



## Fish farming in the Arctic

Aquaculture is the fastest growing food sector in the world. In the Arctic sealice, contaminated discharge, and escaping fish remain problems. **BY DAG NAGODA AND MAREN ESMARK**

More stable and predictable production volumes, as well as large markets in the EU and the US, are among the advantages of aquaculture, the farming of marine organisms, seen from a business perspective. There is already a large salmon and trout industry in northern Norway. In northwest Russia there is some production of salmon, rainbow trout and mussels. The Russian market for seafood is growing, and both the Norwegian and Russian governments advocate further development of aquaculture in the Barents Sea Region.

### Impacts of aquaculture on the Arctic environment

If properly regulated, aquaculture can provide good opportunities for local development without large impacts on the ecosystem. Poorly managed and poorly regulated aquaculture, however, can

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have severe negative impacts through the release of excessive nutrients and chemicals, as well as escapes of farmed fish and the risk of disease transfer. The expansion of the aquaculture industry gives rise to two overriding concerns: the intrusion of fish farms into vulnerable marine and coastal areas, and the overall sustainability of an industry that depends on large catches of wild fish to feed farmed fish.

In the Barents Sea there are different types of aquaculture. Mussel farming is conducted in sea, with natural seeding, and apart from potential local conflicts with seabirds, this production has no significant environmental impact on the marine ecosystem. On-shore fish farming of species such as charr and trout is possible in Arctic areas, even in low temperatures, if clean water and energy for heating is available. Environmental impacts of such production are limited. However,

the extraction of freshwater from rivers can have severe impact on the river habitat. Discharge of waste water can contain harmful concentrations of nutrients, chemicals and be a potential source for infection of, for example, the lethal salmon parasite *Gyrodactylus salaris*.

### Less discharge – for now

The most common aquaculture production in the Barents Sea is that of open sea cage farming of Atlantic salmon (*Salmo salar*) and rainbow trout (*Oncorhynchus mykiss*). Improved farming techniques over the last ten years have severely cut the amount of nutrients released from such farms and good monitoring systems address local impacts on bottom habitats. However, sufficient regulations for controlling cumulative effects of several farms in one area are missing. The use of antibiotics has been significantly

reduced, but might increase as new species are developed and new diseases appear. Copper is toxic to marine organisms, and is used as an anti-fouling agent on nets. As the industry grows, so does the total discharge of copper.

### 600,000 escapees a year

The total number of escaped farmed fish in Norway in 2002 was 630 000 salmon and trout. Ecological impacts of escaped fish are mediated through habitat and feed competition, genetic pollution and the spread of parasites and infectious diseases. Historically, the amount of escaped fish has been low in Troms and Finnmark county. However, the numbers for 2002 shows that at Kinn, in Troms/Nordland, there was an alarming 48 percent of farmed fish caught in the sea fishery. In the Altavassdraget (Altariver) the catch included 20 percent escaped fish in 2002.

### Sealice infect the fish

Sealice is another problem connected with fish farming. The louse is a marine parasite, naturally occurring on salmonids. More than ten lice can be lethal to migrating smolts. The millions of farmed fish that stay in coastal areas all year round now serve as a host for the sealice and can be a reservoir for the parasite. In 2002, results from Møre and Romsdal County up to Finnmark County show that infections of sealice are significant, and are likely to affect local stocks of seatrout and Arctic charr.

### Indirect impacts on wild fish stocks

Because most species used in marine fish farming are carnivores, fish farming causes a high demand for fatty and protein-rich fish feed. Most fish species used for fish feed are important for the marine ecosystem, as they are prey for fish, birds and mammals. In Norwegian fish farms, 1 kg of farmed salmon requires 3–4 kg of wild caught fish. Species occurring in the North Atlantic, such as capelin, herring, Norway pout and blue whiting are frequently used in fish feed. An expansion of the aquaculture industry in the Arctic will therefore increase pressure on wild fish stocks.

