Canadian National Committee for SCOR
Comité national canadien pour SCOR

Scientific Committee on Oceanic Research

CANADIAN OCEAN SCIENCE NEWSLETTER
LE BULLETIN CANADIEN DES SCIENCES DE L'OCÉAN

Table of Contents, Newsletter Number 10, September 16, 2004
Table des matières, Bulletin numéro 10, 16 septembre 2004

JOBS:

- No contributions

OCEAN SCIENCE PROGRAMS

- STRATOGEM - Coupled Biology and Physics in the Strait of Georgia
- A Viewpoint on Canada and the International Polar Year
- Littoral Zone Sediment Transport System for Geological Survey of Canada
- ASL to Provide Wave and Current Data for Vancouver Port Authority

PERSONNEL:

- Canadian IPY Steering Committee

MEETINGS:

- Research Shows Oceans Becoming More Acidic
- Ocean Innovation 2004 Conference & Exhibition

GENERAL:

- NOAA'S National Data Buoy Center to Re-Compete $500 Million Technical Services Contract

STRATOGEM - Coupled Biology and Physics in the Strait of Georgia.

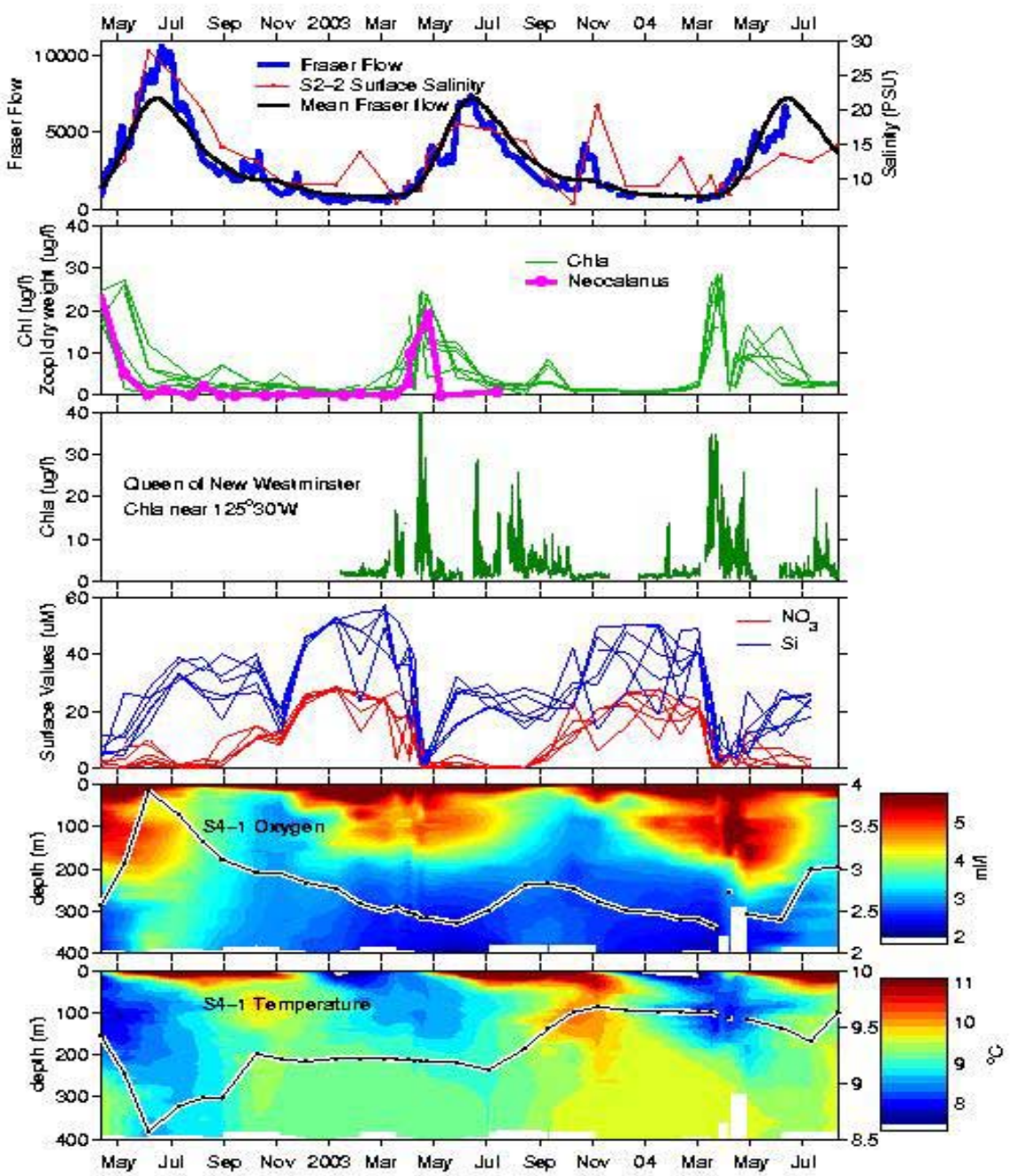
Rich Pawlowicz, Susan Allen, Randall Lee, Kate Collins, Mark Halverson, Olivier Riche, Shannon Harris (UBC), John Dower, Tom Bird, Akash Sastri, Rana El Sabawi (UVic)

