PAME

Protection of the Arctic Marine Environment

PROGRAM FOR THE

PROTECTION OF THE ARCTIC MARINE ENVIRONMENT

PAME

Working Group Meeting Report
No: I-2003

FEBRUARY 25-27, 2003
Stockholm, Sweden

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LIST OF APPENDICIES

Session I: Welcome and Introduction

Session I (1): Adoption of Agenda

The Protection of the Arctic Marine Environment (PAME) Working Group met in Stockholm, Sweden, February 25-27, 2003. The list of participants attending the Meeting is in Appendix I.

The meeting was opened with a warm welcome by Mr. Anders Boheman, Director of the International Secretariat of the Swedish Environmental Protection Agency. He welcomed the initiative to develop an Arctic marine strategic plan and noted that Sweden had strengthened its focus on the protection of the marine environment through participation in the development of the EU Marine Strategy and the on-going work of PAME.

The Meeting was chaired by Mr. Tom Laughlin of the National Oceanic and Atmospheric Administration (NOAA), United States. The Chair expressed its gratitude to the Swedish Environmental Protection Agency in arranging the Meeting.

A list of documents submitted for consideration at the Meeting is in Appendix II.

A breakout session was provided for the purpose of finalizing the draft version of the Arctic Waters Oil Transfer Guidelines.

The Meeting adopted the agenda as amended in Appendix III.

Session I (2): Report from PAME Secretariat

The PAME Secretariat provided a summary of the activities and a budget statement for the period of January 1, 2002 – December 31, 2002 as well as the expected operational expenditures for the calendar year 2003 and total voluntary contributions and expenditures for the period of 1999-2002 (Appendix IV).

The PAME Secretariat also presented a revised version of the PAME Communication Strategy, including a suggested format of reporting of the PAME Secretariat to PAME representatives and Draft PAME brochure for 2002-2004.

The Meeting noted that the RPA publication is out of print and that copies would be needed for the Arctic marine strategy workshop. Canada offered to undertake a second printing of the publication.

The Meeting agreed to submit comments and pictures for the draft PAME brochure to the PAME Secretariat by 1 April 2003 to be finalized prior to the next SAO meeting.

Session I (3): Report from meeting of Chairs of the Working Groups

The Chair informed the Meeting on the main issues addressed at the meeting of the working group chairs held 16 January 2003 in Reykjavik, Iceland, including:

- The interaction between and coordination among the working groups of the Arctic Council.
- The need to integrate the cross-cutting themes i.e. sustainable development, capacity building, traditional knowledge, mainstreaming of gender issues and implementation of WSSD Plan of Implementation.
- Cooperation with other International Organizations and regional bodies.
- Funding of Arctic Council projects and cooperation with International Financial Institutions.

The Chair noted that the Arctic Marine Strategic Plan Context Paper, prepared by Canada and Iceland, was well received, in particular as coordination of efforts and the roles of other working groups are identified.

Session I (4): Report from SAO/Ministerial Meeting

The Chair noted that all participants should have received the SAO Report to the Ministers and the Inari Declaration which are available on the Arctic Council homepage at www.arctic-council.org. He pointed out that the SAO/Ministerial meeting welcomed PAME´s 2000-2002 work and approved its new Work Plan for 2002-2004 including the new Arctic Marine Strategic Plan initiative.

Session II: Marine Strategic Plan

Session II (1): Introduction and setting the scene

Canada and Iceland, as the lead countries in the development of the Arctic Marine Strategic Plan, noted the importance of retaining and enhancing the Arctic Councils marine focus through the development of this plan. Integration and coordination with the working groups of the Arctic Council and other stakeholders was noted.

Norway informed the Meeting of its White Paper on the marine environment and noted its relevance to the development of the Marine Strategic Plan. The White Paper contains, amongst others, a policy issue to draw up an integrated management plan for the Barents Sea taking into account environmental concerns and the needs of fisheries, the petroleum industry and maritime transport.

Sweden informed the meeting of the developments of the EU Marine Strategy.

Session II (2): Introduction to Context Paper

Canada and Iceland introduced the draft Context Paper in Preparation of Strategic Plan for the Protection of the Arctic Marine Environment (Appendix V).and distributed a draft Strategic Plan workshop agenda (Appendix VI)

The Meeting reviewed these two papers and reached the following conclusions:

It was agreed that the scope of the Strategic Plan should, in principle, be comprehensive. The exact nature and extent of the final product will depend on information available to the process and outcomes will be consistent with the terms of reference of the Arctic Council.

The Meeting proposed changes to the draft Strategic Plan workshop agenda, identified possible elements of a strategic plan and developed a timeline for inputs and decisions about the workshop. The text on these three points is found in Appendix VII and must be read in association with the Canada/Iceland Context Paper and the draft workshop agenda.

The Meeting agreed that the purpose of the workshop is to highlight and discuss key issues for use in development of the Strategic Plan and is not intended as a decision-making event. Preparation of the final Strategic Plan will occur in a PAME-led process after the workshop.

The Meeting discussed the definition of marine ecosystem. It was noted that ecosystems can be defined according to ecological parameters and that political boundaries often transect these boundaries. *The Meeting agreed that these points should be considered further as work proceeds.*

WWF noted the importance of this initiative and the need for a dialogue with industry representatives in the development of the Strategic Plan. WWF provided a summary of their marine work and noted the possible need for concrete actions to implement the Strategic Plan.

Representatives of ACAP, AMAP and CAFF expressed support to the Strategic Plan and will contribute to its development.

Session II (3): Ecosystem approaches

Dr. Kenneth Sherman of the National Oceanic and Atmospheric Administration (NOAA), United States presented the Large Marine Ecosystem Approach (LME) (paper in Appendix VIII).

Dr Sherman noted that the World Summit on Sustainable Development called for the application of the ecosystem approach by 2010. He noted that LMEs are regions of ocean space encompassing coastal areas from river basins and estuaries to the seaward boundaries of

continental shelves and the outer margins of the major coastal currents. They are relatively large regions, on the order of 200,000 km^2 or greater, characterized by distinct (1) bathymetry, (2) hydrography, (3) productivity, and (4) trophically dependent populations.

A modular strategy has been developed to provide information for the monitoring, assessment, restoration and management of LMEs. The modules are focused on ecosystem (1) productivity, (2) fish and fisheries, (3) pollution and ecosystem health, (4) socio-economic conditions, and (5) governance.

Dr Sherman noted that LMEs can provide centers of effort to reduce coastal pollution, restore damaged habitats and recover depleted fishery stocks.

The following websites were identified for additional information:

- LME Website: http://www.edc.uri.edu/lme University of British Columbia: http://data.fisheries.ubc.ca IUCN Website: http://www.iucn.org IOC Website: http://www.ioc.unesco.org IWLearn Website: http://www.iwlearn.netNorway informed the Meeting on the status and proposed methodology on the development of an integrated management plan for the Norwegian Barents Sea. Norway noted that this effort seeks to apply an integrated ecosystem approach.

Session III: Regional Programme of Action

Session III (1): Update status of the GEF/Russian NPA-Arctic

Mr. Vitaly Lystsov of the Advisory Committee on Protection of the Sea (ACOPS) reminded the Meeting of the main goals, structure and four basic elements of GEF Project *Support to Russian NPA- Arctic* (GEF/Russian NPA-Arctic).

Mr. Boris A. Morgunov, Deputy Director of the Department for the Economy of the Environment and Natural Resources, spoke on behalf of the Ministry of Economic Development and Trade of the Russian Federation. He gave an overview on the development of the GEF/Russian NPA-Arctic Project since the last meeting of PAME (April 2002) as well as on related events in the Russian Federation. He noted that the third Ministerial Meeting in Inari, Finland, October 2002 greeted adoption by Russia of NPA-Arctic and multilateral and bilateral financial support of it. The Ministry of Economic Development and Trade of the Russian Federation, ACOPS and UNEP finalized the GEF project document during a consultative meeting held in Moscow in November 2002. In December 2002, UNEP sent the GEF Project document to Russian Federation and to all potential partners of the project with the aim of confirming their readiness for Project co-financing. The Russian Federation officially confirmed its readiness to make the planned input into implementation of the GEF Project.

The Ministry of Economic Development and Trade of the Russian Federation wrote to Nordic countries ministries of foreign affairs and/or environment inviting them to participate in the GEF Project, either directly or through bilateral projects. In January 2003, Russia expressed the readiness to engage in consultations in this regard.

In the second quarter of 2003, the European Commission will prepare a new Action Plan on Policy of the Northern Dimension. The Russia´s SAO proposed to the Arctic Council that this Action Plan include support for the *NPA-Arctic*.

In November 2002, the first session of the Russian Federation Council on Problems of Far North and Arctic took place under the chairmanship of Prime Minister Mr. M. Kasjanow. *A Plan of Action for Implementation of the Principles of the State Russian Policy in the Arctic* was approved, and GEF/Russian NPA-Arctic project is a component of this plan.

In January 2003, the Interagency Coordination and Expert Council on Project Initiatives in the Field of Sustainable Development was established. This Council will decide about state support of priority investment projects and will include the participation of the public in project development. Information on this Council was provided to the PAME Secretariat.

Finland expressed its gratitude to Russia for its efforts towards environmental protection and informed the Meeting that at present it is not in a position to co-finance this project but expressed the hope that their Arctic cooperation with Russia could be further developed within the framework of existing bilateral agreement on environmental cooperation. Finland informed the Meeting of ongoing work of NEFCO in cooperation with AMAP Working Group in updating a list of hot spots in the Barents region.

Iceland noted its continued support towards the implementation of the GEF Project and its relevance to the implementation of the RPA and informed the Meeting of decision taken by the Icelandic government to provide co-funding of this project of a total of $100,000 over a 5 year period.

Canada noted the importance of the GEF/Russian NPA-Arctic to the overall work of the Arctic Council and expressed its continued support to this project through both financial and technical means.

United States noted its continued support to the GEF/Russian NPA-Arctic project both through financial means and by holding the first proposed roundtable meeting.

The Russian Association of Indigenous Peoples of the North (RAIPON) stressed the importance of the GEF/Russian NPA-Arctic project, firstly because this is the largest ever international cooperation project in the Arctic region and secondly, because it incorporates a unique component of utmost importance to the indigenous peoples of the North in Russia. RAIPON

noted that the demonstration projects include a component on Indigenous Environmental Co-management with the mining companies through the establishment of a practical regime of co-management at one specific traditional land use area, where environmental protection and development of the traditional way of life are to be secured through this process.

Taking into consideration the overall institutional and conceptual importance of the project, RAIPON has been supportive since its inception and has consistently endorsed the project at all meetings of the Arctic Council and its Working Groups, as well as at the national level. During discussions of the project RAIPON is targeted to ensure the practical outcome of the project for the indigenous peoples of the North and has made requests to be considered as one of its co-managing organizations responsible for the execution of this part of the project. RAIPON has already an extensive and successful experience in the international project implementation, including among others GEF-funded projects, both independently and as a partner.

RAIPON noted its concerns of not being directly involved as one of the co-executing organizations of the related parts of the GEF/Russian NPA-Arctic project as one of the means to ensure practical outcomes for the indigenous peoples of the North in Russia. RAIPON prefers to avoid circumstance that would force it to refrain from participation in the GEF project.

Mr. Igor Volodin, Team Leader of the Country Service Framework for the Russian Federation gave a presentation on UNIDO´s (United Nations Industrial Development Organization) regional works in Russia which is done through the North-West Cleaner Production & Environment Management Center as a part of the UNIDO Country Service Framework for the Russian Federation. He noted that its work mainly aims at implementation of the Stockholm Convention through inventory of POP's in the North-West Russia including the Arctic. A Preliminary inventory has been conducted in the Murmansk region.

Further information on UNIDO activities in north-west Russia, including the Arctic, can be found at: http://www.nwicpc.ru

Session III (2): Status on planning of roundtables

United States informed the Meeting of ongoing preparations on the roundtables in support of the GEF/Russian NPA-Arctic project and noted that it has been proposed that the first roundtable will take place in USA, and after some period, the second roundtable will be held in a Nordic country. The timing of the roundtables is linked to the preparation of sufficiently detailed projects that would be expected about 15 months after the beginning of the GEF Project.

Russia informed the Meeting that the Partnership Conference would take place in Russia with participation of all national and international stakeholders after the results from the roundtables are finalized.

Session III (3): Status on LBA Chapter/1996 PAME report update

Canada as the lead-country on LBA suggested that follow-up and update on LBA over the next 2 years be set aside as a separate item and incorporated into the development of the Marine Strategic Plan.

The Meeting agreed to this approach.

Session III (4): Inventorying of technical solutions for sewage treatment in small coastal Arctic communities

Iceland introduced a questionnaire for inventory of technical solutions for sewage treatment alternatives in small Arctic costal communities.

The Meeting agreed that work on sewage should take place in the context of the Marine Strategic Plan. The Meeting further agreed to exchange appropriate literature on best pollution control and treatment practices.

Session III (5): RPA Reporting

Canada noted that PAME should consider ways to consolidate reporting on the implementation of the RPA in light of the reporting requirements of the RPA and the upcoming review of the GPA in 2006.

The Meeting agreed that the PAME Secretariat review the "Programme Supporting Elements" of the RPA and provide suggestions on ways to proceed by June 2003.

Session IV: Shipping Activities

Session IV (1): Proposal on follow-up activities of the Snap Shot Analysis

With regard to future activities on the Snap Shot Analysis, Norway proposed and the Meeting agreed that it should also be considered in the context of the Marine Strategic Plan.

Session IV (2): Arctic Waters Oil Transfer Guidelines

Canada as the lead country on developing Arctic Waters Oil Transfer Guidelines gave an update on its status. A breakout group led by Mr John Murray of Canada met in two breakout sessions over the duration of the Meeting to finalize these Guidelines and provide a timeframe for its completion.

