

# **U. S. GLOBEC Standing Committee for Synthesis (SCS)**

## **Meeting Minutes**

**(Due to a faulty audio recording system, these minutes are partial only)**

**Doubletree Hotel at Reid Park**

**Tucson, AZ**

**13-14 October 2009**

### **GLOBEC Documentary**

Elizabeth North discussed her plans for a GLOBEC documentary. The documentary will examine how scientists are uncovering the interactions among variations and ocean currents and the creatures that thrive in the ocean. There are four key scientific components:

- Climate variability
- Topography of the ocean
- Organisms and ecosystems reactions to different conditions
- The relationship between water motion, ecosystem changes and harvested organisms

Other concepts of the film that will be communicated

- The need for people with long term vision
- The work of scientific study is rewarding
- Human diversity enriches the system
- The need for long-term observing systems
- Scientific discovery benefits everyone

The basic outline of the film will be

- Introduction – preview of the four regions, the provisional titles are “Turning the Tides on Georges Bank, Cod and Scallops”, “Upwelling the Pacific Salmon, a Decades Long Story”, “Alaskan Coastal Currents, Rivers of Life”, “Hot Spots in a Cold World, Krill and Predators in Antarctica”. Another region (possibly the Gulf of Mexico) may be added that may not be related to GLOBEC, but may be part of a story that needs to be told about the pulse of the ocean. The Dead Zone was suggested.
- Footage of researchers working on the world’s oceans as well as computer-generated graphics and interviews with scientists and fishery managers will be used.
- The conclusion will be an integration of information linking all of these systems within a storytelling framework.

The strategy is to submit a proposal for an informal science education planning grant (due December 18, 2009) for a one and a half year project. Cinematographer Michael Fincham and Elizabeth will be the lead PIs, and there will be a scientific advisory panel (Nick Bond, Cabell Davis, Eileen Hofmann and Dale Haidvogel have agreed to be involved). We hope to have a week of funding for the key people who will help to disseminate and create the story line. The GLOBEC standing committee for synthesis will continue to provide information and support. Hal Batchelder suggested that Ted Strub and Peter Wiebe may also be unfunded collaborators. We will also have an intern from the American University Film School.

Partnerships need to be developed for broadcasting the documentary. Michael Fincham has contacted Joe Cohn at Oregon State Sea Grant, who has contacted Oregon Public Television to see if there is interest in being a sponsor. He will also contact Maryland. We are looking into aquariums and working with the COSEE network to see if there is an interest in using some products of the film. A partnership with a computer graphics production agency also needs to be developed. The Innovative Learning Institute in Maryland can help us ensure that we have focus groups and assist in evaluation of the product.

### **North Carolina State Museum for the Natural Sciences**

Dale Haidvogel was invited to speak at the North Carolina State Museum for the Natural Sciences in Raleigh. They are currently building an 80,000 square foot nature research center including a hands-on active research museum and anticipate to be completed by late 2011. Dale also met with the Museum Director and the Director of Exhibits who are interested in having a GLOBEC component in the nature research center. They are within a network of museums that exchange exhibits, therefore it is entirely possible that a kiosk based on US GLOBEC would then go around the country. Dale will follow up and set up regular exchanges to determine what form our contribution might take.

### **Pan-Regional Funded Projects**

Enrique Curchitser, Mike Alexander and Nick Bond are PIs in an effort to bring the IPCC work into the GLOBEC research and to look at the three regions, trying to evaluate how the IPCC models represent those regions and to try to make connections between the low-frequency large-scale fluctuations variability that those models have as well as the regional impact in the GLOBEC regions. Another aspect of this proposal is to explore finding some statistical connections by performing statistical downscaling (most of the work that has been done regionally with the models has been dynamical downscaling). The idea would be to try to do statistical downscaling in the ocean which, to the best of Enrique's knowledge, has not been done before. It is typically done in the atmosphere where there is an abundance of data. We want to take a high-resolution model, such as one of the ROMS implementations in the NE Pacific and pretend that that is the data and if that was real data then how would you go about doing a statistical downscaling to that region from the IPCC model. There are no new hindcast simulations involved, it is all based on IPCC. Most of this will be done on the global scale,

except for the statistical downscaling exercise. For that we will concentrate on one region (probably one where we already have a simulation).

