THE U. S. GLOBAL OCEAN ECOSYSTEMS DYNAMICS PROGRAM

Northwest Atlantic Field Studies, Phase III: Modeling, Observation and Process Field Studies, and Synthesis

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Announcement of Opportunity

Deadline: 15 December 1997

NATIONAL SCIENCE FOUNDATION
Directorate for Geosciences, Division of Ocean Sciences

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Coastal Ocean Program & National Marine Fisheries Service

INTRODUCTION

Research activities in the coastal Northwest Atlantic Ocean are supported by a number of organizations including the National Science Foundation's (NSF) Division of Ocean Sciences (OCE) and the National Oceanic and Atmospheric Administration's (NOAA) Coastal Ocean Program (COP) and National Marine Fisheries Service (NMFS). NSF/OCE generally supports research projects focused on basic oceanographic and ecological processes and the study of natural systems. A component of NOAA's COP focus is directed towards developing tools and capabilities to improve ecosystem management and NOAA/NMFS manages the nation's living marine resources. Environmental and resources management decisions are most appropriately based on knowledge gained from both basic and applied research.

This Announcement of Opportunity is under the auspices of the Global Ocean Ecosystems Dynamics (U. S. GLOBEC) program within NSF/OCE and the regional ecosystem studies and U. S. GLOBEC initiatives of NOAA's COP. An opportunity exists for U.S. scientists to propose **modeling, broad-scale and process-oriented field studies, and synthesis/comparative analysis** projects that address the broad intersection of basic and applied research interests of the Northwest Atlantic Georges Bank program. This Announcement of Opportunity addresses the anticipated third and final field phase of the U.S. GLOBEC program on Georges Bank.

The anticipated funding for the Phase III activities is approximately $5 million per year for up to three years, contingent on the availability of funds. The deadline for proposals is Monday, **15 December 1997**. Final recommendations for awards will be made by 15 June 1998.

DESCRIPTION

Global Ocean Ecosystems Dynamics (U. S. GLOBEC) is a component of the U.S. Global Change Research Program, with the goals of understanding and ultimately predicting how populations of marine animal species (holozooplankton, fish and benthic invertebrates) respond to natural and anthropogenic changes in global climate. U.S. GLOBEC is also the U.S. component of the International GLOBEC program, a core project of the IGBP (International Geosphere-Biosphere Program), with co-sponsorship from the Scientific Committee on Oceanic Research (SCOR) and the Intergovernmental Oceanographic Commission (IOC). The U.S. GLOBEC study in the Northwest Atlantic/Georges Bank region is an integral part of the pan-North Atlantic Cod and Climate Change (CCC) Program and the Trans-Atlantic Study of *Calanus* (TASC) sponsored by the International Council for the Exploration of the Sea (ICES). These programs emphasize the biology of cod and the copepod *Calanus* in the North Atlantic coupled with large- and meso-scale circulation. The Atlantic component of Canada GLOBEC recently initiated a four-year program (1996-2000) to investigate the effect of environment on gadoid finfish (cod and haddock) and copepods (*Calanus finmarchicus* and *Pseudocalanus* spp.). These other national and international investigations complement the studies being done by U.S. GLOBEC on Georges Bank, and provide a unique opportunity for both regional and inter-regional comparisons and the evaluation of large-scale environmental influences (e.g., the North Atlantic Oscillation) on these pan-North Atlantic species (cod and *Calanus*).

The U.S. GLOBEC Northwest Atlantic Implementation Plan (U. S. GLOBEC Report No. 6) was developed following several community-wide meetings where U.S. scientists from the oceanographic and fisheries communities identified key scientific issues and research prospectuses for the Northwest Atlantic region. The overall objectives of the U.S. GLOBEC program are described in the U.S. GLOBEC Initial Science Plan (Report No. 1). Background information pertinent to the Northwest Atlantic is found in U.S. GLOBEC Report No. 2. Investigators who plan to submit proposals in response to this Announcement should refer to the Northwest Atlantic Implementation Plan (U.S. GLOBEC Report No. 6). Copies of these documents are available from the following address or homepage:

The U.S. GLOBEC Coordinating Office
Department of Integrative Biology
University of California
Berkeley, CA 94720-3140
Phone:510-643-0877;
Fax: 510-643-1142
Internet: kaygold@uclink4.berkeley.edu
http://www.usglobec.berkeley.edu/usglobec/globec.homepage.html

THE RESEARCH PROGRAM

The recommendations contained in the U.S. GLOBEC Northwest Atlantic Implementation Plan present the rationale for a coordinated study in the Northwest Atlantic on Georges Bank and environs. The NW Atlantic/Georges Bank Study is not restricted to the continental margin and shelf, but encompasses also the processes and phenomena of the larger oceanic boundary region that affect the Bank. The initial phases of this inter-agency research program have supported integrated,

multi-investigator, inter-disciplinary programs of modeling, retrospective analysis, and broad-scale and process-oriented studies. Ultimately, the U.S. GLOBEC effort in the Northwest Atlantic has an overall goal of improving predictability and management of living marine resources of the region through improved understanding of ecosystem interactions and the coupling between the physical environment and the living resources.