Working from the initial draft submitted at this meeting, the drafting group distilled the original document and simplified the language used. The drafting group agreed to develop 3 additional

appendices, 2 checklists and an annotated bibliography. The drafting group agreed to have a draft of the Guidelines prepared for distribution to all members, Arctic Council working groups and Permanent Participants by June 1st 2003.

Some countries noted the need to establish outreach and communication mechanism to test the Guidelines and to ensure its practical use and integration within local communities

The U.S. Coast Guard informed the Meeting of its willingness to fund the translation of the Guidelines into another language (e.g. Russian).

The Meeting agreed on the following timeline in finalizing the Guidelines:

- *A new draft of the Guidelines prepared comments and for distribution to all members, Arctic Council working groups and Permanent Participants by June 1st 2003.*

- *The final version of the Guidelines be ready for adoption at the next PAME working group meeting (early part of 2004) followed by submission and approval at the next Ministerial meeting of the Arctic Council in fall 2004.*

Session IV (3, 4 and 5): Work in Arctic Shipping of relevance to PAME

Dr. Lawson Brigham/United States provided an overview of ongoing activities of relevance to PAME's work in Arctic shipping. He discussed the following four key ongoing activities:

- the new Arctic ship guidelines of the *International Maritime Organization* (IMO),

- the Arctic marine transport project of the *International Arctic Science Committee* (IASC),

- the Arctic Council's *Circumpolar Infrastructure Task Force* (CITF), and

- the *Arctic Climate Impact Assessment* (ACIA).

The *Guidelines for Ships Operating in Arctic Ice-covered waters* were approved by IMO in December 2002. The 10-year process of development of these guidelines included delegations from all the circumpolar nations under Canada´s leadership and representatives of the maritime industry. The guidelines focus on protection of the Arctic marine environment and maritime safety of polar ships and are as yet voluntary, with focus on Arctic ship structures, equipment, and operational considerations (for example, the training of ice navigators). The guidelines also define *Arctic waters* and seven classes of polar ships. A key element of the guidelines is that they supplement, rather than replace, existing maritime conventions and protocols (such as the IMO convention on Safety of Life at Sea (SOLAS); the International Convention for the Prevention of

Pollution from Ships (MARPOL 73/78); and the Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW)).

He noted the importance that PAME National Representatives inform their respective governmental agencies and other organizations of these new guidelines because of their role in its development and the need to recognize potential impact of the guidelines on PAME´s work

Dr. Brigham also informed the Meeting on activities of the International Arctic Science Committee (IASC). He noted that IASC initiated a new project on Arctic marine transport in 2003 titled; *Marine Transport and Changing Access in the Arctic Ocean*. This project will be a comprehensive assessment of recent and future Arctic sea ice changes and include analysis of how these changes impact marine transport routes in the Arctic Ocean and Baltic Sea.

The ACIA scientific report will include sections on changing Arctic sea ice and the associated potential impacts on Arctic shipping routes. Several sea ice maps (from climate models) for the years of 2010-30, 2050-70, and 2070-90 were described. Most of the climate models indicate considerable open water around the coastal regions of the Arctic basin during all time periods.

Finally, he suggested that PAME utilize the expertise within the marine group of CITF.

The Meeting agreed that the IMO should be encouraged to promote the use of the guidelines, for example through the posting on their website.

Session V: Offshore Oil and Gas Guidelines 2002

Session V (1): Update of the 1997 Guidelines

Mr. Dennis Thurston United States presented the updated version of the Offshore Oil and Gas Guidelines on behalf of the United States, as the lead-country. All sections were revisited and updated to varying degrees with summary of major changes available in Appendix IX.

The updated version of the Guidelines was submitted and endorsed by the Ministerial meeting of the Arctic Council in Inari, 2002. The Guidelines have been translated into Russian and are available on PAME´s homepage: www.pame.is. Hard copies will be made available at the next SAO meeting in English and Russian.

The Meeting expressed its gratitude to the contributions by countries and partners in the update of the Guidelines, in particular the extensive work done by Mr. Thurston in its overall coordination.

Session V (2): Ways to increase the use of the updated Guidelines

The Meeting agreed that appropriate presentations at the Strategic Plan Workshop (October 2003) could stimulate discussion of how best to promote the use of the revised Guidelines.

Session VI: Relations with other Organizations and Working Groups

ACAP

The Chair of ACAP, Mr. Per Dovle, informed the Meeting on progress and status on ongoing ACAP projects, in particular the projects on PCB and Obsolete Pesticides. The inventory of PCBs and the feasibility of 9 studies have been finalized and the pilot project phase of the PCB project will be discussed at the next PCB Steering Group meeting 11-12 March, 2003 and at the ACAP meeting 13-14 March 2003. The project on Obsolete Pesticides is in its implementation phase within 11 oblasts of the Russian Federation.

CAFF

Mr. Sune Sohlberg noted the importance of collaboration and cooperation through the work of ACIA and CPAN (Circumpolar Protected Areas Network), in particular with respect to their marine components, during the development of the Marine strategic Plan.

Session VII: Other PAME Related Activities and Future Work Programme

Session VII (1): The next PAME Working Group meeting

The Meeting agreed that the next PAME meeting should take place shortly after the Marine Strategic Plan workshop which is planned to be held in Iceland in October 2003. Exact time and place to be determined.

Session VII (4): Reporting to the next SAO Meeting

The Chair will report on the outcome of the PAME meeting at the next SAO meeting that will be held in Reykjavik, Iceland, 9-10 April 2003.

APPENDIX I
LIST OF PARTICIPANTS
PAME Working Group Meeting
February 25-27, 2003 – Stockholm, Sweden

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APPENDIX II
LIST OF DOCUMENTS
PAME Working Group Meeting
February 25-27, 2003 – Stockholm, Sweden

AGENDA ITEMS	DOCUMENTS
Agenda Item I: Welcome and Introduction	(1) Annotated Agenda (1) Agenda (2) Financial statement and voluntary contributions (2)/INF Communication Strategy (2) PAME Brochure (3)/INF WG Chairs Meeting (4) The Review of the Arctic Council Structures (4) Experts from the SAO report to the Ministers (4) Inari Declaration
Agenda Item II: Marine Strategic Plan	(2) Marine Strategic Plan – letter on proposed discussions (2) Context paper as prepared by Iceland and Canada and letter from Iceland (3) WWF Discussion Paper Strategic Environmental Assessment (SEA) (3) Policy Proposals and Operational Guidance for Ecosystem-Based Management of Marine Capture Fisheries
Agenda Item III: Regional Programme of Action	(3) Update on Land Based Activities, submitted by Canada (3) Update on the 1996 Recommendations as submitted to the Ministerial meeting in Inari 2002 (4) Submission by Iceland, questionnaire for inventory of technical solutions for sewage treatment alternatives in small Arctic coastal communities.
Agenda Item IV: Shipping Activities	(2) Proposed Breakout Session for the Guidelines, Canada (2) Draft of the Arctic Waters Oil Transfer Guidelines
Agenda Item V: Offshore Oil and Gas Guidelines 2002	Cover letter regarding the update of the Arctic Offshore Oil and Gas Guidelines

APPENDIX III
AGENDA
PAME Working Group Meeting
February 25-27, 2003 – Stockholm, Sweden

TUESDAY, February 25

09:00-09:30, Registration and Coffee

09:30-10:30, Session I: Welcome and Introduction (Chair)

1. Adoption of agenda
2. Report from Secretariat (expenditures, voluntary contributions, etc.)
3. Report from meeting of Chairs of the Working Groups
4. Report from SAO/Ministerial meeting

10:30-12:00, Session II: Marine Strategic Plan

1. Introduction and setting the scene – Canada
2. Introduction to Context Paper – Canada/Iceland
3. Presentation on ecosystem approaches – Dr. Kenneth Sherman/NOAA

13:00-15:00, Session II: Marine Strategic Plan - Continues

4. Discussion on proposed ways forward and the involvement of other groups in the process.

15:30-17:00, Session III: Regional Programme of Action

1. Update status of the GEF/Russian NPA-Arctic – Russia/ACOPS
2. Status on planning of roundtables – USA
3. Status on LBA Chapter/1996 PAME Report update – Canada (Chris Cuddy)
4. Inventorying of technical solutions for sewage treatment in small coastal Arctic communities – Iceland
5. Reporting on RPA status

Reception by the Swedish Environmental Protection Agency

WEDNESDAY, February 26

09:00-12:00, Session IV: Shipping Activities

1. Proposal on follow-up activities of the Snap Shot Analysis – Norway.
2. Arctic Waters Oil Transfer Guidelines – Canada.
3. Circumpolar Infrastructure Task Force (CITF) – Dr. Lawson Brigham/U.S.
4. IASC Proposed Project on Arctic Marine Transport - Dr. Lawson Brigham/U.S.
5. IMO Guidelines for ships operating in Arctic ice-covered waters - Dr. Lawson Brigham/U.S.

13:00-14:00, Session V: Offshore Oil and Gas Guidelines 2002

1. Summary of the updated version of the 1997 Guidelines - MMS
2. Discussion on ways to increase the use of the Guidelines

14:00-15.30, Session VI: Relations with other Organizations and Working Groups

1. General Short summary from each working group on upcoming/continuous work of relevance to PAME work
2. Emerging issues (e.g. ACIA) and collaboration with other working groups

16:00-17:00, Breakout session for the Arctic Waters Oil Transfer Guidelines

THURSDAY, February 27

09:00-14:00, Session VII: Other PAME Related Activities and Future Work Programme

1. The next PAME Working Group meeting
2. Any other activities
3. Review draft meeting report
4. Reporting to the next SAO Meeting

PAME Meeting Concludes

APPENDIX IV

Voluntary contributions and expenditures

Provided below are operational expenditures and voluntary contributions in support of the PAME Secretariat as follows:

- Country contributions and expenditures from 1999-2002
- Operational Expenditures for the Period of Jan 01 '02 – Dec 31 '02
- Projected Operational expenditures for the year 2003

PAME INTERNATIONAL SECRETARIAT

Country Contributions and Operational Expenditures

COUNTRY CONTRIBUTIONS AND EXPENDITURES FROM 1999 - 2002 (in USD)					
Country	**1999**	**2000**	**2001**	**2002**	**Total/Country**
Canada		$20.000	$12.800 *)	$13.600 *)	$46.400
Denmark		$11.000	$11.000	$11.000	$33.000
Finland		$9.700	$7.600	$6.900	$24.200
Iceland	$133.400 1)	$66.700	$60.000	$65.000	$325.100
Norway		in-kind	in-kind	in-kind	
Russia		in-kind	in-kind	in-kind	
Sweden		$17.600	$17.600	$17.600	$52.800
United States		$30.000	$30.000		$60.000
Total Contributions:	$133.400	$155.000	$139.000	$114.100	**$541.500**
Total Expenditures:	$55.000 2)	$165.000	$160.000	$154.561	**$534.561**
Closing Balance:	**$78.400**	**-$10.000**	**-$21.000**	**-$40.461**	**$6.939**

OPERATIONAL EXPENDITURES FOR 2002	
Operation of the Secretariat:	
Staff:	**USD**
Salaries, benefits, taxes, insurance, pension	$84.579
(1 person full time, 1 person 40%)	
Contract help *(home-page)*	$5.666
Subtotal:	**$90.245**
Office:	
Service (Telephone, Fax, Computer, Photocopying)	$11.617
Office Supplies	$5.155
Housing (Rent, Heat, Electricity, Cleaning)	$15.498
Shipping/Postage/Bank Services	$3.052
Subtotal:	**$35.322**
Travel:	
International-*airline tickets, per diem, transportation*	$24.292
Domestic-*airline tickets, transportation*	$4.702
Subtotal:	**$28.994**
Total Projected Expenditures for 2002	**$154.561**

Notes:

1) Icelandic contribution towards the start-up and operation of the PAME Secretariat in 1999

2) Of the total expenditure of 55.000 USD then 30.000 USD went into the start-up cost.

*) Canada contributes annually 20,000 CAD but variations in the amont presented in USD is due to significant changes in the ISK towards USD (for 2001 20,000 CAD=1,194,637 ISK at 93,5 ISK/USD but for 2002 20,000 CAD=1,251,925 ISK at 100,5 ISK/USD)

PROJECTED OPERATIONAL EXPENDITURES FOR 2003

Operation of the Secretariat

		USD
STAFF:	Salary, benefits,taxes,insurance,pension (1 person full time and 1 person 40%)	85.000
	Subtotal:	**85.000**
OFFICE:	Service (Telephone, Fax, Computer, Photocopying)	12.000
	Office supplies	5.500
	Housing (rent, heat, electricity)	16.000
	Shipping/Postage/Bank Services	3.100
	Subtotal:	**36.600**
TRAVEL:	***Domestic*** - airline tickets, taxis,transportation	6.000
	International - airline tickets, hotel, per diem, transportation	25.000
	Subtotal:	**31.000**
Total Projected Expenditures for 2003		**152.600**

APPENDIX V

Draft Context Paper in preparation of Strategic Plan for the Protection of the Arctic Marine Environment - Prepared by Iceland and Canada

Table of Content

1. Terms of Reference

From the Inari Declaration:"Recognize that existing and emerging activities in the Arctic warrant a more **coordinated** and **integrated** strategic approach to address the challenges of the Arctic coastal and marine environment and agree to develop a strategic plan for protection of the Arctic marine environment under leadership by PAME."

2. Rationale

Abundant natural resources, increasing transportation and economic activity, and significant changes due to climatic processes, are resulting in increased use and threats to the Arctic marine environment. Measures to control and reduce these pressures and impacts exist but they have largely been reactive and developed on a sector-by-sector basis resulting in a patchwork of policies, legislation and programs. A more coordinated and strategic approach to managing the Arctic marine and coastal environment is needed. Integrated approaches offer an effective and cost-efficient way to address existing and emerging challenges.

3. Objective and Approach

Develop an Arctic Council strategic plan for the protection of the Arctic marine environment based on comprehensive, collaborative and integrated **ecosystem management approaches**.

A collaborative approach to management aims to improve working relationships and seek decisions that meet the needs and interests of all parties to the greatest degree possible.