Dale commented that a feature of this proposal is that it is trying to do Pan Regional synthesis across all of the regions in a systematic way.

John Steele is also trying to draw conclusions across all of the US GLOBEC study regions. The background is about ecosystem based management. What's emerging is an over fishing climatic change end-to-end model comparison. One of the challenges is how to compare different data. We also want to look at processes rather than just comparing productivity and diversity. There seems to be no obvious way of modeling the complete end to end influx. Some models are partial. There are two ways, one is trying to combine very large ones such as Atlantis, or to combine different ones to use from the morrow type from the bottom with an ecopath in the top and put an IBM if you want to get a particular species. If you do this in the different areas, it makes the comparison a problem. We are looking to see if there is some meta analysis or meta model that can be used where the input is not data, the input is the other models which may be of their own specific links, and particular characteristics of each region. This is what we are looking to explore, looking at the data, how to combine models, and how you can compare them either directly or indirectly through some type of synthesis approach. And getting out of that processes such as resilience, (conductivity) and measures of system performance. We want to do that for the four regions.

Dennis McGillicuddy discussed the population dynamic of *calinus finmarchicus* from a basin-scale perspective. The underlying conceptual model is the three-gyre hypothesis by Peter Wiebe and Ann Bucklin. There are three distinct population centers of calinus in the North Atlantic, one in the central part of the North Atlantic basin, one on the Western North Atlantic gyre and one in the Norwegian Sea. Ann Bucklin has genetic data that suggests that these are to some degree distinct populations. The circulation connects the three population centers; the issue is the rate of mixing and how do these three sustain themselves. The data set on which the study is based is the data from the continuous plankton recorder and pictures of the mean distribution of calinus finmarchicus in the North Atlantic that have been compiled from those data. The three population centers are clearly visible in these data at certain times of the year, but the main problem is the CPR data are only at the surface. The approach is an essentially inverse approach; we will assimilate the CPR data and the data from various other sites in the North Atlantic via the adjoint system that is part of the ROMS modeling infrastructure. The main control parameter will be the mortality, which is the least well constrained of all of the population dynamics processes. Other key aspects that will be looked at are entry and exit from diapause. There are a number of hypotheses that have been investigated in prior modeling studies by Dougie Spears and other with some initial investigations into those various aspects whether it is photoperiod, photovariability and the like. The long term view includes climate forcing, however it is difficult to speak about how that system is going to fluctuate on inter-annual to inter-decadal time scales until we understand what the mean seasonal signal looks like. We will start by taking a climatological simulation of the circulation and assimilating the long term means of the data sets; try to understand the basic dynamics that govern the mean state and hopefully by the end of the project be able to look at climate driven protobations about that with a ROMS model simulation that is characteristic of a high NAO period and a low NAO period. The collaborators on this

project are Dale Haidvogel, Julia Levin, Ann Bucklin, Peter Wiebe. Gregory Bogrand is the international collaborator.

Dale Haidvogel discussed at least two other projects that map really well in several respects to the project that Dennis described. One is another ROMS based project, Avijit Gangopadhyay is the senior PI along with Fei Chai, Dale and Enrique. The concept is to look at the calanus and the regional ecosystems in the whole North Atlantic from the point of view of what their response might be to varying fresh water inputs that are ongoing and are expected to continue. This will not be an adjoint based project, but rather be based on a high-resolution forward modeling of the combined North Atlantic and Arctic. The model will incorporate a full suite of hydrologic forcings including sea ice and river input. The concept is to look at both recent years and a seasonal cycle as well and then to begin to speculate about what the changes implicit in future scenarios imply for changes in the coming years.

