

Annual Report for 2000 of the Scientific Committee on Oceanic Research (SCOR)

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INTRODUCTION

The Scientific Committee on Oceanic Research (SCOR) was created by ICSU in 1957 as the first of its interdisciplinary bodies. SCOR is charged with promoting international activities in oceanography, which it does primarily through two types of activities. First, the traditional mechanism by which SCOR has operated since its inception is the small, short-lived Working Group, formed to address specific ocean science topics. Second, SCOR has also taken the lead in planning longer-term, large-scale international research programs in oceanography designed to address issues of the role of the ocean in global climate change. SCOR also serves as an official scientific advisor to the Intergovernmental Oceanographic Commission (IOC) of UNESCO.

MEMBERSHIP

The members of SCOR are the "Committees for SCOR," which in 2000 existed in 37 countries. There were no new additions to the SCOR membership in 2000; however, one member (Thailand) withdrew from SCOR due to continuing financial problems in Southeast Asia. Each SCOR Committee is permitted to nominate as many as three scientists to represent it in SCOR; other individual members of SCOR include the chairs of all SCOR scientific subsidiary bodies and the representatives of other ICSU organizations.

VITAL STATISTICS

Reference to scientific meetings and publications will be found in the discussion of SCOR's scientific activities below. In summary, about 5 refereed books and journal articles, 4 scientific reports, and several issues of newsletters and articles resulted from SCOR activities during 2000. In 2000, three SCOR working groups; the JGOFS, GLOBEC, and GEOHAB Scientific Steering Committees (SSCs); and a number of JGOFS and GLOBEC subsidiary groups held meetings. These accounted for 30 meetings in 2000 supported fully or partially by SCOR. Approximately 250 scientists were involved in SCOR working groups and the SSCs of SCOR-sponsored major ocean programs at the end of 2000. Another 100 scientists served as Nominated Members to SCOR.

ORGANIZATIONAL MATTERS

Meetings: The 25th General Meeting of SCOR took place in Washington, D.C. in October 2000 at the invitation of the U.S. National Committee to SCOR. All of SCOR's scientific activities were reviewed and plans for activities in 2001 were considered. Several working groups were disbanded, having completed their terms of reference, and two new working groups were established (see below).

Finances: The Finance Committee reviewed the state of SCOR's finances and drafted a budget for 2001 activities, which was accepted by the General Meeting. Increases in membership fees will, for the

foreseeable future, be limited to the levels suggested by ICSU (a 1% increase from 2000 to 2001). SCOR is reviewing its membership policies and dues levels in light of continuing difficulties of several developing nations to maintain their dues payments.

Secretariat: The search for a new Executive Director was completed in August 2000 and the Dr. Edward R. Urban, Jr. succeeded Elizabeth Gross in this position in October 2000.

Constitution: SCOR approved two changes in its constitution. First, the terms of the SCOR President and Secretary will be staggered, starting in 2002, to avoid the situation faced in 2000, in which both officers rotated off the SCOR Executive Committee at the same time. Second, SCOR members approved a constitutional change to allow the president of affiliated organizations to delegate their position on the SCOR Executive Committee to another member of their organization. These changes were forwarded to ICSU.

ACTIVITIES UNDERTAKEN DURING 2000

Scientific Meetings: The traditional SCOR Working Group is a small (8-10 members), international group established to address a specific scientific problem that would benefit from international attention. Working Groups are expected to accomplish their objectives in four years or less. At the end of 2000, SCOR had 12 active working groups. In addition, four new groups were in various stages of formation at the end of the year (two of which had been approved in 1999). The SSCs for three SCOR-sponsored global programs, and a number of their sub-groups, also held meetings during 2000. A few selected achievements of these groups in 2000 follow.

