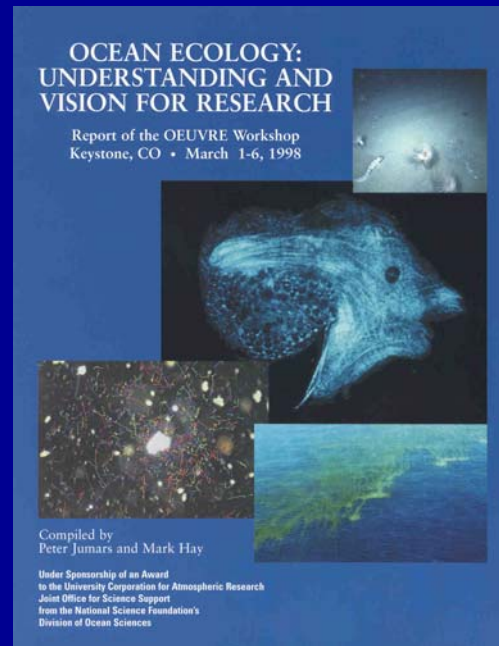
- NSF OCE has recognized the importance and need of Fundamental Science relevant to the evaluation and use of Marine Protected Areas to sustain marine populations and ecosystems.
- Specific attention in OCE began almost a decade ago (1998) with the "**Futures**" meetings in both Biological and Physical Oceanography: Community/NSF discussions about the most important challenges in ocean sciences, and about NSF-OCE creating the opportunities to pursue them.
- **OEUVRE: Ocean Ecology: Understanding and Vision for Research**
- **APROPOS: Advances and Primary Research Opportunities in Physical Oceanography Studies**



Next: NSF Millennium Report (2000)

The NSF Committee on
OCEAN SCIENCES
at the New Millennium

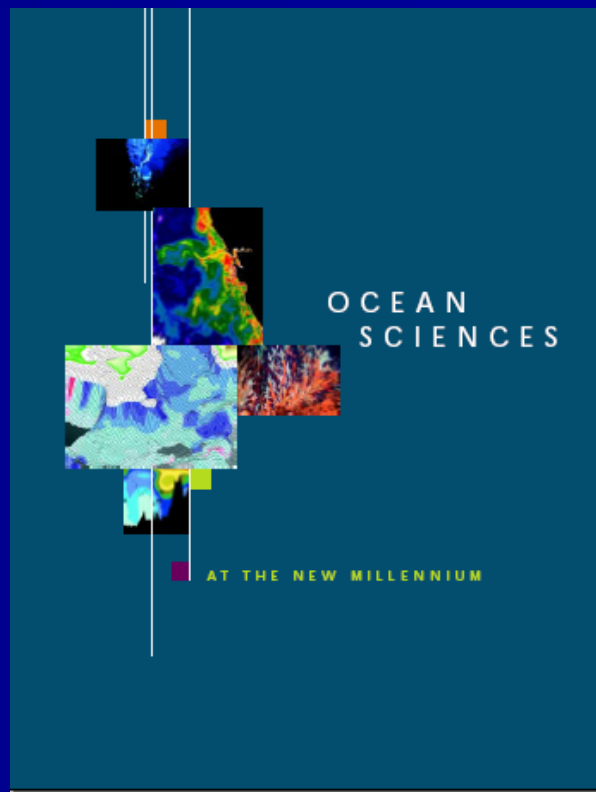
Building on >100 Years of Research

Identify "the most important and promising opportunities for discovery and new understanding in ocean sciences over the next decade."

Based on the four NSF disciplinary reports and input from >400 community members.

- Important inter-disciplinary questions that cannot be fully addressed until we can pursue the processes on the appropriate space-time scales, with advanced technology and

- **Population Connectivity** highlighted for marine ecosystems research



Limited, qualitative understanding of how coastal circulation affects dispersal of early life stages in marine populations, and the consequences of that dispersal for the spatial dynamics of those populations and near-shore communities.

This is a basic research bottleneck constraining advancement in several areas including:

- **the use, design & layout of marine protected areas - MPAs,**
- **the evolution and biogeography of marine populations,**
- **community ecology of coastal species,**
- **recruitment to coastal fisheries, and**
- **the spread of introduced, exotic species.**

Exciting for NSF because

- Strongly inter-disciplinary, including coupled natural-human systems
- Great questions in evolution, ecosystem response to climate change, thresholds and non-linearity in ecosystem response
- Using cutting edge and developing tools in genomics, isotope and tracer geochemistry, in situ sensors
- Modeling is a Grand Challenge for Peta-scale Computing

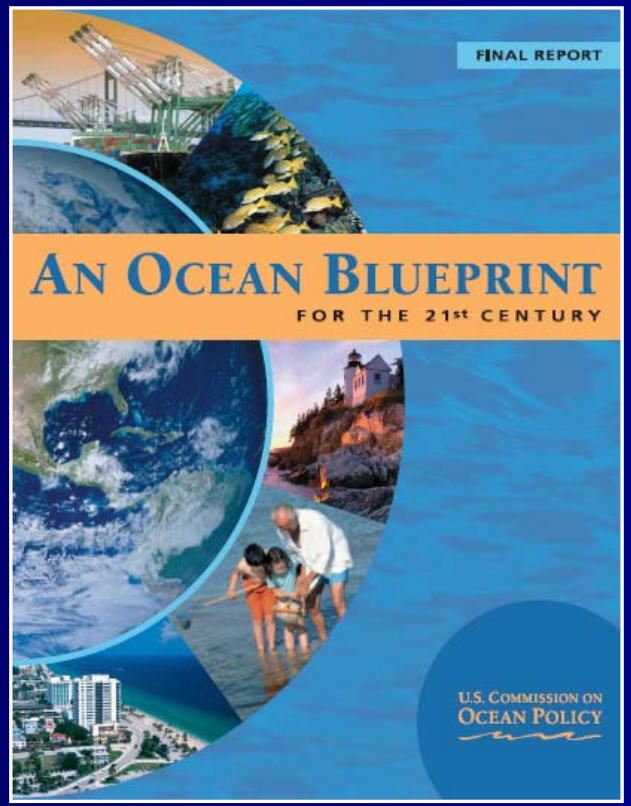
Challenging because:

- Scales are too large for single/small group of investigators
- Ship time costs continue to escalate
- In situ sensing technologies are often slow, expensive to develop
- Large multi-disciplinary studies are expensive
- Building truly interdisciplinary communities is slow
- Understanding ecosystem interaction factors makes modeling very challenging intellectually

Ocean Policy

Oceans Act 2000

USCOP Report 2004



Bush Response 2004

Recent ocean policy efforts that provide the foundation for the development of the Ocean Research Priorities Plan and Implementation Strategy.

CHARTING THE COURSE FOR OCEAN SCIENCE IN THE UNITED STATES FOR THE NEXT DECADE

AN OCEAN RESEARCH PRIORITIES PLAN AND IMPLEMENTATION STRATEGY

NSTC JOINT SUBCOMMITTEE ON OCEAN SCIENCE AND TECHNOLOGY
JANUARY 26, 2007

Stewardship of Natural and Cultural Ocean Resources

- *Research Priority (RP) 1:* Understand the status and trends of resource abundance and distribution through more accurate, timely, and synoptic assessments.
- *RP 2:* Understand interspecies and habitat/species relationships to support forecasting resource stability and sustainability.
- *RP 3:* Understand human use patterns that may influence resource stability and sustainability.
- *RP 4:* Apply advanced understanding and technologies to enhance the benefits of various natural resources from the open ocean, coasts, and Great Lakes.

The Ocean's Role in Climate

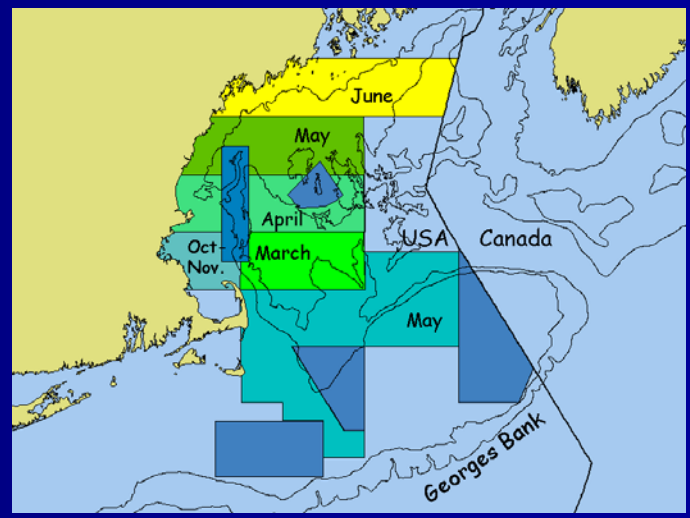
- *RP 11:* Understand ocean-climate interactions within and across regions.
- *RP 12:* Understand the impact of climate variability and change on the biogeochemistry of the ocean and implications for its ecosystems.
- *RP 13:* Apply understanding of the ocean to help project future climate changes and their impacts.

Improving Ecosystem Health

- *RP 14:* Understand and predict the impact of natural and anthropogenic processes on ecosystems.
- *RP 15:* Apply understanding of natural and anthropogenic processes to develop socioeconomic assessments and models to evaluate the impact of multiple human uses on ecosystems.
- *RP 16:* Apply understanding of marine ecosystems to develop appropriate indicators and metrics for sustainable use and effective management.

Comparative Analysis of Marine Ecosystem Organization

- Management of marine ecosystems can be improved by determining the underlying dynamics of these systems at a variety of scales. This effort will provide:
  - Greater basic understanding of ecosystem processes
  - Practical tools for evaluating effectiveness of ecosystem-based management efforts
- 2008 Budget Request
  - NOAA-NMFS: $5M
  - NSF-GEO: $5M



CAMEO - First steps will seek to link the data obtained through integrated ecosystem assessments, with research that seeks to understand how human and other pressures on the system change important ecosystem state indicators.

- development of advanced modeling frameworks that extend existing approaches in novel ways and extend the theory of ecosystem dynamics modeling;
- application of common modeling frameworks to a set of representative marine ecosystems to compare and contrast how ecosystem organization and productivity interact with anthropogenic change;
- comparison of existing marine protected areas as a management tool, focusing on key unresolved scientific questions underpinning their use.

CAMEO Steering Committee established

The key initial tasks **for the steering committee will be to:**

- **develop a series of key research questions for each of the thematic areas,**
- **develop research priorities for addressing them,**
- **select two or three candidate regions with which to focus research efforts (e.g., for the MPA task MPAs),**
- **develop specific RFPs to inform the funding agencies and organizations.**
- **outline a structure and operating principles to oversee the program and effectively allocate resources.**

(Cowan, Micheli, Hixon, Houde, Steele, Werner, Essington, Fogarty, Hollowed, Levin, Polovina, Rosenberg, along with science managers from Moore, Packard, USGS, MMS, NOAA and NSF)