The Strait of Georgia (SoG) is part of an estuarine system that extends from the mouth of the Fraser River around Vancouver Island to the outer coast. It is a deep basin (400m), separated by channels and sills of about 100m in depth from the Pacific Ocean. The SoG has a well-stratified shallow surface layer dominated by a plume resulting from the freshwater input of the Fraser (and other) rivers. Below this is an intermediate water layer (down to 200m or so), and a deep water which is renewed once or twice a year. SoG productivity is apparently limited by available light in the winter and by nutrients in the summer, although the precise mechanisms governing the timing and magnitude of blooms are still only poorly known.

STRATOGEM (www.stratogem.ubc.ca) is an NSERC-funded project which is attempting to better understand the role of physical mechanisms on planktonic abundance. As part of this work the hovercraft Siyay is used to carry out hydrographic surveys over the southern Strait. The first survey was in April 2002, and the program will continue through to May 2005. Surveys occur roughly monthly, but at weekly intervals during the spring bloom period (37 surveys have been carried out so far). A variety of physical and biological parameters are measured using CTDs, water samples, and net tows. Part of this dataset is shown in the figure.

The upper panel shows the flow of the Fraser River at Hope (a proxy for the total fresh-water input), as well as the Fraser's long-term seasonal cycle and the surface salinity at Station S2-2 (central SoG off Fraser river). The Fraser flow was above average in 2002, about average through June in 2003 (and rather lower afterward until the torrential rains of October), and had a substantially sub-average peak in 2004. Plume salinity adjusts rapidly to the Fraser flow. Note that the Fraser flow is not a good proxy for the plume in winter when a larger proportion of the runoff comes from smaller local rivers.

The next panel shows the peak Chlorophyll concentrations at 6 stations along the SoG from the Swartz Bay ferry track north past Halibut bank. Several spring blooms are visible (mostly composed of plankton larger than 20 um), roughly coinciding with the appearance of Neocalanus plumchrus in the upper 100m. Detailed analysis suggests that the bloom slightly precedes the freshet, the turbid waters of which act to limit growth. During the summer a variety of smaller blooms appear, with plankton in a range of sizes. Winter biomass is low, and mostly dominated by plankton smaller than 2 um. Although our hydrographic surveys apparently catch the broad-brush details of biological activity they are actually too far apart in time to adequately determine details of the biological evolution. Spatial and temporal variability on time scales down to fractions of a day is being captured by an instrumentation program on both BC ferry routes out of Nanaimo. The next panel shows surface Chla fluorescence from this dataset. The spring bloom is actually composed of a rapid series of peaks and valleys as dominating species succeed each other, and wind bursts and other effects sometimes delay and at other times accelerates growth. Note also the presence of some rather large blooms in the summer 2003 which were missed by the hovercraft surveys.



