

2009 ESSAS Annual Science Meeting

by Kenneth Drinkwater, Margaret M. McBride and George L. Hunt, Jr.

The 2009 Annual Science Meeting (ASM) of the Ecosystem Studies of Sub-Arctic Seas (ESSAS) program was held on June 18–19 at the University of Washington in Seattle (U.S.A.) and attended by approximately 70–80 scientists.

The morning of June 18 was taken up with a plenary workshop on “*Gadoid-Crustacean Interactions*” convened by Drs. Earl Dawe (Canada) and Franz Mueter (U.S.A.), Co-Chairmen of the ESSAS Working Group (WG) on *Climate Effects at Upper Trophic Levels*. This WG is undertaking comparative studies between different subarctic seas to elucidate the processes that lead to shifts between demersal fish, especially gadoids such as cod and pollock, and crustaceans, such as shrimp and crabs. The workshop began with two keynote papers; the first one was given by Dr. David Armstrong (U.S.A.) on crab dynamics with special emphasis on the Bering Sea stocks. The second keynote was by Dr. Svein Sundby (Norway) on cod dynamics in the North Atlantic. These were followed by regional reviews of gadoid–crustacean dynamics, environmental conditions, and the effects of targeted fisheries for several ESSAS areas, including the Oyashio, Bering Sea, Newfoundland and Labrador, West Greenland, Iceland and the Barents Sea.

The WG met in closed session during the afternoon of the second day to discuss the results of the plenary workshop and to plan future activities. In contrast to previous work that suggested particular top-down control of shrimp populations by cod, the overviews revealed that this is not a general pattern across the 6 regions, and that there may be relatively little control by cod on shrimp or crab populations. The reviews also revealed a great deal of variability across ecosystems, with some systems exhibiting fluctuations of shrimp and cod that were in phase while others showed out of phase relationships. There was general agreement that more attention must be paid to spatial processes within each region, in particular, the spatial overlap between gadid and crustacean stocks. The WG agreed that more research is needed to establish the spatial overlap among the gadoid and crustacean stocks to quantify the extent of the match or mismatch between populations. Other areas of research that are needed included the influence of alternative prey and hence the temporal variability in predation of shrimp and crab by gadids, and how the diets of the gadids change as a function of size and season. The WG will follow up on some of these issues before reporting at next year’s meeting. They are also contemplating writing a paper comparing the gadoid–crustacean interactions in the different regions.

In the afternoon of June 18, the WG on *Bio-physical Coupling* convened a workshop on “*The Role of Advective*

Processes in Sub-Arctic Ecosystems” led by Dr. Ken Drinkwater (Norway), Co-Chairman of ESSAS. This was a follow-up workshop to one on advection held at the 2008 ESSAS ASM in Halifax, Canada. This year’s workshop was conducted jointly with scientists from the Arctic/Sub-Arctic Ocean Fluxes (ASOF) program and was used to explore the possibility of greater collaboration between ESSAS and ASOF in the future. ASOF has been involved in the measurements of volume, heat, and salt exchanges between Arctic and sub-Arctic regions over the last 5 plus years and recently published a book entitled “*Arctic-Subarctic Ocean Fluxes: Defining the Role of the Northern Seas in Climate*” (Eds. R.R. Dickson, J. Meincke and P. Rhines, Peter, 2008, X, 738 p.) on the results of their findings. ASOF is moving into Phase II of their research program during which they wish, through collaboration with ESSAS, to determine the effects of these exchanges on the flora and fauna.

A total of nine presentations were made on various aspects of transport and their effects, three by ESSAS and six by ASOF. These included presentations on the physical oceanographic dynamics of the circulation patterns and flows, for example in the Bering Sea, the Bering Strait, the Barents Sea and the North Atlantic Sub-Polar Gyre. The circulation patterns in the Sea of Okhotsk were shown to carry significant quantities of iron into the Northwest Pacific, which increases primary production in the region. At West Greenland, the offshore transport of low salinity water into the northeastern Labrador Sea is responsible for the early spring bloom in the region through the establishment of sufficient vertical stratification for the phytoplankton to grow. Initial results from the Atlantic Bloom Experiment southeast of Iceland were presented using state-of-the-art sampling platforms, including gliders, to follow the initiation and development of a spring bloom. An example of the role of advection on zooplankton distribution in the Oyashio region off Japan was also given, as was a talk on the effects of changes in the Sub-Polar Gyre circulation on blue whiting in the region in the Northeast Atlantic. Following the presentations, a discussion of potential future collaborations between ESSAS and ASOF was held. Possibilities included: the addition of biological sensors on ASOF moorings, the use of ASOF transportation estimates for biological fluxes, the development of joint proposals for new field research aimed at determining the processes through which advection influences the biota, and cooperative modeling studies. These possibilities will be explored further during the coming year.

