

Three Oceans of Biodiversity

A Canadian National Plan 2004-2009



THREE OCEANS OF BIODIVERSITY

A CANADIAN NATIONAL PLAN: 2004-2009

Based upon deliberations arising from the White Point CoML
- DFO sponsored workshop, February 2002

A REPORT OF THE CENTRE FOR MARINE BIODIVERSITY

Vision Statement and Mission

A bringing together of the scientific community to focus research on marine biodiversity in Canada's three oceans

The National Advisory Group on Marine Biodiversity (Appendix I) envisages a response from scientists, scientific organisations and governments to this vision statement. Our goal is to increase our knowledge of marine biodiversity in Canada at all levels of organization (e.g., genes, populations, species and communities) in our territorial waters of the Pacific, Arctic and Atlantic Oceans. This vision embodies:

A census of marine life as well as an understanding of the processes that influence biodiversity

Given the vastness of our submarine landscape, this mission can only be met through a concerted national endeavour that is closely allied with the global Census of Marine Life.

Introduction

In 1992 at the Earth Summit in Rio de Janeiro, Canada and more than 145 other countries, signed the legally binding agreement referred to as the Convention on Biological Diversity. Those signing parties agreed on a program for implementing the CBD with respect to marine and coastal biodiversity at their second Conference of Parties held in Jakarta, Indonesia in 1995. In these accords, diversity is defined as “*the variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems.*”

In the same year as the Jakarta meeting, the Food and Agriculture Organization (FAO) of the United Nations (FAO) Code of Conduct for Responsible Fisheries was endorsed. The Code requires that: “*States and users of living aquatic resources should conserve aquatic ecosystems. The right to fish carries with it the obligation to do so in a responsible manner so as to ensure effective conservation and management of the living aquatic resources*”.

Together, these agreements have significant potential to assist in the preservation of biodiversity. Canada, as signatory to both documents, has responded with measures to protect marine resources for the future. The 1997 Oceans Act defines Canada’s obligation to incorporate ecosystem considerations within an Oceans Management Strategy (OMS). Species-At-Risk legislation (SARA) addresses a high profile component of biodiversity, while in 2003, Canada established its first Marine Protected Area in the Queen Charlotte Islands through the Marine Parks Bill. The Federal Fisheries Act predates the CBD and provides protection for fish species and their habitats.

Recent institutional changes also support better biodiversity protection. These include the Biodiversity Convention office established in Environment Canada, new federal-provincial structures for species-at-risk, increased interdepartmental activities, and changes within

Fisheries and Oceans (DFO) - support for the Centre for Marine Biodiversity, establishment of the Biodiversity Science Branch.

However, these legal and institutional instruments and governance structures can only operate within our sphere of knowledge. Canada has the world's longest coastline (approx. 244,000 km) and a total of 6.5 million square kilometres of marine habitat. These include intertidal shores, vast continental shelves with shallow offshore banks, deep holes and channels, as well as underwater canyons, seamounts and rifts. These habitats occur across



three broad climate zones: temperate, boreal and arctic, with influences and incursions from tropical waters, and in three oceans: Pacific, Arctic and Atlantic with great inland seas, Hudson's Bay and the Gulf of St. Lawrence marine ecosystem. No other country in the world shares this range of ecosystem diversity in the marine environment.

It is safe to say that many of the species living in our waters are completely undocumented, meaning that we have no knowledge of their

population dynamics and the processes that influence their distribution and abundance. This ignorance distorts our vision of biodiversity and hinders our ability to provide adequate protection. Current major issues constraining biodiversity protection include a lack of taxonomists to identify organisms, incomplete inventories, monitoring and assessments, insufficient knowledge on processes that regulate and help to maintain biodiversity and a lack of agreement on which metrics best represent "biodiversity". In short, we lack the necessary information needed to make informed decisions on protection and management of marine biodiversity. By embracing the Three Oceans of Biodiversity vision statement, we will gain the knowledge to provide Canadians with a true picture of the diversity of their marine life, which in turn will empower existing legislation to protect this priceless heritage for future generations.