Surface nitrates and silicic acid are shown in the next panel for 6 stations. N and Si is plentiful in the winter (surface values are similar to deep values), but are almost completely used up in the

spring bloom. Through the rest of the summer N levels are low, mainly appearing within the Fraser plume (which is composed of a mixture of nutrient-rich deeper water with turbid fresh water). In the fall levels rise again as production ceases. Phosphates follow a very similar pattern to nitrates, but Si is slightly different. Although driven almost to depletion in the spring bloom, Si levels rapidly rise to intermediate values over the summer. This probably reflects a compositional change in the dominant phytoplankton from diatoms to flagellates.

Dissolved Oxygen and Temperature from station S4-1 off Nanaimo (a traditional time-series station) are shown in a time-depth format in the last two panels. DO levels shallower than 10m tend to be near saturation except during the spring bloom when observations have found values as high as 150% of saturation. Intermediate waters are oxygenated in the spring (Jan - May) of each year as cold water flows in from the Haro Strait/Boundary pass region. Intermediate waters warm up through the rest of the summer and then cool as water continues to enter, but the inflow amounts are apparently not enough to reverse the overall decay of DO levels. In the deep water (see also white curves which give values at 370m) renewal is more infrequent, occurring in May 2002, Aug/Sept 2003, and both April and June 2004. Renewals in the first part of the year are accompanied by temperature decreases, and in the latter part of the year with increases. Note that annual and interannual variability in the deep water are of the same magnitude.

This detailed view of the evolution of the SoG shows that a variety of processes are at work in Strait, and that large year-to-year changes in physical and biological evolution can be expected. By next spring the STRATOGEM field program will be completed, and our focus will shift to a more quantitative analysis of the workings of this system.

A Viewpoint on Canada and the International Polar Year

Humfrey Melling, Fisheries and Oceans Canada, MellingH@pac.dfo-mpo.gc.ca

The vision for the International Polar Year (IPY) 2007-2008 is “an intense, internationally coordinated campaign of research that will initiate a new era in polar science”. Its implementation will strive “to educate and involve the public, and to help train the next generation of engineers, scientists and leaders”. This context is admirable. It is important that the IPY vision function as a stimulus to Canada, whose efforts to describe and understand the Arctic and to address the challenges of Arctic change have been on the wane for many years.

With an area of 3.85 million square kilometres, Canada is the second largest country in the Arctic. Moreover, this vast area of land is surpassed by the almost 5 million square kilometres of ice-covered ocean, one third of the northern marine cryosphere, which lies within the Canadian Exclusive Economic Zone. Beyond these obvious parochial interests, both Polar Regions have profound significance for the climate and environments of the entire Earth. As a wealthy country of the First World, Canada has philanthropic responsibility to contribute to understanding the magnitude and causes of environmental changes, so that mitigation and adaptation can be timely and effective. At present we are poorly cognizant of how polar climate operates and of how it interacts with global climates, ecosystems and civilizations.

The galvanizing potential of an International Polar Year should not be underestimated. The most recent IPY, concurrent with the International Geophysical Year in 1957-58, involved 80,000 scientists from 67 countries. In Canada, the IGR left the legacy of the Polar Continental Shelf Project, an agency of inestimable value that stimulated and facilitated research by university and government in northern Canada and the Arctic Ocean for almost four decades.

Perspectives on the Earth's environment have changed significantly since the late 1950s. The concept of a world that is variable in the short term – day-to-day, season-to-season and perhaps year-to-year – but stable over decades is no longer considered valid. Within our new paradigm, resonant oscillations of inter-decadal and longer periods, with various spatial footprints, interact with each other and with "trends" to create a complex pattern of variability and change in space and time. Some "trends" may be anthropogenic; others may be the presently monotonic manifestations of cycles that have periods long in relation to the ebb and flow of scientific careers, or of civilizations.