The model will be ROMS on the circulation side and Fei Chai's COSINE model, which is a ten box ecosystem model. They will be run either in loosely coupled or tightly coupled mode depending on some considerations that need to be further worked out. Due to the threads that run simultaneously through Dennis' lead project and Avijit's project, it was decided early on that the PIs would work in a coordinated fashion with at least these two projects. The PIs on these two projects have met in Woods Hole in September. A coordinated ROMS strategy of these projects was mapped out and hope that these links will continue to the Pan Regional phase.

The third project that has similar threads to the two projects is the Davis and Chen project, which is FVCOM-based, but which also has an interest in examining the response of North Atlantic ecosystems to changes in the future across the North Atlantic Arctic system. A three-way PI team meeting needs to be planned to discuss the overlapping issues and technologies.

Zack Powell discussed the (concepts) of trying to estimate the uncertainties in models, primarily in the physics, but also in both the ocean and the atmosphere using bayesian techniques. The coupled biological physical models in a larger functional mathematical sense have very many degrees of freedom. As a result, the calculations are very lengthy; this is a way to "jump over" some of it. All assumptions require setting up a prior probability distribution. We will be working primarily in the Northeast Pacific and we will be using already published data from the Western Pacific in the Koroshia by Japanese investigators and we will be using an emerald model which is now part of the suite of ecosystem models that is released through ROMS to see how we can estimate some uncertainties with the very many perimeters which are utilized in that emerald model. Funding for this particular project received co-funding from the math director at NSF.

Other funded pan-regional projects include:

- Comparative Ecology of Krill in Coastal Corners Around the Pacific Rim - Hal Batchelder
- Collaborative Research and Comparative Analysis of Salmon and Cod population responses - Lou Botsford
- Pacific Ocean Boundary Systems - Manu DiLorenzo with Peter Franks

- Life Histories of Species in the (Genus) *Calinus* in the North Atlantic and North Pacific

### **Pan-Regional Workshops**

Chuck Green discussed a series of workshops and a symposium as part of the Pan Regional synthesis. This project is supported via the national office at Rutgers University and a subcontract at Cornell. The idea is to look at global ocean ecosystems and climate, specifically the role of climate variability, and to synthesize the results that come out of the different regional efforts. The focus will be looking at regime shifts and biogeographic range shifts. The goal is to improve our understanding of climate forcing of both North Atlantic and Pacific shelf ecosystems so that we are in a better position to model and predict the effects of the regional impact that suggests climate change in the future. The approach will be to look at the role of climate forcing ecosystems, regime shifts and biogeographic range shifts on both sides of the North Atlantic as well as the North Pacific and to review the evidence linking the dynamics to those shifts to two important modes of high latitude climate variability in the NW and NE North Atlantic oscillation and the Arctic oscillation and from there contrast and compare our findings from the North Atlantic with comparable findings from the North Pacific ones that specifically attempt to link ecosystem regime shifts and biogeographic range shifts for the Pacific oscillation and North Pacific gyre oscillation.

In October a regional working group meeting which was the last meeting of the regional synthesis. That will be followed next autumn by the first ten regional group meetings also in Portsmouth, NH. There will also be a Pan Regional symposium on the topic at Friday Harbor Labs at the end of summer 2010. We are hoping to prepare a special issue coming out of that symposium. Time will be spent during 2010 and 2011 getting the authors to work on their manuscripts. The second Pan Regional working group meeting will also be in Portsmouth in the spring of 2011. We hope to have most of our manuscripts in hand for preliminary review. In the fall of 2011 we will try to get final editing and a grand synthesis manuscript targeted for either science of nature that will sum up all that we have learned to be submitted in the winter of 2011. The first Pan Regional working group meeting began in the autumn of 2009, held at Marine Laboratory Creek Farm Estate in Portsmouth. We will:

- Review the evidence for ecosystem regime shifts and biogeographic range shifts from each region as well as the analytical method used to detect them
- Review alternative hypothesis used to explain the causes of these regime and biogeographic range shifts
- Review the status of modeling studies being conducted in each region to link climate forcing to the observed regime shifts

In addition to the work that has been conducted in the Northwest Atlantic, we are hoping to expand the work into the Pacific.