Ecosystem based management recognizes the complexity of ecosystems and the inter-relationships among component parts.

4. PAMEs Role

The 3rd Arctic Council Ministerial (Inari, 2002), through the Declaration and SAO Report to Ministers, supported the need for a more coordinated approach for the protection of the Arctic marine environment and recognized the relevance to PAME's mandate. Accordingly, PAME's has been tasked with the development of a strategic plan by 2004. PAME will advance a collective approach, respecting existing mandates, to produce a plan that will guide Arctic Council activities related to the protection of the Arctic seas.

As a means to ensure broad-based input and facilitate the development of a strategic plan, Iceland and Canada have offered to host a workshop/conference in 2003.

5. Guiding Principles

The guiding principles that PAME will use to develop a strategic plan are:

- build on existing Arctic Council principles, policies, strategies and programs (Scope of work for the strategic plan will be limited to sustainable development topics covered by the Arctic Council.),

- involve indigenous people and incorporate traditional knowledge,

- promote cooperation and collaboration with the Arctic Council working groups, other relevant international, regional and non-governmental organizations to ensure coordinated and cost-effective approach,

- apply a broad ecosystem-based and sustainable development management approach.

6. Multilateral instruments

There are a vast number of multilateral instruments which provide the framework for the international regime in the protection of the marine environment. The summary provided below only serves as background information and provides some examples with a short qualitative description of their content. The purpose is not to propose exhaustive analysis and status of these instrument but rather to illustrate the need for collaboration of efforts and the use of integrated approaches in addressing the protection of the Arctic marine environment.

Arctic ocean agreements, policies and strategies

AEPS (1991). The Arctic Environmental Protection Strategy (AEPS) was initiated in 1991 (Rovaniemi process). Under this framework, the countries acknowledged the growing national and international appreciation of the importance of Arctic ecosystems and an increasing knowledge of global pollution and resulting environmental threats inside and out of the Arctic region. AEPS provides an intergovernmental strategy for the environmental protection of the Arctic. The 1991 Rovaniemi Declaration committed Arctic countries to:

"Protection of the Marine Environment in the Arctic, to take preventative and other measures directly or through competent international organizations regarding marine pollution in the Arctic irrespective of origin."

Arctic Council (1996): In 1996, the eight Arctic countries created the Arctic Council. The *Declaration on the Establishment of the Arctic Council* created the Council as a high level forum to address common concerns and challenges in the circumpolar region. Through intergovernmental and non-governmental cooperation the Council aims to protect the Arctic environment and promote sustainable development as a means of improving the economic, social and cultural well-being of the north.

International agreements and conventions

- MARPOL (1973/78) – (to be added)

- Chapter 17 of Agenda 21 (1992) Agenda 21 is the blueprint for sustainable development and was a major product of the 1992 UN Conference on Environment and Development, a.k.a. the "Earth Summit". Chapter 17 is dedicated to oceans and outlines the essential elements for sustainable development. It promotes an ecosystem approach to address habitat degradation, pollution, living marine resources, etc.

- Convention on Biological Diversity (1993). The purpose of the Convention is to conserve and sustainably use biological diversity and ensure the fair and equitable sharing of the benefits arising out of the use of genetic resources. The Jakarta Mandate of the Convention is a program of action with respect to marine and coastal biodiversity, it premised on the application of an ecosystem-based management.

- UNCLOS (1994) is an international convention providing a comprehensive framework for the management of the world's oceans, considered the "constitution of the ocean". The principles under the terms of Article 194 (5) support the management of living marine resources and coastal habitats from an ecosystem perspective.

- Framework Convention on Climate Change (1994) – (to be added)

- Global Programme of Action (1995) is an intergovernmental agreement aimed at addressing marine pollution that originates from land-based activities. It addresses pollution discharges through the application of an ecosystem approach.

- Protocol to the London Convention (1996) - (to be added)

- Consultative Process on Ocens (2000)– The UN open-ended Informal Consultative process on Oceans and the Law of the Sea was launched in 2000 as an annual consultation between governments, NGOs and international organizations to consider means of improving coordination and cooperation for improved ocean management and better inform the UN General Assembly annual debate on oceans and Law of the Sea. The Process has highlighted the complex and interrelated nature of the oceans, and the need to manage oceans in a more holistic, integrated and ecosystem-based manner.

- Stockholm Convention on Persistent Organic Pollutants (adopted 2001) –(to be added)

- WSSD 2002 An international conference intended to review progress made since the 1992 Earth Summit and determine how to proceed to attain sustainable development goals etus to protection of the environment. A major product was the Plan of Implementation which outlines a number of specific goals and target dates. A discrete section on oceans includes goals related to marine assessment, pollution, applying an ecosystem approach and addressing fishing capacity. The Summit has given a strengthen impetus for integrated and regional approaches to resource management, and managing for environmental, social and economic needs.

Regional seas agreements and conventions

HELCOM – (to be added)

OSPAR – (to be added)

7. Global Trends

The evolution of natural resource management has increasingly been towards more holistic and integrated approaches. The ineffectiveness and failure of attempting to manage single components of inter-related systems has repeatedly been borne out. The necessity to manage entire ecosystems and address environmental, social and economic objectives was widely endorsed at the Earth Summit in 1992 and reconfirmed at WSSD.

What WSSD also revealed is that there have been an incredible number of agreements, conventions and institutions formed which are intended to achieve sustainable development but there is an "implementation gap". While the frameworks exist and principles such as precaution and ecosystem approach are widely accepted and included in most multilateral instruments, the challenge now is how to implement these principles and manage to meet sustainable development goals and objectives.

The UN Secretary General's Report on Oceans and Law of the Sea reveals that to advance ocean management, existing instruments must be better implemented and adhered to. The Consultative Process on Oceans supports this observation and has called for increased compliance and improved coordination and collaboration, particularly at the regional level. The trend has been an increased understanding that resources must be managed within the context of entire ecosystems and that regional cooperation and action has the greatest potential to address and avoid problems of degradation. The regional level best approximates the scale of impact and the most relevant and efficient level of coordination. Working regionally offers "economy of scale" for such joint efforts as research, monitoring and enforcement.

Abundant natural resources, increasing transportation and economic activity, and significant changes due to climatic processes, are resulting in increased use and threats to the Arctic marine environment. Measures to control and reduce these pressures and impacts exist but they have largely been reactive and developed on a sector-by-sector basis resulting in a patchwork of policies, legislation and programs. A more coordinated and strategic approach to managing the Arctic marine and coastal environment is needed. Integrated approaches offer an effective and cost-efficient way to address existing and emerging challenges.

8. Cooperation and collaboration with Arctic Council Working Groups

An important feature of the strategic plan will be to offer an integrated approach for the various marine related activities that are managed by the different working groups. The integrated

approach will respect the roles and responsibilities assigned to the various Arctic Council Working Groups and will focus on partnership arrangements to achieve the desired results.

Working Groups will be asked to identify the marine components of their existing programmes and ensure that they are accurately and appropriately reflected in the strategic plan. Working Groups will also be asked to assist with developing the best approach for dealing with the emerging challenges for the protection of the Arctic marine environment.

The strategic plan will be developed in an inclusive and transparent fashion as illustrated in Table 1 below. Iceland and Canada will serve as lead countries with PAME providing the lead Working Group coordination and support. All Arctic Council Working Groups and Arctic Council participants will be provided regular opportunities to contribute to the development of the strategic plan.

The proposed workshop scheduled for October 2003 is a critical step in the development process.

9. Major milestones and required deliverables/actions

PERIOD	DELIVERABLES/ACTIONS
Jan 16/03	**WG Chairs** – provide paper describing main characteristics and objectives of wksp
Feb 01/03	Iceland & Canada prepare an agenda outline for PAME
Feb 25/03	**PAME mtg** – develop draft wksp agenda
Mar 10/03	Submit draft agenda to WGs, SAOs
Apr 9/03	**SAO mtg** – planning session with WG Chairs and other interested parties, SAOs approve draft agenda
May XX/03	Announce wksp
Sep 23/03	Submit progress report (incl. template) to PAME, WGs, SAOs et al
OCT XX/03	**HOLD WORKSHOP**
Oct 23/03	**SAO mtg** – planning session with WG Chairs and other interested parties
Dec XX/03	Iceland & Canada prepare a draft strategic plan, circulate to PAME
Jan XX/04	Circulate to WGs/SAOs
Feb XX/04	**PAME mtg** – continue to develop draft strategic plan

Apr XX/04	Submit draft strategic plan to SAOs et al
May XX/04	**SAO Mtg** – comments on draft strategic plan
Jun XX/04	Iceland & Canada revise strategic plan, circulate to PAME
Jul XX/04	Circulate to WGs, SAOs
Aug XX/04	Finalize strategic plan
Sep XX/04	Submit to SAOs
Oct XX/04	**4th AC Ministerial** – endorse strategic plan

10. Workshop

The workshop is an opportunity to ensure broad-based input into the development of a strategic plan, explore improved collaboration and coordination on the Arctic ocean agenda, move towards modern ocean management and meet international commitments related to the protection of the Arctic marine environment.

Objectives

The proposed principle objectives/outcomes of the workshop are to:

- confirm the strategies, policies and programmes that are applicable to a strategic plan;
- recommend the objectives and activities which should be included in the strategic plan; and,
- recommend the coordinating and reporting mechanisms to support a strategic plan.

Specific themes of the workshop will be developed after further consultations with the Arctic Council Working Groups but will include issues addressed in the PAME 1996 Report such as land-based activities, dumping of wastes at sea, shipping activities, offshore oil and gas activities and other emerging issues through the use of integrated ecosystem management approaches (e.g LMEs).

Possible Workshop papers

In order to inform workshop discussions and contribute to the development of the strategic plan a number of background papers could be solicited from governmental and non-governmental sources. The following are examples of subjects that warrant specific consideration and analysis:

1. Arctic Marine Transportation - a summary of current shipping activities and forecast trends in shipping taking account of environmental, economic and social factors that could significantly affect marine transportation.

2. Understanding Arctic Marine Science: - An Overview for Policy Makers of What is Know and What is Yet to be Learned. This would take into account AMAP's Second Assessment and other current sources of information.

3. Indigenous Peoples Interests and Needs in the Protection and Utilization of Arctic Marine Resources.

4. Offshore Arctic Oil and Gas Development - What Does The Future Hold? This paper could set out the issues and an overview of policy, program and operational measures to address conflicting uses.

5. Understanding the Legal Framework for Arctic Marine Protection: Where is it Today and Where Might it be Going in the Next Decade?

6. Ecosystem-based approaches to conserving and managing Arctic flora and fauna

7. Sustainable coastal communities and WSSD outcomes (Canada)

8. State of the Marine Environment Reporting (Iceland)

9. Ecosystem based Approach (Iceland – Ministry of Fisheries) – Framework and current trends in legal conventions and agreements.

10. Emerging issues - the overall trends in climate change and potential effects on the marine environment (e.g. shipping activities).

11. Partnership approaches for pollution prevention projects

12. Risk-based management approaches

Other papers to be determined.

Invitees

- Working Groups of the Arctic Council
- Permanent Participants and Observers
- Indigenous and local groups
- Relevant international, regional and non-governmental organizations
- Individual experts

11. Presentation at he meeting of the Chairs of the Working Groups

(Refer to a separate document with slides)

APPENDIX VI

Draft Strategic Plan Workshop Agenda - Prepared by Iceland and Canada

FOR DISCUSSION (Draft Feb. 21)

PRELIMINARY WORKSHOP AGENDA

October 19 – 22, 2003

Svartsengi, Iceland

DAY ONE:

SUNDAY, OCTOBR 19, 2003		
1800 hrs	**Registration**	Room X
1900 hrs	**Welcoming Remarks** By…	
1920-2100	**Reception** *Key note speaker?*	

EXHIBITS

Countries, intergovernmental and non-governmental organizations will have an opportunity to showcase their work related to the marine environment. For the duration of the workshop, space will be provided to allow exhibitors to display images and distribute material outlining their efforts towards improved ocean management.