The final report of the WG on *The Impact of World Fisheries on the Stability and Biodiversity of Marine Ecosystems* was published as a special issue of the *ICES Journal of Marine Science*. The joint SCOR/World Climate Research Programme (WCRP) WG on the *Intercomparison and Validation of Ocean-Atmosphere Flux Fields* completed its report by the time of the SCOR General Meeting and the report has since been published in the WCRP report series. The main focus of the group related to the uses of flux data from different sources and different scientific disciplines, as well as the accuracy and reliability of the products derived from these data. Resolution of flux issues will be critical to the success of such programs as the Climate Variability and Prediction (CLIVAR) program and the Surface Ocean-Lower Atmosphere Study. The WG on the *Magnitude of Submarine Groundwater Discharge and its Influence on Coastal Oceanographic Processes* met during the year to conduct two intercalibration experiments—in Florida, USA and near Perth, Australia—to resolve existing problems in measuring groundwater (offshore springs and seeps of freshwater) input to the coastal ocean. A SCOR/International Union of Pure and Applied Chemistry (IUPAC) WG on *Biogeochemistry of Iron in Seawater* has a book in press that provides the first comprehensive review of the wealth of new information arising from the intensive research carried out during the 1990s on iron limitation in the ocean; bioavailability and bioaccumulation of iron in seawater; atmospheric iron inputs to the oceans; and sources, sinks, and distributions of iron in seawater; as well as large-scale, in situ iron-addition experiments. During the course of its activities, the working group identified reference standards for iron as a critical need; therefore, SCOR approved an activity by a subgroup of the working group to conduct intercalibration work and produce a manual for creation of iron standards in seawater. Finally, a WG on *New Technologies for Observing Marine Life* met for the first time in 2000. This working group, funded by a private foundation, is contributing technological expertise to the Census of Marine Life, a major international effort that intends to develop biogeographic databases and

conduct ocean surveys to provide a better understanding of the distributions and relationships among non-commercial marine organisms.

In addition to these working groups, SCOR is the lead sponsor of three large-scale oceanographic programs, two of which are also Core Projects of the International Geosphere-Biosphere Programme (IGBP). These latter two projects were supported by ICSU grants in 2000 and are described in greater detail below.

Education/Training Activities: SCOR's education and training activities are focused in the area of capacity building, as described below.

Activities Involving Developing Countries and Capacity-Building Initiatives: SCOR continued to offer travel awards to ocean scientists from developing and post-communist countries in 2000, as it has for the past 17 years. This program was supported through a grant from the U.S. National Science Foundation and approximately 50 scientists were awarded full or partial travel grants in 2000 to participate in major international ocean science meetings. SCOR is also developing an activity on Regional Graduate Schools of Oceanography, which would foster the establishment of regional centers of excellence in oceanographic and marine environmental education in Southeast Asia, Latin America, Africa, and India. SCOR is cooperating with IOC and the Partnership for Observation of the Global Ocean (POGO) in a new program of fellowships for developing nation scientists to visit developed nations for 1-2 months to learn techniques of ocean observations. Finally, SCOR makes efforts to involve scientists from developing nations in all working groups. GLOBEC's Small Pelagic Fishes and Climate Change program has been particularly active in involving scientists from developing nations.

Joint Activities With Other ICSU Members: SCOR cooperates with IGBP on a number of different research programs and planning activities related to global change, as described elsewhere in this report. SCOR also conducted cooperative work with WCRP and IUPAC in 2000, as mentioned above. At the request of ICSU and IOC, SCOR and the Scientific Committee on Problems of the Environment (SCOPE) are providing scientific input to an assessment of the state of marine science and its applicability to sustainable development. The resulting book, dealing with the environmental issues that are likely to challenge the international ocean science community during the next two to three decades, is in progress.

Publications: Exemplary publications from SCOR activities in 2000 include:

- Schwartzlose et al. 1999. World-wide large-scale fluctuations of sardine and anchovy populations. *S. Afr. J. mar. Sci.* 21:289-347.
- C.E. Hollingworth (ed.). 2000. *Ecosystem Effects of Fishing*. *ICES J. Mar. Sci.* 57:465-792.
- R.B. Hanson, H.W. Ducklow, and J.G. Field. 2000. *The Changing Ocean Carbon Cycle: A Midterm Synthesis of the Joint Global Ocean Flux Study*. International Geosphere-Biosphere Programme Book Series 5. Cambridge University Press, Cambridge, UK.
- F.J. Millero. 2000. Effect of changes in the composition of seawater on the density-salinity relationship. *Deep-Sea Research I* 47:1583-1590.