On June 19, Dr. James Overland (U.S.A.), Chairman of the ESSAS WG on *Regional Climate Prediction*, presented the

final report of this WG, which was charged with exploring which of the IPCC Global Circulation Models (GCMs) would be most useful to downscale to regional models of the sub-Arctic seas. Based on how well the GCMs performed in hindcasting recent climate, a list of GCMs was published for several Sub-Arctic seas with the selected GCMs differing between regional seas (Overland and Wang, 2008). It was also suggested that several GCMs should be used when downscaling to regional models. A “best practices” manual for downscaling is also being written. Following the report, Dr. Michael Wallace of the University of Washington gave an open lecture entitled “Global Modes of Climate Variability on Regional Ecosystems”. The global modes he discussed included the Northern and Southern Annular Modes that are centered over the Arctic and Antarctic, respectively, as well as the El Niño–Southern Oscillation (ENSO) and the Pacific–North America (PNA) Mode. These modes were shown to be strongest in winter and to impact regional coastal systems such as the subarctic at annual time scales and longer through their effects on winds, precipitation and temperature patterns.

This was followed by a report from Dr. George Hunt (U.S.A.) who provided an update on work initiated at the 2007 ESSAS ASM in Hakodate, Japan, on biological hotspots in sub-Arctic seas, *i.e.*, areas of high biomass concentrations. Dr. Hunt is leading a paper on the locations of biological hotspots and the physical/ biological processes that determine them. He reported that the paper is well underway and should be completed by next year’s meeting. Dr. Mike Sigler (U.S.A.) then presented a paper on forage fish hotspots in the southeastern Bering Sea and their influence on Steller sea lions. He showed that geographical persistence of the prey may be just as important as density of prey aggregations to predators; particularly for predators that do not have the ability to search large areas efficiently.

The final workshop of the ESSAS ASM was organized by the Working Group on *Modeling Ecosystem Response* and was convened by two of its Co-Chairmen, Drs. Shin-ichi Ito (Japan) and Kenny Rose (U.S.A.). The main purpose of the workshop was to discuss the development of different end-to-end models and how to compare and contrast them. Presentations were given on three different types of end-to-end models. The first was on a model for the Bering Sea called FEAST (Forage and Euphausiid Abundance in Space and Time) that is an upper trophic level model, including zooplankton and fish, and connects to a lower trophic model. It also will provide input to a fisheries and economic model. The second model is being developed by the ESSAS Modeling Working Group in collaboration with others. They are designing and constructing a fully integrated, biophysical ecosystem model that will be coupled to a hydrodynamic model using the Regional Ocean Modeling System (ROMS), include biogeochemical

cycles that support biological production (nutrient dynamics) and primary/secondary production using multiple functional groups (NPZ) and a spatially explicit, individual-based model to represent upper trophic level (UTL) functional groups, which initially will be fish but could be extended to include birds and marine mammals. The third model is ATLANTIS, an end-to-end model developed in Australia by Dr. Beth Fulton. This model includes physics to fish as well as fisheries and economics. It has been applied throughout Australia and in several locations around the world. ESSAS was informed about the application of ATLANTIS in the California Current and its use to explore different fisheries management scenarios. A second presentation was made on the development of an ATLANTIS model for the Barents Sea, what it will be used for and the challenges in implementing it. Finally, a presentation was given on minimal ecosystem models to remind us that sometimes simple models may be the best way to go to answer some fishery questions. The presentations were followed by a lively debate on various aspects of ecosystem modeling and how to carry out comparative modeling studies.



Drs. Jim Overland (top) and Shin-ichi Ito (bottom) presenting the results from the Working Group on Regional Climate Prediction and on Modeling Ecosystem Response during the ESSAS SSC Meeting.

