

1. Introduction

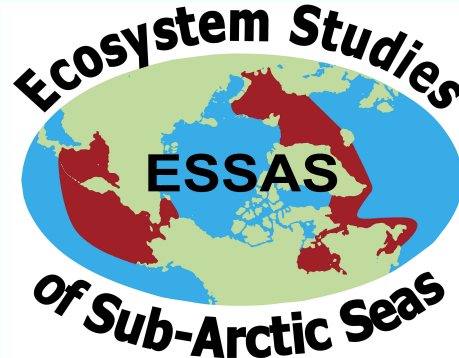
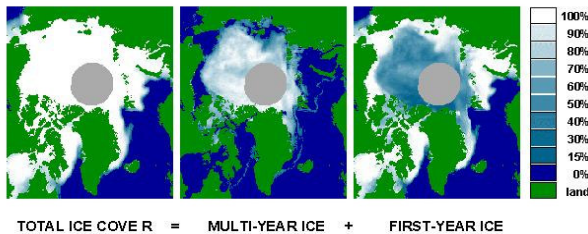
ESSAS is a comparative, ecosystem-based regional programme of GLOBEC.

The Subarctic Seas are important because of:

- High biological productivity
- Large commercial demersal fisheries
- Large numbers of marine mammals and seabirds
- Projected large effects due to global climate change

Goal of ESSAS: to compare, quantify and predict the impact of climate variability on the productivity and sustainability of Sub-Arctic marine ecosystems.

3. Some examples of ESSAS Research Interests



2. Geographical Areas of Interest

• The principal regions of interest within ESSAS are the Oyashio, the Sea of Okhotsk and the Bering in the Pacific and the Barents Sea, the Nordic Seas, Iceland, Greenland shelves, Newfoundland/ Labrador shelves, Gulf of St. Lawrence and Hudson Bay in the Atlantic (outlined in red in ESSAS logo).

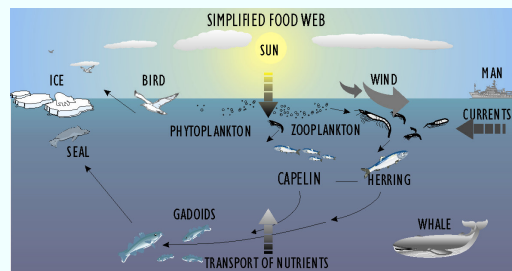
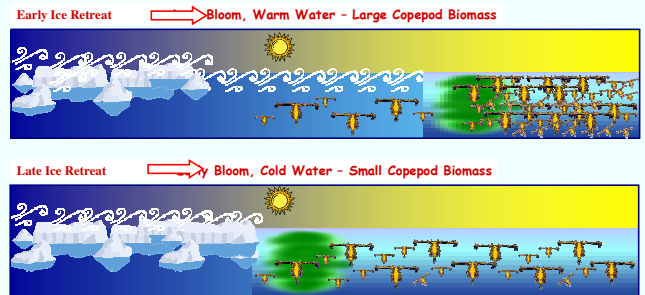
SEA ICE

- Subarctic seas exhibit large variability in both seasonal and interannual ice coverage. Sea ice:
 - controls heat exchanges with the atmosphere
 - determines the depth of light penetration
 - is an important source of freshwater and vertical stratification in spring when it melts.
- Most of the subarctic seas will lose all or substantial portions of their seasonal ice cover. **What effect will this have on the marine ecosystem?**

PHYTOPLANKTON PRODUCTION

• Subarctic seas are regions of intense primary production with some areas having production rates equivalent to upwelling systems.

• In the SE Bering Sea, when sea ice retreats in late winter there is sufficient 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 sufficient light to support an ice-associated bloom (bottom panel). A late bloom tends to 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 results. **Why is there a difference between regions?**



ECOSYSTEM STRUCTURE AND FUNCTION

- There are several links common to most subarctic marine ecosystems. Some of these are:
 - Zooplankton (copepods) are the main food of forage fishes.
 - Demersal species, such as adult pollock and cod, feed mainly on forage fishes but also on zooplankton
 - Warm conditions tend to promote higher recruitment of demersals.
 - Production and community structure and function change under different climate conditions.

What will the response be to future climate change?

4. Present ESSAS National Programmes

- Japan-ESSAS on the Oyashio Region
- The US Bering Sea Study (BEST) in the eastern Bering Sea
- Norwegian-ESSAS in the Barents Sea
- Iceland's Iceland Sea Ecosystem Project with a focus on capelin.



For more information contact either of the authors or see the GLOBEC website (www.GLOBEC.org) and follow the links to ESSAS.

5. ESSAS Activities

- A Symposium on Climate Variability and Subarctic Marine Ecosystems was held in May 2005 in Victoria, Canada. Papers from the Symposium will be published in DSR-II.
- A Workshop on Comparisons of Subarctic Ecosystems was held in June 2006 in St. Petersburg, Russia.
- A Workshop on the Role of Sea Ice in Subarctic Marine Ecosystems will be held in June 2007 in Hakodate, Japan.
- ESSAS is leading an International Polar Year (IPY) Consortium consisting of 22 proposals and 14 nations.