- WCRP. 2000. Final report of the Joint WCRP/SCOR Working Group on Air-Sea Fluxes (SCOR Working Group 110). Intercomparison and validation of ocean-atmosphere energy flux fields. WCRP-112, WMO/TD-No. 1036.

Special Projects and New Areas of Interest: SCOR has played a leading role in planning longer-term, large-scale research programs designed to study the role of the ocean in global change. For example, SCOR was instrumental in developing the international components of the Joint Global Ocean Flux Study (JGOFS) and the Global Ocean Ecosystem Dynamics (GLOBEC) project. Both of these major projects are now guided cooperatively by SCOR and IGBP. Likewise, SCOR is cooperating with IOC in the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) project, which has developed a science plan for global research on the causes of harmful algal blooms.

IGBP's Phase II will be implemented on January 1, 2003. IGBP II will feature integrated projects of terrestrial, oceanic, and atmospheric research, as well as interface projects on land-atmosphere, ocean-atmosphere, and land-ocean interactions. Two of these new projects are being planned and implemented jointly between SCOR and IGBP:

Surface Ocean-Lower Atmosphere Study (SOLAS)—Processes at the ocean-atmosphere interface govern the transfer of chemical species, momentum, and energy between the ocean and atmosphere. Ignorance of the magnitude and temporal variability of such transfers hinder our ability to develop a predictive understanding of global change. SOLAS will focus on understanding biogeochemical and physical interactions of the uppermost layer of the ocean (0 – 200 m) and the portion of the atmosphere immediately above the ocean surface (to about 1 km). SOLAS will serve as IGBP II's ocean-atmosphere interface project.

The Future of Ocean Research in Earth System Science—SCOR and IGBP are cooperating to develop a new framework for future ocean research in Earth System Science. The new framework will build on the results of JGOFS and other programs, integrate with ongoing programs (i.e., GLOBEC, SOLAS, and the Land-Ocean Interactions in the Coastal Zone project), and address new research questions that previously were not possible to study or were unrecognized. This activity will serve as the integrated marine project of IGBP II.

New Working Groups were established on the following topics:

Quantitative Ecosystem Indicators for Fisheries Management—Definition of quantitative indicators of marine ecosystem status could provide a bridge among the different scientific disciplines and provide an effective way to present results to fishery and coastal managers. The aim of this working group is to promote sound theory to underpin ecologically sustained fisheries and to develop a scientific approach for defining quantitative indicators to assess changes in marine ecosystems.

Marine Phytoplankton and Global Climate Regulation: The *Phaeocystis* spp. Cluster as a Model—An integrated, multidisciplinary research plan is urgently needed, based on a description of the state of the science and modeling of the regional and global significance of the phytoplankton species *Phaeocystis* and of its role in elemental cycles that are central to biogeochemistry of the ocean

and the overlying atmosphere. (*Phaeocystis* is a major source of dimethyl sulfide, which can promote cloud formation, potentially providing a negative feedback to global warming.) The working group will create an inventory of challenging research issues, identify critical areas of ignorance, and design an action framework.

Brief Report of Use of 2000 ICSU Grants to SCOR: SCOR received two Category II grants (\$10,000 each) from ICSU in 2000, in support of two of the major ongoing international research programs in oceanography, JGOFS and GLOBEC. Although both of these programs are also part of IGBP, SCOR is the lead sponsor, especially in terms of financial support.

Joint Global Ocean Flux Study (JGOFS): The goal of JGOFS is to understand better the ocean carbon cycle and feedbacks between the atmosphere and the deep-ocean basins through biogeochemical and physical measurements of the vertical transport of carbon. Since 1989, the JGOFS SSC has coordinated the field activities of over 20 international programs.