The Three Oceans of Biodiversity Strategy

Research, Development and Technology Strategy

A research, development and technology (RD&T) strategy based on and complementing this mission statement, underpin this National Plan. Given the broad range of topic areas that have relevance to the question of marine biodiversity, it is imperative to adopt a conceptual framework to define the scope of our objectives. The conceptual framework, which has guided the development of this plan, is encapsulated in the following matrix:

	Inventory	Monitor	Conserve
Ecosystem			
Species			
Population			

This matrix presents both a summary of Canada’s obligations under the Convention for Biological Diversity (to inventory, monitor, and make plans to conserve biological diversity), and three levels of biological organization (communities or ecosystems, species, and populations). This biological hierarchy does not explicitly define variability below the level of species and above the level of population (e.g., sub-species, ecologically significant units), genetic variability that crosses all categories, or collections of species into functional guilds or by habitat. The framework is simplified for practical purposes. The intersection of these topics, represented by the elements of this matrix, defines the ambit of strategic RD&T activities in the five-year plan. Background for the development of this National Plan can be found in Zwanenburg et al. 2003. Institutional development in support of this plan is essential. The following five goals were defined at the White Point meeting:

Goal 1. Complete and maintain a national Marine Biodiversity Registry with metadata compiled by region and taxon and following international standards

Historical information on marine biodiversity is fragmented and often not available electronically. Collections reside in museums, universities, government labs and private institutions and require experienced personnel to verify metadata and correct taxonomic misidentifications and changes in nomenclature. The strategy for this goal is to fund biodiversity informatics through establishment of a national Marine Biodiversity Registry. In order to maintain the registry, recipients of government funds should be required to register their metadata as a condition of funding. Through such a database, it will be possible to map the distributions of most of the larger and more abundant species in Canada’s oceans and identify their habitat characteristics.

Goal 2. Document the marine species of Canada including their distribution with an emphasis on Arctic marine species, species living below 300 m depth, and microfauna

The strategy for this goal is to mount research expeditions to document biotic diversity in poorly known environments following the All Taxon Biodiversity Inventory (ATBI) model, e.g. BioICE in Iceland, BioFAR in the Faeroe Islands. This requires an increased number of well-trained taxonomists. This strategy should be coupled with programs to encourage young scientists to train with the dwindling number of experienced taxonomists and to participate in data collection, identification and archiving. This effort must integrate genetic surveys with morphology-base taxonomy to ensure the comparability and accuracy of

taxonomic designations, and evaluate genetic variability in representative species. Currently we have very little knowledge of the genetic structure of marine species, including exploited species. This knowledge is critical for their sustainable management. Although both approaches are currently used in Canada, they are typically poorly coordinated and rarely directed at broad-scale biodiversity questions.

Goal 3. Apply existing and developing technologies and sampling designs to identify, collect, measure and enumerate marine biodiversity

Traditional methods of identifying species and documenting their abundance and distribution represent a basic and essential tool for evaluating biodiversity, but they are time consuming. DNA-based technologies, such as the DNA-barcoding concept, will be useful as a means of rapidly identifying specimens only if the species are first accurately identified as DNA reference data are accumulated. This approach offers a means of rapidly identifying species, while technological improvements to sampling equipment, image analysis of underwater video and design of optimal sampling programmes are critical to achieving an accurate assessment of marine biodiversity.

Goal 4. Characterize factors influencing biological diversity

Efforts to understand how biodiversity is structured and maintained require a two-tiered approach. The first is descriptive work on pattern and environment, and the second is process-oriented studies. The fundamental characteristics of pelagic marine ecosystems are determined by a relatively small number of physical factors (e.g., irradiance and wind mixing of the upper water column) much as soil types determine terrestrial biomes. For benthic marine ecosystems, habitat heterogeneity is an important factor in shaping community diversity. Research on the determinants of biological diversity, including the structure and functioning of populations and communities is fundamental to interpreting human dependence and influence on them. Habitat characterization allows for extrapolation of detailed biodiversity studies to broader regions, and thereby improves our ability to predict species distributions and diversity patterns at large spatial scales. Patterns of biodiversity are also influenced by other factors such as biological interactions and physical disturbance. Descriptive studies must therefore be conducted in parallel with process studies.