From the perspective of this new paradigm, we recognize the important role of the upcoming IPY as a catalyst for a strengthened and continuing programme of Arctic (and Antarctic) observation and research within Canada. From the perspective of this new paradigm, the upcoming IPY should not be viewed as simply a short-lived "festival". The societal challenges that are rooted in the Arctic and Antarctic will certainly not be addressed by a single year of study in the polar region of each hemisphere. When the festival is over, a rapid redeployment elsewhere of the effort and resources assembled for the IPY would not be sensible.

The concept of a short-lived festival has some merit: it can foster coordinated interdisciplinary research that will yield a detailed "snapshot" of the Polar Regions. The issue for discussion is whether a snapshot really tells us much about the true state of the system and how it works. I believe that the clear disparity among such snapshots from past years illustrates the limitations of the festival model. We actually know a fair bit about the Polar Regions from a short-term perspective. What we lack is the ability to string these beads onto a necklace that represents the progression of change. Change in the environment, in ecology and in society over a broad spectrum of parameters, of scales and of frequencies is our greatest present uncertainty. I believe that we now require more than an occasional polar snapshot to advance the science.

I propose that Canada work towards an IPY festival, but only as one element of a well-designed and sustained matrix of polar observations and research. Such a matrix is essential as context for the meaningful interpretation of new data from the Arctic and Antarctic in 2007 and 2008. The acknowledged importance of long time series is implicit in the vision of the present generation of WCRP projects. The legacy of WOCE, which acquired a "snapshot" of the World Ocean over a 10-year period, is CLIVAR with a 15-year time line to explore coupled resonances between the atmosphere and ocean. The legacy of ACSYS, which scratched the surface of the Arctic over a 10-year period and largely ignored the Antarctic, is CliC with a 15-year time line to explore the role of the cryosphere in climate globally.

How can Canada contribute meaningfully to the International Polar Year?

First, Canada could restore, modernize and enhance its networks for routine observation of the physical environment – atmosphere, land surface, hydrosphere, cryosphere and ocean. All Canadian scientists have experienced embarrassment during discussions of the "Canadian Hole" at scientific meetings. The IPY provides an opportunity for Canada to meet international expectations for environmental observation and monitoring within the millions of square kilometres of its Arctic domain.

Second, Canada could rebuild and enhance the logistic infrastructure needed for Arctic observation and research – permanent bases, observatories and field stations; aircraft and ships. An important, and frequently overlooked, corollary is that Canadian Arctic researchers must have access to funding sufficient to use such infrastructure once it is in place.

Third, Canada could greatly enhance support for the development of new technology for polar observation. New technology is needed to provide extended capability in environmental observation and reporting. New technology – autonomous observational platforms, satellite reporting instruments, robot vehicles, etc. – provide means to reduce the high cost, risk and difficulty of Arctic logistics.

Fourth, Canada could work to increase the retention in Canada of Canadians trained in science and technology relevant to the Polar Regions. In particular, there are good reasons to entrain Northerners into all disciplines of Polar science, at all levels of activity – logistics, operations, technology and science.

Fifth, Canada could choose to mount special initiatives ("festivals") in Arctic and Antarctic science, in 2007 and 2008 respectively, coordinated with the efforts of other countries through existing mechanisms such as WCRP and IGBP.

Littoral Zone Sediment Transport System for Geological Survey of Canada

Contribution by Chris Elmer, chriselmer@fsmail.net

Building on similar work done a year ago, ASL Environmental Sciences of Sidney, BC Canada has deployed its custom designed NORTON sediment dynamics instrument package on Roberts Banks in the Strait of Georgia on Canada's West coast. Unlike previous studies, however, this instrument package is located directly on the tidal flats and is underwater for only part of the tidal cycle.

