Report of the BASIN Open Workshop

2-4 June 2010
Rutgers University

Introduction

The objective of the meeting was to discuss the Implementation Plan of the BASIN program (http://www.globec.org/structure/multinational/basin/basin.htm) with the aim of providing the background information including ongoing activities in Canada and the EU including updates on the recently funded EURO-BASIN project in order to allow interested parties in North America to begin to plan and coordinate the development of individual and group proposals. The meeting was held in the Rutgers University Student Center, New Brunswick, New Jersey. Included in this report is a brief narrative of the meeting, some of the results of the planning efforts, and two appendices that contain the meeting agenda, the list of participants, and links to the available presentations. The powerpoints of individual presentations are available via the link: http://www.na-basin.org/meetings/workshop_June2010/workshop_June2010_presentations.html

Narrative

Day 1 (June 2, 2010)

The meeting was opened by Rutgers host, *Cisco Werner*, who in the opening remarks laid out the objectives of the meeting and reviewed the Agenda. After brief introductions of all the participants, he presented an overview of the BASIN Science Plan and rationale. One point was that there was a need to complete an Implementation Plan for the program since the Science Plan only contained an Implementation Strategy. Also reviewed briefly were the related programs with a North Atlantic focus that are currently under development or in their initial stages [i.e., the Atlantic Meridional Ocean Circulation Program (AMOC http://www.atlanticmoc.org/), Ocean Carbon and Biogeochemistry Program (OCB http://www.us-ocb.org/), GEOTRACES http://www.ldeo.columbia.edu/res/pi/geotraces/], and other existing programs with strong links to anticipated BASIN activities (e.g., U.S. GLOBEC pan-synthesis http://www.usglobec.org/, ESSAS http://www.globec.org/structure/regional/essas/essas.htm, and some currently funded CAMEO projects).

Peter Wiebe presented an overview of the current work done to create a BASIN Implementation Plan and its current status. The outline for this document is the following:

A. Introduction
B. Program Goals
C. Major Components of the BASIN Study
    Modeling
    Synthesis
    Observations
    Management Applications
    Escience
D. BASIN Deliverables and Activities Required to Achieve them.
E. Program Phasing

F. Related Existing Programs Relevant to BASIN

There was a meeting in March 2010 in Woods Hole, MA of representatives from the U.S. and Canada to create the first draft of the document, but additional work is needed to complete the task. This was the subject of additional discussion during the meeting.

Presentations: A combined set of presentations reviewing the EURO-BASIN Work Packages (WPs) and presentations by North American investigators took up the rest of the afternoon.

Mike St.John presented an overview of the European Proposal, which has been approved for funding for 4-years. There are 23 partners in this project that has nine WPs. Overviews of several WPs followed:

WP leader *Stéphane Pesant* reviewed WP1 Data Management and Integration. "The primary objective is to develop methods to consolidate and integrate long-term observations from European and international databases. EURO-BASIN will use these methods to assemble historical data, new field observations and experimental results into comprehensive datasets for modelling and prediction of the Atlantic Ocean ecosystem and related services."

Mike St.John reviewed two WPs:

WP3 Distribution of Key Species and Ecosystem Types (WP leaders: Kurt Tande and Xabier Irigoien). "The primary objective of this work package is to resolve the oceanographic habitats utilized by key biogeochemical and ecosystem species in the North Atlantic. This will be done by:

1. Conducting retrospective analyses on different scales (basin, meso- and small-scale) of key ecological and biogeochemical species and trophic positions in relation to oceanography (e.g., T, S stratification and advection regime) and seasonality of the systems
2. Characterizing the distribution of food web types and key species in the basin and shelves in terms of abundance, biomass and size spectra
3. Characterizing the population genetic structures in keystone species within biogeochemical and trophic cycles using novel molecular approaches (temporal sampling in combination with genome scans) to determine evolutionary responses to climate change
4. Developing habitat and process models for monitoring and predicting the future changes in key species and food web biogeography due to prominent ecosystem drivers
5. Provide indices of the physical characteristics of key species and food web habitats for development of past present and future states to be simulated in WP 6 and the development of ecosystem trajectories in WP8 and bioeconomic modelling and management in WPs 7 and 8."