Goal 5. Understand the role biodiversity plays in the functioning of marine ecosystems

This goal is inter-related with Goal 4 but places an emphasis on determining the importance of biodiversity to the viability and integrity of marine ecosystems, for example, what is the relative importance of species diversity versus functional diversity? Marine ecosystems have been estimated to account for two thirds of the ecosystem services provided on Earth, but the role that biodiversity plays in delivering these services is almost completely unknown. Thus, carbon sequestration, provisioning of food resources and other trophic support processes, provisioning of critical habitat, cycling of nutrients, metabolism of pollutants and stabilization of shorelines are all key goods and services provided by marine organisms, but our knowledge of whether biodiversity influences the delivery of these goods and services represents a large unknown for any marine environment.

Funding Strategy

In order to engage scientists it is necessary to establish funding envelopes directed at marine biodiversity research. In Canada, the Natural Sciences and Engineering Research Council of Canada (NSERC) is the most appropriate body for funding of research on marine biodiversity. NSERC allocates research funds on a competitive peer-reviewed basis to university scientists. In the past, the *Strategic Project Grants* Program was a vehicle for encouraging project research in targeted areas of national importance. However, this program has been phased out and replaced by a new program, *Special Research Opportunities* (SRO) that does not target specific research priorities. The criteria established by the SRO program encourage national and international collaboration, which facilitates Canadian involvement in programs such as the International Census of Marine Life (CoML). The only funding envelope specifically dedicated to biodiversity research within NSERC is the *Supplements Program*, which offers incremental funding to graduate students conducting Systematics Research.

Government scientists depend upon Treasury Board (TB) for targeted funding for new initiatives, or upon departmental realignments to free up resources for new activities. At present, there is no TB submission to target marine biodiversity research within government labs, and no new resources for marine biodiversity research within Fisheries and Oceans.

Recommendation:

National funding envelopes available to both academic and government scientists must be established to target research on marine biodiversity. Subprograms in Taxonomy, Surveys and Inventories, Informatics and Processes are recommended.

The Future

The adoption of the Recommendation and five RD&T goals outlined in this five year National Plan will lay the groundwork for marine biodiversity research in Canada and ultimately fulfilment of our mission statement:

A census of marine life as well as an understanding of the processes that influence biodiversity

Implementation of these objectives can be addressed through activities outlined in the Science Plan (Appendix II).

References

Zwanenburg, K.C.T., K. Querbach, E. Kenchington and K. Frank (editors). 2003. Three Oceans of Biodiversity. Development of a Science Plan for Marine Biodiversity in Canada. Canadian Technical Report of Fisheries and Aquatic Sciences No. 2432: viii + 72pp.

APPENDIX I - NATIONAL ADVISORY GROUP 2002

PARTICIPANTS AT THE WHITE POINT WORKSHOP AND MEMBERS OF THE NATIONAL STEERING COMMITTEE (*)

Mary Arai*

Senior Volunteer Investigator
Pacific Biological Station
Nanaimo, BC V9R 5K6

Jesse Ausubel

Program Director
Alfred P. Sloan Foundation
630 5th Avenue
New York, NY 10111-0242

Richard Bailey

Institut Maurice Lamontagne
PO Box 1000
Mont-Joli, QC G5H 3Z4

Paul Bentzen

DFO Chair, Fisheries
Resource Conservation
Genetics
Dept. of Biology, Dalhousie
University
Halifax, NS B3H 4J1

Jerry Black

Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Jim Boutillier*

Head Shellfish and Mammals
Assessment
3190 Hammond Bay Road
Nanaimo, BC V9R 5K6

Bob Branton

Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Heather Breeze

Department of Fisheries
and Oceans
P.O. Box 1006
Dartmouth, NS B2Y 4A2

Kate Bredin

Zoologist
Atlantic Canada
Conservation Data Centre
Mount Allison University
P.O. Box 6416
Sackville, NB E4L 1G6