DAY TWO:

MONDAY, OCTOBER 20, 2003		
0800-0900 hrs	**Registration and Refreshments**	
0900-0930 hrs	**Opening Address – Setting the Scene** *The origins, goals and objectives of the workshop and a presentation of key issues and opportunities by…*	Room X
Session 1: Drivers of Change for the Arctic Marine Environment A summary of the key threats and challenges		
0930-0950 hrs	**WSSD and the Arctic** *A summary of the implications for the Arctic*	
0950-1020 hrs	**State of the Marine Environment** *A summary of ocean assessment and reporting by…*	
1020-1040 hrs	Health Break	
1040-1110 hrs	**Emerging Issues (e.g., human and economic)** Presentation by	
1110-1200 hrs	**Plenary Discussion** *Participants will have an opportunity to discuss the changing nature of the Arctic. Co-Chairs will summarize the key pressures and threats.*	
1200-1300 hrs	Lunch	
Session 2: Trends in Ocean Management Examples of various international, regional and national approaches		
1300-1330 hrs	**Integrated Management Approaches** Presentation by	
1330-1400 hrs	**Regional Seas Overview** Presentation by UNEP Presentation by HELCOM Presentation by OSPAR	
1400-1420 hrs	**EU Marine Strategy** Presentation by	
1420-1500 hrs	**National Ocean Strategies and Programmes** Canada / White paper from Norway? Russian NPA-Arctic	
1500-1520 hrs	Health Break	
1520-1600 hrs	**Strategies by regional/international Organizations** Presentations by (IUCN and WWF?)	
1600-1700 hrs	**Plenary Discussion** *Participants will have an opportunity to discuss the relevant policies, programs and strategies for a strategic plan. Co-Chairs will summarize the key elements.*	

DAY THREE:

TUESDAY, OCTOBER 21, 2003		
0830-0900 hrs	**Refreshments**	
Session 3: Panel - Arctic Council Working Groups *A summary of marine components of the various workplans presented by a panel of Working Group Chairs*		
0900-0910 hrs	PAME Presentation by	
0910-0920 hrs	AMAP Presentation by	
0920-0930 hrs	ACAP Presentation by	
0930-0940 hrs	CAFF Presentation by	
0940-0950 hrs	EPPR Presentation by	
0950-1000 hrs	SDWG Presentation by	
1000-1020 hrs	Health Break	
1020-1100 hrs	**Panel Discussion** *Co-Chairs will moderate a discussion of coordination and collaboration and reporting on progress from an Arctic Council context.*	
Session 4: The Circumpolar Response Considering the changes, pressures, approaches and initiatives what should be the circumpolar response?		
1100-1200 hrs	**Breakout Groups** **What are the key elements of a strategic plan?** - What are the basic tools necessary for integrated approaches? - How could integrated approaches be applied in the Arctic? - What are the mechanisms for cooperation and collaboration? - How do we measure progress?	
1200-1300 hrs	Lunch	
1300-1345 hrs	**Breakout Group Summaries** *Rapporteurs will present the results of the morning's discussions*	
1345 hrs	**Session 4: *Continued*** *Co-Chairs will introduce the afternoon session with a focus on opportunities*	
1400-1500 hrs	**Breakout Groups**	

	What are the opportunities offered by a strategic plan? - What are the sustainable development opportunities? - Are there opportunities for enhanced technical cooperation and assistance? - What are the partnering opportunities, within and outside the Arctic Council?	
1500-1520 hrs	Health Break	
1520-1600 hrs	**Breakout Group Summaries** *Rapporteurs will present the results of the afternoon discussions*	
1600-1645 hrs	**Plenary Discussion** *Participants will have an opportunity to discuss the key characteristics of a strategic plan. Co-Chairs will summarize the day's discussions.*	
1645-1700 hrs	**Wrap up**	

DAY FOUR:

WEDNESDAY, OCTOBER 22, 2003		
0830-0900 hrs	**Refreshments**	
Session 5: A Roadmap for the Arctic Marine Environment		
0900-1000 hrs	**Panel Discussion** *Co-Chairs will moderate a panel discussion of the desired state of the Arctic Marine Environment and vehicles to get there. Panel representatives to include government, NGO, industry? and intergovernmental representatives*	
1000-1020 hrs	Health Break	
1020-1100 hrs	**Plenary Discussion** *Participants will have an opportunity to discuss future directions. Co-Chairs will summarize discussions.*	
1100-1130 hrs	**Workshop Summary and Next Steps** *Co-Chairs will summarize the priorities and strategic directions and outline the way forward to facilitate the development of a strategic plan.*	
1130 hrs	**Adjourned**	

APPENDIX VII

Proposed changes to the draft workshop agenda and possible elements of the draft marine strategic plan

I Possible elements of a strategy (see also Context Paper)

The following proposed elements reflect initial discussions at the PAME Working Group meeting. Outlining the basic components of a strategic plan served to frame discussions. It is understood that the elements of the strategic plan will evolve with on-going consultations.

Statement of issues/concerns:

Pressures/threats will be based on current knowledge and an assessment of potential risk.

Internal/ external sources of pollution

Base it on work of AMAP, CAFF, ACIA, IASC, SDWG, EPPR, CITF, + other inputs.

Assess also potential risks related to e.g., increased transport shipping, opening of new oil fields and other issues

Goals and Objectives:

Based on ACs/AEPS objectives, considering the outcome of WSSD set out for the next term.

Could also be new goals based on the general line of previous goals.

Guiding Principles:

- Good scientific knowledge
- Polluter Pays
- Ecosystem Approach
- Sustainable development
- Indigenous knowledge
- Cost efficiency
- Shared issues and common problems

- Timing and relative importance/severity of risks

Strategies to achieve the goals and objectives

The Arctic Marine Strategy will be based on the Ecosystem Approach

Overarching strategies and Strategies aimed to solve potential problems and concerns, e.g.,

- POPs
- Species and habitat
- Transport
- Oil and Gas
- Radionuclides
- Social/Cultural changes
- etc.

Some of these strategies may require an Action plan on national/sub-regional (i.e. Arctic Council) and regional basis

II Draft Decisions on Workshop Agenda:

Session #1

Need to add one or two papers on State of the Environment/Projections (see Context Paper). Possible paper/presentation should deal with understanding the Arctic marine ecosystem and how it functions.

Session #2

Combine HELCOM and OSPAR presentations on experiences and developments in applying an ecosystem approach. Plenary discussions will be clarified to focus on the session 2 – Trends in Oceans Management. Consider adding a presentation on trends and issues in legal measures with emphasis on the Arctic.

Session #3

Canada and Iceland to get WG chairs input on how to approach this session as a number of different options exist. When the revised agenda is circulated to Chairs they will be explicitly invited to provide input to how this session should unfold.

Session # 4

Further work needs to be done on the "instruction" to the breakout groups. These Breakout Groups should be focused on specific issues and concerns but not asked to draft strategies.

III PAME Input to the Workshop:

1. Review and comment on Feb 21 draft by March 4

2. Comment on revised draft by April 1 2003

3. Lead countries finalize the agenda May 1, 2003

Note for Meeting report In order to clarify PAME opportunities for input into the workshop and strategic plan in general lead countries will elaborate the work plan and schedule, included on page 5 of the Context Paper.

APPENDIX VIII

Paper prepared for the PAME Workshop, Protection of the Arctic Marine Environment, Stockholm, Sweden, 25-27 February 2003, Dr. Kenneth Sherman

Assessment and Recovery of Large Marine Ecosystems

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SUSTAINABILITY OF MARINE ECOSYSTEMS

There is ample evidence of the degradation of coastal waters around the globe from habitat alteration, fish and fisheries depletion, eutrophication, pollution and emerging diseases (Harvell et al. 1999, Jackson et al. 2001). A global campaign is underway to reverse this trend and improve global prospects for the long term sustainability of resources and environments of international coastal waters. Scientific and technical assistance is being provided to developing countries by NOAA-NMFS, IUCN (the World Conservation Union), and the Global Environment Facility (GEF) in partnership with several United Nations agencies (e.g. UNIDO, UNDP, UNEP, IOC, FAO) for advancing new policies and taking direct actions for the recovery of depleted fish stocks, restoration of degraded habitats, and control of coastal pollution and eutrophication in Large Marine Ecosystems located around the margins of the world's oceans (Duda and Sherman 2002). These actions are consistent with movements by coastal countries toward the targets adopted during the recent World Summit on Sustainable Development (WSSD) in Johannesburg for implementing the application of an ecosystem-based approach for the restoration of coastal ecosystems by 2010, and the recovery of depleted fish populations to Maximum Sustainable Yield (MSY) levels by 2015.

Large Marine Ecosystems

Large Marine Ecosystems (LMEs) are regions of ocean space encompassing coastal areas from river basins and estuaries to the seaward boundaries of continental shelves and the outer margins of the major coastal currents (Figure 1). They are relatively large regions, on the order of 200,000 km^2 or greater, characterized by distinct (1) bathymetry, (2) hydrography, (3) productivity and (4) trophically dependent populations. The theory, measurement and modeling relevant to monitoring the changing states of LMEs are embedded in reports on ecosystems with changing states, pattern formations, and spatial diffusion (Holling 1993, Pimm 1984, Mangel 1991, Levin 1993). On a global scale, 64 LMEs produce 95 percent of the world's annual marine fishery biomass yields. Within their waters, most of the global ocean pollution, overexploitation of fish and fisheries, and coastal habitat alteration occurs. For 39 of the 64 LMEs, retrospective studies have been conducted of the principal driving forces effecting changes in biomass yields. They have been peer reviewed and published in eleven volumes; volume twelve has been peer reviewed and is currently in press (Table 1).

MODULAR ASSESSMENTS SUPPORTING RESTORATION ACTIONS

Based on information obtained from the LME case studies, a modular strategy has been developed to provide information for the monitoring, assessment, restoration and management of LMEs. The modules are focused on ecosystem (1) productivity, (2) fish and fisheries, (3) pollution and ecosystem health, (4) socioeconomic conditions, and (5) governance. Principal components of the modules and indicators of the changing states of ecosystems are shown in Figure 2.

The Productivity Module

Productivity can be related to the carrying capacity of the ecosystem for supporting fish resources (Pauly and Christensen 1995; Pauly et al. 1998; Williams 1998). Studies indicate that the maximum global level of primary productivity for supporting the average annual world catch of fisheries has been reached, and further large-scale unmanaged increases in biomass yields from marine ecosystems are likely to be at trophic levels below fish in the marine food chain (Beddington 1995; Pauly and Christensen 1995). This appears to be corroborated by changes in the species composition and decline in average species size of the catches of fisheries from the East China Sea LME (Chen and Shen 1999). Measuring ecosystem productivity can also serve as a useful indication of the growing problem of coastal eutrophication (NSQSR 1993, Seitzinger and Kroeze 1998). In several LMEs, excessive nutrient loadings of coastal waters have been related to algal blooms that have been implicated in mass mortalities of living resources, emergence of pathogens (e.g. cholera, vibrios, red tides, paralytic shellfish toxins) and explosive growth of non-indigenous species (Epstein 1996).

The ecosystem parameters measured in the productivity module are zooplankton biodiversity and information on species composition, zooplankton biomass, water column structure, photosynthetically active radiation (PAR), transparency, chlorophyll-a, NO_2, NO_3, primary

production, and environmental variability. The plankton of LMEs has been measured by deploying Continuous Plankton Recorder (CPR) systems from commercial vessels of opportunity (Glover 1967). Technically advanced plankton recorder towed-bodies can be fitted with sensors for temperature, salinity, chlorophyll, nitrate/nitrite, petroleum, hydrocarbons, light, bioluminescence, and primary productivity (Aiken et al. 1999, Berman and Sherman 2001), providing the means to monitor changes in phytoplankton, zooplankton, primary productivity, species composition and dominance, and long-term changes in the physical and nutrient characteristics of the LME, as well as longer term changes relating to the biofeedback of the plankton to environmental change (Colebrook 1986; Colebrook et al. 1991; Dickson et al. 1988; Williams 1993).

The fish and fisheries module

Changes in species composition within the fish communities of LMEs have resulted from (1) excessive exploitation (Sissenwine and Cohen 1991), (2) shifts in the environmental and/or climate regime (Bakun 1993; 1999) or (3) coastal pollution (Mee 1992; Bombace 1993). These three sources of variability in fisheries yield are operable in most LMEs. They can be described as primary, secondary, and tertiary driving forces in fisheries yields, contingent on the ecosystem under investigation. For example, in the Humboldt Current, Benguela Current, and California Current LMEs, the primary driving force influencing variability in fisheries yield and ecosystem productivity is the changing upwelling strength (Bakun 1993; MacCall 1986; Crawford et al. 1989; Alheit and Bernal 1993, Shannon and O'Toole in press, Lluch-Belda et al. in press, Wolf and Mendo in press). Fishing and pollution effects are secondary and tertiary effects on fisheries yields. In continental Shelf LMEs including the Yellow Sea and Northeast US Shelf, excessive fisheries effort has been the cause of large-scale declines in catch and changes in the biodiversity and dominance in the fish community (Tang 1993; Sissenwine 1986; Murawski 1999; NEFC 1999,2000). In these ecosystems, pollution and environmental perturbation are of secondary and tertiary influence. In contrast, significant coastal pollution and eutrophication have been the principal factors driving the changes in fisheries yields of the Northwest Adriatic (Bombace 1993), the Black Sea (Mee 1992), and the near coastal areas of the Baltic Sea (Kullenberg 1986). Overexploitation and natural environmental changes are of secondary and tertiary importance. Changes in the biodiversity of the fish community can generate cascading effects up the food chain to apex predators and down the food chain to plankton components of the ecosystem (Overholtz and Nicolas 1979; Payne et al. 1990).

The Fish and Fisheries module includes fisheries-independent bottom trawl surveys and acoustic surveys for pelagic species to obtain time-series information on changes in biodiversity and abundance levels of the fish community (Pope 1977; Ntiba 1998). Standardized sampling procedures, when deployed from small calibrated trawlers, can provide important information on diverse changes in fish species. The fish catch provides biological samples for stock assessments, stomach analyses, age, growth, fecundity, and size comparisons (ICES C.M. 1991), data for clarifying and quantifying multispecies trophic relationships, and the collection of samples to monitor coastal pollution. Samples of trawl-caught fish can be used to monitor

pathological conditions that may be associated with coastal pollution. The trawlers can also be used as platforms for obtaining water, sediment, and benthic samples for monitoring harmful algal blooms, virus vectors of disease, eutrophication, anoxia, and changes in benthic communities.

Pollution and the ecosystem health module

In several LMEs, pollution has been a principal driving force in changes of biomass yields. Assessing the changing status of pollution and health of the entire LME is scientifically challenging. Ecosystem "health" is a concept of wide interest for which a single precise scientific definition is problematical. Methods to assess the health of LMEs are being developed from modifications to a series of indicators and indices described by several investigators (Costanza 1992; Costanza and Mageau 1999; Rapport 1992; Norton and Ulanowicz 1992; Karr 1992). The overriding objective is to monitor changes in health from an ecosystem perspective as a measure of the overall performance of a complex system (Costanza 1992). The health paradigm is based on the multiple-state comparisons of ecosystem resilience and stability (Holling 1973, 1986, 1993; Pimm 1984; Costanza 1992) and is an evolving concept.