The Pan Regional Symposium is planned for the end of summer 2010 at Friday Harbor Labs. We will bring in 30-35 participants (Support from NSF allows 35 participants provided they are from the United States). We will:

- Review evidence for ecosystem regime shifts and biogeographic range shifts in all represented regions
- Review alternative hypothesis of up down versus bottom up structuring of the ecosystems and the consequences for regime shifts and range shifts and specifically look at over fishing and climate contrast and compare

The second Pan-Regional working group meeting is in the spring 2011 and will be focused on pulling everything together, reviewing the manuscripts for the special issue, discuss the implications of the findings and the context of marine ecosystems and responses to climate change and use that as the basis for putting together a grand synthesis paper to report all of our findings.

### **Reporting GLOBEC program accomplishments in a consolidated graphical form**

Beth Turner discussed several ways of reporting accomplishments. One way is to put a number of things on one axis such as funding, phases, GLOBEC reports, GLOBEC publications and special issues. Beth went through the archives on the GLOBEC website for publication numbers and the regional site for start and end dates of various phases and projects.

Another way of reporting this information is to expand the publications, giving the report titles and the titles of special issues to show the breadth of what GLOBEC has accomplished.

A third way is a number tally of the number of publications. This is using the same data as the first suggestion, but in a bar form, allowing for the increase of special publications to be better reported.

An additional way is to show the number of days at sea.

Lastly, reporting the number of PIs supported per year. There is very good documentation of the PIs on each project abstract, however there is no data for the earliest modeling retrospective.

Also discussed were ways to portray GLOBEC program accomplishments in a consolidated graphical form.

- One way is to put a lot of things on one axis; funding, phases GLOBEC reports, GLOBEC publications and special issues. Beth went through the archives at the GLOBEC website for publication numbers and the regional site for start and ending dates of various phases and projects.
- Another way is to expand publications, giving the report titles and the titles of special issues to show the breadth of what GLOBEC has accomplished in their reports and special issues.
- Number tally of the number of publications. This would show the increase in special publications during the years
- Display the number of days at sea

- Number of PIs supported per year. There is very good documentation of the PIs on each project abstract, however in the earliest modeling retrospective, there is no data.

Beth and Linda attempted to go through every proposal to see how many grad students and post docs were either named or in a “to be named” status.

### **Marine Ecosystem from Function to Prediction**

There will be a meeting in Victoria during June 22-June 26. The theme is Marine Ecosystem from Function to Prediction. The steering committee is essentially the steering committee for GLOBEC SSC. The structure somewhat follows the PISCES type of meeting. The first and second days are workshops. These workshops do not need to run as parallel sessions, there is room for discussion. The third day is the start of the Open Science Meeting and the next three days proceed by theme; Ecosystem Structure and Function, Observation Modeling and Prediction and Ecosystem Management Looking Towards the Future. Confirmed speakers will be on Wednesday; historical overview with Roger and Liz Gross, Eileen Hofmann will talk about physical biological coupling, Colleen Maloney on food web processes, the human component and feedback between marine ecosystems and the human element with (Ian) Perry, looking forward with Yasu Yamanaka and John Steele will look back on what we have achieved Friday will include closing ceremonies.

### **US GLOBEC Final Symposium**

A short proposal was submitted last fiscal year for monies to support the final symposium for US GLOBEC. Proposed was an organizing committee composed of prior senior leaders in US GLOBEC (Dale Haidvogel, Zack Powell, Mike Fogerty and Bill Peterson) as conveners. Also proposed was the National Office take care of all of the logistical activities. A partnership was proposed with the Integration and Application Network from the University of Maryland. A likely venue for the symposium is the Hoover Building in Washington DC. The reason for Washington DC is access to policy makers, government personnel, staffers and agencies. It was suggested that the symposium be presented as “Impact of Climate Change” in order to attract congressional interest.

