

## ESSAS workshop in St. Petersburg, Russia

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From 12 to 14 June, the first ESSAS (Ecosystem Studies of Sub-Arctic Seas) workshop met in St. Petersburg, Russia, to lay the ground work for developing comparative studies of the sub-arctic seas. To this end, 27 scientists from 6 nations (Canada, Greenland, Japan, Norway, Russia and the USA) attended. Four sub-arctic ecosystems were selected for the first comparison: two from the Pacific (the Okhotsk Sea/Oyashio region and the Bering Sea) and two from the Atlantic (the Newfoundland/Labrador region and the Barents Sea). The workshop was co-sponsored by the International Project Office of GLOBEC and by PICES, both of whom contributed travel funds, while the latter also arranged and provided logistic support at the meeting. Our local host was the State Scientific and Projecting Institute, *GIPRORYBLOT*.

The primary objective of ESSAS, one of the GLOBEC regional programmes, is to understand how climate variability affects the productivity of sub-arctic ecosystems and their ability to support sustainable commercial and subsistence fisheries. The ESSAS Science Plan outlined a 5-stage implementation strategy that consisted of (1) ecosystem summaries, (2) regional programmes, (3) comparative analyses, (4) prediction and (5) synthesis. The first major ESSAS activity was the Symposium on Climate Variability and Sub-arctic Marine Ecosystems held in Victoria, Canada, in May 2005, which brought together over 220 scientists from different sub-arctic regions to present their recent work and understanding of their particular seas (GLOBEC International Newsletter 11(2)). Thus the Symposium largely addressed item (1). Newly funded ESSAS research programmes in Japan, Norway, Iceland and the US, with some activities also developing in Canada, Russia and West Greenland, provide a strong start on the development of regional programmes (Item 2). Comparative studies between different sub-arctic ecosystems (Item 3) are a major focus of ESSAS. Therefore, building on the Victoria Symposium and other recent work, an ESSAS Workshop was held in St Petersburg to explore how these comparative studies should be developed.

Many excellent compendia of information about particular sub-arctic ocean basins are available, although few have explicitly compared mechanisms and responses to climate forcing across basins or between Atlantic and Pacific systems. For the comparative method to be used successfully, it is necessary

to identify important underlying structuring features of the ecosystems and then determine how climate forcing, acting on those mechanisms, will result in ecosystem change. It is also necessary to develop datasets that can be used to parameterise, test and validate models. Although each system is unique, ESSAS seeks to search for those basic elements common to many, if not all sub-arctic seas.

The workshop began with a presentation on the atmospheric forcing over the four sub-arctic regions by Jim Overland. He showed that all regions have decreasing trends in sea level pressure (more wind forcing), but with no link in the phasing between the basins. Of particular note was the different decadal

forcing between the Barents and Labrador regions in the Atlantic. Surface air temperature associated with variability in the North Atlantic Oscillation have been out of phase between the two sides of the Atlantic, until recently, when both regions showed enhanced warming. In the Pacific, the Bering Sea and Sea of Okhotsk have experienced enhanced heating in winter and spring since 1970. Next Wieslaw Maslowski gave a talk on a physical model for the arctic and sub-arctic

regions. He stressed the importance of the circulation and sea ice on ecosystem structures and showed that many of these features are well represented in existing models. However, he noted that other important processes, such as baroclinic coastal currents and eddies, need increased horizontal and vertical resolution before they will be adequately simulated.

These two talks were followed by several presentations covering the ecosystems of each of the four regions. Several interesting comparisons were made. In the Labrador region, with the collapse of the Atlantic cod stocks in the early 1990s, no cod-like species appeared to fill the niche left vacant by the disappearance of cod, unlike in some more southern systems such as Georges Bank. There was however, an increase in invertebrates, in particular snow crab and northern shrimp, but their biomass was much lower than that of the cod that was formerly present. A similar change occurred off West Greenland in the late 1960s, where northern shrimp increased when the cod disappeared. These responses appear to be the inverse of what happened in the eastern Bering Sea where, when the climate changed in the late 1970s and early 1980s, populations of crabs decreased and pollock and Pacific cod increased.



*ESSAS Workshop participants, St. Petersburg, Russia.*



ESSAS scientists at work.