Pierre Brunel*

Département de sciences
biologiques
Université de Montréal
C.P. 6128 Succursale
Centre-ville
Montréal, QC H3C 3J7

Alida Bundy

Research Scientist
Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Manon Cassista

Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Mark Costello

Huntsman Marine
Science Centre
1 Lower Campus Road
St. Andrews, NB E3B 2L7

Cliff Cunningham

Duke University
Durham, NC
27708 USA

Derek Davis

10 Forest Road
Dartmouth, NS B3A 2M3

Cynthia Decker

CORE Suite 800
1755 Massachusetts Ave.
NW
Washington, DC
20036-2102

Bob DeWreede

Department of Botany
3529-6270 University Blvd.
Vancouver, BC V6T 1Z4

Julian Dodson

Directeur/Chair
Département de biologie
Université Laval
Ste-Foy, QC G1K 7P4

Richard Eisner

Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Derek Fenton

Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Kenneth Foote

Woods Hole Oceanographic
Institution
Applied Ocean Physics &
Engineering, MS#10
Woods Hole, MA 02543

Ken Frank

Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Jean-Marc Gagnon*

Canadian Museum of Nature
PO Box 3443 STN D
Ottawa, ON K1P 6P4

Kent Gilkinson

Aquatic Resources Division
Ecosystem Processes
Science, Oceans and
Environment Branch
Northwest Atlantic
Fisheries Centre
P.O. Box 5667
St. John's, NL A1C 5X1

Graham Gillespie

Research Biologist, Stock
Assessment
3190 Hammond Bay Road
Nanaimo, BC V9R 5K6

Patricia Gonzalez

Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Rajashree Gouda

Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Michel Harvey

Institut Maurice-Lamontagne
Mont-Joli, QC G5H 3Z4

Bruce Hatcher

Biology Department
Dalhousie University
1355 Oxford Street
Halifax, NS B3H 4J1

Erica Head

Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Paul Hebert

Canada Research Chair
Molecular Biodiversity
Professor of Zoology
Department of Zoology
University of Guelph
Guelph, ON N1G 2W1

Lea-Anne Henry

Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Glen Jamieson

Research Scientist
MEHS
3190 Hammond Bay Road
Nanaimo, BC V9R 5K6

Andres Jaureguizar

Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Ellen Kenchington

Bedford Institute of
Oceanography
PO Box 1006
Dartmouth, NS B2Y 4A2

Dale Kiefer

Division of Marine Biology
and Biological
Oceanography
University of Southern
California
3620 S. Vermont Ave.
KAP 246
Los Angeles, CA 90089-
2538

David Kulka

Northwest Atlantic
Fisheries Centre
Box 5667 Whites Hills
St. Johns, NL A1C 5X1

Phil Lambert

Invertebrate Curator
Royal British
Columbia Museum
675 Belleville St.
Victoria, BC V8W 9W2

Alan Longhurst

Place de l'Eglise
46160 Cajarc
France

Connie Lovejoy

Biological Oceanographer
Dept de biologie &
Centre d'etudes nordiques
Laval University
Sainte-Foy, QC G1K 7P4

Kathleen Martin

Arctic Marine Ecosystem
Dynamics
Department of Fisheries
and Oceans
501 University Crescent
Winnipeg, MB R3T 2N6

Barry McCallum

Science, Oceans
and Environment
Northwest Atlantic
Fisheries Centre
St. John's, NL A1C 5X1

Chris Mckindsey

Institut Maurice-Lamontagne
Mont-Joli, QC G5H 3Z4

Arran McPherson

Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Christine Michel*

Freshwater Institute
501 University Cr.
Winnipeg, MB R3T 2N6

Ken Minns

Department of Fisheries
and Oceans
867 Lakeshore Road
Burlington, ON L7R 4A6

Lene Mortensen

Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Clyde Murray
Science Stock Assessment
Division
Pacific Biological Station
3190 Hammond Bay Road
Nanaimo, BC V9R 5K6

Bob O'Boyle
Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Howard Powles*
Directeur, Sciences de la
biodiversité - Director,
Biodiversity Science
Pêches et Océans - Fisheries
and Oceans
200 Kent Street
Ottawa, ON K1A 0E6