WP4 Trophic flow: Production and Controls (WP leaders: Torkel Nielsen and Kevin Flynn). "The overall objective of this WP is to quantify the key processes controlling the flow of carbon and energy, within and between trophic levels in the North Atlantic and shelf ecosystems. More specifically, the objectives are:

1. To quantify the role of key species and functional groups in the rate of transfer of biomass and carbon within the marine food web.
2. To evaluate the relative importance and interactions of top down versus bottom up

controls on community structure and carbon sequestration.

3. Provide field and experimental data for understanding the physiological range of key ecological species i.e. vital rates

4. To quantify vital rates and potential competitive interactions between co-existing species

5. To develop rate parameterizations and provide data for validation of the integrated models produced in WP6.

6. Develop indices of key species and ecosystem status for use in WP8."

The description of the other EURO-BASIN work packages was delayed to allow time for groups that had to present during the first day.

NSF Program Manager *Cynthia Suchman* talked about NSF proposal writing and the fact that proposals for BASIN will be submitted to the general calls for proposal and support for approved proposals will come out of OCE funding. These sections of NSF are seeing a significant number of complicated proposals coming into the review process and they are not fairing very well. There is criticism about the integration of the proposals and one solution is to submit smaller proposals that are interlocking, but standalone as well. One solution might be to have the BASIN group write a two-pager to provide the overview of the program and implementation effort. Adding extra pages to a proposal requires a request some weeks in advance of submission. Each individual proposal writer must submit an independent request. There is the possibility to have support letters of support in a supplementary information section at the end of the proposal. She emphasized the need to have sufficient information in the proposal to allow reviewers to evaluate the program. It might be possible to ask for an additional third page to be used to show the relationship between complementary proposals. There was the issue of what NSF sections to submit proposals to and this was not clearly resolved. Other issues discussed but not resolved were how a U.S. program service office might be created and whether there would be support for an International Program Office.

Scott Glenn - on Gliders: (It was noted that there is no component in the EURO-BASIN proposal that uses of gliders. Any use of gliders would come from national contributions.) The Rutgers Glider group has completed a glider transect of the North Atlantic and another is underway. Rutgers' gliders are conducting surveys in the Gulf of Mexico as a rapid response to the BP oil disaster. The use of such gliders in BASIN would be two fold. Shallow gliders would be used to study mixing and transformations in upper water column and deep gliders would provide information on the meso-scale structure and advective transports. While not gliders are in EURO-BASIN, there are EU partnerships that could be created through US proposals.

Oscar Schofield: LETZGO was a project that was proposed to NSF (2009) but not funded to examine the physical and biological export of carbon flux into the deep ocean. There are plans to restructure this effort and to integrate it with the work in WP 3 (Biological Carbon Pump).

Avijit Gangopadhyay reviewed ongoing work to understand and model the impact of freshwater inputs on regional ecosystems in the North Atlantic. Future interests are in conducting realistic simulations with ice and rivers to compare and contrast the effects on the physics, chemistry and

biology of the eastern and western portions of the North Atlantic Ocean. He suggested a need for a workshop with Europeans to foster interactions.

Dale Haidvogel described a comprehensive modeling program in support of the US contribution to BASIN. He summarized the results of a conference call discussion and presented the concept of an integrated set of science driven modeling proposals sharing a comparative component - model comparison and evaluation. A workshop is planned for the latter part of July to continue to define the proposals. Potential science themes: physical oceanographic processes and climate; shifts in biogeography; shifts in phenology; timing of blooms (Spring and Fall); model upscaling and the influences of biology: the carbon budget and role of the "twilight zone". One aim is to establish a basis for and uncertainty in future predictions.