Recently, all ESSAS regions except the Sea of Okhotsk have experienced warmer than normal sea temperatures and reductions in sea ice coverage. In the Barents Sea, there have been distributional shifts in the fauna, with the appearance of large numbers blue whiting, traditionally a more southern species. Also, the spawning grounds of cod off the coast of Norway have shifted further northward.

In the southeastern Bering Sea, years with cold temperatures and extensive sea ice lead to earlier phytoplankton blooms and more benthic production, while years with warm temperatures and less ice result in later blooms, higher abundance of copepods and less benthic production. These responses were not observed in the Barents Sea, however, and the question arose as to why not? Is it related to the latter's more northern location and the fact that the seasonal cycle in temperature is delayed in the Barents by about a month relative to the Bering? The warm conditions in the northern Bering Sea in recent years have led to significant reduction in benthic production and increase in the pelagic production, but information is lacking for the southeastern Bering Sea.

The workshop participants recognised the importance of understanding the roles of mesopelagic organisms and forage species. For example, we found that there were interesting parallels between the roles played by squid in the Oyashio Current system, and their roles in waters offshore of the continental shelves of eastern Canada.

In addition to the regional presentations and discussions, the workshop developed tables listing the dominant species in the food web (both as prey and predators) for some of the major commercial fish species (or their prey) from nanoplankton up through to their marine mammal predators as a means of focusing the comparisons. Another table listed the major climate processes that affect each of these species. This led to discussions centred on the mechanisms linking climate to the ecosystems followed by evaluation of modelling strategies that could be employed to elucidate how climate variability may impact these marine ecosystems.

The workshop then developed possible ways forward for ESSAS. The idea of focused working groups was adopted. Three working groups were suggested: biophysical coupling,

modelling and climate change predictions. The Modelling Working Group would deal with the various modelling strategies (conceptual, mechanistic and statistical) as part of the comparisons. Questions arose as to whether to integrate the various methods or if they should be pursued separately. The Predictions Working Group would guide ESSAS through developing likely ecosystem responses to future climate change as taken from the most recent Intergovernmental Panel on Climate Change (IPCC) climate scenarios, thereby also addressing part of Item 4 in the ESSAS Implementation Plan. The Biophysical Coupling Working Group would compare different sub-arctic ecosystems through annual workshops. Each workshop would focus on a particular climate variable, for example sea ice, and how the ecosystems were affected by this variable. Emphasis would be on developing papers that compared all or as many of the ESSAS areas as possible. Further implementation of the Working Groups was left to the ESSAS SSC.

In addition to plotting the future of ESSAS, workshop participants were asked to assess how the next edition of the PICES North Pacific Ecosystem Status Report might be modified to increase its utility to scientists developing comparative studies of the PICES regions in the North Pacific. The workshop participants felt that the present format and content were valuable, and that increased standardisation of the content of regional reports would facilitate comparisons. In addition, the development of some tabular comparisons in the Synthesis Chapter could be of value. Although difficult to develop, such tables help to sharpen the focus on the important elements, as was found in the workshop when we attempted to develop tables for the four ESSAS regions comparing trophic linkages and biophysical coupling mechanisms vulnerable to climate variability.

Participants at the meeting also took advantage of the wonderful surroundings, warm weather and delicious food in the many restaurants of St. Petersburg. In addition, most of the participants and several accompanying spouses enjoyed a scenic evening canal and river cruise complete with food and beverages. St. Petersburg offered lots of nightly entertainment with several workshop participants attending one or more of the many ballet, opera and concert performances. The Hermitage Museum, which houses the largest art collection in the world and is located in the former place of the Czars, was probably the number one attraction, although many participants also had a pleasant time wandering around the gardens and fountains at Peterhof, the summer home of Peter the Great.

We, the conveners, would like to thank all of the participants for making our first ESSAS Workshop a great success. Special thanks go to Alex Bychkov, Executive Secretary of PICES for his support and efforts in arranging the venue and logistics for the meeting, and to those at the *GIPRORYBFLOT* who also helped, especially Ludmila Zaslavskaya who did an excellent job of seeing that we were well taken care of throughout our stay in St. Petersburg. Thanks also to PICES and GLOBEC for their financial support and encouragement.