The study is on behalf of the Geological Survey of Canada who are making a detailed study of sediment transport in this area on behalf of Environment Canada's Disposal at Sea Program.

The NORTON platform has been designed by ASL and carries an array of off-the-shelf instruments in order to measure and record various parameters. All of these instruments are available individually from ASL's extensive oceanographic instrument lease pool. In addition to deploying and recovering NORTON, ASL has processed one month of acquired data as specified by the customer. For more information see: www.aslenv.com

ASL to Provide Wave and Current Data for Vancouver Port Authority

Report provided by Chris Elmer, chriselmer@fsmail.net

The Vancouver Port Authority (VPA) is looking at expanding its terminal at Roberts Bank in British Columbia, Canada, just south of Vancouver, through its Roberts Bank Container Expansion Project. In support of this project, ASL Environmental Sciences of Sidney, BC has been contracted to provide long-term wave and current data for input to engineering and environmental studies. In a novel approach, ASL designed a two part mooring assembly to hold the Nortek AWAC instrument, which will provide the data from a depth of 8 meters. The bottom part of the mooring is deployed first and positioned with weights and the instrument assembly is then lowered onto leveling bolts on the base and attached by divers. Subsequent refurbishment requires only the recovery of the instrument itself. Initial deployment was in April 2004 and data will be collected over a 12 month period. ASL will be discussing its role this project in detail in a paper being presented at Oceans 2004 in Kobe, Japan 9-12 November 2004.

Canadian IPY Steering Committee

The Canadian Polar Commission (CPC), in its role as Canada's adhering body to IASC and SCAR and Canada's point of contact for the International Polar Year (IPY), is establishing a National IPY Steering Committee and Secretariat. These are necessary in order for Canada to take a leading role in the IPY planning process, and to develop and coordinate the national IPY program.

Rob Macdonald, research scientist at DFO's Institute of Ocean Sciences and current member of the Canadian National Committee for SCOR, will participate as a member in the IPY National Steering Committee. In that role, Rob would welcome any input from the oceanographic community on IPY that could be placed before this committee. The National Steering Committee will provide direction and guidance Canadian IPY efforts, and to the Secretariat. The Steering Committee will ensure that Canadian IPY activities address both Arctic and Antarctic, involve scientists from a range of disciplines, and maintain a focus on compelling scientific questions.

Confirmed Members of the Canadian IPY Steering Committee are:
Dr. Yves Bégin, Centre d'Études nordiques, Université Laval
Dr. Charles Bélanger, Laurentian University
Dr. Gérard Duhaime, Université Laval
Dr. Nancy Gibson, Canadian Circumpolar Institute, University of Alberta
Dr. Barry Goodison, Environment Canada
Mr. Geoff Green, Students on Ice
Dr. Peter Harrison, National Research Council of Canada
Dr. Irwin Itzkovitch, Natural Resources Canada
Dr. Peter Johnson, Canadian Polar Commission
Dr. Jim McDonald, Association of Canadian Universities for Northern Studies
Dr. Robert W. Macdonald, Fisheries and Oceans Canada
Dr. Gordon McBean, Canadian Foundation for Climate and Atmospheric Sciences

Dr. Ludger Müller-Wille, McGill University
Dr. Wayne Pollard , Canadian Committee for Antarctic Research
Mr. Jamal Shirley, Nunavut Research Institute
Dr. Sally Webber, Yukon College

Ex-officio Members are:
Mr. Steven Bigras, Canadian Polar Commission
Mr. Paul Dufour, Office of the National Science Advisor, Privy Council Office
Dr. David Hik, Canadian IPY Secretariat

Research Shows Oceans Becoming More Acidic

The world's oceans are absorbing an unprecedented amount of carbon dioxide (CO_2), which is increasing their acidity and possibly threatening the long term survival of many marine species, especially calcifying organisms including corals, shellfish and phytoplankton. According to research presented recently at a symposium organized by UNESCO's Intergovernmental Oceanographic Commission and the International Council for Science's Committee on Oceanic Research (SCOR), this in turn could disrupt marine food chains and alter ocean biogeochemistry in ways that are not yet understood or predictable.

