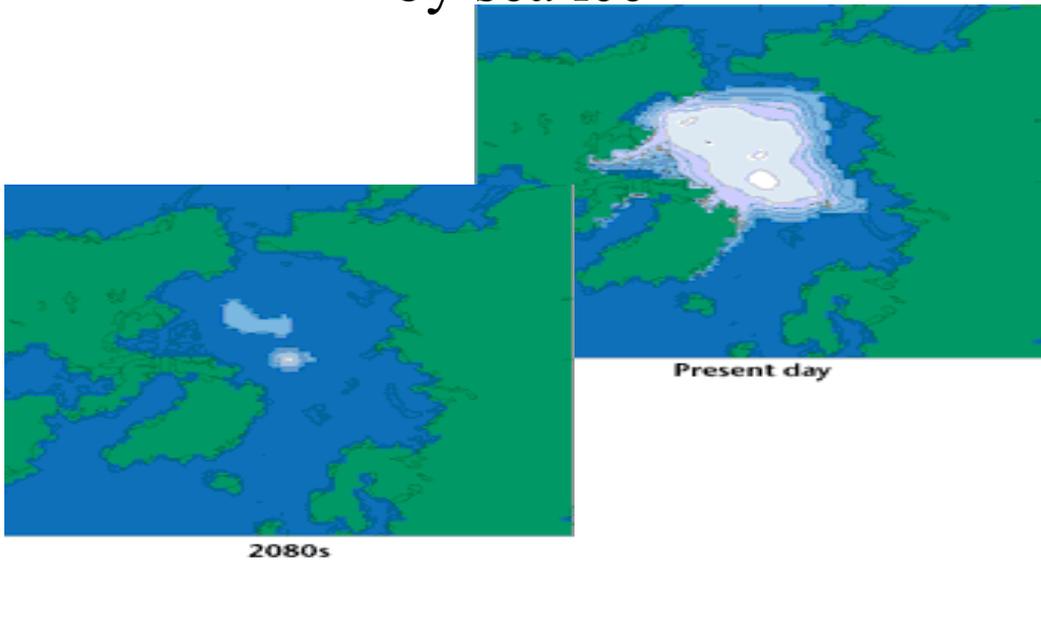


<http://www-pcmdi.llnl.gov/cmip>

# Arctic ice extent 1900 - 2000



# Fraction of ocean covered by sea ice



# Why the Barents Sea?

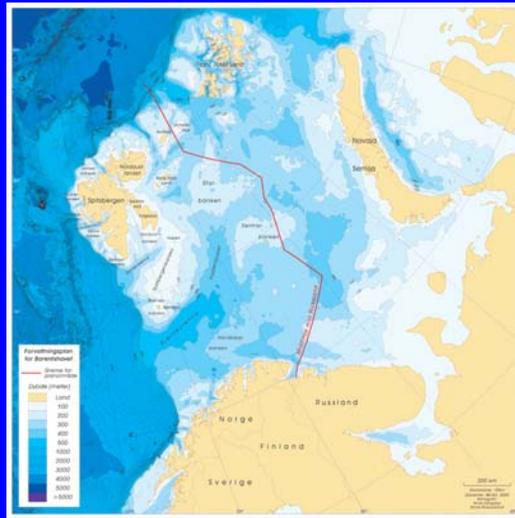
- **Economic sector**
  - Fisheries
  - Petroleum activity
- **Environmental considerations**
  - Biological production
  - Biological diversity
- **Other interests**
  - Geopolitical
  - Military

The ultimate objective is to establish Integrated Management plans for all of Norway's coastal and marine waters. As a first step the Government envisages drawing up an integrated management plan for the Barents Sea where overall account is to be taken of the environment, fishing activities, oil operations and shipping. Experience gained from this work can then be used as a basis for a decision to develop similar, integrated management plans for the Norwegian Sea and the North Sea.

There are many reasons why the Government wants to start with the Barents Sea and to establish frameworks for future activities in this area which ensure the preservation of the quality of the environment. This is a maritime area, which is exposed to human activities to a relatively small extent. It is one of the areas in the world, which has the most abundant populations of fish, sea birds and marine mammals that it is important to preserve for future generations. Many of the stocks merit international protection. The main characteristics of the ecosystems are known, but we know very little about how pollutants affect species and systems. Low temperatures and drift ice mean a lengthy degradation period for oil and chemicals discharged into the environment. These factors, along with high waves at times during the dark season of the year considerably reduce the scope for effective systems to deal with acute oil pollution. A weaker infrastructure in the provinces of Nord-Troms and Finnmark than that found in other parts of the country also makes it more difficult to deal with emergencies.

## Geographical area

- **The shelf break, the continental shelf, including the areas north of Svalbard and the Lofoten area**
- **Other areas – when natural for the description of a species**
  - i.e. migrating species



The average depth in the Barents Sea is 230 m, but Storfjordrenna is 250–350 m deep and Bjørnøyrenna is 400–500 m. The deep channels on the continental shelf to the west of Svalbard are characterized by horizontal soft bottom resulting from accumulated sediments. It is well suited to bottom trawling and yields the greatest shrimp catches around Svalbard. In contrast many banks have relatively little sedimentation because of the strong current, others are retention areas, while Spitsbergen have depths of 20–100 m. Mixing reaches the bottom and cause a steady supply of nutrients at the same time as there is sufficient light for production, resulting in one of the most productive areas in the Barents Sea.

Some species of fish and seabirds spend only parts of the year in the analysis area. Examples include Norwegian spring spawning herring, capelin and Northeast Arctic cod. The Barents Sea is an important nursery area for these species. For capelin and Northeast Arctic cod, it is also an important feeding area. Polar cod, a typical circumpolar fish, has its spawning, nursery and feeding areas in the Barents Sea. With the exception of ivory gull and black guillemot, most common seabird species migrate southward during the winter half of the year. Some whale species have polar feeding areas and temperate mating and calving areas (e.g. minke, fin and humpback whales), while others reside in the polar region the year round (e.g. white whale, narwhal and bowhead).