In addition to the Annual Science Meeting, ESSAS held a Scientific Steering Committee (SSC) meeting the day before the ASM and for half a day after. The most important issue dealt with was the future of ESSAS after the completion of GLOBEC at the end of 2009. GLOBEC was one of two IGBP (International Global Biosphere

Program) programs dealing with the oceans. The other is Integrated Marine Biogeochemistry and Ecosystems Research (IMBER), which developed after GLOBEC and will continue after GLOBEC finishes. The question was whether ESSAS would join IMBER. Dr. Julie Hall, the Chairman of IMBER, made a presentation to the ESSAS SSC on IMBER, its goals, what it could do for ESSAS and what it would request from ESSAS. After discussion, the SSC unanimously voted to join IMBER. The aims and goals of ESSAS will not change but there will be an effort to include more biogeochemistry within ESSAS. ESSAS looks forward to working within IMBER and with the other regional programs of IMBER.

Another important issue discussed by the SSC was the planning of the ESSAS Open Science Symposium in 2011. This will be at approximately the expected mid-life of ESSAS, and it was felt it would be an opportunity to present some of the results of ESSAS to date, and to explore new avenues of research for the coming years. It was decided to hold the meeting in Seattle, pending exploration of the costs and availability of suitable facilities. PICES has agreed to have the Secretariat help with the registration and the logistics of the Symposium, and ICES will be approached to support it as well. Several different theme sessions were discussed and a decision will be made as to which ones will be chosen in the coming months.

Reports on the ESSAS national and multinational activities were provided to the SSC by representatives from Japan, Korea, the United States, Canada, Denmark (representing West Greenland), Iceland and Norway. Decisions were also made on the future of the ESSAS Working Groups. The WG on *Regional Climate Prediction* has completed its

terms of reference and has been terminated. Discussions were held on forming a new Working Group to investigate the effects of future climate change on the sub-Arctic seas. It was decided to wait until after the PICES/ICES/FAO Symposium on “Climate Change Effects on Fish and Fisheries” to be held in the spring of 2010, in Sendai, Japan, before deciding what the terms of reference should be for such an ESSAS Working Group. The WG on *Bio-physical Coupling* will be terminated with its completion of the paper on hotspots. The work on the role of advection in sub-Arctic ecosystems will continue and may form the basis of a new Working Group. The WG on *Modeling Ecosystem Response* will continue its development of an end-to-end model as well as comparative modeling studies between regions and between different types of models. The WG on *Climate Effects at Upper Trophic Levels*, having gathered together data sets of environmental and relevant fish and invertebrate data for many of the sub-Arctic seas, will undertake extensive comparative studies to understand the processes linking climate variability and gadoid–crustacean dynamics. Each of the existing Working Groups and potential new Working Groups will be discussed at next year’s ESSAS meeting. Iceland offered to host the 2010 ESSAS ASM in Reykjavik during the first week in September.

In addition to the scientific presentations and discussions, the ESSAS meeting provided the opportunity for catching up on the news of old friends to meet new ones. To facilitate this a meeting dinner was held at Ivar’s Salmon House in Seattle. George Hunt hosted a smaller gathering for the SSC and international visitors at his apartment at the end of the Science Meeting, complete with beef steaks, wine and cheese.



Dr. Kenneth Drinkwater (ken.drinkwater@imr.no) is a fisheries oceanographer conducting research on climate variability and its effects on the marine ecosystem, with a special interest in fish populations. Having worked many years at the Bedford Institute of Oceanography in Canada, he is now working at the Institute of Marine Research (IMR) in Bergen, Norway. Ken is Co-Chairman of the ESSAS Scientific Steering Committee.

Ms. Margaret Mary McBride (margaret.mary.mcbride@imr.no) is a research fisheries biologist with over 30 years of experience. She is now a coordinator of the ESSAS International Project Office at IMR. In addition to this duty, Margaret is working on issues related to ecosystem-based research and management through an Intergovernmental Personnel Action (IPA) between IMR and NOAA Fisheries.

Dr. George Hunt (geohunt2@u.washington.edu) joined the School of Aquatic and Fishery Sciences at the University of Washington as a Research Professor after retiring from the University of California, Irvine. For many years, George studied the reproductive and foraging ecology of seabirds in various regions. More recently, he has participated in ecosystem-level studies of the southeastern Bering Sea and the Aleutian Archipelago. He co-chairs the ESSAS Scientific Steering Committee and serves as a member of the PICES CFAME (Climate Forcing and Marine Ecosystems) Task Team.