Icarus Allen reviewed WP6: Basin-scale Integrative Modeling. This WP is focused on lower end of the food chain to mid levels. Work package leaders are Icarus Allen and Laurent Memery. The objectives of this WP are:

1. "To determine the spatial and temporal dynamics of economically and trophically important key fishstocks and top down effects of these fish stocks on ecosystem structure and dynamics in the North Atlantic basin and its regional seas;
2. To determine how carrying capacity and trophic controls may change with changing climate and its impact on the production and ecosystem role of these key fish stocks;
3. Contribute to an assembly of key species and ecosystem indicators and conduct simulations on their performance under climate change for synthesis in WP8 Advancing Ocean Management."

Julia Levin described work ongoing in a GLOBEC pan-synthesis project on climate forcing of *Calanus finmarchicus* populations in North Atlantic. The project focuses on studying mechanisms that control mean seasonal variations in the abundance and distribution of *C. fin.* in the N. Atlantic; the biophysical environments which sustain the populations of *C. fin.* in the three (postulated) gyres of the N. Atlantic, and whether these populations are connected to one another, and by what pathways and processes. Forward and inverse models of *C. fin.* populations as used in the study. This work will contribute to new modeling initiatives for BASIN.

Enrique Curchitser described his interests in understanding the combined effects of bottom up and top down drivers on North Atlantic marine ecosystems. Today's climate models have a large bias in how they depict temperature in certain regions of the Northwest Atlantic in part because of the model resolution. This can be reduced by having higher resolution grids in areas of high bias. He also presented some ongoing coupled physical/biological model work in the Pacific using a global climate model with 2-way regional models. These can be applied in the North Atlantic as part of BASIN.

Day 2 (June 3, 2010 - Additional presentations)

Manual Barange reviewed WP7: Bioeconomic modelling of N. Atlantic fish resources. "The overall objective of WP 7 is to assess the impacts of Global Environmental Change (GEC), including climate change, fisheries management and market developments, on the productivity,

dynamics and services of North Atlantic-wide Fish commodities. Specifically we will:

1. Estimate the economic cost of sub-optimal fisheries management (hindcast);
2. Predict the distribution and production of key fish stocks based on climate change projections;
3. Develop and apply a bio-economic model of fish commodities in the North Atlantic;
4. Investigate the consequences of climate change and economic globalisation on the basin-wide fish production system;
5. Contribute to an assembly of key species and ecosystem indicators for synthesis in WP8 Advancing Ocean Management."

Richard Sanders reviewed WP2: Biological Carbon Pump (Work package leaders: Richard Sanders, Christina de la Rocha). "WP2 will advance the state of the art by producing new observations of particle formation, aggregation, sinking and decomposition in a range of marine ecosystems, focused on the North Atlantic basin…. Specific objectives are as follows:

1. Perform laboratory experiments to establish the relationship between plankton community composition and size structure and aggregate formation, sinking rate and stability under idealised conditions.
2. Perform a mesocosm experiment to determine the influence of plankton community composition, size structure and grazing pressure on aggregate formation, sinking rate and stability under environmentally realistic conditions.
3. Perform observations at sea on the link between plankton community composition and size structure, grazing and aggregate formation, sinking and decomposition and organic carbon export.
4. Develop and apply new algorithms for particle export and decomposition based on experimental work above and on literature information available from WP1.
5. To implement these new algorithms in 1D models and assess their skill in representing particle flux via a comparison of model output with a defined validation dataset assembled in WP1. The most environmentally realistic algorithms will be passed to WP6 for preliminary implementation in large-scale models.
6. Perform surveys at the broad scale of the biological sequestration of carbon dioxide in the Nordic seas and high latitude North Atlantic and, in collaboration with WP6, to use these data to evaluate how well existing versions of models implemented in WP6 represent the Biological Carbon Pump.
7. Synthesise these previous activities in order to estimate, in conjunction with WP8, the economic value of the contemporary biological carbon pump and how this value may change as ocean functioning changes in response to an evolving climate and a changed exploitation of top predator species."