Following the definition of Costanza (1992), to be healthy and sustainable an ecosystem must maintain its metabolic activity level, its internal structure and organization, and must be resistant to external stress over time and space scales relevant to the ecosystem. These concepts were discussed by panels of experts at two workshops convened in 1992 by NOAA (NOAA 1993). Among the indices discussed by the participants were five that are being considered as experimental measures of changing ecosystem states and health: (1) biodiversity; (2) stability; (3) yields; (4) productivity; and (5) resilience. The data from which to derive the experimental indices are obtained from time-series monitoring of key ecosystem parameters (Sherman et al. 2002; EPA 2001). The ecosystem sampling strategy is focused on parameters relating to the resources at risk from overexploitation, species protected by legislative authority (marine mammals), and other key biological and physical components at the lower end of the food chain (plankton, nutrients, hydrography). The parameters of interest include zooplankton composition, zooplankton biomass, water column structure, photosynthetically active radiation (PAR), transparency, chlorophyll-a, NO_2, NO_3, primary production, pollution, marine mammal biomass, marine mammal composition, runoff, wind stress, seabird community structure, seabird counts, finfish composition, finfish biomass, domoic acid, saxitoxin, and paralytic shellfish poisoning (PSP) (Sherman 1994). The experimental parameters selected incorporate the behavior of individuals, the resultant responses of populations and communities, as well as their interactions with the physical and chemical environment. The selected parameters provide a basis for comparing changing health status within and among ecosystems.

Fish, benthic invertebrates and other biological indicator species are used in the pollution and ecosystem health module to measure pollution effects on the ecosystem including the bivalve monitoring strategy of "Mussel-Watch", the pathobiological examination of fish (Goldberg 1976; Farrington et al. 1983; ICES 1988; O'Connor and Ehler 1991; White and Robertson 1996)

and the estuarine and nearshore monitoring of contaminants in the water column, substrate, and selected groups of organisms. The routes of bioaccumulation and trophic transfer of contaminants are assessed, and critical life history stages and selected food-chain organisms are examined for a variety of parameters that indicate exposure to, and effects of, contaminants. Contaminant-related effects measured include diseases, impaired reproductive capacity, and impaired growth. Many of these effects can be caused by direct exposure to contaminants, or by indirect effects, such as those resulting from alterations in prey organisms. The assessment of chemical contaminant exposure and effects on fisheries resources and food-chain organisms consists of a suite of parameters, including biochemical responses that are clearly linked to contaminant exposure coupled with measurements of organ disease and reproductive status that have been used in previous studies to establish links between exposure and effects. The specific suite of parameters measured will cover the same general responses and thus allow for comparable assessment of the physiological status of each species sampled as it relates to chemical contaminant exposure and effects at the individual species and population level (Svanberg 1992; Turgeon et al. 1992; Varanasi et al. 1992). In addition, the implementation of protocols for assessing the frequency and effect of harmful algal blooms (Smayda 1991) and emergent diseases (Epstein 1993, Sherman and Duda 1999) are included in the pollution module.

The socioeconomic module

The socioeconomic module is characterized by its emphasis on practical applications of its scientific findings in managing the LME and on the explicit integration of economic analysis including valuations of ecosystem goods and services with the science-based ecosystem structure and function assessments to assure that prospective management measures are cost-effective. Economists and policy analysts will need to work closely with ecologists and other scientists to identify and evaluate management options that are both scientifically credible and economically practical.

Published reports addressing the developing paradigm of ecosystem management based on economic valuations of ecosystem goods and services include the findings of an expert panel of the Ecological Society of America (Christensen et al. 1996), reports by NOAA (Griffis and Kimball 1996; Baker 1996), reports of the U.S. Congressional Research Service (Zinn and Corn 1994; Lubchenco 1994), and SIMCOAST modeling efforts of McGlade (1999). Examples of processes, goods, and services expected from healthy ecosystems are listed in Table 3.

Special consideration should be given to improved knowledge of how the natural system generates economic values. Many valuable services provided by natural systems are not traded in markets or included in planning evaluations, so extra care must be made to assure that they are not sacrificed through ignorance. The services provided by coastal wetlands as nurseries for fisheries, natural pollution filters, and storm buffers are well-known examples that have particular relevance to coastal reclamation activities. Other examples are more subtle, including the importance of predator-prey relationships and the possibility of losing unrecognized "keystone" species in a valuable ecosystem. Experience indicates that growing economic values

on aesthetic and recreational/tourism amenities are to be expected in the LMEs. A variety of sources of economic value arising from the natural diversity of the LME should be identified and assessed in regard to existing uses and potential management innovations (Hoagland et al. 1999).

Each project should include a generalized characterization of the ways in which human activities affect the natural marine system and the expected "sensitivity" of these forcing functions to various types and levels of human activity. Population dynamics, coastal development, and land-use practices in the system's drainage basin are clear examples. Work integrating the efforts of natural and social scientists should concentrate further on resolving apparent effects (such as eutrophication-associated red tide events or changing fish population structures) that are confounded by cycles or complex dynamics in the natural system itself. Progress is possible, too, in achieving better characterizations of the way in which human forcing is mediated by alternate management options. Emphasis should be on isolating and quantifying those forcing activities (sewage discharge, agricultural runoff, fishing effort) likely to be expressed most prominently in effects on the natural system. Other considerations in ecosystem valuation analyses involve trade-offs in multi-use systems among finfish/shellfish, aquaculture/capture fisheries, as well as various options to be considered in habitat restoration (Levin 1999). A summary of steps needed to properly monitor and assess socioeconomic and governance activities considered as "human dimensions" of LMEs is given as Table 2. A more complete description of the approach is given in Sutinen (2000).

The Governance module is evolving, based on case studies now underway among ecosystems to be managed from a more holistic perspective than generally practiced in the past. In projects supported by the Global Environmental Facility (GEF) for the Yellow Sea ecosystem, the Guinea Current LME, and the Benguela LME agreements were reached among the environmental ministers of the countries bordering these LMEs to enter into joint resource assessment and management activities. Among other LMEs, the Great Barrier Reef ecosystem is being managed from an ecosystems perspective (Kelleher 1993) along with the Northwest Australian Continental Shelf ecosystem (Sainsbury 1988) being managed by the state and federal governments of Australia. The Antarctic marine ecosystem is being managed from an ecosystem perspective under the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and its 21-nation membership (Scully 1993). Movement toward ecosystems management is emerging for the North Sea (NSQSR 1993), Barents Sea (Eikeland 1992), Black Sea (Hey and Mee 1993) and Baltic Sea (Thulin 2000 and ICES website, Baltic Sea OPS Plan). Recent reports have examined options for improving linkages between the science-based productivity, fish and fisheries, and ecosystem pollution and health modules to the socioeconomic (Sutinen 2000) and governance modules (Juda 1999; Juda and Hennessy 2000).

APPLICATIONS OF THE LME APPROACH

LME – Global Environment Facility Operational Strategy

Following a three-year pilot phase (1991-1994), the Global Environment Facility (GEF) was formally launched to forge cooperation and finance actions in the context of sustainable

development that address critical threats to the global environment: biodiversity loss, climate change, degradation of international waters, ozone depletion, and persistent organic pollutants. Activities concerning land degradation, primarily desertification and deforestation as they relate to these threats, are also addressed. GEF projects are implemented by UNDP, UNEP, and the World Bank and expanded opportunities exist for participation by other agencies.

The only new funding source to emerge from the 1992 Earth Summit, the GEF today counts 171 countries as members. During its first decade, GEF allocated $US 3.2 billion in grant financing, supplemented by more than $US 8 billion in additional financing, for 800 projects in 156 developing countries and those in economic transition. All six thematic areas of GEF, including the land degradation cross-cutting theme, have implications for coastal and marine ecosystems. Priorities have been established by the GEF Council in its Operational Strategy (GEF 1995) adopted in 1995. The international waters focal area was designed to be consistent with both Chapter 17 and 18 of Agenda 21. In 1995, the Global Environment Facility (GEF) Council included the concept of LMEs in its GEF Operational Strategy as a vehicle for promoting ecosystem-based management of coastal and marine resources in the international waters focal area within a framework of sustainable development. The Report of the Second Meeting of the UN Informal, Open-ended Consultative Process on Ocean Affairs (UN 2001) related to UNCLOS recognized the contribution of the GEF in addressing LMEs through its science-based ecosystem approach. The geographic extent of the LME, its coastal area, and contributing basins constitute the place-based area for assisting countries to understand linkages among root causes of degradation and integrating needed changes in sectoral economic activities.

GEF Supported LME Projects

The LME areas serve to initiate capacity building and for bringing science to pragmatic use in improving the management of coastal and marine ecosystems. The GEF Operational Strategy recommends that nations sharing an LME begin to address coastal and marine issues by jointly undertaking strategic processes for analyzing factual, scientific information on transboundary concerns, their root causes, and by setting priorities for action on transboundary concerns. This process has been referred to as a Transboundary Diagnostic Analysis (TDA) and it provides a useful mechanism to foster participation at all levels. Countries then determine the national and regional policy, legal and institutional reforms and investments needed to address the priorities in a country-driven Strategic Action Program (SAP). This allows sound science to become the basis for policy-making and fosters a geographic location upon which an ecosystem-based approach to management can be developed. Stakeholders within the geographic area are encouraged to contribute to the TDA/SAP dialogue and support an ecosystem-based approach that can be pragmatically implemented through the application of the LME science-based assessment and management strategy by the communities and governments involved. Without such participative processes to engage specific stakeholders in a place-based setting, marine science has often remained confined to the marine science community or has not been embraced in policy-making. Furthermore, the science-based approach encourages transparency through joint monitoring and assessment processes (joint cruises for countries sharing an LME) that

builds trust among nations over time and can overcome the barrier of false information being reported. The LME projects that have been approved by the GEF or are under preparation with GEF funding are listed in Table 3. The approved GEF-LME projects include developing nations or those in economic transition as well as other OECD (Organization for Economic Co-operation and Development) countries since the living resources, the pollution loading, or the critical habitats have transboundary implications across rich and poor nations alike. Over one-half billion dollars in total project costs from the North and South are currently being invested as of December 2001 in 10 LME projects in 72 countries with $225 million in GEF grant finance. An additional 7 LME projects are under preparation involving 54 nations. A total of 126 different countries are participating in these GEF LME projects (Table 3). With OECD countries involved that share the LMEs with the GEF recipient nations, expectations are that reforms will take place in both the North and the South in order to operationalize this ecosystem-based approach to managing human activities in the different economic sectors that contribute to place-specific degradation of the LME and adjacent waters. Systematic application of the 5 modules through the TDA-SAP processes is fostering an adaptive management approach to joint governance based on the application of assessment indicators to guide governance decisions. This process facilitates the integration of science-based information into the management regime.

LME ASSESSMENT, RESTORATION AND GOVERNANCE

Angola, Namibia and South Africa are jointly moving forward within the framework of the GEF supported Benguela Current LME program (BCLME) toward the recovery of depleted fish stocks, restoration of damaged habitats, control of coastal pollution, and improved forecasting of ocean variability effecting coastal upwelling and fish stock productivity. Governance considerations led to the formulation of the BCLME program as an international body under the terms of the UN Convention on the Law of the Sea (UNCLOS) and, the establishment of an Interim Benguela Current Commission (IBCC) to strengthen regional cooperation. The IBCC is supported by a Program Coordinating Unit and subsidiary bodies including Advisory Groups on 1) Fisheries and other Large Marine Resources, 2) Environmental Variability and Ecosystem Health, 3) Marine Pollution, 4) Legal Affairs and Maritime Law, and 5) Information and Data Exchange. The IBCC is to become a fully operational Commission with a supporting Secretariat within the initial 5 years of the BCLME Program's operation. Similar governance mechanisms in the form of Joint Program Commissions, Joint Compacts, and Joint Steering Committees serve as important governance mechanisms in GEF supported LME projects, for the Guinea Current LME, the Humboldt Current LME, and the Yellow Sea LME. Other GEF supported projects, including those for the Baltic Sea, Red Sea, and Black Sea LMEs, are using existing regional institutions to address management and governance issues. The LME assessment and governance activities are conducted in harmony with the existing UNEP Regional Seas Agreements under UNCLOS and, with other thematic conventions (e.g. Abidjan Convention, Commission on Biological Biodiversity [CBD]; the Global Program of Action [GPA] for the protection of the Marine Environment from land-based Activities, the UN Framework Convention on Climate Change [UNFCCC], and the UN Fish Stocks Agreement [FSA]). The LME programs are broader in scope and content than any one of the more narrowly focused

thematic international and regional instruments. Operationalization of the 5 module assessment strategy serves as a means for introducing ecosystem-based assessment and management to a growing number of LMEs and their bordering countries and regions around the globe. Joint LME monitoring surveys are being employed to provide transparency in collection of data and confidence and trust among participating nations. In the Gulf of Guinea and Benguela Current LME projects in Africa, joint fish stock assessment surveys also serve to build capacity among nations to utilize sound science so that management decision-making can be improved.

Toward Restoration of the U.S. Northeast Shelf Ecosystem

The U.S. Northeast Shelf ecosystem is presently undergoing a significant transition from depleted fish stocks to the recovery of pelagic and demersal fish species important to the economy of the adjacent northeast states from Maine to North Carolina. Although the recovery has not as yet been fully achieved, the corner has been turned from declining over-harvested fish stocks toward a condition wherein the stocks can be managed to sustain their long-term potential yield levels. The management decisions taken to reduce fishing effort to recover lost biomass was supported by science-based monitoring and assessment information forthcoming from the LME (1) productivity, (2) fish and fisheries, (3) pollution and ecosystem health, (4) socioeconomics, and (5) governance modules that have been operationalized by NOAA's Northeast Fisheries Science Center (NEFSC) in collaboration with state, federal, and private stakeholders from the region.

From the mid-1960s through the early 1990s, the biomass of principal groundfish and flounder species inhabiting the US Northeast Shelf ecosystem declined significantly from overfishing of the spawning stock biomass (NEFSC 1999). In response to the decline, the biomass of skates and spiny dogfish increased from the 1970s through the early 1990s (NEFSC 1999). The impact of the increase in small elasmobranches, particularly spiny dogfish, shifted the principal predator species on the fish component of the ecosystem from silver hake during the mid-1970s to spiny dogfish in the mid-1980s (Sissenwine and Cohen 1991) By the mid-1990s a newly developing fishery for small elasmobranches initiated a declining trend in biomass for skates and spiny dogfish (NEFSC 1999).