Also discussed was the possibility of making the meeting a more international “flavor”, provided US GLOBEC has a strong showing and impact since US GLOBEC was first and helped “spawn” the International GLOBEC program. Part of US GLOBEC’s legacy and offering is the large scale view of global ocean ecosystem dynamics, therefore fostering the interconnected oceans. Also possible would be highlighting how other nations are represented through science(1/3 international, 2/3 US GLOBEC) or constructing a program to be overtly comparative between what was done at US GLOBEC and some other international GLOBEC programs either by topic, region, etc..

An issue was brought up that by 2011 the number of PIs that will have active funding will be a very small fraction of the number of GLOBEC participants over the years, so there is no need to delay any further.

## **Workshop and Symposium on Arctic Climate Change**

**Chuck** discussed upcoming plans for workshop and symposium. The focus of the first workshop will be on Arctic climate change, forcing regime shifts and biogeographic range shifts including the trans-Arctic invasions of Pacific species into the North Atlantic. They are trying to bring a number of numerical modelers for retrospective analysis of time series data and want to test the feasibility and hypothesis that have come out of the data in a quantitative way. **Zhang** has a FECOM model for the Arctic Ocean. Wang also has some good models that address the interaction of atmosphere and ocean up in the Arctic as well as how that influences the outflows of salinity anomalies.

This workshop will be in session in the days before the Ocean Science meeting. One of the potential outcomes of some of the work is a proposal into NSF for international and domestic education to set up a trans-Arctic invasion network which will include Cornell, Duke, University of Maryland, University of South Carolina and the University of Alaska; internationally this will include a number of institutions in Plymouth and the United Kingdom (the Plymouth Marine Science partnership which includes the Allistair Harvey Foundation of Ocean Science and Plymouth Marine Laboratory, University of Plymouth and the Marine Biological Association).

This coming summer there is a symposium planned on Global Ocean Ecosystems and Climate to be held in August at Friday Harbor Laboratory in Washington. There is funding for thirty five participants (there may be international participants as well). The funding from NSF can only support US participants. We could have up to fifty people, maybe more. We are planning on about five days, the first two days participants will present twenty minute talks and or posters on their research. Day three and four will be used for reviewing the results of the previous findings on regime shifts and begin comparisons of regions, and possibly review evidence for biogeographic range shifts. On the fifth day, we plan on splitting into breakout groups that are intended to evolve into a team of co-authors to propose manuscripts for a publication or special issue. The final workshop is planned for Spring 2011. By that time the co-authors will have prepared their manuscripts and submitted them for review.

## **Third Pan Regional Synthesis Meeting**

The third Pan Regional Synthesis meeting was held at NCAR in early February and was very successful. The idea was to essentially introduce the participants across the ten projects and to try to build some bridges. Reports were presented from each of the projects, then the participants broke out into five working groups. A fourth Pan Regional Synthesis Workshop will hopefully be held next Spring. There is a video of all of the presentations.

## **GLOBEC Book**



[Marine Ecosystems and Global Change](#) by Manuel Barange, John G. Field, Roger P. Harris, and Eileen E. Hofmann. If you go to Oxford University Press, you will find the book. The price is projected at \$ 150.00 and has a publication date of April 2010. There are nine or ten chapters, not organized by region. The book is organized into four sections; The Changing of the Ocean Ecosystems, Advances and Understanding Structure and Dynamics in Marine Ecosystems, The Human Dimensions and A Way Forward. This is not a general book. Undergraduates with an interest and knowledge of the ocean and above should understand it.

### **ICED (Integrating Climate and Ecosystem Dynamics) Program**

Most of what is in the Southern Ocean Program is moving into the ICED program. So far there have been two special issues on Deep Sea Research, the third volume is being prepared at the time of the meeting. The Southern Ocean Group is finalizing the third DSR volume. There were workshops and presentations on Southern Ocean Group results at the third GLOBEC Ocean Science meeting. There was an article in April 2009 in the International GLOBEC newsletter on highlights of US GLOBEC; the article was based on the Pan Regional meeting last February. David Walton asked Eileen Hofmann to put together an editorial for Antarctic Science on lessons learned from Southern Ocean Group and how would the program legacy contribute to Southern Ocean research.

