Ecosystem Studies of Sub-arctic Seas (ESSAS)

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INTRODUCTION

A comparative Ecosystem Study of the Sub-Arctic Seas (ESSAS) is being planned that may become a regional program within GLOBEC. These sub-Arctic seas require attention because they:

- Have high biological productivity.
- Contain the largest commercial demersal fisheries in the Northern Hemisphere.
- Are home to large numbers of marine mammals and migratory seabirds.
- Are projected to be strongly affected by global climate change.

Goal of ESSAS: *To compare, quantify and predict the impact of climate variability on the productivity and sustainability of subarctic marine ecosystems.*

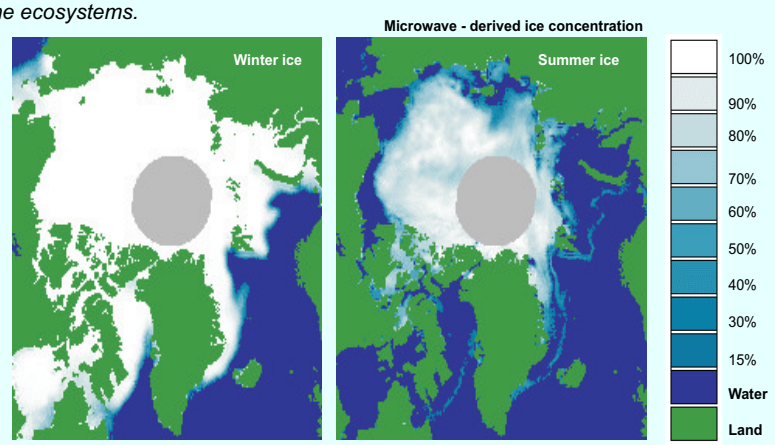
AREA OF INTEREST

The intended areas of interest include the Barents Sea, the Nordic Seas, Icelandic waters, West Greenland, the Labrador and Newfoundland shelves, the Gulf of St. Lawrence, Hudson Bay and Hudson Strait, the Bering Sea, the Sea of Okhotsk, and the Oyashio Region.

SEA ICE

Subarctic seas exhibit large variability in both seasonal and interannual ice coverage. Sea ice

- controls heat exchange with the atmosphere,
- determines the depth of light penetration, and
- is an important source of freshwater and vertical stratification in the spring when it melts.

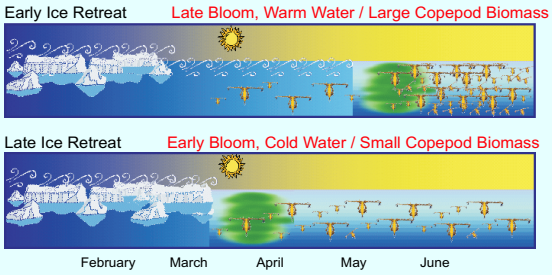


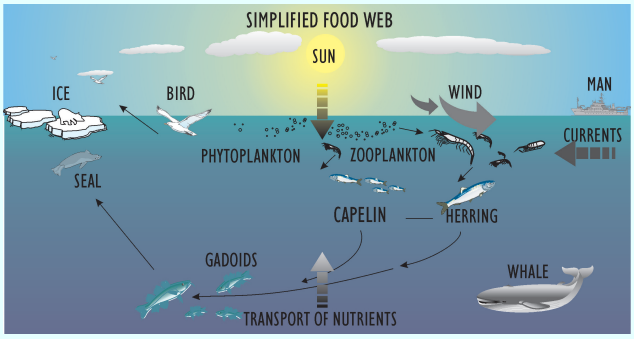
Source: Johannessen & Miles (2000) Science Progress,83 (3), pp. 209-222

PHYTOPLANKTON

Sub-Arctic seas are regions of intense primary production, with some areas having production rates equivalent to the most productive upwelling systems.

In the southeastern Bering Sea, when the sea ice retreats in late winter there is insufficient light to support a phytoplankton bloom and the bloom is delayed until late spring when light and stratification increase (right-hand, top panel). However, when the ice retreat is delayed to the spring, there is then sufficient light to support an ice-associated bloom (bottom panel). A late bloom may be associated with higher zooplankton production. In contrast, in the Barents Sea cold winters with a more southern distribution of ice results in early melting. This leads to a phytoplankton bloom too early for zooplankton and thus low secondary production.





SUBARCTIC ECOSYSTEMS

There are several links common to most subarctic marine ecosystems. These include:

Zooplankton production depends upon the ice-influenced phytoplankton production.

Zooplankton (copepods) is the main food of pelagic species such as capelin, polar cod and juvenile walleye pollock .

Demersal species, such as adult pollock and cod feed mainly on pelagic fish, but also on zooplankton.

Cannibalism by the dominant demersal fish may help regulate their populations.

Recruitment tends to be higher in warm years.

Large abundance of marine mammals, such as seals and whales, and large numbers of breeding seabirds that migrate into these areas in summer.

INTENTION FOR AN ARCTIC COMPONENT WITHIN THE GLOBEC PROGRAM

Strong national programmes focussing upon subarctic seas will be enhanced by comparison with other subarctic regions. Examples of scientific questions being considered for this program include:

What are the ecosystem implications of the differences in advection, wind mixing, and the amount, duration and timing of retreat of sea ice cover in the various sub-Arctic seas?

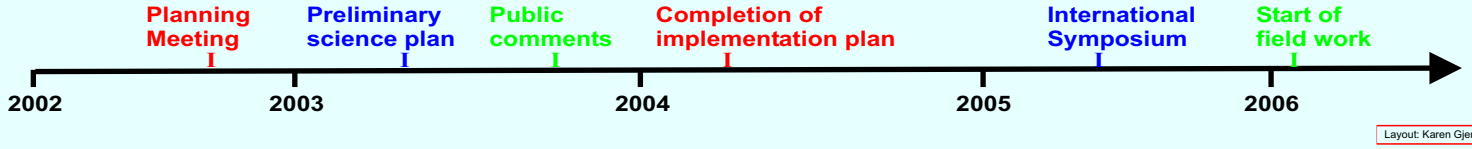
How does latitudinal variation in light availability affect the timing and amount of primary production and the foraging of visual predators?

What determines the temporal variation in the biomass of copepods? What triggers the release of calanoid copepods from diapause, and what are the relative contributions of advection and *in situ* production to the abundance of copepods in the upper water column?

How does the role of cannibalism by the dominant gadoid vary among the subarctic seas, and what are the implications for the regulation and stability of these dominant gadoid species?

PROGRESS PLAN

The initial planning meeting was held in September 2002 and the planning document with an implementation plan will be completed in the spring of 2004. An **International Symposium** on Subarctic Ecosystems is planned for **May 2005** with scheduled field studies hopefully to begin in 2006.



Layout: Karen Gjertsen, IMR