Program Goals

Within the overall goal outlined above, the NW Atlantic/Georges Bank Study has four general goals:

• To determine the processes that control the Georges Bank circulation and transport of biological, chemical, and geological materials in a strongly tidal- and buoyancy-driven system and to determine the physical and biological processes that control the population dynamics of the target species (cod, haddock, and the copepods *Calanus finmarchicus* and *Pseudocalanus* spp.)

• To embody this understanding in diagnostic and prognostic models capable of elucidating ecosystem dynamics and responses on a range of time scales, including interannual fluctuations.

• To understand the effects of climate variability and climate change on the distribution, abundance and production of the target species in the Northwest Atlantic/Georges Bank region.

• To apply the understanding of biophysical processes which affect distribution, abundance and production of the target species to the identification of critical variables that support ecosystem-based forecasts and indicators, as a prelude to the implementation of a long-term ecosystem monitoring strategy.

Toward these ends, the Georges Bank field program has been structured to have alternate years of intensive study (1995, 1997, 1999). Broad-scale studies (via ship, drifter, mooring and satellite observations) were/will be conducted in each of the intensive process-study years and in the intervening years (1996 and 1998). The continuity of the broad-scale observations over 5 years (95 - 99) will provide the longer-term context for the process-oriented investigations, and permit analysis of interannual variability in physical forcing and biological responses. In Phase I (1995 field year), the primary focus of process studies was on vertical mixing and stratification processes and their control over biological rates and interactions. In Phase II (1997 field year), the primary focus of process studies was on the sources, retention, and losses of water and organisms from the bank. The primary focus for Phase III (1999 field year) will be on cross-frontal exchange processes. Although each phase has a different primary focus, information on all processes, e.g., stratification, retention and loss, and frontal processes, has been and will be collected during all intensive process-study years. Specific information about the NW Atlantic/Georges Bank Study Phase I and Phase II activities already funded [including program description (see Wiebe et. al., 1996), cruise and meeting reports, data archives, and bibliography] can be obtained from the following address or homepage:

U.S. GLOBEC Northwest Atlantic Georges Bank Coordinating Office
Department of Biology
Woods Hole Oceanographic Institution
Woods Hole, MA 02543
Phone:508-289-2409;
Fax: 508-457-2169
Internet: rgroman@whoi.edu
http://globec.whoi.edu/

Structure of the Phase III Research Program

The NW Atlantic/Georges Bank Study has comprised to date four major components: (a) broad-scale field survey and observational studies, (b) process-oriented field studies, (c) modeling investigations, and (d) retrospective/comparative analysis. Research conducted during Phase III will continue to follow this four-pronged approach, with the process study primarily focusing on cross-frontal exchange processes and synthesis activities replacing the retrospective analysis.

Broad-scale studies: The broad-scale studies include shipboard surveys, multi-disciplinary moorings, long-term drifter deployments, and analysis of satellite data. Ship-board studies are needed to determine the distribution and abundance of the target species in relation to their physical environment during the pelagic period of cod and haddock larvae (January to June). The approximate scale of the ship-based broad-scale sampling is shown in Wiebe et al. 1996, and is also available on the web site above. In addition, there is a continuing need for long-term mooring- and drifter-based observations and interpretation of regional satellite data. The fundamental importance of the broad-scale studies is to provide the basis for multiple interannual comparisons of population processes and their coupling to the physical structure and variability of the environment. The broad-scale studies will provide a regional context for the Phase III cross-frontal exchange study and provide further data to evaluate stratification and source, retention, and loss processes.

Process studies: To further identify and understand the physical and biological processes that control the population dynamics of the target species, the Phase III process studies will primarily focus on cross-frontal

exchanges. The Georges Bank region has major frontal features around the periphery of the Bank (the shelf/slope water front along the southern flank of the Bank and a front between the Bank and the Gulf of Maine waters along the northern edge of the Bank) and a tidal mixing front located near the 60 m isobath which surrounds the well-mixed water over the shallow crest of the Bank. The exchange of physical and biological properties across these fronts can influence the supply of nutrients for primary production, the retention (loss) of the target species and their prey on (from) the Bank, and interactions between the target species, their prey, and their predators. Cross-frontal exchange is influenced by physical processes which determine the location, deformation, and movement of the front including tides, winds, seasonal heating/cooling, and offshore forcing, and by biological characteristics and behavior which may enhance or minimize exchange. Fronts often are regions of aggregation for marine plankton, both because of physical processes such as divergence or convergence and biological responses such as enhanced production or behavior (i.e., depth-keeping swimming). Such aggregations of plankton provide an enhanced food source for predators including larval cod and haddock. Fine-scale description of the physical and biological fields comprising fronts may reveal aggregations of phytoplankton and zooplankton associated with specific physical (e.g., density, temperature) structures.