Given the increasing interest in aquaculture in the Barents region and its potential negative impacts on the ecosystem, the mitigation measures undertaken in the future will decide if the industry develops in a sustainable fashion or turns into a new major threat to the biodiversity in the Barents Sea.

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This text is part of a large report to be published in November 2003 by WWF, A Biodiversity Assessment of the Barents Sea Ecoregion. Please contact WWF's Barents Sea Program for more information at + 47 22 03 65 00 or info@wwf.no

## Understanding human development in the Arctic

A first-ever Arctic report on human development will be issued in 2004. The report is uniquely based on a mix of UN and traditional values and concepts.

**BY ORAN R. YOUNG**

The concept of human development has become popular in recent years among those seeking an alternative to Gross Domestic Product (GDP) per capita as a measure of the quality of life. But what does this concept mean in the Arctic? This question has emerged as a key issue for those seeking to fulfill the Arctic Council's mandate to produce an Arctic Human Development Report (AHDR) in time for delivery at the next ministerial meeting in 2004.

The UN Development Programme (UNDP) has devised a Human Development Index (HDI) based on an average of three distinct factors: (1) a long and healthy life measured in terms of life expectancy at birth; (2) knowledge measured as a combination of adult literacy and school enrollments; and, (3) a decent standard of living construed as GDP per capita. Simple as it is, the HDI has allowed UN statisticians to show that beyond a certain point this broader measure of human development diverges significantly from GDP per capita.

This is an important result. But is the HDI a good measure of human development in the Arctic? It is hard to quarrel with some aspects of the HDI. Who does not wish to enjoy a long and healthy life? But the deeper team members behind the new Arctic report have delved into the meaning of human development in the Arctic, the more they have come to doubt the usefulness of the HDI in this setting.

### The good life

Many Arctic residents – especially those who are indigenous to the region – associate a good life with the maintenance of traditional hunting, gathering, and herding practices. Yet it is difficult to use indicators like GDP per capita to measure the health of these subsistence systems. For many, a good life is one that minimizes the need for the sorts of material goods and services implicit in the idea of GDP per capita

as a measure of welfare.

Nor is the situation any clearer with regard to knowledge. Arctic residents often possess extraordinary knowledge. But their education may not produce high scores in terms of measures like adult literacy and gross enrollments. Even the simple notion of life expectancy at birth is suspect in this setting. Living a long life is undoubtedly desirable. But what if the choice is between a shorter life rooted in traditional activities and a longer life spent trying to adjust to the loss of a deeply valued lifestyle and the need to function in an alien setting?

### A broadened concept of HDI

Considering these issues, the Arctic Report's Steering Committee decided early on that computing and tracking changes in the HDI should not be the starting point for the assessment of human development in the Arctic. The report will not contain an alternative index of human development that can be compared directly with the UN's HDI. The issues at stake – ranging from efforts to establish rights through responses to rapid social change and on to the challenges of changing gender roles in the circumpolar world – are too complex for that.

Rather, the report will seek to broaden the concept of human development, documenting dimensions of the quality of life that are critical to Arctic residents but yet do not show up in any meaningful way in the HDI. The goal is to contribute to the development of Arctic-specific policies that will improve the quality of life in this region, without imposing a concept of human development that is not based on the realities of life in the Arctic and that does not capture the aspirations of many of the region's residents.

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For more information on the project in terms of structure and process, chapters and lead authors, I recommend a visit to the web site of the project secretariat at the Stefansson Arctic Institute, [www.svs.is](http://www.svs.is).

### The chapters of the Arctic Human Development Report

1. Introduction to Sustainable Human Development in the Arctic
2. Arctic Demography
3. Arctic Economies
4. Arctic Environments and Resource Governance in the Arctic
5. Globalization and the Arctic
6. Arctic Political Systems
7. Arctic Legal Issues
8. Arctic Societies and Cultures: Change and Persistence
9. Human Health in the Arctic
10. Human and Social Capital in the Arctic
11. Community Viability in the Arctic
12. Gender Issues in the Arctic
13. International Cooperation in the Arctic
14. Conclusions and Key Issues