Following the secession of foreign fishing on the Georges Bank-Gulf of Maine herring complex and the Atlantic mackerel stock in the late 1970s, and over a decade of very low fishing mortality, both species began to recover to high stock sizes in the 1990s (Figure 3B). Bottom trawl survey indices for both species increased dramatically, showing over a ten fold increase in abundance (average of 1977-1981 vs. 1995-1999) by the late 1990s [NEFSC 2000(27); NEFSC 2000(30)]. Stock biomass of herring increased to over 2.5 million metric (mm) tons by 1997 and ssb was projected to increase to well over 3.0 mm tons in 2000 (NEFSC 1999). The offshore component of herring, which represents the largest proportion of the whole complex, appears to have fully recovered from the total collapse it experienced in the early 1970s (NEFSC 2000). For mackerel, the situation is similar, total stock biomass has continued to increase since the collapse of the fishery in the late 1970s. Although absolute estimates of biomass for the late

1990s are not available, recent analyses concluded that the stock is at or near a historic high in total biomass and ssb (NEFSC 2000). Recent evidence following mandated substantial reductions in fishing effort indicate that both haddock and yellowtail flounder stocks are responding to the catch reductions rather favorably with substantial growth reported in ssb size, since 1994 for haddock and flounder. In addition, in 1997 a very strong year-class of yellowtail flounder was produced, and in 1998, a strong year-class of haddock was produced (Figure 3).

At the base of the food web, primary productivity provides the initial level of carbon production to support the important marine commercial fisheries (Nixon et al. 1986). Zooplankton production and biomass in turn provide the prey-resource for larval stages of fish, and the principal food source for herring and mackerel in waters of the NE Shelf ecosystem. Over the past two decades the long-term median value for the zooplankton biomass of the NE Shelf ecosystem has been about 29cc of zooplankton per $100m^3$ of water strained produced from a stable mean-annual primary productivity of $350gCm^2yr$. During the last two decades, the zooplanktivorous herring and mackerel stocks underwent unprecedented levels of growth, approaching an historic high combined biomass. This growth is taking place during the same period that the fishery management councils for the New England and Mid-Atlantic areas of the NE Shelf ecosystem have sharply curtailed fishing effort on haddock and yellowtail flounder stocks. Given the observed robust levels of primary productivity and zooplankton biomass, it appears that the "carrying capacity" of zooplankton supporting herring and mackerel stocks and larval zooplanktivorous haddock and yellowtail flounder is sufficient to sustain the strong year-classes reported for 1997 yellowtail flounder and 1998 haddock, herring and mackerel (Figure 3 a and b).

The zooplankton component of the Northeast Shelf ecosystem is in a robust condition at biomass levels at or above the levels of the long-term median values of the past two decades, providing a suitable prey base for supporting a large biomass of pelagic fish (herring and mackerel), while providing sufficient zooplankton prey to support strong year-classes of recovering haddock and yellowtail flounder stocks (Sherman et al. 2002). No evidence has been found in the fish, zooplankton, temperature, or chlorophyll component that is indicative of any large-scale oceanographic regime shifts of the magnitude reported for the North Pacific or northeast Atlantic Ocean areas.

The robust condition of the plankton components at the base of the food web of the Northeast Shelf ecosystem was important to the relatively rapid rebuilding of zooplanktivorous herring and mackerel biomass from the depleted condition in the early 1980s to a combined biomass in 1999 of an unprecedented level of approximately 5.5 mm tons, following the exclusion of foreign fishing effort and the absence of any significant U.S. fishery on the stocks. The milestone action leading to the rebuilding of lost herring and mackerel biomass was the decision by the United States to extend jurisdiction over marine fish and fisheries within 200 miles of the coastline. Recently the Fishery management councils of New England, and the mid-Atlantic coastal states agreed to reduce fishing effort significantly on demersal fish stocks of the NE Shelf ecosystem. With the reduction of exploitation rate, the spawning biomass of haddock and yellowtail flounder

increased over a 4-year period and led to the production of large year-classes of haddock in 1998 and yellowtail flounder in 1997.

The Northeast Shelf ecosystem is presently undergoing a significant trend toward biomass recovery of pelagic and demersal fish species important to the economy of the adjacent northeast states from Maine to North Carolina. Although the recovery has not as yet been fully achieved, the corner has been turned from declining overharvested fish stocks toward a condition wherein fisheries management is focused on rebuilding of depleted fish stocks to sustain their long-term potential yield levels. The management decisions taken to reduce fishing effort to recover lost biomass was supported by science-based monitoring and assessment information forthcoming from the productivity, fish and fisheries, pollution and ecosystem health, socioeconomics, and governance modules that have been operational by NOAA's Northeast Fisheries Science Center for several decades in collaboration with state, federal, and private stakeholders from the region. This case study can serve to underscore the utility of the modular approach to ecosystem-based management of marine fish species. In an effort to stem the loss of fisheries biomass in other parts of the world, applications of this generic modular approach to LME management are presently underway by countries bordering the Yellow Sea, Benguela Current, Baltic Sea, and Guinea Current LMEs (IOC 2000), with financial assistance of the Global Environment Facility, collaborating UN agencies, and the technical and scientific assistance of other governmental and non-governmental agencies and institutions.

Special concerns about nitrogen over-enrichment of LMEs

A common thread regarding degradation of LMEs in GEF projects is the large number of eutrophication cases. More and more, GEF receives requests for interventions in LMEs for such eutrophication concerns. Nitrogen over-enrichment has been reported as a coastal problem for two decades, from the southeast coast of the US as described by Duda (1982) twenty years ago to the Baltic and other systems (Helsinki Commission 2001).

In European LMEs, recent nitrogen flux increases of from 3 fold in Spain to 4 fold in the Baltic and 11 fold in the Rhine basin draining to the North Sea LME have been recorded (Howarth et al. 2000). Duda and El-Ashry (2000) described the origin of this disruption of the nitrogen cycle from the "Green Revolution" of the 1970's as the world community converted wetlands to agriculture, utilized more chemical inputs, and expanded irrigation to feed the world. As noted by Duda (1982) for the Southeast estuaries of the US and (Rabalais et al. 1999) for the Gulf of Mexico, much of the large increase in nitrogen export to LMEs is from agricultural inputs, both from the increased delivery of fertilizer nitrogen as wetlands were converted to agriculture and from concentrations of livestock as shown Duda and Finan (1983) for eastern North Carolina, where the increase in nitrogen export over the forested situation ranged from 20-500 fold in the late 1970s. Industrialized livestock production the last two decades increases the flux, the eutrophication, and the oxygen depletion even more as reported by the NRC (NRC 2000). The latest GESAMP Assessment (The Food and Agriculture Organization 2000) also identified sewage as a significant contributor to the eutrophication in drainages from large cities and

atmospheric deposition from automobiles/agricultural activities may also contribute depending on proximity to sources.

GEF is being asked more frequently by countries to help support the agreed upon incremental cost of actions that reduce such nitrogen flux. Actions range from assisting in development of joint institutions for ecosystem-based approaches for adaptive management described in this paper to on-the-ground implementation of nitrogen abatement measures in the agricultural, industrial, and municipal sectors and breaching of floodplain dikes so that wetlands recently converted to agriculture may be reconverted to promote nitrogen assimilation. The excessive levels of nitrogen contributing to coastal eutrophication constitute a new global environment problem that is cross-media in nature. Excessive nitrogen loadings have been identified as problems in the following LMEs that are receiving GEF assistance: Baltic Sea, Black Sea, Adriatic portion of the Mediterranean, Yellow Sea, South China Sea, Bay of Bengal, Gulf of Mexico, and Plata Maritime Front/Patagonia Shelf. In fact, preliminary global estimates of nitrogen export from freshwater basins to coastal waters were assembled by Seitzinger and Kroeze (1998) as part of a contribution to better understanding LMEs. Included as Figure 5 and adapted from Kroeze and Seitzinger (1998), these preliminary estimates of global freshwater basin nitrogen export are alarming for the future sustainability of LMEs. Given the expected future increases in population and fertilizer use, LMEs may be, without significant N mitigation efforts, subjected to a future of increasing harmful algal bloom events, reduced fisheries, and hypoxia that further degrades marine biomass and biological diversity.

North-South Cooperation in LME Projects

An increasing number of developed and developing countries, now totaling 126 around the world, are concerned enough with the degraded condition of their coastal and marine ecosystems to collaborate on GEF-LME projects. Ministerial level commitments to ecosystem-based approaches for assessment and management may ultimately lead to establishing joint adaptive management regimes in support of the global objectives of Chapter 17 of Agenda 21, the Jakarta Mandate of the CBD, UNCLOS, the GPA, and the regional seas agreements countries have signed and the targets adopted during the Johannesburg World Summit on Sustainable Development (WSSD), calling for introduction of the ecosystem-based approach by 2010, and the movement toward the recovery of depleted fish stocks to Maximum Yield Levels by 2015. It appears that an important corner has been turned by these countries toward a focused global effort to restore biomass and biological diversity to coastal oceans as concerned governments understand the poverty reduction and security enhancement that accompanies more sustainable management regimes.. The GEF international waters focal area has played a catalytic role through its emphasis on joint management of Large Marine Ecosystems, their coastal assets, and linked river basins in an integrated manner. Through tests of these approaches, countries are starting to establish practical, science-based management regimes that address in collective and ecosystem-oriented ways the themes and programs under existing Agenda 21 and otherglobal instruments.

While many of the multi-country-driven LME initiatives supported with GEF grant funding have just started, and in others the national and regional reforms in progress will take a number of years to achieve, several lessons are becoming evident for the world community to consider in reversing the decline of its coastal oceans. A geographic approach, based on the LMEs of the world, their adjacent coastal areas and linked freshwater contributing basins (where appropriate), is likely to overcome the limits of more thematically directed activities to address global environmental problems (e.g. fisheries, sewage, sediment, contaminants). In this manner, the different stresses that are important to each specific area can be addressed jointly through processes that result in collective national actions in different economic sectors where needed. Processes such as the TDA and SAP foster multi-stakeholder dialogue, inter-ministerial dialogue, and a discourse with the science community in unraveling complex situations so they can be divided into priority components for more effective management than is now in general practice. Fragmented, thematic, single purpose agency programs are just not able to harness stakeholder involvement sufficiently to drive needed reforms compared to geographic-based initiatives.

Now, at the beginning of this new century, a global common understanding is emerging in recognition of the accelerated degradation of coastal marine ecosystems and that the decline is not just a problem of developing nations but is also driven by over-consumption from developed nations. The $50 billion annual trade in fisheries makes those nations a stakeholder in LMEs of the South in addition to their own LMEs. Indeed, rich countries now acknowledge the need to adopt many reforms as well, not only for their degraded marine waters but also to provide a safety net to conserve marine waters of developing nations that are exploited for global commerce. The $15 billion in annual fishing subsidies represent a powerful driving force for depletion and reforms in those countries are just as essential as the reforms needed in developing nations. Many developed nations share LMEs with developing nations and the GEF has shown that they can work together for adopting an ecosystem-based approach for joint assessment and management purposes.

GEF LME projects are demonstrating that ecosystem-based approaches to managing human activities in LMEs, their coasts, and their linked watersheds are critical, and provide a needed place-based area within which to focus on multiple benefits to be gained from multiple global instruments. Instead of establishing competing programs with inefficiencies and duplication, which is the norm now, the LME projects foster action on priority transboundary issues ACROSS instruments in an integrated manner—across UNCLOS, Chapter 17 of Agenda 21, the Jakarta Mandate of the Convention on Biodiversity (CBD), the Global Program of Action for Land-based Sources of Pollution (GPA) and its pollution loading reductions, and in dealing with inevitable adaptation issues under UN Framework Convention on Climate Change (UNFCCC). In fact, this ecosystem-based approach, centered around LMEs and participative processes for countries to undertake for building political and stakeholder commitment and inter-ministerial buy-in, can serve as the way ahead on reversing the degradation of marine ecosystems

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Table 1. List of LMEs and subsystems for which syntheses relating to primary, secondary, or tertiary driving forces controlling variability in biomass yields have been completed for inclusion in LME volumes (also listed below).

PACIFIC OCEAN		
Large Marine Ecosystems (with LME map #)	**Volume no.**	Authors
California Current (3)	1	MacCall
	4	Mullin
	5	Bottom
	12	Lluch-Belda et al.
Pacific American Coastal(11)	8	Bakun et al.
Humboldt Current (13)	5	Bernal
	12	Wolff
Gulf of Thailand (35)	5	Piyakarnchana
	11	Pauly and Chuenpagdee
South China Sea (36)	5	Christensen
Indonesian Sea (38)	3	Zijlstra and Baars
Northeast Australian Shelf (40)	2	Bradbury and Mundy
	5	Kelleher
	8	Brodie
	12	Brodie
East China (47)	8	Chen and Shen
Yellow Sea (48)	2	Tang
	5	Tang
	12	Tang
Kuroshio Current (49)	2	Terazaki
Sea of Japan (50)	8	Terazaki
Oyashio Current (51)	2	Minoda
Okhotsk Sea (52)	5	Kusnetsov et al.

INDIAN OCEAN		
Somali Coastal Current (31)	7	Okemwa
Bay of Bangal (34)	5	Dwividi
	7	Hazizi

POLAR REGIONS		
East Bering Sea (1)	1	Incze and Schumacher
	8	Livingston et al.
West Greenland Shelf (18)	3	Hovgärd and Buch
	5	Blindheim and Skjoldal
	10	Rice
Barents Sea (20)	2	Skjoldal and Rey

	4	Borisov
	5	Skjoldal
	10	Dalpadado et al.
	12	Matishov
Norwegian Shelf (21)	3	Ellertsen et al.
	5	Blindheim and Skjoldal
North Sea (22)	1	Daan
	9	Reid
	10	McGlade
	12	Hempel
Iceland Shelf (59)	10	Astthorsson and Vilhjálmsson
Faroe Plateau (60)	10	Gaard et al
Antarctic (61)	1	Scully et al.
	3	Hempel
	5	Scully et al.