Among other JGOFS accomplishments, its Hawaiian ocean time series (HOT) station has been instrumental in showing that a regime shift is occurring in the North Pacific Ocean, as indicated by a variety of changes over the past decade, including increased dissolved inorganic carbon in the surface ocean, a decrease in surface ocean dissolved inorganic phosphorus, increased activity of nitrogen-fixing species such as *Trichodesmium*, a switch from nitrogen-limitation to phosphorus-limitation of phytoplankton, increased dissolved organic carbon concentrations, and decreased vertical export of carbon. These changes might be driven by changes in the frequency of the El Niño-Southern Oscillation phenomenon, which could cause changes in mixing intensities in the surface ocean.

The major highlight of JGOFS activity in 2000 was the Second JGOFS Open Science Conference. More than 200 individuals attended the conference and participated in plenary sessions, poster sessions, and round-table discussions. The meeting featured a strong emphasis on synthesis of research results, which is also the focus of the remaining years of JGOFS activity. A book from the meeting will be produced in the Springer-Verlag IGBP book series in about two years. The third and final JGOFS Open Science Conference will be held in Washington, D.C. in 2003. The JGOFS synthesis effort also includes (1) regional syntheses with publications of refereed articles in international journals and data sets on CD-ROMs, (2) a global synthesis under relevant ocean biogeochemical themes to be published in a book, (3) the integration of JGOFS activities within the IGBP-wide synthesis, and finally (4) archiving of all JGOFS data sets at the World Data Center-A for Oceanography.

In 1999, the Norwegian Research Council announced its financial support of the JGOFS IPO for the remainder of the project, until the end of 2003. The U.S. National Science Foundation provides additional support for JGOFS synthesis activities through SCOR.

Global Ocean Ecosystem Dynamics (GLOBEC)—Following publication of the GLOBEC Implementation Plan in 1999, the GLOBEC SSC and IPO developed an ambitious program of activities for the next few years. The project is based on three pillars: foci working groups, regional programs, and national activities.

Focus 1 WG: Retrospective analysis and time-series studies

The general objective of this focus is to identify and understand the characteristic, natural, modes of physical forcing and marine ecosystem variability over a range of temporal and spatial scales. The first meeting of the working group took place in Sitges, Spain, on 18-19 May 2000, to set a calendar of activities and develop a working plan.

Focus 2 WG: Process Studies

Under Focus 2, GLOBEC will investigate specific mechanisms thought to link ecosystem responses with environmental variability. To initiate activities in this focus, the working group met in Roscoff, France on 11-14 September 2000.

Focus 3 Predictive and modeling capabilities

This focus is designed to understand and predict how populations of marine animals respond to natural and anthropogenic changes in global climate, by bringing together the expertise and the activities of regional and national programs in predictive modeling. The group was appointed early in 2000 and met in Chapel Hill, North Carolina, USA on 10-12 July 2000.

Focus 4 WG: Feedback from Changes in Marine Ecosystem Structure

At the GLOBEC SSC meeting in Spain during May 2000, two specific issues were identified for early activation in this focus: (1) effects of fishing and (2) natural and human system implications of large-scale changes in marine ecosystems. GLOBEC will not appoint a working group for this focus. Rather, because of the diversity and breadth of potential topics, it will convene ad hoc groups of experts to work on particular topics.

Regional GLOBEC Programs

Small Pelagic Fishes and Climate Change Programme (SPACC)—A planning meeting to review the implementation of the program was held in La Jolla, USA in March 2000. At the meeting, four main lines of activity were identified: (1) long-term changes in ecosystems, (2) comparative population dynamics, (3) reproductive habitat dynamics, and (4) economic implications of climate change. SPACC has field activities in the Benguela, California, Humboldt, and Kuroshio currents, as well as the temperate environment of the Bay of Biscay. As part of the International GLOBEC support to developing regions, a SPACC workshop was held in Namibia in October 2000. An initiative to coordinate SPACC research in East Asia has been planned for 2001 with the support of the Asia-Pacific Network for Climate Change research.