Questions to be addressed by process studies in Phase III include:

• What is the three-dimensional circulation associated with the fronts around and on Georges Bank?

• What are the important processes and interactions between plankton and larval fish at the fronts, and how are they affected by small-scale temporal and spatial physical variability? What is the influence of fronts upon the vital rates and population dynamics of the target species?

• What are the exchange rates, due to frontal processes, of water properties and the target species across the fronts on the Bank? And what are the consequences for the individual and the population of these exchanges?

• How do biological and physical processes interact to control cross-frontal exchange of target organisms?

• Does frontal movement (e.g., of the tidal front due to fortnightly variability in the tidal currents or of the shelf/Slope Water front due to offshore forcing) influence the exchange of water and organisms across the different fronts?

• How do temporal variations on different scales (e.g., diel tidal, neap/spring tidal cycles, and seasonal cycles) interact with the population development of target species? What are the consequences of this temporally variable exchange to the recruitment of the target species?

Modeling: The research conducted during Phases I and II will result in a significant archive of data concerning abundance and distribution of the target species, source regions, and vital rates. Also expected from Phase II are specific estimates of population dynamics parameters arrived at by inverse modeling. These archives and tools will provide significant opportunities for hypothesis testing concerning biophysical processes. Data-assimilative studies are expected to continue in hindcast mode throughout Phase III, and the emergent Phase III data relative to cross-frontal exchange will provide the opportunity to test data-assimilative models at finer spatial scales, with resultant improvement in the representation of these processes. In addition, process-oriented model studies are encouraged. Finally, the large number of studies of cod and *Calanus* being conducted across the North Atlantic (e.g., the TASC, CCC, and ICES programs) provide an opportunity for larger (basin) scale modeling of coupled biological/physical dynamics at the basin scale.

Synthesis/comparative analyses: Efforts to synthesize the results of U.S. GLOBEC NW Atlantic studies are encouraged to maximize the utility of GLOBEC research to Georges Bank resource managers and to other ecosystem-based research programs. In addition to examining data sets emerging from this study, studies are encouraged that will compare and integrate data from other regions (especially the Scotian Shelf and Northeast Atlantic) with data from this study. Such comparative studies could help separate those aspects of animal behavior and population dynamics which respond to basin-scale climate variability from those influenced primarily by local variability. Synthesis and comparative studies will be useful for investigating the physical and biological consequences of climatic variation and should be tied to resource management needs.

PROPOSAL FORMAT

Proposals submitted in response to this Announcement of Opportunity should be prepared and submitted in accordance with the guidelines provided in the NSF brochure, *Grant Proposal Guide* (GPG) NSF 98-2. Single copies of this brochure are available at no cost from the NSF Clearinghouse: phone (301) 947-2722, or via
e-mail from pubs@nsf.gov, or the NSF homepage (http://www.nsf.gov/). Proposals will be subjected to initial screening for the requirements in the GPG and will be returned without review or advance notification if

deficiencies are found. Proposals will **NOT** be forwarded to other Programs if found to be inappropriate for this competition.

PROPOSAL SUBMISSION

All proposals involving Federal and/or academic scientists must be submitted to the address below. Federal scientists will be eligible for funding by NOAA but not NSF. **Proposals submitted in response to this Announcement of Opportunity must be received by 15 December 1997** and be identified by entering "**U.S. GLOBEC Northwest Atlantic NSF 97-163**" in the Program Announcement block of the cover page. Proposals received after the deadline will be returned to the sender without review.

Prospective investigators should provide in their proposals a full scientific justification for the research and not simply reiterate justifications laid out in the implementation plans. In addition, it would be helpful if a brief statement is included as to how proposed efforts may be co-ordinated with efforts of other potential investigators. Because of page limitations (GPG, page 5, Project Description), individual proposals with overly complex structure and large numbers of investigators are discouraged. Proposals should be written to allow adequate review of the details of such things as goals and objectives, conceptual framework, methodological approaches, integration with other likely projects, and synthesis.

An original and 20 copies of the proposals should be sent to:

Announcement Number (NSF 97-163)
Biological Oceanography Program
Division of Ocean Sciences
National Science Foundation
4201 Wilson Blvd., Room 725
Arlington, VA 22230

Proposals may also be submitted electronically. For information, contact the Electronic Proposal Submission Program Director, Division of Information Systems, phone (703) 306-0214, or via e-mail, eps@nsf.gov (Internet).