Cisco Werner presented information sent by Mary Jane Perry that described a plan to conduct a sustained 1-year sampling program as part of BASIN that would build on the 2008 North Atlantic Spring Bloom experiment. There would be use of drifters, gliders as well as ships for calibration of the measurements.

Mike St.John reviewed WP5: Dynamics of living resources and their utilization (work package leaders: Verena Trenkel, Brian McKenzie). "The objectives of this WP are:

1. To determine the spatial and temporal dynamics of economically and trophically important key fish stocks and top down effects of these fish stocks on ecosystem structure and dynamics in the North Atlantic basin and its regional seas;

2. To determine how carrying capacity and trophic controls may change with changing climate and its impact on the production and ecosystem role of these key fish stocks;

3. Contribute to an assembly of key species and ecosystem indicators and conduct simulations on their performance under climate change for synthesis in WP8 Advancing Ocean Management."

Mike St.John reviewed WP8: Advancing Ocean Management (Work Package leaders: Mike St.John, Fritz Köster). "The overall objective of this WP is to synthesise and extend findings of earlier WPS to develop understanding and approaches that will improve and advance ocean management by strengthening the ecosystem approach to resource management. To this end, activities in this WP will buttress our understanding of the variability, potential impacts, and feedbacks of global change and anthropogenic forcing on ecosystem structure, production of exploited fish stocks, sequestration of carbon, changes in ecosystem state and key species abundance of the North Atlantic Ocean and associated shelf seas. Based on activities in WP1-6 to assess the future development and susceptibility of North Atlantic marine ecosystems and their key species to changes in climate and exploitation patterns; Evaluate existing and alternative ecosystem and key species indicators under contrasting environments and exploitation regimes; Furthering the activities in WP7 assessing the impact of climate change and resource exploitation on the North Atlantic carbon cycle in economical terms; Assess the applicability of existing EC management measures and directives (i.e., CFP; MSDF) or their principles for application in the wider North Atlantic Ocean management."

Erica Head reviewed the Canadian Atlantic Zone Monitoring Program (AZMP http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/azmp-pmza/index-eng.html) and highlighted the monitoring relevant to BASIN including transects, fixed stations, and ground fish surveys on North Atlantic Canadian shelves and the offshore monitoring program the Labrador Sea. There is also satellite remote sensing work involving ocean color, SST, and primary production, and the Continuous Plankton Recorder (CPR) surveys that are relevant to BASIN. She emphasized the opportunity for collaborators to go out to sea on their cruises.

Pierre Pepin reviewed the Newfoundland (NL) AZMP standard sections. There are "teleost" trips in spring and summer, and a Hudson cruise in the fall. Ecosystem research initiative goals are designed to enhance NL surveys and identify and track main pathways for energy flow in the NL system.

Brad deYoung reviewed Canadian opportunities on the academic side. While there is no general call for BASIN on academic side and he does not anticipate many will apply for funds under the BASIN banner, there is basin-scale modeling going on using several different models. There is also some glider work that may be done along with some sensor development and hybrid glider development.

Ben Ward described ongoing modeling work on the biogeography of primary producers in the

sub-polar North Atlantic. He discussed biogeography of diatoms and dinoflagellates and niche separation of individual taxa? Also described was the succession of diatoms and dinoflagellates and how mixotrophy affect primary production and chlorophyll biomass, i.e., mixotrophs cannot survive at steady state, and how a fluctuating nutrient pulse generates a successional niche.

Robao Ji described a basin-scale inter-regional study of copepod population dynamics involving *Centropages*, *Pseudocalanus*, and *Calanus* as the target species. The FVCOM (Finite Volume Community Ocean Model) will be applied to the North Atlantic Basin, linking hydrodynamics, lower trophic level food web and copepod population dynamics. Key scientific questions include the climate forcing driving the phonological variability and biogeographic boundary of ecologically important copepod species.