Southern Ocean GLOBEC—The SO GLOBEC field program intends to conduct year-round monitoring of krill habitat, prey, predators, and competitors, with emphasis on sampling in winter. Attempts are being made to fill possible sampling gaps in collaboration with International Whaling Commission. The program has two core sampling areas, the Antarctic Peninsula and the 70°E region, although additional sites may be added.

ICES Cod and Climate Change Programme (CCC)—A basic hypothesis behind this program is that the environment regulates the growth of cod larvae, both directly and through zooplankton growth and survival. The CCC is halfway through its 5-year plan. The 7 major components of the program are (1) incorporation of environmental information into fisheries management, (2) retrospective analysis, (3) zooplankton-cod linkages, (4) comparative analysis (between stocks and regions), (5) climate and atmosphere-ocean linkages, (6) data availability and management, and (7) synthesis.

The CCC held a workshop on the dynamics of growth in cod, in May 2000, as well as their annual conference. In 2001, the CCC plans to initiate synthesis activities, possibly leading to the publication of a synthesis book in 2003.

PICES Climate Change and Carrying Capacity (CCCC)—The CCCC consists of four task teams that are conducted jointly between GLOBEC and North Pacific Marine Sciences Organization (PICES). The task teams conducted several workshops at, and leading up to, the PICES Annual Science Conference in Hakodate, Japan, in 2000. Other task team activities include a delineation of ecozones in the North Pacific and planning of iron fertilization experiments in the western gyre (2001), Station P (2002), and the open ocean (2003); a compilation of relevant sampling strategies and methods; and assisting in planning a pilot Continuous Plankton Recorder project.

National Activities—Activities are carried out by 15 national GLOBEC programs: Angola/Namibia/South Africa, a consortium of Black Sea nations, Brazil, Canada, Chile, China, France, Italy, Japan, Mexico, Netherlands, Portugal, Spain, United Kingdom, and United States. To facilitate co-ordination and program development, the GLOBEC IPO is in the process of publishing a GLOBEC Report describing the activities of each national program.

GLOBEC IPO—The IPO is financially supported by the Natural Environment Research Council (UK) and the University of Plymouth. The former has extended its commitment until 2004, while the latter has an initial commitment until end of 2003. The U.S. National Science Foundation provides support for planning and coordination activities conducted by the IPO through SCOR. Attempts to secure additional funding for the program from the European Union have not yet been successful. Securing adequate, ongoing funding for the IPO operation remains an area of concern.

Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB)—The last two decades have been marked by an extraordinary expansion in the nature and extent of blooms of toxic or harmful microalgae, which represent a significant and expanding threat to human health and fishery resources throughout the world. In spite of a large body of research on the toxicology of HABs and much effort to monitor them, little is known of the biological, chemical, ecological, and physical factors that regulate bloom dynamics or bloom impacts. This was the premise for SCOR/IOC Workshop in Havreholm, Denmark in 1998 on “Global Ecology and Oceanography of Harmful Algal Blooms”, which was the starting document for the GEOHAB SSC and formed the basis for a detailed Science Plan for the program. The GEOHAB Science Plan was approved by SCOR and IOC in 2000 and will be published in mid-2001. The plan identifies 5 major program elements for GEOHAB: (1)

Biodiversity and Biogeography; (2) Nutrients and Eutrophication; (3) Adaptive Strategies; (4) Comparative Ecosystems; and (5) Observation, Modeling, and Prediction. The GEOHAB SSC has just begun developing its Implementation Plan.

CONCLUSION AND FUTURE PLANS

The 36th Executive Committee Meeting of SCOR will take place in Mar del Plata, Argentina on October 29 and 30, 2001. SCOR is successfully accomplishing its transition to a new Executive Director and several new officers, including the President, Secretary, and one of three Vice-Presidents.

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