The symposium brought together scientists from the world's leading oceanographic institutions to discuss how the ocean might be affected by higher levels of atmospheric carbon dioxide, and to develop research priorities to study these future effects. They were also called upon to discuss potential environmental consequences of proposals to use the ocean to sequester excess atmospheric CO_2, which is one of the most important greenhouse gases.

A report on the meeting's conclusions, now available online*, points out that the ocean is one of the Earth's largest natural reservoirs of carbon and each year absorbs approximately one third of the carbon dioxide emitted by human activities. According to research** led by Christopher Sabine of the National Oceanographic and Atmospheric Administration in the United States (NOAA, an IOC Member State Agency)* the ocean has taken up approximately 120 billion metric tons of carbon generated by human activities since 1800. The IOC reports that some 20-25 million tons of CO_2 are being are being added to the oceans each day.

The absorption of carbon dioxide by the oceans is considered a beneficial process that reduces the concentration of CO_2 in the atmosphere and mitigates its impact on global temperatures. However there is growing concern over the price of this service. For the symposium participants, it is now well established that by the middle of this century, the accumulating burden of CO_2 entering the ocean will lead to changes in pH or acidity of the upper layers that are three times greater in magnitude and 100 times faster than those experienced between ice ages. Such dramatic changes in the CO_2 system in open-ocean surface waters have not been observed for more than 20 million years of earth's history, concluded the meeting.

The initial findings of limited observation, research and modeling conducted to date and presented to the symposium indicate that in a high CO_2 world:

- the ocean would be more acidic globally, and would also be more stratified in the high latitudes. In addition nutrient concentrations in surface waters of high-latitude regions would be lower, subsurface waters would be less oxygenated, and phytoplankton would experience increased exposure to sunlight. These changes would affect many species and change the composition of biological communities in ways that are not yet understood or predictable.

- many calcifying organisms, including certain species of plankton and corals, and also non-calcifying organisms, would be unable to grow and reproduce effectively at higher CO_2 and lower pH levels. Rising temperatures - combined with elevated CO_2 and decreasing pH - pose a serious threat to coral reefs, possibly leading to the elimination of some reefs by the end of this century.

Participants at the symposium stressed that although the impact of climate change on the ocean has been much debated, the direct chemical and biological impact of CO_2 itself has largely been neglected. However, they concluded, changes are clearly underway and their effects may be large and may seriously destabilize marine ecosystems. Their report signals the need for more research and identifies research priorities, in a bid to increase understanding of the changes taking place and their consequences, and to allow for more informed policy decisions in this area.

*The report is accessible at http://ioc.unesco.org/iocweb/co2panel/HighOceanCO2.htm
** A report on Dr. Sabine's research and findings appears in the July 15 edition of Science magazine, along with a report from fellow NOAA scientist and participant at the UNESCO meeting, Dr. Richard Feely (www.sciencemag.org)

Ocean Innovation 2004 Conference & Exhibition

The Ocean Innovation 2004 Conference & Exhibition is being held at the Victoria Conference Centre, Victoria, British Columbia on October 24-26, with a fourth day of workshops scheduled offsite on October 27. The theme for this year's event is Achieving a Balance: Ocean Development and Environmental Health. Plenary sessions will reflect the four pillars of Canada's Ocean Action Plan: Integrated Oceans Management for Sustainable Development; Oceans Technology Innovation; Health of the Oceans; and International Leadership, Sovereignty and Security. Ocean Innovation 2004 will be chaired by Dr. Peter Harrison, Senior Research Fellow, Oceans, National Research Council. The two concurrent offsite workshops are focused on Marine Remote Sensing (hosted by Dr. Timothy L. Walzak, University of Victoria), and Maritime Simulation (hosted by Rear-Admiral J.Y. Forcier, CFB Esquimalt). Additional information and program details may be found at: http://www.oceaninnovation.ca/

