Report on recent ESSAS activities

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During the last several months the Ecosystem Studies of Sub-Arctic Seas (ESSAS) regional programme of GLOBEC has been active on several fronts. The following summarises some of the products and activities within ESSAS.

ESSAS special volume

At the end of 2007, the Deep-Sea Research II special volume on Climate Variability and Sub-Arctic Marine Ecosystems was published containing 35 papers presented at the ESSAS kick-off Symposium held in Victoria, Canada, in May 2005 (Fig. 1). The overarching scientific objective of the symposium was to present the current knowledge of the effects of spatial (regional) and temporal (seasonal to multi-decadal) climate variability on the structure and function of sub-arctic marine ecosystems. The volume consists of regional reviews of four sub-arctic regions (Oyashio Current, Eastern Bering, Iceland Sea, and Barents Sea) and a comparative paper on climate forcing in several sub-arctic areas. These regional review papers will serve not only as introductions to the marine literature of each region, but also as benchmarks against which future change may be measured. Disciplinary papers focused on physical and chemical aspects, on primary production, on zooplankton, on higher trophic levels, including benthos, fish, seabirds and marine mammals, and on the human dimension side of climate impacts on marine ecosystems. Many papers focused on mechanisms whereby climate might impact biological processes in marine ecosystems.

Figure 1. ESSAS special issue of Deep-Sea Research II. G.L. Hunt, Jr., K. Drinkwater, S.M. McKinnell and D.L. Mackas. (Eds.). Effects of climate variability on sub-arctic marine ecosystems: A GLOBEC symposium. Deep-Sea Research II 54(23-26): 2453-2970.

Several sub-arctic seas have experienced high air and water temperatures in recent years with subsequent reductions in the extent of sea ice. Moreover, the large-scale atmospheric forcing of the sub-arctic regions can account for the regional patterns of the responses across widely separated sub-arctic seas. Major changes in community structure and changes in the productivity and abundance of major commercial fish species have taken place or are presently occurring. Many species have extended their geographic boundaries northward. Biophysical models have made great strides during the past 5 to 10 years in their ability to simulate the observations, and offer great potential to improve our understanding and predict future changes over the coming years. While it was clear that climate variability affects sub-arctic seas, it was also equally clear that industrial fisheries have played a major role in the restructuring of these marine ecosystems. One major challenge to the scientific community will be to develop a better understanding of ecosystem responses to climate forcing, and to evaluate how these natural forcing factors interact with anthropogenic impacts (activities) to produce the changes that we observe. Another major challenge is to make the results of the research understandable and relevant to the communities affected, including fisheries management.

MENU

The Marine Ecosystem Comparison of Norway and the United States (MENU) involves scientists from NOAA in Wood's Hole and Seattle, the University of Washington, the University of Alaska, and from the Institute of Marine Research in Bergen. MENU is comparing the ecosystems of the eastern Bering Sea, the coastal region of the Gulf of Alaska, the Gulf of Maine/Georges Bank region, and the Barents/Norwegian seas. A MENU workshop funded by the Research Council of Norway was held in Bergen during March 2007. The participants, who covered various components of the ecosystems, brought their datasets and modelling results to the meeting. Based on the synthesis efforts at the workshop, five papers were outlined. Two dealt with the responses to recent climate variability in the different regions, one on physical oceanography and the second on the biota. The other three compared selected characteristics of the ecosystem. These included recruitment of functionally analogous fish stocks, community and trophic structure based on energy budgets and system metrics, and trends in the biotic communities including synchronies, differences, and commonalities. These papers were presented along with the four regional overviews of the different ecosystems to a MENU-sponsored theme session the 2007 ICES Annual Science Meeting in Helsinki Finland titled "Comparative Marine Ecosystem Structure and Function: Descriptors and Characteristics". Four of the comparative papers were also presented at the PICES 16th Annual Science Meeting held in Victoria, Canada, during late October-early November. A special volume of Progress in Oceanography has been commissioned to publish the papers presented at the ICES theme session. The five MENU comparative papers will be submitted to this special volume. In addition to the presentations, talks and

journal articles that emerged from the work within MENU, the collaboration between Norway and US investigators has also resulted in an effort to develop a MENU II proposal. This proposal will be based on what has been achieved in the MENU project, but will be a much larger proposal including more basic research. It is hoped to submit the proposal jointly to the Research Council of Norway and NOAA later this year.