Kirsten Querbach
Centre for Marine
Biodiversity
Bedford Institute of
Oceanography
1 Challenger Dr.
P.O. Box 1006
Dartmouth, NS B2Y 4A2

Robert Rangeley*
Marine Program Director
Atlantic Regional Office
World Wildlife Fund Canada
Suite 504, Duke Tower
5252 Duke Street
Halifax, NS B3J 1P3

Ray Ratynski
Species At Risk Coordinator
Freshwater Institute
501 University Cr.
Winnipeg, MB R3T 2N6

Jake Rice
Department of Fisheries and
Oceans
200 Kent Street
Ottawa, ON K1A 0E6

John Roff
Acadia University
Wolfville, NS B4P 2R6

Daniel Ruzzante
Danish Institute for
Fisheries Research
Department of Inland
Fisheries
Vejlsovej 39
Silkeborg - DK 8600
Denmark

Jean-Marie Sévigny
Institut Maurice Lamontagne
Mont-Joli, QC G5H 3Z4

Jason Simms
Ocean Biologist
Department of Fisheries
and Oceans
Northwest Atlantic Fisheries
Centre
PO Box 5667
St. John's, NL A1C 5X1

Mike Sinclair*
Regional Director of Science,
Maritimes Region,
Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Norman Sloan
Gwaii Haanas
Box 37
Queens Charlotte, BC
V0T 1S0

Darlene Smith*
Senior Advisor Biodiversity
Biodiversity Science Branch
Department of Fisheries
and Oceans
200 Kent St.
Ottawa, ON K1A 0E6

Paul Snelgrove
Ocean Sciences Centre
Memorial University of
Newfoundland
St. John's, NL A1C 5S7

Margaret Treble
Freshwater Institute
501 University Cr.
Winnipeg, MB R3T 2N6

Lou Van Guelpen
Curator of Fishes and
Collections Manager
Atlantic Reference Centre
Huntsman Marine
Science Centre
1 Lower Campus Road
St. Andrews, NB E5B 2L7

Scott Wilson
Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Kees Zwanenburg*
Department of Fisheries
and Oceans
PO Box 1006
Dartmouth, NS B2Y 4A2

Ex Officio Member

Victoria Clayton
Administrative Officer
Centre for Marine
Biodiversity
PO Box 1006
Dartmouth, NS B2Y 4A2

APPENDIX II - SCIENCE PLAN

Elements of the Science Plan (2004-2009)

Goal 1. Complete and maintain a national Marine Biodiversity Registry with metadata compiled by region and taxon and following international standards

- Establish regional registries for species diversity and produce an accessible dynamic atlas for this information
- Establish data base standards for species diversity
- Collate information on genetic diversity of marine species, including population structure
- Expand regional databases by filling gaps
- The Canadian databases should be developed consistent and interoperable with the Ocean Biogeographic Information System (OBIS), which aims as part of the Global Biodiversity Information Facility (GBIF) to integrate databases on marine life and its context from all over the world

Goal 2. Document the marine species of Canada including their distribution with an emphasis on Arctic marine species, species living below 300 m depth, and microfauna

- Establish criteria for identification of geographic focus areas where species and habitat mapping will be concentrated. Potential criteria include areas that are representative of specific habitat types, areas that are poorly sampled, areas that might represent biodiversity “hotspots”, and areas where key ecosystem functions are believed to occur
- Encourage taxonomic and descriptive research in focus areas and the publication of identification manuals, taxonomic papers and monographs in a newly established taxonomic journal or series
- Partner with International Census of Marine Life (CoML) Arctic transect project to document Arctic marine species
- Partner with International CoML projects in development on Continental margins, Deep corals, Marine microbial diversity and Seamounts
- Partner with Gulf of Maine GOMA-GOOS initiative to describe biodiversity

Goal 3. Apply existing and developing technologies and sampling designs to identify, collect, measure and enumerate marine biodiversity

- Select methodology for delineation of geographic patterns of benthic and pelagic ecosystem types
- Evaluate metrics for marine biodiversity
- Investigate DNA-based identification methods