NOAA'S National Data Buoy Center to Re-Compete $500 Million Technical Services Contract

Contact: Kent Laborde, Kent.Laborde@noaa.gov

NOAA's National Data Buoy Center (NDBC) announced plans to re-compete its $500 million Technical Services Contract, which is ending and will be up for bid. The proposed contract is

projected as a $500 million, ten-year performance based contract. It will provide life cycle support for NOAA's Marine Observation Network and its Data Assembly Center. Contract functions will include operation, maintenance and repair of buoy and land based environmental data collection networks; operation of the NDBC facilities; testing of existing and new buoy systems; data processing and transmissions; logistics support; quality assurance and safety; configuration and scientific support for new technology, development and test programs.

Located on the Mississippi Gulf Coast at John C. Stennis Space Center in Bay St. Louis, NDBC is comprised of a combination of NOAA civil service employees, U. S. Coast Guard personnel and a service contractor. Working as an integrated team, NDBC manages the development, operation and maintenance of the Marine Observation Network (MON). The MON is an integrated, sustained ocean observation and information delivery system that serves U. S. coastal waters, as well as the offshore waters of the Pacific and Atlantic Oceans, the Gulf of Mexico and the Great Lakes. The system consists of headland and moored buoy data acquisition platforms, real-time processing and information quality control, and product delivery systems. The delivery system components include; moored buoys, Coastal Marine Automated Network sites, voluntary observing ships, and oceanographic drifting buoys and subsurface oceanographic "floats."

NDBC requires technical services to provide uninterrupted delivery of high quality, real-time environmental data to the operational elements of NOAA and the National Weather Service (NWS) for weather and ocean forecasts and warnings and climate variability indications and assessments. The technical services contractor is expected to provide engineering, operational, logistical, and information technology support to operate and maintain the MON.

This procurement will be advertised on the Federal Business Opportunities Web site (http://www.eps.gov/spg/DOC/NOAA/http://www.eps.gov/spg/DOC/NOAA/). Prior to release of an official solicitation, NDBC will issue a draft Request for Proposal (RFP) and host an Industry Day. The draft RFP was issued on August 31, 2004. The Industry Day was to be held at Stennis Space Center on September 15, 2004. This acquisition will be unrestricted and is open to all firms.

CANADIAN OCEAN SCIENCE NEWSLETTER
LE BULLETIN CANADIEN DES SCIENCES DE L'OCÉAN

Previous newsletters may be found on the CNC/SCOR web site.
Les bulletins antérieurs se retrouvent sur le site web du CNC/SCOR.

Newsletter #11 will be distributed on October 28, 2004. Please send contributions to dick.stoddart@sympatico.ca
Bulletin #11 sera distribué le 28 octobre 2004. Veuillez faire parvenir vos contributions à dick.stoddart@sympatico.ca

If you wish to subscribe to this newsletter, please send an email to listserv@lists.mcgill.ca with the following message: SUBSCRIBE OCEAN-NEWSLETTER.
If you wish to cancel your subscription, please send an email to listserv@lists.mcgill.ca with the following message: SIGNOFF OCEAN-NEWSLETTER.

Si vous désirez vous abonner à ce bulletin de nouvelles, veuillez envoyer un courriel à listserv@lists.mcgill.ca incluant le message: SUBSCRIBE OCEAN-NEWSLETTER.
Si vous désirez annuler votre souscription, veuillez envoyer un courriel à listserv@lists.mcgill.ca incluant le message: SIGNOFF OCEAN-NEWSLETTER.

WWW.CNCSCOR.CA