NORCAN

The 3rd meeting of the Norway-Canada Comparative Study of Marine Ecosystems (NORCAN) was held on 14-17 January 2008 in Bergen, Norway. The project includes Norwegian scientists from the Institute of Marine Research in Bergen and Canadian scientists from the Northwest Atlantic Fisheries Center in St. John's, Newfoundland, and the Bedford Institute of Oceanography in Dartmouth, Nova Scotia. It has been funded jointly by the Research Council of Norway and the Newfoundland Region of the Department of Fisheries and Oceans in Canada. NORCAN is comparing different aspects of the ecosystems in the Labrador Sea and Labrador/Newfoundland Shelves with the Barents and Norwegian seas. Eight separate papers are in progress on: climate forcing and physical oceanography; phytoplankton dynamics; ecology of *Calanus finmarchicus*; fish community structure; capelin recruitment; capelin distribution; cod dynamics; and marine mammals. During the first day of the meeting, reports on the progress of the various writing groups were given and linkages between the various papers discussed. The next two days, the different writing groups meet to discuss their papers and proceed with the writing. The final day was spent discussing the progress that had been made at the meeting as well as the form of the synthesis paper that should be written. The plan is to have first drafts of the papers by June and to publish the papers together in the ICES Journal of Marine Science.

Ocean Sciences Meeting Theme Session and Workshop

On 3 March 2008 in Orlando Florida, ESSAS sponsored a theme session on Climate Impacts on Sub-polar Seas: Mechanisms of Change and Evidence of Response. A total of 10 oral presentations and 13 posters were included in the theme session. Two of the former were comparative papers, one on the recent responses in four northern hemisphere regions and the other on the ecology of *Calanus finmarchicus* in the Norwegian and Labrador seas. The remainder dealt with regional issues within specific areas, including the Bering Sea, the North Pacific, the Barents Sea, and the Antarctic. These covered all components of the ecosystem including chemistry, phytoplankton, zooplankton, fish, marine mammals and seabirds. Another ESSAS/MENU-associated theme session on Comparing Aquatic Ecosystems was held on 4 March that attracted five oral presentations and two posters.

During the noon break on 3 March, ESSAS also sponsored a mini workshop on Understanding Climate Impacts on Sub-Arctic Seas: Ecological Issues and Comparative Approaches. The purpose of the Workshop was to exchange experiences and ideas on how to conduct comparative studies. Following presentations on programmes in the eastern Bering and Barents seas and on the MENU programme's comparative studies of the eastern Bering, Gulf of Alaska, Gulf of Maine/Georges Bank and the Barents Sea, a general discussion was held. Methods included the use of ecosystem models and using similar models for different regions and different models for one or more regions. Also it was suggested it is useful to gather together data from each region that one is going to compare and let the data determine the ideas rather than coming with preconceived hypotheses.

Establishment of an ESSAS Project Office

The Research Council of Norway and the Institute of Marine Research (IMR) in Bergen have recently agreed to fund an ESSAS Project Office at IMR. The goal of the ESSAS Project Office will be to facilitate ESSAS activities. The Office will be run by an ESSAS Coordinator, under the direction of ESSAS Co-chairs and SSC. The Office will: organise annual and special ESSAS meetings and workshops including arranging meeting logistics in cooperation with local hosts; help guest editors of ESSAS special volume publications by acting as managing editor (i.e. oversee the review process and participate in editing through ensuring correct formats, proper figures, etc.); write reports of ESSAS meetings including those of the SSC; write summaries of ESSAS meetings for newsletters and the web; liaison with the various institutions involved in ESSAS; develop and maintain an ESSAS website; foster communications amongst ESSAS members; promote ESSAS activities and philosophy; provide information on ESSAS to scientists outside the programme, to funding agencies, the media and the general public; and provide information on ESSAS to the GLOBEC International Project Office and other international organisations when requested. The Coordinator's position will be half time and will be for 5 years. It is presently planned to combine it with a half-time position in physical oceanography at IMR and to hire the person by at least the summer of this year.

2008 ESSAS Annual Meeting

The 2008 annual meeting of ESSAS will be held 15-17 September in Halifax, Nova Scotia, Canada, followed by a two day meeting of the ESSAS SSC. The ESSAS meeting will occur the week prior to the ICES ASC meeting, also to be held in Halifax. The ESSAS meeting will consist of three workshops: (1) the Role of Transport in Sub-arctic Marine Ecosystems; (2) Future Climate Scenarios and their Impacts on Subarctic Regions; and (3) Modelling of Subarctic Marine Ecosystems. The Workshop on Transport will examine the effects of advection on the physical oceanography and biology of sub-arctic seas. The latter includes the role of transport on the supply of zooplankton from the deep ocean onto to the continental shelves, on the drift of fish eggs and larvae, and on biogeographic shifts. The Workshop on Future Ecosystem Impacts will use the most recent IPCC climate scenarios and their physical oceanographic consequences to generate discussion on the possible biological consequences. The Workshop on Modelling Sub-arctic Seas will discuss the use of various biophysical models and how to compare model results from different regions. There will also be presentation and discussion of papers that were outlined and commenced based on workshops held at the June 2007 ESSAS Annual Meeting in Hakodate, Japan. These papers include investigation of the effects of climate change on thresholds affecting ecosystem function and the role of hotspots in sub-arctic seas. Anyone who is interested in attending the 2008 ESSAS meeting and workshops please contact either George Hunt (geohunt2@u.washington.edu) or Ken Drinkwater (ken.drinkwater@imr.no). All are welcome.