Mingshun Jiang described an interest in zooplankton ecosystem connectivity and carbon fluxes. This work would focus on meso-scale and sub-meso-scale fields with a variety of instrument systems (ADCP, LOPC, etc.) and modeling work that was based on biological size spectra. Interest is in looking at shelf/deep-ocean exchanges and the role of small to intermediate scale eddies.

Gareth Lawson described observational studies of zooplankton distributions and their interaction with predators. This work requires development of new acoustic sensors and their use on autonomous vehicles in addition to the more conventional hull mounted and towed systems. He described a current proposed BASIN project that involves work in the Northwest Atlantic including the Gulf of Maine and Slope Water and participation in some of the proposed EURO-BASIN cruises in the Northeast Atlantic.

Hongsheng Bi described work on the connectivity between the coastal ocean and Chesapeake Bay. The focus is on Atlantic menhaden and recruitment variability. They are looking at changes in physical forcing that affects circulation using a 3D HYCOM model. There are large changes in menhaden between MARMAP years and last ten years associated with changes in spawning in late winter.

Jamie Pierson is studying how individual behaviors affect population dynamics. He is looking at vertical migrations and feeding behaviors. His current work is in Puget Sound, the Gulf of Mexico, and Chesapeake Bay. One element of the study involves hypoxia and its impact on individuals. He is also interested in how climate affects individual zooplankters. He noted that prey changes can affect fitness of individuals and that temperature can alter growth and development. He is interested evaluating carbon flux in the context of whether animals feed to satiation, swim down to depths, and then defecate, or whether they do more random swimming with less defecation at depth.

Jeff Runge is interested in a BASIN study of shelf exchanges of mesozoplankton and the role of the western North Atlantic Gyre. The Northwest Atlantic very different from the Eastern Atlantic and there is a need for estimates of local (shelf) versus remote (deep ocean) natural and anthropogenic impacts on ecosystem dynamics and exploited resources. Basin-scale coupled models are needed for identification of the climate forcing processes that have the greatest

influence on ocean and ecosystem variability. He described a current project studying the life histories of *Calanus* species in Pacific and Atlantic oceans and the fact that they now have a mechanistic explanation for triggers for ontogenetic migrations. He is interested in a study of Western North Atlantic Gyre that would look at cross-shelf exchanges on/off the Scotian shelf and Gulf of Maine, and their relationship to coastal shelf fisheries in the Gulf of Maine.

Charlie Stock briefly compared the climate model runs for the Fourth Assessment Report (AR4) versus an Earth System Model that allows closing the carbon cycle running for AR5. Primary interest is in BASIN because they see a convergence in scales of interest with one group (BASIN) moving from the shelves to deep ocean and other (climate modelers) moving from deep ocean to shelves. But there is uncertainty about how the two communities will be able to collaborate. The model COBALT (Carbon Ocean Biogeochemistry and Lower Trophics) is addressing how much primary production is translated to mesozooplankton production. Transfer efficiencies vary on a global scale. Areas of interest include the biological pump and transfer of energy to higher trophic levels.

Chuck Greene said that the promise of GLOBEC was to develop a predictive understanding of ecosystems and he argued the program has been successful. He thinks we have modeling capability to do predictions. He illustrated this by the talking about the lessons learned on how low NAO events give rise to major changes in the physics and biology in the Gulf of Maine with lags of a year or two. He anticipates that another low NAO event that happened recently will be showing up in the Gulf of Maine in next year and a half. He also noted that Great Salinity Anomalies occur about once per decade and that now there is the highest freshwater storage in Arctic Ocean on record. It could be the next big anomaly. There is a need to have monitoring in Canadian waters to see such events coming down the advective flow fields on the western side of the North Atlantic.

These individual presentations ended at noon on 3 June.

Working Groups

The early afternoon was spent in breakout groups that were defined in a brief plenary session after lunch. Three groups were formed:

1) Meso-scale and sub meso-scale processes (Climate forcing on Shelf/Slope Exchange Modeling and field work).
2) Basin-scale Modeling (Physics and Biology) & Basin-scale observations - coupling between EU and North America efforts.
3) Creation of a Virtual BASIN observatory.