If you have questions or require further information, contact Kendra Daly or Phil Taylor NSF Division of Ocean Sciences: 703-306-1584, (email: kdaly@nsf.gov, prtaylor@nsf.gov), or Judy Gray, NOAA Coastal Ocean Office: 301-713-3338, (e-mail: jgray@cop.noaa.gov.

PROPOSAL REVIEW

Review of proposals and support of the U. S. GLOBEC Northwest Atlantic program will be handled cooperatively by NSF and NOAA. Proposals will be evaluated based on the two general criteria described in the NSF Grant Proposal Guide and in accordance with established NSF and NOAA procedures for external merit review. The proposal's responsiveness to the stated goals of the U. S. GLOBEC programs at NSF/OCE and the regional ecosystem studies and U. S. GLOBEC initiatives at the NOAA Coastal Ocean Program, and the degree to which the proposed project complements other proposed and ongoing research projects will also be considered in the evaluation by panel(s) of expert scientists.

Proposals should include plans for the documentation, archiving, and dissemination of U. S. GLOBEC research data. All funded participants must adhere to the U.S. GLOBEC data policy (see U.S. GLOBEC Report No.10) and to data management policies applying to recipients of federal funding in geosciences. The U.S. GLOBEC Data Policy is available through the U. S. GLOBEC office and homepage. Following the review process, Federal scientists and others who are selected to receive funding from NOAA, may be required to submit additional forms and paperwork required by NOAA.

GRANT ADMINISTRATION

Grants awarded as a result of this announcement will be administered in accordance with the terms and conditions of NSF GC-1 (10/95) or FDP-III (7/1/96), ***Grant General Conditions***. Copies of these documents are available at www.nsf.gov [select 'Grants and Awards', then 'Online Document System'] or from the NSF Forms and Publications Unit. More comprehensive information is contained in the **NSF *Grant Policy Manual*** (7/95) (NSF 95-26), for sale through the Superintendent of Documents, Government Printing Office, Washington, DC 20402.

REFERENCES

U.S. GLOBEC Report No. 1, 1991. U.S. GLOBEC Initial Science Plan.

U.S. GLOBEC Report No. 2, 1991. GLOBEC: Northwest Atlantic Program, GLOBEC U.S./Canada Meeting on Northwest Atlantic Fisheries and Climate.

U.S. GLOBEC Report No. 6, 1992. Northwest Atlantic Implementation Plan.

U.S. GLOBEC Report No. 10, 1994. U.S. GLOBEC Data Policy.

Wiebe, P.H., R.C. Beardsley, D. Mountain, and A. Bucklin. 1996. Global Ocean Ecosystem Dynamics--Initial Program in the Northwest Atlantic. Sea Technology 37(8): 67-76.

The National Science Foundation (NSF) and the National Oceanic and Atmospheric Administration (NOAA) provide awards for research in the sciences and engineering. The awardee is wholly responsible for the conduct of such research and preparation of the results for publication. The NSF and NOAA, therefore, do not assume responsibility for such findings or their interpretation.

The NSF and NOAA welcome proposals on behalf of all qualified scientists and engineers, and strongly encourage women, minorities, and persons with disabilities to compete fully in any of the research and research-related programs described in this document. In accordance with Federal statutes and regulations, and NSF and NOAA policies, no person on grounds of race, color, age, sex, national origin, or disability shall be excluded from participation in, denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from the NSF and NOAA.

Facilitation Awards for Scientists and Engineers with Disabilities provides funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on an NSF project. Contact the program coordinator in the Directorate for Education and Human Resources. The telephone number is (703) 306-1636. The Foundation has TDD (Telephonic Device for the Deaf) capability, which enables individuals with hearing impairment to communicate with the NSF Information Center about NSF programs, employment, or general information. To access NSF TDD, dial (703) 306- 0090; for FIRS, 1-800-877-8339.

PRIVACY ACT AND PUBLIC BURDEN

Privacy Act. The information requested on proposal forms is solicited under the authority of the National Science Foundation Act of 1950, as amended. It will be used in connection with the selection of qualified proposals and may be disclosed to qualified reviewers and staff assistants as part of the review process; to applicant institutions/grantees to provide or obtain data regarding the application review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers as necessary to complete assigned work; and to other government agencies in order to coordinate programs. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 60 Federal Register 4449 (January 23, 1995), and NSF-51, "Reviewer/Proposal File and Associated Records," 59 Federal Register 8031 (February 17, 1994).

Public Burden. Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of your receiving an award.

The public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding this burden estimate or any other aspect of this collection of information including suggestions for reducing this burden, to:

Gail A. McHenry
Reports Clearance Officer
Information Dissemination Branch
National Science Foundation
4201 Wilson Boulevard
Suite 245
Arlington, VA 22230

This program is described in the Catalog of Federal Domestic Assistance category 47.050

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