ATLANTIC OCEAN		
Gulf of Mexico (5)	2	Richards and McGowan
	4	Brown et al.
	9	Shipp
	9	Pauly et al.
	9	Brown
	9	Gracia and Vasquez Baden
Southeast U.S. Continental Shelf (6)	4	Yoder
Northeast U.S. Continental Shelf (7)	1	Sissenwine
	4	Falkowski
	6	Murawski
	6	Anthony
	10	Sherman
	12	Sherman
Scotian Shelf (8)	10	Zwanenburg et al.
Caribbean Sea (12)	3	Richards and Bohnsack
Patagonian Shelf (14)	5	Bakun
South Brazil Shelf (15)	12	Ekau and Knoppers
East Brazil Shelf (16)	12	Ekau and Knoppers
North Brazil Shelf (17)	12	Ekau and Knoppers
Baltic Sea (23)	1	Kullenberg
	12	Jansson
Celtic-Biscay Shelf (24)	10	Lavin
Iberian Coastal (25)	2	Perez -Gandaras
	10	Wyatt and Porteiro
Mediterranean Sea (26)	5	Caddy
Canary Current (27)	5	Bas
	12	Roy and Cury
Guinea Current (28)	5	Binet and Marchal

	11	Koranteng and McGlade
	11	Mensah and Quaatey
	11	Lovell and McGlade
	11	Cury and Roy
	11	Koranteng
Benguela Current (29)	2	Crawford et al.
	12	Shannon and O'Toole
Black Sea (62)	5	Caddy
	12	Daskalov

Vol.1 Variability and Management of Large Marine Ecosystems. Edited by K. Sherman and L. M. Alexander. AAAS Selected Symposium 99. Westview Press, Inc., Boulder, CO, 1986. 319 p.

Vol.2 Biomass Yields and Geography of Large Marine Ecosystems. Edited by K. Sherman and L.M. Alexander. AAAS Selected Symposium 111. Westview Press, Inc., Boulder, CO, 1989. 493 p.

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Vol.4 Food Chains, Yields, Models, and Management of Large Marine Ecosystems. Edited by K. Sherman, L.M. Alexander, and B.D. Gold. AAAS Symposium. Westview Press, Inc., Boulder, CO, 1991. 320 p.

Vol.5 Large Marine Ecosystems: Stress, Mitigation, and Sustainability. Edited by K. Sherman, L.M. Alexander, and B.D. Gold. AAAS Press, Washington, DC, 1992. 376 p.

Vol.6 The Northeast Shelf Ecosystem: Assessment, Sustainability, and Management. Edited by K. Sherman, N.A. Jaworski, and T. J. Smayda. Blackwell Science, Inc., Cambridge, MA, 1996. 564 p.

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Vol.8 Large Marine Ecosystems of the Pacific Rim: Assessment, Sustainability, and Management. Edited by K. Sherman and Q. Tang. Blackwell Science, Inc., Malden, MA. 1999, 455 p.

Vol.9 The Gulf of Mexico Large Marine Ecosystem: Assessment, Sustainability, and Management. Edited by H. Kumpf, K. Stiedinger, and K. Sherman. Blackwell Science, Inc., Malden, MA, 1999. 736 p.

Vol.10 Large Marine Ecosystems of the North Atlantic: Changing States and Sustainabiity. Edited by H.R. Skjoldal and K. Sherman. Elsevier, Amsterdam and New York. 2002. 449 p.

Vol.11 Gulf of Guinea Large Marine Ecosystem: Environmental Forcing and Sustainable Development of Marine Resources. Edited by J. McGlade, P. Cury, K. Koranteng, N.J. Hardman-Mountford. Elsevier Science, Amsterdam and New York. 2002.

Vol.12 Large Marine Ecosystems of the World: Trends in Exploitation, Protection, and Research. Edited by G. Hempel and K. Sherman. In press; Elsevier Science.

Table 2. Steps for monitoring and assessment of the human dimensions of an LME, and of the use of its resources (from Sutinen 2000).

1.	Identify principal uses of LME resources
2.	Identify LME resource users and their activities
3.	Identify governance mechanisms influencing LME resource use
4.	Assess the level of LME-related activities
5.	Assess interactions between LME-related activities and LME resources
6.	Assess impacts of LME-related activities on other users
7.	Assess the interactions between governance mechanisms and resource use
8.	Assess the socioeconomic importance of LME-related activities and economic and sociocultural value of key uses and LME resources
9.	Identify the public's priorities and willingness to make tradeoffs to protect and restore key natural resources
10.	Assess the cost of options to protect or restore key resources
11.	Compare the benefits with the costs of protection and restoration options
12.	Identify financing alternatives for the preferred options for protecting/restoring key LME resources

Table 3. Countries where Marine Resource Ministries (fisheries, environment, finance) are supportive of resource assessment and management from an ecosystems perspective, and LME project planning and/or implementation is underway.

Approved GEF Projects

LME	Countries
Gulf of Guinea (6)	Benin, Cameroon, Côte d'Ivoire, Ghana, Nigeria, Togo[a]
Yellow Sea (2)	China, Korea
Patagonia Shelf/Maritime Front (2)	Argentina, Uruguay
Baltic (9)	Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia, Sweden
Benguela Current (3)	Angola,[b] Namibia, South Africa[b]
South China Sea (7)	Cambodia, China, Indonesia, Malaysia, Philippines, Thailand, Vietnam
Black Sea (6)	Bulgaria, Georgia, Romania, Russian Federation, Turkey,[b] Ukraine
Mediterranean (19)	Albania, Algeria, Bosnia-Herzegovina, Croatia, Egypt,[b] France, Greece, Israel, Italy, Lebanon, Libya, Morocco,[b] Slovenia, Spain, Syria, Tunisia, Turkey, Yugoslavia, Portugal
Red Sea (7)	Djibouti, Egypt, Jordan, Saudi Arabia, Somalia, Sudan, Yemen
Western Pacific Warm Water Pool-SIDS (13)	Cook Islands, Micronesia, Fuji, Kiribati, Marshall Islands, Nauru, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu
	Total number of countries: 72[c]

GEF Projects in the Preparation Stage

Canary Current (7)	Cape Verde, Gambia, Guinea,[b] Guinea-Bissau,[b] Mauritania, Morocco, Senegal
Bay of Bengal (8)	Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka, Thailand
Humboldt Current (2)	Chile, Peru
Guinea Current (16)	Angola, Benin, Cameroon, Congo, Democratic Republic of the Congo, Côte d'Ivoire, Gabon, Ghana, Equatorial Guinea, Guinea, Guinea-Bissau, Liberia, Nigeria, Sao Tome and Principe, Sierra Leone, Togo
Gulf of Mexico (3)	Cuba,[b] Mexico,[b] United States
Agulhus/Somali Currents (8)	Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, South Africa, Tanzania
Caribbean LME (23)	Antigua and Barbuda, The Bahamas, Barbados, Belize, Columbia, Costa Rica, Cuba, Grenada, Dominica, Dominican Republic, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, Venezuela
	Total number of countries: 54[c]

[a]The six countries participating in the Gulf of Guinea project also appear in a GEF/LME project in the preparatory phase

[b]Countries that are participating in more than one GEF/LME project

[c]Adjusted for multiple listings

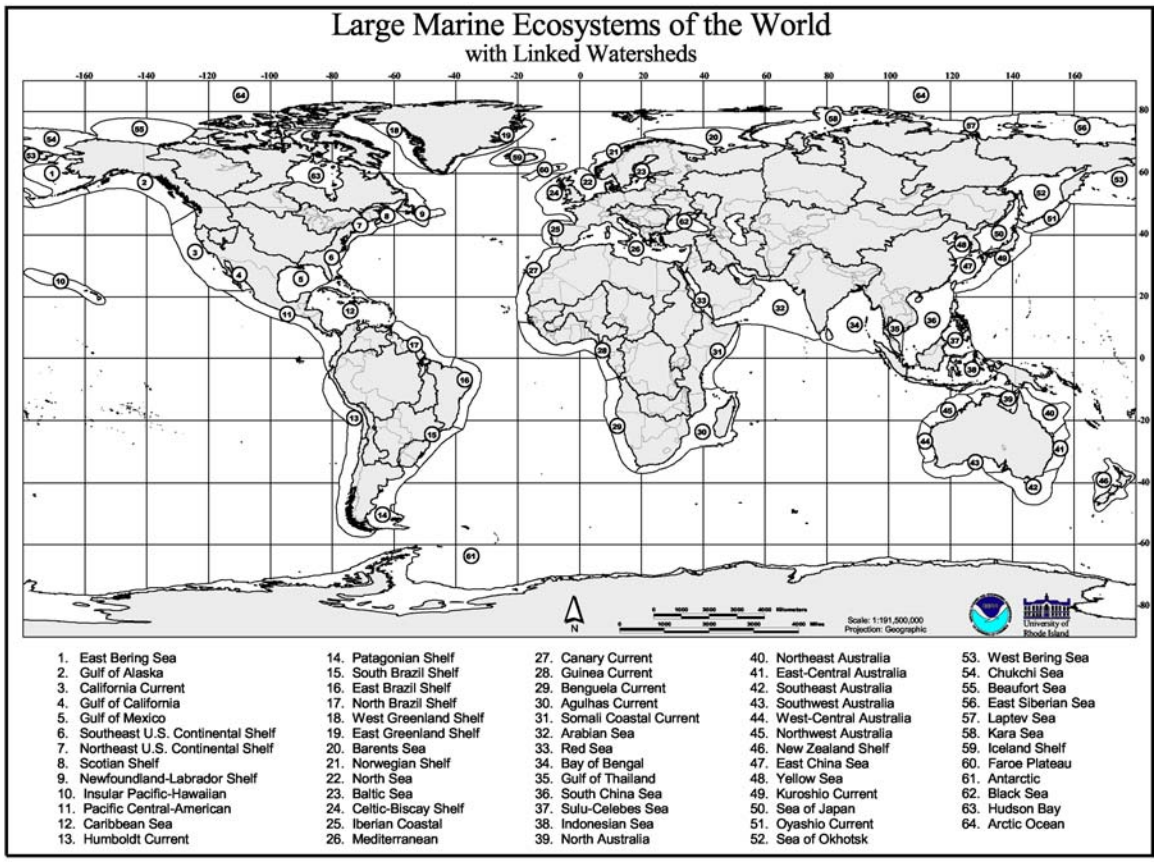


Figure 1 Map of the 64 LMEs and their watersheds

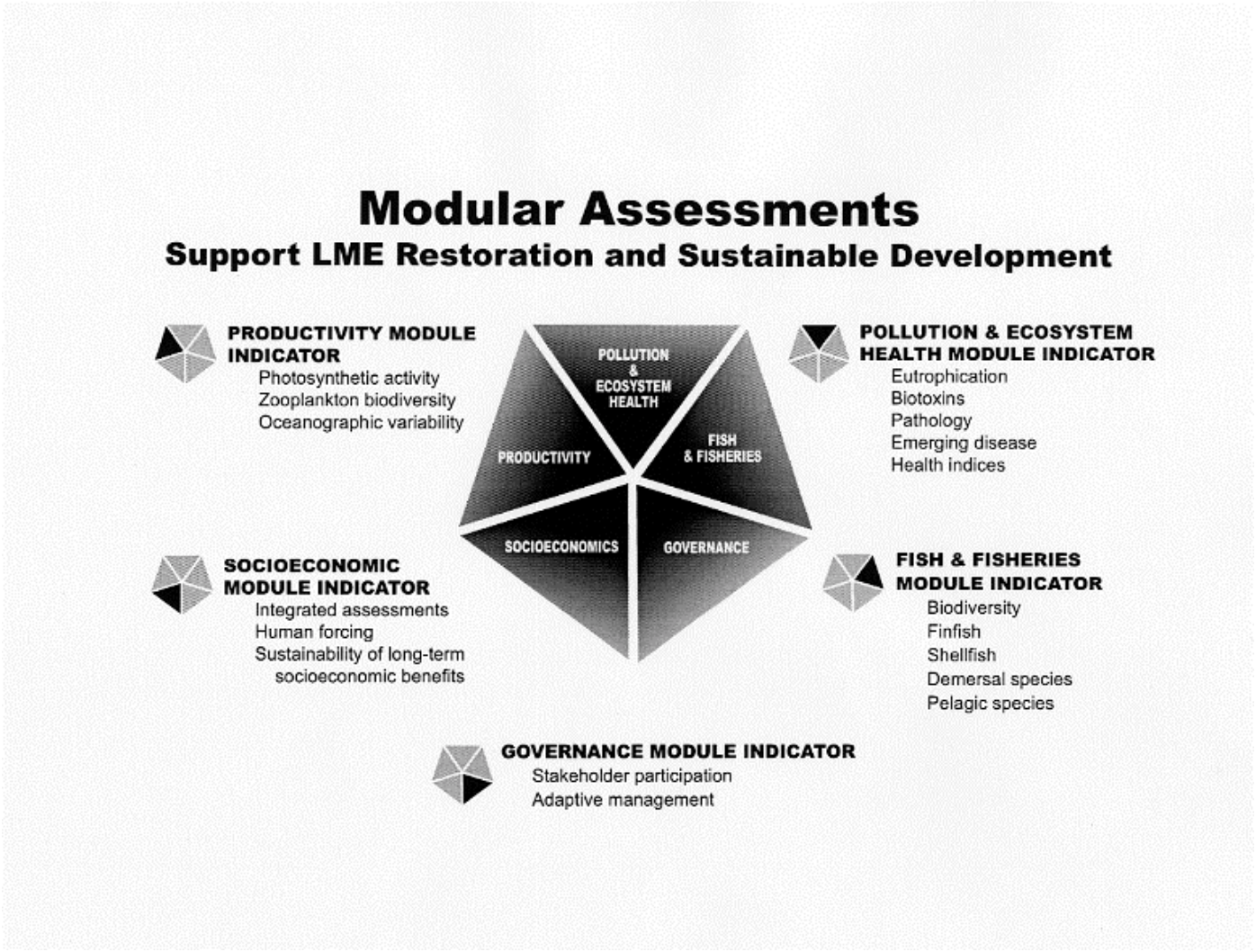


Figure 2. The 5 module LME assessment and management strategy

Figure 3A. Trends in spawning stock biomass (ssb) and recruitment in relation to reduction in exploitation rate (fishing effort) for two commercially important species inhabiting the Georges Bank subarea of the Northeast Shelf ecosystem: yellowtail flounder and haddock