The ICED program is now underway. In June there was a workshop held in Princeton (Southern Ocean Scoping Workshop) funded by the Ocean Carbon Biogeochemistry program. The workshop explored where the US would go in Southern Ocean research over the next ten to thirty year. The report is being prepared.

ICED is putting together a session next May in Norway for the IPY conference. The session is being developed from reports that came out of the food web modeling workshop and the Southern Ocean workshop under ICED. It is designed to be a fifty year monitoring program of the Southern Ocean.

### **GLOBEC Projects**

- Gulf of Georges Bank
- Lavado Fish Study
- Basic Scale Calanus

Copepods went up on Georges Bank during the GLOBEC period. We looked at the salinity anomaly that is associated with low salinity on a spring bloom and found it causes an earlier spring bloom which leads to better feeding conditions for the copepod; a numerical response. The 90's were fresher than the 80's. The Kane study shows 44% of the total variant is species composition from the CPR from the Labrador shelf to the mid Atlantic byte over four decades (70's, 80's, 90's and 2000's). There is a model for the haddock larvae. We are now ready to put it into a 3D model.

There is a paper out that discussed cod and haddock species specific foraging behavior. The larvae that stay in the dark can't see to eat but avoid predators. The larvae that stay in the light can see to eat but risk predators. The larger larvae that stay in the dark tend to starve to death. The data shows that they tend to stay in the patch of food day and night. It appears that they have evolved to stay in the light and ignore predation.

### **Special issue - Deep Sea Research**

Hal Batchelder discussed a deep sea research special issue which will be published in November. There are twelve papers plus an editorial. Eleven of the papers are on the Gulf of Alaska and one is multiregional. This is the third special issue on the Northeast Pacific region.

### **Growth and Condition - Survival of Juvenile Pink Salmon**

Four hatcheries in the Prince William Sound are releasing six hundred million marked salmon every year. They mark them with a thermal signature. The number of fish that come back to the hatchery and those caught by fishermen provide data of actual survival. The data was presented; interpretation and analysis to follow.

### **Current Magazine**

Current Magazine has expressed an interest in a special issue with GLOBEC to come out in early 2011. The basic draft outline thus far is the history, regional projects (similar to the Oceanography article some years ago), data and modeling. One of their requests is that they have some activities outlined that teachers can take into their classrooms that would relate to what the issue is about; a few examples of GLOBEC data and walk them through the steps of how they can perform this in a classroom.

Articles should be in "first cut" form by mid to late summer 2010 because it has to go for review. We will pick the reviewers.

### **Final Synthesis Meeting**

It was proposed that instead of a large meeting with fifty to sixty people, a series of smaller targeted workshops be arranged. This approach would enhance synthesis.

The GLOBEC legacy would be the models, synthesis, data sets, the people that have been trained and the applications. The challenge is to develop a visually stunning presentation to NOA, NSF and Capitol Hill reflecting the fifteen years of the GLOBEC program.

Spring 2011 is a potential date, however the venues do not book more than one year in advance. It was agreed that the meeting should be two to three days in duration rather than a week long event. Since there is limited space at the facility, the attendees that must be there should be accommodated first, others would be on a first come first served basis. The invitations should be

distributed enough in advance to allow participant to meet prior to the meeting. An agenda should be drafted ahead of time to determine which points need to be made and who should be invited.

Five themes for sessions were suggested:

- Population Dynamics of Target Species
- Ecosystem Structure and Function
- Climate Forcing of Biological Systems
- Transition to Management

The morning of the first day would be introductory synthesis discussions. One person would deliver the information for five or six co-authors working together to come up with a coherent picture. Next would be "cross cutting", moving the decadal scale and climate forcing up front. Through GLOBEC the decadal scale changes in both the physical condition through the ecosystem to target species observations. This would be followed by the processes behind these observations. Finally synthesize back to management applications.