The breakout group presented reports in mid-afternoon and general discussion in plenary session ensued.

Group #3 presented an overview of their deliberations, which included some of the key elements for the BASIN Virtual Observatory. BASIN will likely have four data centers managing and

serving data collected during the course of the program (two in Europe – Pangaea http://www.pangaea.de/, and ICES), one in Canada (DFO), and one in the US (BCO-DMO http://www.bco-dmo.org/). An effort is needed to create an informatics structure that will allow the four centers share data and information, and to provide access to computing resources for data discovery, use, and re-use. This effort would include forming an Alliance that would meet regularly to facilitate the development of the informatics tools and services needed to allow BASIN investigators to transparently access data and information regardless of which repository they were residing in.

Group #1 reported next, and identified the following questions:
• What is the remote contribution of BASIN scale processes to productivity of shelf and coastal fishery?
• What is the importance of local versus remote forcing effects in controlling species abundance (and productivity) in shelf seas – coupled with physiological observations and understanding of life histories?
• What is the exchange of carbon/nutrients both onto and off of the continental shelf?
• Are the responses to large-scale processes different in the eastern and western regions of the North Atlantic?
• How does the influence of the intensity of the shelf-break front (e.g., the Gulf Stream boundary) influence the relative importance of mesoscale processes in the regions of the North Atlantic
• Because of the differences in community structure in the different regions of the North Atlantic, are there differences in the efficiency of trophic energy transfer efficiency related to the accumulation patterns of lipids in key prey species? Is this influenced by the pathways from primary producers?
• What are the key differences that we need to address in Northwest Atlantic that are not adequately dealt with by studying the northeast Atlantic?

Group #2 reported that discussions centered on the issue of climate influence on Basin-scale ecosystem and the controversy about bottom up versus top down control of the ecosystem structure and function. Also discussed was which fish stocks in the Northwest Atlantic might be compared with those now the foci of the EURO-BASIN work (tuna, herring, blue whiting, and mackerel). The issue of making predictions of ecosystem change also came up again with the possibility of using the recent drop in the NAO index for making model predictions. Some skepticism about making model predictions beyond seasons was expressed. There was a question about the Great Salinity Anomalies and whether they could be predicable. It was said that in hindcast mode models can prove useful, but decadal prediction experiments are more problematical. Questions about model resolution and geographic boundaries were raised. To get the flux of freshwater from the Arctic into the North Atlantic correctly, resolution higher than that current in model basin-scale models is needed especially in the Canadian archipelago. Another point was the need for vertical migration studies in the deep ocean to help provide the information essential for modeling. There was discussion about the use of OSSEs to assist in determining what kind of meso-scale sampling should be done in BASIN.

Day 2 (Wrap-up)

In wrapping up the day's discussions, the group returned to the first two of the three BASIN themes, which were the focus of much of the day's discussions, as a way to determining gaps that needed to be filled by contributions from the North American side. The question was posed about the extent to which the EURO-BASIN investigators will be able to answer in the next four years the questions of Theme One [How will climate variability and change, for example changes in temperature, stratification, transport and acidification, influence the seasonal cycle of primary productivity, trophic interactions, and fluxes of carbon to the benthos and the deep ocean?] and Theme Two [How do life history strategies of target organisms, including vertical and horizontal migration, contribute to observed population dynamics, community structure, and biogeography?]. It was clear that there were significant gaps and significant needs for North American investigators to conduct field and modeling to complement what was proposed by the Europeans. For example, with respect to Theme One, the carbon flux fieldwork will be done in a 1D context at three different stations. To transform this, there is a need for a 3D context. So another ship from the North American side is needed to provide the 3D context in which the work is being done. Much of this work will take place in the sub-polar region and there is a need to have complementary work in the subtropics. In addition, there is need for collaboration in the mesocosm experiments planned in Norway to study how particles are packaged by grazers to transport into the deep-sea. Regarding Theme 2, it was clear that only a limited number of species would be the subject of life history studies mostly in the eastern Atlantic and that there is a need for other "key" species identified in the science plan to be studied by others as well as the study of EURO-BASIN target species in the western Atlantic. On the modeling side, there is need for OSSEs to help provide an observational framework for BASIN research. Currently there is no OSSE work or data assimilation in the EURO-BASIN proposal, so this would be good work to have proposed.