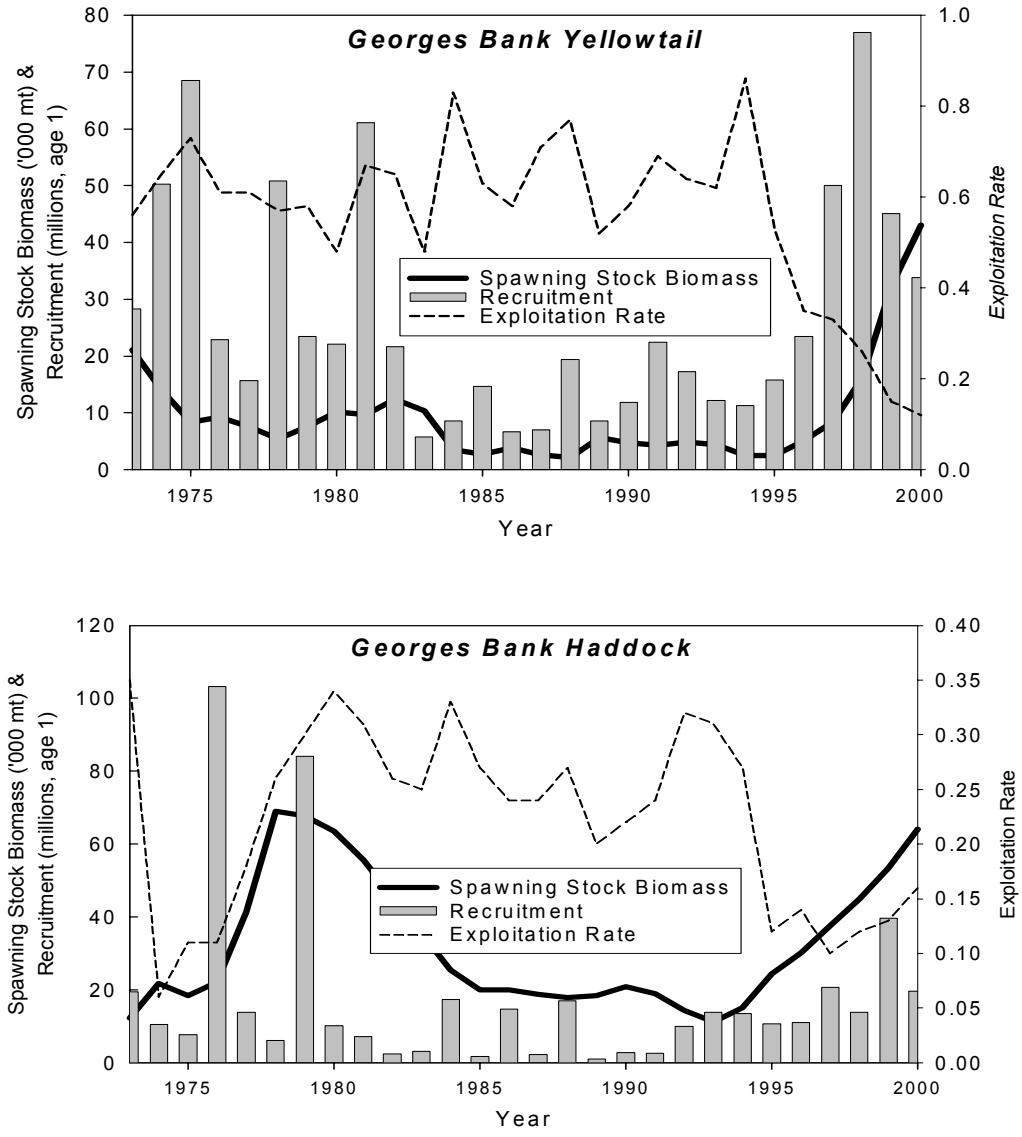
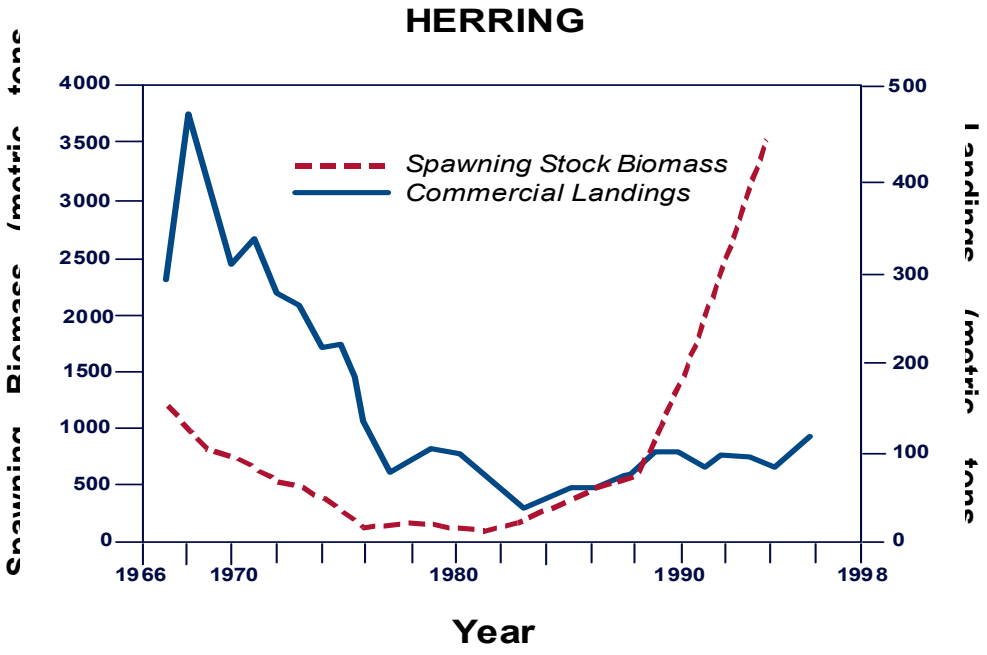
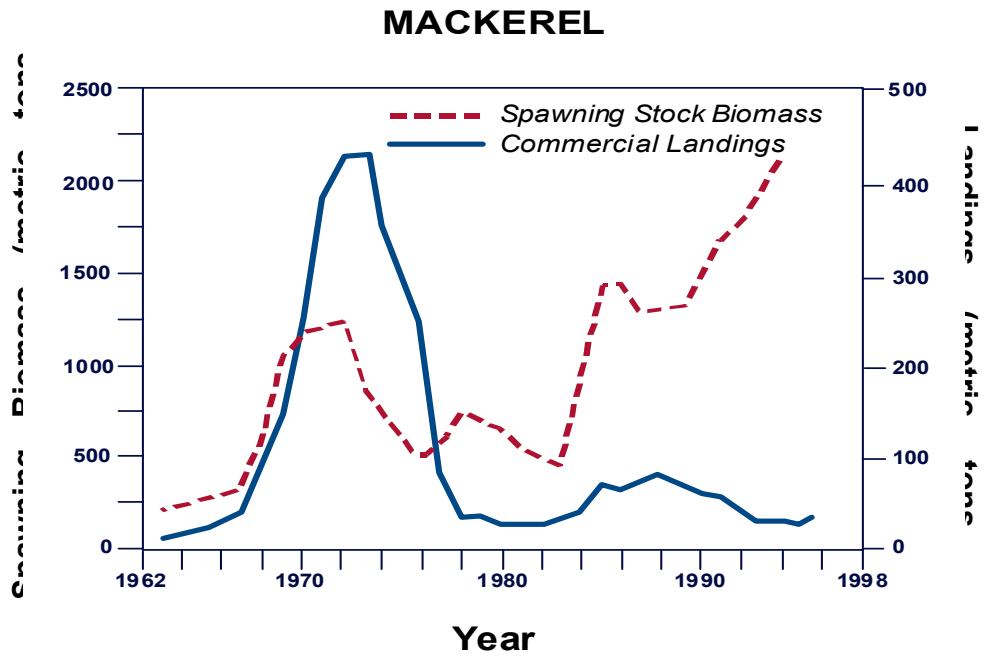


Figure 3B. Trends in spawning stock biomass (ssb) and exploitation rate(fishing effort) for Herring and Mackerel of the Northeast Shelf LME.





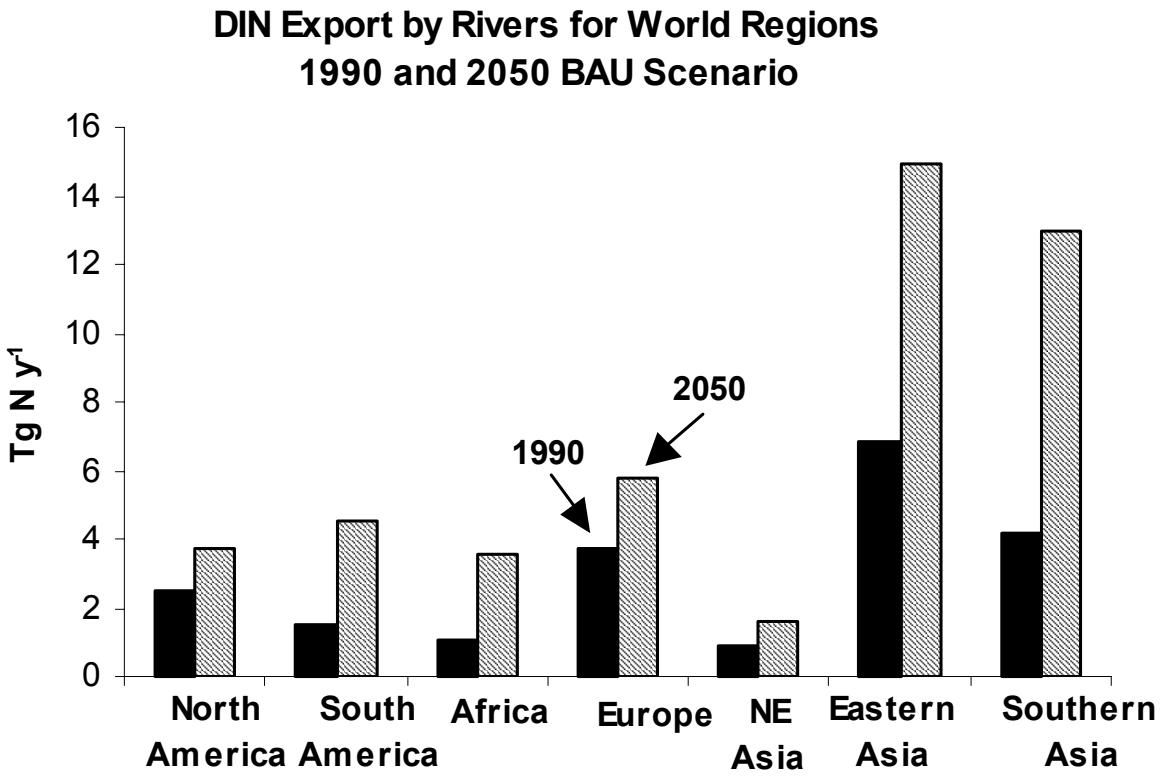


Figure 4. Model-predicted nitrogen (dissolved inorganic N) export by rivers to coastal systems in 1990 and in 2050 (based on a business-as-usual [BAU] scenario). Figure modified from Kroeze and Seitzinger 1998.

APPENDIX IX

Summary of major changes made to the updated version of the 1997 Offshore Oil and Gas Guidelines

All Sections were revisited and were updated to varying degrees.

The major changes are:

- Web Friendly format with hyperlink navigation to various parts in the document and to external web-pages with relevant information.
- 123 new references added; the existing 115 references were updated, and web-links were added to all references.
- International Instruments and Treaty text references were updated linked to relevant web-pages.
- All tables and appendices moved to the end of the document.

Section 1 includes updated information, new references to the need for socioeconomic assessment before development, a new map of the Arctic Region.

Section 2 Environmental Impact Assessment, was substantially rewritten to include updated information, text on Risk Assessment and Risk Analysis, and new text on Strategic Environmental Assessments, and summary examples of the EIA processes for several Arctic countries.

Section 3 Arctic Communities, Indigenous Peoples, Sustainability and Conservation of Flora and Fauna was updated to include more discussion of traditional knowledge and protection of indigenous peoples lifestyles.

Section 4 Safety and Environmental Management was completely rewritten.

Section 6 Operating Practices was extensively rewritten, including an extensively rewritten section 6.1 Waste Management:

- Updated to reflect the Best Available Techniques and the promotion of zero discharge to the marine environment.
- Extended the discussion of Waste from Drilling Activities to include reinjection as a disposal option.

- Expanded and updated the discussion on Production Waste Discharges.
- 6.5 Transportation of Supplies and Transportation Infrastructure includes new text on ice roads.

Section 7 Emergencies, Extensively rewritten including 7.2 Response, text added on response to oil spills in broken ice conditions.

Completely new **Section 8** Decommissioning and Site Clearances

A new **Section 9** combining Definitions with Abbreviations with relevant web-links.

Expanded Table: Overview of Offshore Activities and Potential Environmental Effects

Updated country information in Annex A: Definition of the Arctic.

New Annex B, BAT and BEP--Criteria for the Definition of Practices and Techniques Mentioned in Paragraph 3(b)(i) of Article 2 of the OSPAR Convention

New Environmental Risk Analysis Flow Diagram (Annex E)

A completely new Russian Translation.

Electronically updateable for new references.