Goal 4. Characterize factors influencing biological diversity

- Using common classification schemes delineate geographic patterns of benthic and pelagic ecosystem types based on available information
- Prepare research proposals to investigate utility of competing hypotheses on control of species diversity in oceans (e.g., Huston, Hubbell), and seek funding
- Prepare research proposals to identify the size and spacing of protected areas in order to protect ecosystem types and species diversity, and seek funding
- Take advantage of available infrastructure that will facilitate accessing and researching process-related studies (e.g., field stations, observatories)
- Prepare research proposals on priority issues/questions on effective population size (N_e), as well as connectivity among populations, for a range of marine species with contrasting life histories, and seek funding
- Hold an international symposium on “Processes Controlling Marine Biodiversity” in order to generate a synthesis of extant knowledge and to identify key questions

Goal 5. Understand the role biodiversity plays in the functioning of marine ecosystems

- Identify and establish reference sites ("discovery corridors") for the monitoring of ecosystems types and species diversity
- Select species (commercial and non-commercial) for the tracking of changes in genetic diversity, with particular attention to species of special concern (i.e. COSEWIC listed species)
- Incorporate monitoring observations in state-of-the-ecosystem reports (ecosystem type, species and genetic diversity levels) with directed field and laboratory experiments that complement observational data to determine how diversity influences the way that ecosystems function

Development of Institutions in Support of Biodiversity Research

- Establish a national oversight committee on marine biodiversity, with regional sub-units, to help implement and adapt the Science Plan
- Prepare CFI and NSERC submissions to establish Marine Biodiversity Knowledge Network
- Consolidate the Centre for Marine Biodiversity (CMB) in the Atlantic and foster parallel initiatives for the Pacific and Arctic Oceans
- Establish CoML pilot in Gulf of Maine area
- Prepare national inventory of expertise in taxonomy with identification of gaps
- Integrate Canadian institutions within the global governance structure for biodiversity
- Establishment of secure funding for Science Plan activities within government departments, museums and universities

Expected Products

- A comprehensive synthesis of decadal scale trends in biodiversity in the well-studied parts of Canada's oceans at the three levels of biodiversity (1950's to the present). This is an

inventory product

- Publication of taxonomic papers and monographs
- An electronic clearing house for existing identification manuals, unpublished keys and guides presently held by individuals at regional labs
- A series of papers on the processes controlling marine biodiversity and on the interpretations of observed pattern trends. The papers will both address the controversial literature on the regulation of biodiversity (predominantly based on terrestrial and freshwater observations) and the specific causes of biodiversity within respective regional seas. These papers will partially address the “processes” activities of the plan
- State-of-the-ecosystem reports for the “study areas” that will provide evaluations of biodiversity status and trends. The evaluations will examine the degree to which well studied areas have been impacted, and possibly the degree to which there is resilience to human activities. This product will also address the “processes” activities
- A Canadian biodiversity monitoring strategy that meets the needs of ecosystem-based management of ocean and coastal zone activities. It is envisioned that within a decade the diverse ocean use sectors will have adopted a common set of ecosystem objectives that constrain their practices. These objectives will require associated indices of biodiversity. The monitoring will provide the data products for the indicators, as well as for decision making. The strategy will also promote monitoring activities required for interpretation of biodiversity trends. This product obviously addresses the monitoring activities
- A “dynamic atlas” of Canada’s marine biodiversity will be an overarching product. This will be a tool that will help with the inventory processes and monitoring activities in support of biodiversity conservation. The atlas, which will be accessible on the web, will allow ongoing updates and provide access of all of the information generated by the “science plan” to decision-makers and the general public



Centre for Marine
Biodiversity

P.O. Box 1006
1 Challenger Drive
Dartmouth, Nova Scotia
Canada
B2Y 4A2
Phone: (902) 426-1415

About the Centre for Marine Biodiversity: www.marinebiodiversity.ca

About the Census of Marine Life: www.coml.org

Cover Photos: A. Cogswell
Photo on page 4: T. J. Kenchington