Day 3 (June 4, 2010)

The meeting began in plenary session with a NOAA presentation.

Jon Hare described the current on-going field cruises that go from Cape Hatteras to Nova Scotia on 6 cruises per year with nutrients, chlorophyll, zooplankton, total alkalinity, and some other measurements. Two cruises are on fish survey cruises and four on dedicated to the ECOMON surveys. In addition, there are CPR surveys across the Gulf of Maine, the Oleander sections from New York to Bermuda (http://www.aoml.noaa.gov/phod/goos/oleander/intro.php), and support for mooring deployments as part of the Gulf of Maine Ocean Observing System (GOMOOS http://www.gomoos.org/). In addition, there are some dedicated cruises in the Northeast that may have bunk space available.

There are several different funding sources within NOAA for BASIN activities. A principal one is CAMEO (Comparative Analysis of Marine Ecosystem Organization http://cameo.noaa.gov/), which is jointly funded by NSF and NOAA. BASIN investigators could apply for funds if presented in right context. Funding cannot be used for foreign salaries, but some funds may be used for travel etc. In addition, there is no exclusion for funding for new field work, but such

requests have more limited prospects. It was emphasized that CAMEO is run by Fisheries at NOAA and proposals must be seen to be relevant to people that think about fisheries and applied science. NOAA has a climate office that also issues calls for proposals, however, BASIN is not presently on their task list. There is a need to work on getting BASIN onto their list. The climate office has not had an ecosystem component, but they are interested in moving in that direction. NOAA will form a climate service office (http://www.climate.gov) with and ecosystem component in an up-coming reorganization, which will happen in next several months. This will provide an opportunity to apply for new resources. Several smaller NOAA NMFS fisheries opportunities are in the works with respect to the environment, ocean acidification program, and carbon cycling also, but all for next year.

There was some discussion about links between BASIN science and fisheries assessments in the Northwest Atlantic. There is the possibility to hire a couple of people to make the links and also to link to WPs 7 and 8 (Barange and Köster in Europe) and also (some people from Canada). BASIN needs to have a 3-pronged approach in the Northwest Atlantic that includes doing the science, working with assessment groups, and addressing the fishery councils. It was emphasized that there was a need for ecosystem and oceanographic investigators to collaborate with fisheries assessment scientists from the program's onset. There is a strong need to include ecosystem level questions in fisheries assessments and consider these (biotic and abiotic ecosystem) effects jointly with fishing pressure. The Terms of Reference of the fisheries assessment working groups should be revisited to include ecosystem assessments an integral part of the assessments.

Gareth Lawson presented a review of discussions that took place during a dinner meeting of the Group #1 participants. An Implementation Plan for research on the shelf-slope exchange in the Northwest Atlantic Slope Water and Gulf of Maine (GoM) system was outlined. There are burning questions about the exchange of species and their dynamics in GoM that are driven by far-field forces in the North Atlantic. Similar efforts are underway in Iceland, Greenland, and Norway that could be linked to this effort. It was clear that basin-scale modeling was needed to address this problem.

Richard Sanders again reviewed the efforts in the EURO-BASIN biogeochemical sphere where the central thrust is carbon pump. There is a need to value this service economically. The central focus of the EU work is to understand how it works and specifically on the downward flux since it is the rate limiting step. For their programs there are three activities - A mesocosm study which has room for North American participation; the second is a cruise in the North Atlantic to study three major sites that will be visited three times (hopefully before, during, and after the spring bloom); and a UK cruise at the PAP site (40°N, 20°E; Porcupine Abyssal Plain - site of the JGOFS North Atlantic Bloom study), which needs additional work to enhance the spatial context. This is a big opportunity for joint North American and EU collaboration, and needs another ship to do this. In addition, the EU work is all planned for sub-polar seas and there is need for Biogeochemistry research south of 50°N. Regarding the shelf pump, models suggest that the North Sea is pumping CO_2 into the deep ocean. There is need for work to look at this, but this work is missing from the EU-BASIN proposal. It would be desirable to see a similar kind of effort on the Northwest Atlantic.

Icarus Allen again reviewed the EURO-BASIN modeling activities and provided an overall framework. There will be an activity centered on using a NEMO 1/4 degree model that includes lower trophic levels. It will be coupled to fish stock models (tuna, herring, blue whiting, herring, makerel) and to bio-economics (climate environment, species, and size spectra), plus economics. Issues to be addressed are top-down and bottom-up controls, the carbon budget, shelf exchange, biogeography. Gaps are regional models, data assimilation, and OSSEs. They are building an ensemble approach - starting with hindcasting and they intend to look at relationships to NAO, salinity anomalies, and shelf sea exchange changes as they impact the ecosystems.

The final discussion of the plenary session was devoted to the finalization of the Implementation Plan and the development of a "Two-Pager" that could be used by U.S. Investigators in their proposals to provide a context for the work that they were proposing. A number of individuals expressed interest in assisting with both tasks.

The meeting ended at noon on 4 June 2010.

Acknowledgements:

We thank Ken Eng and Chip Clancy for their excellent support in helping to organize this meeting. Thanks also to the Rutgers Student Center support staff for providing the meeting room facilities and coffee break drinks etc. We greatly appreciate the attendance of a number of the EURO-BASIN work package leaders and our Canadian colleagues from DFO and Memorial University whose participation greatly aided informed discussions of the BASIN initiative and its current status. Partial support for this workshop was provided by NSF grant OCE-0638387.

Appendix I. Agenda

BASIN
Agenda

Wed 2 June (objective: put all ideas on the table)

1:00pm – Welcome
Introductions
Meeting Objectives

1:30pm – BASIN Program
Overview
Relation to other programs, e.g., AMOC
Status of Implementation Plan

2:00pm – EU BASIN (funded projects)
Mike St. John, Manuel Barange, Icarus Allen,
Stéphane Pesant, Richard Sanders, …
Others…

3:00pm – **Coffee Break**

3:30pm – Individual US and Canadian contributions (3 slides/5 minutes each)
Jeff Runge, Oscar Schofield, Scott Glenn,
Rubao Ji, Mary Jane Perry, Meng Zhou,
Ann Bucklin, Enrique Curchitser, Dale Haidvogel,
Ben Ward, Pierre Pepin, Erica Head, Chuck Greene,
Andy Pershing Gareth Lawson, Avijit Gangopadhyay,
Jamie Pierson, Hongsheng Bi, …
Others…

5:30pm – Adjourn

7:00pm – **Group dinner**

Thurs 3 June (objective: identify collaborations and advance the Implementation Plan)

8:00am – **Breakfast**

8:30am – Review and formation of breakout groups

9:00am – Breakout groups meet (coffee break included)

11:30am – **Lunch**

1:00pm – Breakout group reports and general discussion

2:00pm – Breakouts (coffee break included)

4:30pm – Breakout group reports and general discussion

5:30pm – Adjourn

Fri 4 June (objective: finalize next steps of Implementation Plan and Cover Letter for future proposals)

8:00am – **Breakfast**

8:30am – NOAA participation

9:30am – Implementation Plan
Need for revisions and enhancements

10:30am – **Coffee break**

11:00 – Draft of 2-page Intro to US proposals, with links to EU and Canadian programs

Noon – Adjourn

Appendix II. Attendees

Icarus Allen	PML	jia@pml.ac.uk
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